Clustering Effects and the Internationalization of High-Tech New Ventures in Technology Parks and Incubators

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Abstract

This paper aims at contributing to the understanding of the extent to which certain clustering effects – that is the potential benefits of firm agglomeration in specific locations – may or not induce early internationalization of high-tech new ventures. Two types of spatial agglomerations – the technology park and the technology incubator – were examined. Two research questions guided the study: (i) *Do the typical clustering effects occur in a technology park or a technology incubator?* (ii) *If so, do they facilitate the internationalization of high-tech new ventures?*

A literature review was conducted covering clustering effects and firm internationalization. We examined four types of clustering effects that could help promote the internationalization of high-tech new ventures in the context of technology parks and incubators: (i) networking; (ii) isomorphism; (iii) cooperation among firms; and (iv) availability of support organizations.

This research is exploratory and qualitative. The study used two levels of analysis. First, it looked at the technology park or the incubator as an entity in itself, following the research tradition on business incubators, science and technology parks, and high-tech clusters. Second, it looked at specific new ventures that were nurtured by these organizations and engaged in internationalization processes. We selected one case of each type of organization for the study, among those considered most successful in Brazil: Porto Digital, a technology park located in Recife, and Genesis Institute, a university business incubator located in the Rio de Janeiro. We then studied software firms from Porto Digital and Genesis Institute that had some degree of international experience. Primary data was gathered by means of 21 in-depth interviews with company founders and key executives, managers of the two focal organizations and other participating organizations, as well as specialists. Additional consultations by telephone and e-mail were made as analysis progressed. Secondary data were extracted from the sites of the organizations studied, as well as dissertations, articles in newspapers and business magazines, and other sources in the internet. Previously selected analytical categories, based on the literature, were then used to organize the data collected for the study.

This study's results showed that although both organizations displayed the clustering effects expected, these effects were to some extent limited, when compared to "natural" or spontaneous clusters. This might be the reason why such clustering effects seemed to have little or no impact on the internationalization of their tenants. A major recommendation to these organizations is that they should aim at helping their tenants to connect to international networks of research institutes, universities, and potential customers. Another recommendation, directed to incubators, is to make agreements with incubators abroad that could accept for incubation "subsidiaries" of local start-ups. This would permit high-tech start-ups to enter international markets without having to bear the associated costs.

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1. INTRODUCTION

The extant literature on internationalization has not focused on the specific issue of the role of technology parks and business incubators in supporting the internationalization of high-tech new ventures. Another stream of research examines industrial clusters (to which technology parks and incubators are similar), but in this research internationalization appears mainly as a side-topic. In fact, Maccarini, Scabini, and Zuchella (2004, p.2) suggest that the internationalization of clusters is "an emerging research subject in the international business agenda". The lack of literature on the internationalization of high-tech start-ups in technology parks and incubators thus presents a research opportunity.

This paper aims therefore at contributing to the understanding of the extent to which these two types of spatial agglomerations may induce or not the early internationalization of high-tech new ventures. Two research questions guided the study: (i) *Do the typical clustering effects occur in a technology park or a technology incubator?* (ii) *If so, do they facilitate the internationalization of high-tech new ventures?*

The paper proceeds as follows. In the next section we review the literature on the internationalization of clusters, and identify four types of "clustering effects" that might support the internationalization of high-tech new ventures. Section 3 examines the concepts of technology parks and incubators, in order to provide an understanding of these types of organizations and their role in the development of high-tech new ventures. Section 4 presents the methodology adopted in the study. Section 5 describes the results of the study, which are discussed in Section 6. The final section presents the final considerations, the recommendations and the limitations of the study.

2. CLUSTERING EFFECTS AND INTERNATIONALIZATION

In the extant literature on clusters, internationalization appears as a peripheral issue, or in the context of global supply chains. Few studies have focused on how clustering effects may promote the internationalization of new ventures. In this study, we focus on four specific clustering effects that might help small firms in a cluster to internationalize: (i) networking, (ii) isomorphism; (iii) cooperation among members; and (iv) availability of support organizations.

Networking is one of the most studied clustering effects. In the industrial districts and clusters literature, networks are seen as the essence of a cluster's competitive advantage. A cluster can be conceptualized as a set of inter-organization linkages, which permits to build trust, foster cooperation, and reduce opportunistic behavior (Iammarino, Sanna-Randacio, and Savona, 2006; Porter, 1998). Relational assets can be used to accelerate firms' growth and competitiveness, and also its internationalization. In fact, networks are believed to be crucial to the internationalization of smaller firms (Bonaccorsi, 1992; Chetty and Holm, 2000; Sharma and Blomstermo, 2003), whether they are located in clusters or not. For most smaller firms, there is often a network in the beginning of their internationalization process. Smaller firms may enter international markets following their networks, or anticipating the network's move. Other firms use their networks to support their first steps of internationalization (Welch and Luostarinen, 1993). In addition, several studies have shown the often positive impact of multinationals' presence in clusters (Rugman and D'Cruz, 1997, 2000). One of the potential benefits could be to facilitate the access of local firms to global networks (Ernst and Kim,

2002). In fact, a study of high-tech firms in a Chinese science park brought evidence that export orientation and performance seemed to be associated to the ability to access global networks (Filatotchev et al, 2009). Foreign buyers in search of suppliers for their global supply chains may trigger the internationalization process (a paradigmatic example is the Sinos Valley footwear cluster in Brazil reported by Schmitz, 19995, 1999a, 1999b). These intermediaries can transfer technical know-how from producers in one country to those in another; they can bridge the gap between supply in developing markets and demand in developed markets; and they can help local firms to mobilize resources and energies to serve foreign markets (Ellis, 2003).

Another clustering effect is *isomorphism*, a phenomenon by which companies in a cluster imitate each other (DiMaggio and Powell, 1991). Isomorphic behavior is a result of proximity and interaction. For this reason, it is in the very nature of a cluster. Therefore, if a leading firm in a cluster goes international, others would tend to imitate, generating a self-fed chain of events, to the point where the whole cluster might become actively involved with foreign markets (Da Rocha, Kury, and Monteiro, 2009).

A third clustering effect is *cooperation among cluster members*. It can be horizontal (for example, among smaller firms in the cluster), or vertical (for example, in a supply chain). The level of cooperation in a cluster is associated to several factors such as the local culture, the history of the cluster, the existence of historical ties among its members, the degree of complementariness in their economic activities, the types of institutions of collective governance, among others (Brusco, 1990; Gaggio, 2006). Cooperation is therefore supported by inter-firm linkages, but the latter are by no means deterministic. In fact, there are several cases reported in the literature on industrial clusters where cooperation among members did not flourish (e.g. Meyer-Stamer, 1998). However, when internationalization becomes a collaborative project, all firms involved may benefit from it.

A fourth clustering effect is the *availability of support services*. Support organizations include government agencies, research institutes, universities, nonprofit organizations, industry associations, trade organizations, etc. These institutions may play a significant role in the development of a cluster, since they provide cost-effective services due to scale and scope economies, concentration and homogeneity of the cluster (Porter, 1998; Scott and Garafoli, 2007). In the case of internationalization, support institutions can offer counseling and coaching services related to international activities; and they are expected to manage the information flow about foreign markets and overseas operations. They are also supposed to offer personnel training.

3. CONCEPTUALIZING TECHNOLOGY PARKS AND INCUBATORS

Technology parks and technology incubators are two different but related forms of spatial agglomerations. In fact, they have many things in common. Their common purpose is to accelerate the creation and development of high-tech new ventures and reduce their failure rates (Aaboen, 2009; Bergek and Normann, 2008). Both are planned, created, and managed to provide an enriching and protected milieu that fosters the development of these firms. In this regard, they differ from the typical cluster or industrial district, which appears spontaneously (Porter, 1998; Wang, 2007).

There is no consensus on a definition for technology parks. According to the International Association of Science Parks, a technology park, also referred to as a "science park", is defined as:

> "…an organisation managed by specialised professionals, whose main aim is to increase the wealth of its community by promoting the culture of innovation and the

> competitiveness of its associated businesses and knowledge-based institutions. To enable these goals to be met, a Science Park stimulates and manages the flow of knowledge and technology amongst universities, R&D institutions, companies and markets; it facilitates the creation and growth of innovation-based companies through incubation and spin-off processes; and provides other value-added services together with high quality space and facilities." (IASP, 2002).

These parks provide the infrastructure, support services, and access to technical and financial networks (Sofouli and Vonortas, 2007). They may have not only new ventures and already established entrepreneurial firms, but also large and medium-sized firms attracted by the opportunities and services offered by the park. A technology park might be physical or cybernetic (Sanz, 2002).

Definitions of incubators also proliferate in the literature, which is said to be plagued with "definitional ambiguity" (Hackett and Dilts, 2004, p.59). In their often-quoted literature review, these authors offer the following definition of a business incubator:

> "…a shared office-space facility that seeks to provide its incubatees… with a strategic, value-adding intervention system… of monitoring and business assistance. This system controls and links resources with the objective of facilitating the successful new venture development of the incubatees while simultaneously containing the cost of their potential failure" (Hackett and Dilts, 2004, p.57).

There are many different models of incubators. Carayannis and Von Zedwitz (2005) proposed a classification with five types of incubators: university incubator, the independent commercial incubator, the regional business incubator, the company-internal incubator, and the virtual incubator. Grimaldi and Grandi (2005) offer a slightly different typology, and suggest that such variety of types is a consequence of the diversity of needs of incubatees. Incubators are expected to provide infrastructure, contact with support organizations, and access to technical and financial networks, and to offer monitoring, counseling and coaching services to incubatees. Peters, Rice and Sundararajan (2004) indicated that networking and coaching were as relevant to the success of incubation as infrastructure and support services. Incubators are created to nurture start-ups until they mature enough ("graduate") to proceed on their own.

The main differences between the two models of organizations have to do with the scope and size of each organization's activities. The incubator focuses on an early stage of a firm's life cycle, while the technology park serves a broader scope of firms, especially those in a more advanced stage of their life cycle. In addition, incubators differ from technology parks in the length of stay: temporary in the incubator, more permanent in the park. The services rendered by the two organizations are similar, except for more personalized services of monitoring, counseling, and coaching, which the incubator is more capable of offering because of its smaller number of tenants. On the other side, because of its larger scale, the technology park is able to manage the flow of knowledge, a service that is typically not expected from incubators, although they do aim at providing access to relevant technical and market knowledge to their incubatees. Table 1 presents a comparison of the characteristics of the two types of organizations.

The Brazilian experience with incubation is well documented in the international literature (e.g. Almeida, 2005; Chandra and Fealey, 2009; Etzkovitz, Mello, and Almeida, 2005). In 2009, there were around 400 business incubators in Brazil, compared to 1,000 in the U.S., and 500 in China, and Brazil ranked 4th in the world in number of incubators (Chandra and Fealey, 2009). As to technology or science parks, according to the USP Innovation Agency (USP,

2011), there are 11 technology parks in Brazil in operation, and another 11 in the process of being established.

Table 1 – Comparison of Technology Parks and Technology Incubators

	Technology Park	Technology Incubator
Goals	Promote innovation and competitiveness of its tenants	Promote the successful new-venture development of its incubatees
Target firms	New ventures SMEs already established Large and medium-sized firms Multinationals	New ventures
Services provided	Infrastructure, space and facilities Contact with support organizations Access to technical and financial networks Management of the flow of knowledge	Office-space facility Contact with support organizations Access to technical and financial networks Monitoring, counseling and coaching Access to knowledge
Size	Larger	Smaller
Length of stay	Permanent	Temporary

4. METHODOLOGY

This research is exploratory and qualitative. The study used two levels of analysis. First, it looked at the technology park or the incubator as an entity in itself, following the research tradition on business incubators, science and technology parks, and high-tech clusters. Second, it looked at specific new high-tech ventures that were nurtured by these organizations and engaged in internationalization processes.

We have selected one case of each type of organization for the study, among those considered most successful in Brazil: Porto Digital, a technology park located in the city of Recife, state of Pernambuco, and Genesis Institute, a university business incubator located in the city of Rio de Janeiro, state of Rio de Janeiro. We then studied software firms from Porto Digital and Genesis Institute that had some degree of international experience. Table 2 provides a comparison of the main characteristics of the two organizations.

Table 2 – Characteristics of Porto Digital and Genesis Institute

Characteristics	Porto Digital	Genesis Institute
Incubation Model	Technology park	Business incubator
Location (city, state)	Recife, Pernambuco	Rio de Janeiro, Rio de Janeiro
Date of creation	2000	1997
Funding	Government, university, private	Government, university, private
No. of firms	130 high-tech firms	51 high-tech firms

Data collection in Porto Digital was carried out during 2008 and in Genesis Institute during 2009. Secondary data were extracted from the sites of the organizations studied, as well as dissertations, articles in newspapers and business magazines, and other sources in the internet. Primary data was gathered by means of in-depth interviews with key players in the organizations. Interviewees were company founders and key executives, managers of the two focal organizations and other participating organizations, as well as specialists. Interviews lasted one hour in the average. A total of 21 interviews were made: 14 (of which eight with business owners or top managers) in Porto Digital and seven (of which four with business

owners) in Genesis Incubator. All interviews were recorded and transcriptions were made of each. Additional consultations by telephone and e-mail were made as analysis progressed. The analysis started with a complete description of each organization and each of its tenants. Previously selected analytical categories, based on the literature, were then used to organize the data collected for the study.

5. THE INTERNATIONALIZATION OF FIRMS AT PORTO DIGITAL

Porto Digital is an information and communication technology (ICT) park, located in the city of Recife, state of Pernambuco, Northeast Brazil. It started in July 2000 as an economic development project, combining public and private investment. The State government also provided the park's infrastructure. The park offers several benefits to member organizations, including a promotional fund, a human capital fund (dedicated to vocational training), and a guaranty fund (providing guarantees to bank loans). In addition, it offers specific financial incentives, including reduction of city taxes, and financing at subsidized interest rates.

After ten years of its inception, the park had 130 small and medium-sized ICT firms, four ICT multinationals (Motorola, Samsung, Dell, and Sun Microsystems), and several other organizations providing a broad set of support and complementary services. The park also hosted four "anchor" organizations, among which the authority responsible for defining and implementing state policies for science and technology, a research institute, a graduate school offering academic programs in ICT, and the local agency for software exports.

Background

The seeds for the establishment of a center of excellence in ICT in Recife are found in the 1980s, when large companies operating locally stimulated the development of a local ICT industry. A parallel movement originated from a group of scholars from the Federal University of Pernambuco. These scholars had obtained their doctoral degrees in the U.S. and Western Europe, and believed that the city had the potential to become a center of excellence in ICT. They created C.E.S.A.R in 1996, a combination of a private research institute and a business incubator. C.E.S.A.R established offices in other major Brazilian cities, and partnerships with several universities in Brazil and abroad. C.E.S.A.R participated in the creation of Porto Digital and moved its headquarters to the park just after its inception. A third initiative, which would later support the creation of Porto Digital, was Softex Recife, an operational arm of the Softex Society, a non government organization dedicated to foster the development of software in the country. According to interviewees, Softex Recife was an important agent to promote cooperation among firms in the park.

Starting two years after its inception, and once the infrastructure was made available, a large number of local small software firms migrated to Porto Digital, and new ventures were established there. Porto Digital grew to become the largest technology park in Brazil. The presence of four large ICT multinational firms in the park created several opportunities for smaller firms to partner and sell their services. Other multinationals, such as IBM and Nokia, also established regional headquarters in Recife, although not in Porto Digital.

The environment at Porto Digital provided, therefore, the necessary requirements to nurture and develop small ICT firms. The greatest challenge, however, was to create market access to existing businesses and to new ventures, which meant to access the larger industrialized markets of the Southeast and South of the country. Efforts to reach the Southern Brazilian markets were quite successful, due mainly to the attainment of a national reputation by the park.

Internationalization Efforts at Porto Digital

A major effort to create the basis for a broad internationalization movement of firms located in Porto Digital started in 2002, with the Integrated ICT Sector Project, a joint initiative of the Softex Society, the Brazilian Trade and Investment Promotion Agency, and the local branch of Sebrae (the Brazilian Service of Support to Micro and Small Enterprises). Contacts were made in several countries, and distribution channels developed in Germany, the United Kingdom, the U.S., and Italy. Nevertheless, it was difficult for these firms to serve those markets because of their small scale. Therefore, the solution adopted to reach international markets was the creation of a firm in the U.S., a joint venture of several firms in the park.

Noordtek was founded by 35 companies in the next year and started to operate, but the initiative as a whole was unsuccessful. Interviewees attributed the failure to several reasons. First, Sebrae apparently withdrew its financial support before the operation was strong enough to survive on its own. Second, there was a lack of trust between smaller firms and C.E.S.A.R, and a suspicion that while the costs were shared, the benefits might go mainly to the larger member. Third, most firms were not committed to internationalization; they would rather stay in their "safety area" and serve the local and Southern markets of Brazil, which required less effort and offered less risk. Fourth, neither the park nor the firms had an internationalization strategy. One entrepreneur pointed out that "internationalization has no mercy with the lack of a strategy to enter foreign markets".

Although the initiative failed, several positive effects remained. First, many firms later benefitted in their individual internationalization processes from these efforts, such as the use of distribution channels in foreign countries that were developed earlier. Also, many firms had the chance to participate in foreign fairs and exhibitions and developed contacts overseas. Finally, the initiative had the merit of opening the minds of small entrepreneurs in the park to the potential of foreign markets.

The Internationalization Process

Table 3 presents some characteristics of Porto Digital's software firms interviewed for the study. Four out of the eight firms were founded in the 1990s, while the other four were created in the 2000s. Only two of the firms studied already started their activities at Porto Digital; all the others operated previously in another location.

Table 3 – Characteristics of the Software Firms from Porto Digital Studied

Firms	Year of Foundation	Year of Location in Porto Digital	Year of international-ization	No.of foreign markets (2008)	Type of software
D'Accord	1999	2002	2003	64	Music
Facilit	1994	2005	1999	1	Portals and virtual communities
InForma	1993	2001	2001	1	Management of physical assets; maintenance
Jynx	2000	2003	2004	2	Games
Meantime	2003	2003	2005	several	Games
Midia Vox	1994	2005	2000	12	Computerized communications
Pitang	2005	2005	2005	2	Software house
Preloud	2003	2005	2004	several	Games

International activities started very early for some firms and later for others: firms that were created after 2000 had their initial sales up to four years after inception, while firms founded in the 1990s varied between four and eight years to start their internationalization. Nevertheless, when considering the years after installation in Porto Digital, the average goes down to one year for the five firms that internationalized after moving to the park.

Interviewees agreed that the number of firms with any international activities in the park was still quite limited, and even those that had foreign sales did not have a large percentage of their total income coming from overseas markets. They believed that although being a member of Porto Digital facilitated their entry in the larger and more developed markets of Southern Brazil, the technology park was inconsequential to their international activities. They were also unanimous in explaining that their internationalization was an individual rather than a group process, independently of whether they had their first international sales before or after locating their facilities in Porto Digital. They saw their internationalization process as a result mainly of their own efforts and the use of their own personal networks.

In fact, firms indicated basically three motivations to internationalize: a desire of the founders to enter international markets since inception; opportunities provided by the founders' personal networks; and unexpected orders from overseas (usually coming from previous contacts). Some companies showed proactive efforts to internationalize; other companies were essentially passive.

When asked whether other firms in the park influenced their internationalization process, only two interviewees answered positively. Yet, when asked whether their own internationalization influenced other firms in the park, they generally believed that it did impact other firms' decisions to go abroad. This suggests that isomorphism takes place in the park, but it might be a more complex process than it could appear at first glance.

One additional reason to believe that firm internationalization benefits from the park environment comes from a general agreement among interviewees of the considerable advantages of networking. Networking is perceived as "the opportunity to have lunch with other entrepreneurs or technical people" and "informal conversations between company owners". The proximity of firms invites frequent contacts which in turn promote the flow of technical, commercial, and strategic information among park members. The park is also seen as providing several other advantages that could facilitate internationalization: access to high-quality human capital, personnel training, easier access to participation in international fairs and exhibitions, and the possibility of combining firms' resources to serve a (foreign) order.

Multinationals in the park did not seem to act as facilitators of the internationalization process; they would rather use the services of local firms to serve the Brazilian market. Nevertheless, they generated positive spillovers, including a continuous supply of well-trained technicians and managers, subcontracting, technology transfer, and financial support to the park. They also promoted the park's reputation and attracted newcomers. However, other multinationals have played a role in the internationalization process of certain firms. For example, one company established a partnership with Vodafone, one of the leading companies in the global mobile telecommunications industry, to distribute its products in several countries in Europe, Asia, and Australia.

The role of C.E.S.A.R is undisputed in every aspect of Porto Digital's development, including the internationalization processes of at least some firms in the park. Because a number of firms in the technology park were first incubated by C.E.S.A.R, they also benefitted from opportunities generated during their incubation period, as well as from their special linkage with the mother organization. C.E.S.A.R is, in fact, the most internationalized organization

within the park, and the one with most international linkages. Although it has been a role model for many firms, it was sometimes also seen as a powerful competitor.

One aspect that also seemed to influence a firm's promptness to internationalize was the specific product-market area where it competed. For example, firms producing computer and mobile games considered internationalization a necessary step for growth, or even survival. The market for games was perceived as a "global market", while the Brazilian market was seen as "too small to have enough scale". To compete in this market a firm needed to sell the product to "at least 500 users" and the product had "to be available in several languages".

Entrepreneurs believed that the main barrier to internationalize was the lack of a "Made in" image, since Brazil was not seen as a provider of software by overseas customers, contrary to India, China, or Israel. They were ambivalent, however, when considering cultural barriers. On one side, there was a perception that technology reduced or eliminated cultural distance: it was easy to relate to partners with similar technical background. On the other side, differences in business practices were perceived by some as a serious obstacle to internationalization. Other obstacles perceived were the lack of scale to compete overseas, and the limited access to channels of distribution abroad.

6. THE INTERNATIONALIZATION OF FIRMS INCUBATED BY GENESIS

Genesis Institute is part of the Pontifical Catholic University of Rio de Janeiro (PUC-Rio). The Institute has several units, including a technology incubator; a pre-incubator, to support the steps before the foundation of the firm; a cultural incubator, to foster the development of new ventures in the area of Culture & Arts; a social incubator, to support new community ventures; a jewelry design incubator; a "junior consulting firm", to develop projects and to serve as a "hands-on" experience for university students; training and academic education programs; and several units that offer support services to the incubatees. The technology incubator was the first to be created and to operate and it is the one examined in this study.

Internationalization Efforts at PUC-Rio and Genesis Institute

The environment of a university incubator, such as Genesis, differs to some extent from that of a technology park. Its ability to fulfill its goals depends on the type of services rendered by the incubator, as well as those offered by the university. It also depends on the ability of the university to provide an enriching and creative milieu to the entrepreneurs in the specific area of incubation. In this regard, PUC-Rio, where Genesis is located, excels. It has a complete range of academic centers and units which are located in a premium area of the city of Rio de Janeiro, allowing easy contact with other institutions or firms in the city. The departments within the university have close interaction with the incubators, which is facilitated by the proximity of buildings inside the campus. In addition, PUC-Rio has a very large number of international linkages with universities and research centers abroad.

The Incubator, the Institute, or the University did not have any specific programs or activities to help incubated firms to go abroad until 2009. In spite of this, Genesis Institute was already a member or had partnerships with several international organizations aiming at the development of new ventures. Nonetheless, most of these organizations were more concerned with innovation and support to new ventures than with internationalization. Aware of these shortcomings in rendering services to support the early internationalization of incubatees, Genesis Institute developed several activities in 2009 to increase its links with international organizations. One of the goals of the Institute was to improve its ability to provide counseling and other support services to foster firm internationalization efforts.

The Internationalization Process

According to sources internal to Genesis Institute, a very small number of firms incubated by Genesis had international activities at the time of the study. This information is not totally reliable, since there was no systematic follow-up of firms' activities after graduation. Table 4 shows some characteristics of the firms studied that were incubated by Genesis Technology Incubator. All incubated firms studied belonged to the software industry. Of the five firms studied, two were created in the 1990s, and the other three in the early 2000s. The two firms born in the 1990s took four and seven years to internationalize. The three firms created in the early 2000s internationalized between two and four years after inception. Four of these firms internationalized in the 2000s and one in 1999. Interestingly, three firms started their internationalization after their graduation from the incubator.

Table 4 – Characteristics of the Software Firms Incubated by Genesis Studied

Firms	Year of Found-ation	Year of Location in Genesis	Year of Graduation from Genesis	Year of internatio-nalization	No.of foreign markets (2008)	Type of software
Compera	2000	2000	2003	2004	3	Games
EduWeb	1998	1998	2000	2005	2	e-learning
Milestone	2001	2003	2006	2003	2	Human resources and knowledge management
QuickMind	1995	1997	1998	1999	6	e-learning
SuperWaba	2000	2005	(*)	2003	several	Platform for personal digital assistants and smart phones

(*) The company had not graduated from the incubator at the time of fieldwork.

The entrepreneurs interviewed whose companies were incubated in Genesis had a favorable view of the role of the incubator in their internationalization, with the exception of one, who considered "small" the impact and relevance of incubation for the firm's internationalization.

The environment provided by Genesis offered three types of opportunities that were propitious to internationalization, which they believed would not be available if they had not been incubated. One was the possibility of connecting to multiple networks, which in turn gave access to opportunities in the domestic market and, in some cases, abroad. One company, for example, early in its internationalization participated in a project with a German research institute, which had a partnership with PUC-Rio. At the end of the project, the firm had developed one of its products, with the support of this institute. In addition, PUC-Rio provided opportunities for the firm partners to spend some months in other countries, thus helping them to develop ties with technical people in foreign institutions. The founders of another company also saw the relationships provided by PUC as relevant to the firm's international development. One of the entrepreneurs argued that the relationship with senior professors allowed accessing the faculty's network abroad. A founder of a third company summarized the role of PUC-Rio in the development of the firm as follows: "What was the contribution of PUC to the development of my business? Everything. My partners are from PUC, as well as my ex-partners. People that helped us to get venture capital also were from PUC. Everything in our experience is connected to PUC."

A second opportunity was more subtle, but was clearly stated by two entrepreneurs. It had to do with acquiring a certain discipline, a specific mind-set, which included values, norms, and practices (such as the need to plan, to define a strategy, and to organize the business). An entrepreneur noted that the incubator and PUC-Rio provided "values and norms that we internalized without even noticing… a way of thinking…" Another entrepreneur considered that the relationship with PUC-Rio gave him "the basis to think about internationalization, an inevitable path for IT firms…" For him, the key element in the formation of this mind-set was the close contact between incubated firms and the various departments and laboratories of the university.

Visibility was a third important opportunity generated by the incubation process, as the firm could associate its name to PUC-Rio's image. The association with the university's brand name also gave firms credibility in the domestic and, to a lesser extent, in foreign markets. Finally, the incubation period gave firms access to a continuous flow of information concerning both the domestic and the external markets, such as information on international fairs and exhibitions, on special programs to support internationalization, etc.

Nevertheless, although the incubator and the university provided an environment favorable to internationalization, the five incubatees agreed in that it did not offer specific services that could facilitate the process, such as market studies, direct contact with potential customers, or even counseling on how to approach foreign markets. In other words, they offered an environment that permitted to access international opportunities, but there were no deliberate actions to support internationalization.

Entrepreneurs believed that internationalization was a gradual process. In spite of the perception of problems and risks, interviewees considered internationalization a necessary step in their companies' growth. One entrepreneur observed that "software is global by nature"; therefore, a software firm could not avoid entering international markets, it was a natural characteristic of the product-market served by the firm. In addition, entering international markets was perceived as creating future opportunities in terms of international financing and access to venture capital, since only firms with international operations would be able to exploit such opportunities. Inward internationalization was also seen as important; one firm, for example, had a contract with an Indian corporation to perform testing services.

Motivations to internationalize in two cases came from PUC-Rio's linkages with international institutions: for example, two firms used contacts provided by the university, and another did so even before entering the incubator. Initial opportunities abroad also came from one entrepreneur's personal networks, while two others were contacted by foreign customers soliciting their products or services. Although their initiation was reactive, both firms seemed to move to a more proactive behavior as internationalization progressed.

Imitation of other firms that were incubated at the same time or before seemed to be an accepted practice. Entrepreneurs saw it as part of their learning environment and did not deny that one firm in the incubator influenced another, and vice-versa. However, because of the small number of internationalized firms incubated by Genesis, the influence of one firm on another was more based on other people`s reports than on informal contacts. This sharing environment seemed to promote cooperation among firms. In fact, it was not uncommon to have associations between firms incubated by Genesis, even after they graduated. Cooperation rather than competition appeared to be the basis for these relationships.

Government agencies and other support organizations seemed to have much less importance to these firms than to their counterparts at Porto Digital in their initiation to international markets. Multinationals played a role in accelerating firm internationalization in certain cases,

but not in connection with the incubator. For example, one firm used Microsoft to access different external markets for an e-learning product; another used Yamaha's Brazilian subsidiary to approach other subsidiaries of the firm in foreign markets.

Again, the lack of a country-of-origin image for the Brazilian software was seen as the most important impediment to firm internationalization, "since foreign markets do not perceive Brazil as a global player in software development". Lack of foreign networks was also mentioned. Interviewees also mentioned the lack of "practical information" to help get started in international business, as well as information about potential export markets. Another limitation concerns the availability of resources to dedicate to overseas business; one major resource was management time. In addition, the availability of financial resources was perceived as a major limitation, and most firms preferred to continue to invest in the domestic market. The need for frequent travelling was another perceived obstacle, since it required resources that were not available to a start-up.

7. DISCUSSION

We have examined in this study four types of clustering effects that could help promoting the internationalization of new ventures in the context of technology parks and incubators: (i) networking; (ii) isomorphism; (iii) cooperation among firms; and (iv) availability of support organizations.

Networking

Inter-firm linkages in a technology park, although similar to those described in the literature on industrial clusters and districts, differ in some important aspects. When a cluster appears spontaneously in a given geographical location, people not only work, but they also live their lives in the cluster (Becattini, 1990, 1991). Thus, relationships are not only work-related, but they also belong to the realm of kinship, friendship, politics, and religion. Therefore, networks based on different levels of interaction coexist in spontaneous clusters. The embedding of multiple networks in these clusters, although to some extent redundant in terms of participants, puts in motion systemic interactions of a kind that is not as easily found in a technology park, where ties among individuals are mainly of a technical nature (Wang, 2007). Porto Digital did not seem to be an exception in this regard. With a large number of its tenants being brought into the park when they were already established firms, they did not develop common roots, or shared experiences. In addition, a large number of firms have been less than five years in the park; not enough time to develop the sense of community that characterizes spontaneous clusters. In contrast, Genesis' incubatees seemed to be more fully embedded in the environment of the university. Part of the reason is that these were typically young entrepreneurs, and most of them graduated from PUC-Rio. They spent, therefore, most of their adult lives at the university, and were strongly influenced by it.

External linkages between Porto Digital's SMEs and other organizations were many, especially when considering the presence of multinationals. The flagship organization at Porto Digital, C.E.S.A.R, also displayed a considerable number of outside linkages (Ferreira, Tavares and Hesterly, 2006). However, the most effective linkages seemed to be with Brazilian rather than international organizations. The same stands for Genesis Institute (although less for PUC-Rio).

The entrepreneurs interviewed in this study, without exception, recognized these linkages (both inter-firm and external) as the outstanding advantage of being a member of a technology park or an incubator. In their view, relationships within these organizations had mainly positive impacts on business growth. They disagreed, however, when evaluating their impact on their firm's internationalization.

Isomorphism

Isomorphism is an important and frequently observed result of clustering (DiMaggio and Powell, 1990). Firms in Genesis displayed more this behavior than those at Porto Digital. The reasons could be associated to their origin. Most Porto Digital firms already existed before the creation of the park; therefore, they had had contact with several ideas and business models. Not only Porto Digital's tenants came from different backgrounds, buy they were also much more heterogeneous with respect to size than Genesis' incubatees. In contrast, Genesis' incubatees, in most cases, started in the incubator, and their founders very often had graduated from the university, having had limited interactions outside this protected environment. They tended to share PUC-Rio's organizational culture and values, and to learn similar business practices. Homogeneity, as well as common ancestry, seems to make firms more prone to isomorphic behavior (Ferreira, Tavares and Hesterly, 2006; Lazerson and Lorenzoni, 1999).

In the case of Genesis, imitation of successful firms in the incubator, or that had already graduated, was considered part of the learning process, and therefore stimulated by the organization. Nevertheless, this process was limited because very few start-ups incubated by Genesis internationalized. At Porto Digital, firms were prouder of their own culture and achievements; in this situation, entrepreneurs would probably tend to be more individualistic. Therefore, imitation might not be considered a desirable behavior, or one of which entrepreneurs should be proud of. Nevertheless, although most firms at Porto Digital did not associate their internationalization to park membership, it appears that, at least to some extent, imitative behavior concerning internationalization was also occurring at Porto Digital.

In fact, imitative processes may happen in a subtle and often unconscious manner in a cluster. It is in the midst of informal contacts that important decisions are taken, new ideas are disseminated, technical information is exchanged, and experiences are shared. Because of the elusive nature of these interactions, entrepreneurs might not be aware of how much their mind-set and their actions are shaped by their counterparts. In a sense, they are absorbing the culture of the cluster – a phenomenon similar to an individual being raised in its own national culture.

Cooperation among firms

Another clustering effect is cooperation (Iglori, 2001; Markusen, 1995). In the case of Porto Digital, this study identified a joint experience designed to unite the efforts of a group of firms to enter foreign markets, but the experience was not successful, the main reason probably being lack of trust among firms. This is not uncommon when firms of very different size develop a joint international effort to sell products that are competitive, not complementary. In spite of this unsuccessful experience, there was learning for the firms involved. In contrast, Genesis start-ups were more cooperative, with frequent associations among firms, but no joint efforts to internationalize were carried out.

Availability of support institutions

The participation of several government agencies, at the state or federal level, universities, and private associations had a very positive impact in the development of Porto Digital. As to Genesis Institute, its location within one of the best Brazilian universities and the several linkages between the incubator and government and private organizations also positively impacted the development of incubatees. Nevertheless, the absence of links with foreign institutions is noteworthy. Neither organization – Porto Digital or Genesis Institute – had a network of foreign universities and institutes with strong linkages, although both showed, at least on paper, some international connections, which could at best be defined as weak linkages.

However, the university (PUC-Rio) offered to the new ventures what Genesis lacked: a network of foreign institutions, which could be accessed using the various departments and laboratories of the university, whose professors and researchers had the person-to-person ties within these foreign organizations. The use of these networks, however, depended on which department, or which professors were associated to the project. It very much depended on luck. As to Porto Digital, the flagship organization – C.E.S.A.R – also displayed several ties with foreign organizations which could eventually be used by Porto Digital's tenants. These ties were not readily available to smaller firms, and their use depended on their connection with C.E.S.A.R.

Porto Digital had a strong advantage over Genesis Institute because of the presence of ICT multinational corporations' facilities in the park (Rugman and D'Cruz, 1997). This advantage, however, did not seem to be, as one might expect, a facilitator of internationalization. Subsidiaries of multinational firms typically used the services rendered by Porto Digital's tenants to serve the Brazilian market. In spite of that, multinationals appeared in several of the cases examined as a distribution channel in foreign markets for software products of tenants of Porto Digital and Genesis. In these cases, the relationship between the entrepreneurial firm and the multinational was not a result of its presence in the park or the incubator, but rather an independent event. It is possible that in the future, with the expansion of Brazilian exports of software, and the creation of a positive country-of-origin effect, multinationals will more readily become distribution channels of Brazilian software abroad, as they create a network of software developers in Brazil. Such outcome is not necessarily only positive, since smaller firms may be alienated from direct contact with international markets, and, as a consequence, may not acquire the experiential learning believed to be crucial to the development of their internationalization processes.

8. CONCLUSIONS AND RECOMMENDATIONS

The two organizations examined in this study present several similarities and differences, and it is to some extent difficult to compare them. This study's results showed that although both organizations displayed the clustering effects expected, these effects were to some extent limited, when compared to "natural" or spontaneous clusters. This might be the reason why such clustering effects seemed to have little or no impact on the internationalization of their tenants.

Networking was the most important clustering effect in these two organizations. However, both lacked other aspects of the community life, so well presented by Becattini (1990, 1991) and other scholars that studied the Italian industrial districts. It is well documented in the literature the role played by networking in promoting firm internationalization (Johanson and Mattson, 1988). Entrepreneurs use their personal and firm relationships to enter foreign markets, while building new ones. The more diversified (non-redundant) these connections, the higher the probability of success in attaining international presence in overseas markets. Under this perspective, a major contribution of the organization would be to provide as many international ties as possible, in order to increase the probability of successful internationalization by their tenants. Therefore, a major recommendation to these organizations is that they should aim at helping their tenants to connect to international networks of research institutes, universities, and potential customers.

Two other clustering effects studied – isomorphism and cooperation – were not important to these firms' internationalization, but had the potential to impact them in the future. In fact, it has been noted that the differences between a technology park and a spontaneous cluster may blur as time passes and firms in the park are more embedded in community life and share common values and experiences (Wang, 2007). Therefore, as linkages between firms become

stronger in the long run, small firms at Porto Digital might develop more joint projects and imitate each other. As to the incubator more efforts should be directed towards creating joint opportunities abroad, since the right climate for cooperation seems to exist.

Finally, despite the existence of several types of support organizations, especially in the technology park, they are not oriented towards supporting internationalization efforts, to a large extent because of the absence of those international linkages in their own structure. Nevertheless, at least in the case of Genesis Institute, there is a concern about developing these links as well as support services to foster new ventures internationalization. One possibility, in the latter case, is to make agreements with incubators abroad that could accept for incubation "subsidiaries" of local start-ups. This would permit incubatees to enter international markets without having to bear the associated costs.

This study has several limitations. The two organizations chosen for analysis – Porto Digital and Genesis Institute – although quite successful in Brazil, are not necessarily representative of other experiences. Another limitation is the choice of Brazil as a locus of research. There is some evidence of a location effect on the characteristics and performance of clusters and incubators, as well as in the appearance and characteristics of new international ventures (Dib, Da Rocha and Da Silva, 2010; Sun, Ni and Neung, 2007). The research also suffers from limitations typical of the methods used, including post-decision bias, since interviews with founders and managers of the firms were conducted after the decision to internationalize was actually made.

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