DETERMINANTS OF INTERORGANIZATIONAL RELATIONSHIPS IN SCIENCE AND TECHNOLOGY PARKS: THEORETICAL AND EMPIRICAL EVIDENCE

DETERMINANTES DAS RELAÇÕES INTERORGANIZACIONAIS EM PARQUES CIENTÍFICOS E TECNOLÓGICOS: EVIDÊNCIAS TEÓRICAS E EMPÍRICAS

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ABSTRACT

The present study aims to identify the factors that determine the formation of interorganizational relationships in the context of science and technology parks. To conduct this study, which consists of qualitative research with multiple case studies, we selected two parks: one located in Brazil and the other in Portugal. The survey's main findings are represented by the theoretical and empirical evidence found in science and technology parks, and the need for reciprocity and legitimacy proved critical to the formation of interorganizational relationships. Although these determinants match the primary theoretical and empirical evidence, other elements may influence the relationships, such as cultural aspects, environmental uncertainty, risk aversion and mistrust.

Keywords: Strategy; interorganizational relationships; science and technology parks.

RESUMO

O presente estudo tem como objetivo identificar os fatores que determinam a formação das relações interorganizacionais no contexto de parques científicos e tecnológicos. Para a realização do estudo utilizou-se uma pesquisa qualitativa, com estratégia de estudo de casos múltiplos, em que foram selecionados dois parques, um localizado no Brasil e o outro em Portugal. As principais conclusões da pesquisa estão representadas pelas evidências teórico-empíricas encontradas em contexto de parque científico e tecnológico, sendo que a necessidade, a reciprocidade e a legitimidade revelaram-se fundamentais na formação das relações interorganizacionais. Embora esses determinantes correspondam às principais evidências teórico-empíricas, existem outros elementos que podem influenciar as relações, tais como: os aspectos culturais; incerteza ambiental; aversão ao risco e desconfiança.

Palavras-chave: Estratégia; relações interorganizacionais; parques científicos e tecnológicos.

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1. INTRODUCTION

The theme of interorganizational relationships has been repeatedly debated in organizational studies, which have attempted to understand the phenomenon of relationships between different types of organizations (GRANDORI; SODA, 1995; MARCON; MOINET, 2001; TODEVA; KNOKE, 2005; CROPPER et al., 2008). In addition, the state of the art in interorganizational relationships reflects numerous studies (OLIVER; EBERS, 1998; BALESTRIN; VERSHOORE; REYES JR., 2010) in several fields.

However, the study of interorganizational relationships involving universities, businesses and government, often formed in the context of science and technology parks, is newer and lacks investigation. Such studies were primarily developed in the early 1990s (VAN DIERDONICK; DEBACKERE; RAPPA, 1991; QUINTAS; WIELD; MASSEY, 1992; AMIRAHMADI; SAFF, 1993; FELSENSTEIN, 1994; WESTHEAD; STOREY, 1995); however, there are still few studies discussing interorganizational relationships.

While studies of organizations in the context of science and technology parks have experienced significant growth since the 1990s, we see a continuing lack of in-depth research of the dynamics of interorganizational relationships. Studies have focused on university-industry interactions (VEDOVELLO, 1997; BAKOUROS; MARDAS; VARSAKELIS, 2002), comparing the performance of companies located inside and outside of parks (QUINTAS; WIELD; MASSEY, 1992; LÖFSTEN; LINDELÖF, 2002, 2003, 2005) and configuring parks as instruments of economic development (PHAN; SIEGEL; WRIGHT, 2005).

The importance of science and technology parks has increased significantly. In the pursuit of economic development, countries in Europe, Asia and in the Americas have invested heavily in park development. Brazil is no different, and science and technology parks have attracted the interest of universities and governments (local, state and federal). Thus, this study seeks to answer the following research question: what factors determine the formation of interorganizational relationships in science and technology parks?

The theoretical importance of this research is related to both the timeliness of the topic (it includes a discussion of interorganizational relationships in science and technology parks) and the pressing need to understand park formation considering the small number of empirical studies. This study represents a practical contribution to public policy, particularly with respect to understanding the situation of parks, because public policy currently emphasizes public resources for park development without duly considering the critical factors identified here.

2. THEORETICAL BACKGROUND

Seminal studies on interorganizational relationships originated in economics (MARSHALL, 1923), sociology (WEBER, 1947) and political science (SELZNICK, 1949). Later, in the 1960s, other studies on interorganizational relationships emerged. Examples include the following: Levine and White (1961), who investigated interorganizational exchanges for achieving common objectives, taking into account the scarcity of resources; Litwark and Hylton (1962), who proposed a theory of interorganizational coordination from factors such as interdependence, awareness, standardization and number of organizations; and Evan (1965), who presented the first proposal for a theory of interorganizational relationships, establishing various dimensions for analysis.

Interorganizational relationships are characterized either as new organizational forms or as intermediate or hybrid forms (THORELLI, 1986; MILES; SNOW, 1986; POWELL, 1987; JARILLO, 1988) on a continuum between markets and hierarchies

(WILLIAMSON, 1991a). These new organizational forms are identified in the literature as interorganizational relationships in terms such as alliance, partnership, cooperation, collaboration, relationship, network, cluster, technopolis, association, trust, joint venture and franchise (GRANDORI; SODA, 1995; MARCON; MOINET, 2001; TODEVA; KNOKE, 2005; CROPPER et al., 2008).

Studies on the evolution of interorganizational relationships appear to include several attempts to classify or establish a typology that helps understanding the different forms of those relationships that have emerged over time (WHETTEN, 1981; GRANDORI; SODA, 1995; MARCON; MOINET, 2001). Thus, the literature presents very different problems and attempts to understand issues from different types of interorganizational relationships to collective gains from these relationships. However, only a few studies have investigated what factors influence the formation of interorganizational relationships (BABIAK, 2007).

In this sense, the literature shows a conceptual diversity related to the determining factors of the formation of interorganizational relationships (OLIVER, 1990). These determinants can be explained by reference to two key issues: the first is explaining the conditions under which such relationships are formed; and the second is seeking to identify the underlying causes or contingencies that lead to the formation of those relationships (SCHERMERHORN JR, 1975; OLIVER, 1990).

Thus, the analysis of the reasons for the formation of interorganizational relationships distinguishes the factors that motivate organizations to establish relationships and the factors that facilitate or hinder the education of those organizations. Thus, Oliver (1990) notes that the literature suggests six critical contingencies as determinants for training organizations involved in interorganizational relationships:

1) Need. This term refers to a situation in which an organization establishes ties or exchanges with other organizations by order of a higher authority for the purpose of fulfilling legal or regulatory requirements (WHETTEN, 1981). In special cases, which the government defines as involving the public interest, government organizations are pressured to establish interorganizational relationships (SCHERMERHORN JR, 1975). Conversely, an organization can establish exchanges because of the scarcity of resources in the environment (LEVINE; WHITE, 1961), thus highlighting resource dependency. The organization has a need for external resources (which may or may not be available), suffers environmental pressures and adapts to the environment, performing an exchange of tangible or intangible resources with other organizations. This external dependence considers the importance of the resource for business continuity, prudence in the allocation and use of the resource, and its own scarcity (PFEFFER; SALANCIK, 1978).

2) Asymmetry. This term refers to a situation in which an organization has power or control over other organizations or resources. Unlike resource dependence (PFEFFER; SALANCIK, 1978), asymmetry focuses relations of power and control based on resource scarcity. Thus, the scarcity of resources causes an organization to exercise power, influence or control over other organizations that have limited resources. However, the desire for control or unwillingness to relinquish control is an asymmetric reason for an organization's decision to interact with others.

3) Reciprocity. This term refers to a situation in which an organization engages in cooperation (SCHERMERHORN JR, 1975), collaboration (LEVINE; WHITE, 1961) and coordination (WHETTEN, 1981) with other organizations to achieve goals or common interests and mutual benefits (ASTLEY; FOMBRUN, 1983). Thus, it has been assumed that the process of forming interorganizational relationships is based on balance, harmony, equity and mutual support. Moreover, a lack of action may induce cooperation instead of competition.

4) Efficiency. This term refers to a situation in which an organization aims to improve efficiency using an orientation that is more internal than external. Efficiency motivates the organization to establish interorganizational relationships to increase returns and reduce costs. Thus, the perspective of transaction costs is consistent with the argument that efficiency is crucial in forming interorganizational relationships (WILLIAMSON, 1991b). Transaction costs determine whether the efficiency of a transaction will be higher within the organization, in an intermediate structure (i.e., a new organizational form) or in the market (THORELLI, 1986).

5) Stability. The formation of interorganizational relationships has been characterized as an adaptive strategy to environmental uncertainty. This uncertainty is caused by resource scarcity and the limited availability of information (imperfect knowledge) about environmental changes (BOWDITCH; BUONO, 2004). Uncertainty leads an organization to the establishment and management of relationships with other organizations to achieve stability.

6) Legitimacy. When the organization decides to establish an inter-relationship, it has reason to increase its legitimacy, which can result in a better image, higher credibility, better reputation or increased prestige. The environment influences the organization through institutional pressures that constrain the search for legitimacy (ZUCKER, 1987), which conforms to existing coercive, mimetic and normative standards (DIMAGGIO; POWELL, 1983).

These critical contingencies are the underlying causes that determine the formation of interorganizational relationships (OLIVER, 1990), which refer to the specific reasons that organizations make strategic choices to establish relationships with other organizations, even if those choices are partially motivated by pressures to conform (PROVAN; SYDOW, 2008). Interorganizational relationships can be understood as a response to environmental pressures to obtain collective gains that are difficult to achieve through individual action (BALESTRIN; VERSCHOORE, 2008).

Organizations form interorganizational relationships to spread risks and enhance returns, generating economies of scale. Collective efficiency can be created by external economies due to the flow of information, the exchange of experiences and access to additional resources (TODEVA; KNOKE, 2005). Thus, analogous to the economy of scale, companies increase the volume and scope of their transactions, increasing their efficiency. Such situations stand out, particularly in interorganizational relationships with greater knowledge transfer, which provide a performance superior to that of competitors not engaged in partnerships (DYER; SINGH, 1998).

The acquisition and allocation of human, material and financial resources are critical attributes for organizational survival, considering the need for such resources, which can be scarce (GALASKIEWCZ, 1985). Resource dependency implies that an organization needs access to scarce resources through internal and external mechanisms—i.e., interorganizational relationships (GALASKIEWCZ, 1985). Moreover, organizations cannot generate essential resources: they have to interact with other organizations and the environment to ensure resource availability (PFEFFER; SALANCIK, 1978).

The formation of interorganizational relationships represents an opportunity to reduce the influence of regulation, considering that the coordination mechanism serves as control over institutional pressures (DIMAGGIO; POWELL, 1983). Thus, relationship formation can reduce the impact of regulation (GALASKIEWCZ, 1985), resulting in organizational benefits.

These relationships are created as a response to environmental uncertainty: they represent an organizational strategy used for adapting to the environment. The introduction of technology has been considered a major source of instability (PFEFFER; SALANCIK, 1978; DOZ; HAMEL, 2000).

Internal factors motivate an organization to establish inter-relationships and are based on efficiency, whereas external factors facilitate or hinder the formation of relationships and are based on necessity, asymmetry, stability and legitimacy. Reciprocity, in turn, is based on each organization's involvement in establishing the relationship.

The formation of interorganizational relationships can determine the need to establish connections for accessing and/or trading tangible or intangible resources, considering that in certain environments, resources are scarce. This scarcity of resources creates the opportunity for an organization to exercise power over another organization with few resources (i.e., there is asymmetry), prompting that organization to establish relationships to access and/or trade resources. This resource exchange motivates an organization to collaborate and extend reciprocity and efficiency from collective gains while reducing costs and increasing returns. Moreover, environmental pressures influence an organization

to adapt in order to achieve stability and legitimacy by establishing stable relationships (Table 1).

Thus, the six determinants of the formation of interorganizational relationships can be configured into six types of relationships. Although each determinant can identify a specific type of relationship, these determinants may be associated with the formation of a given relationship. Therefore, an inter-relationship may have a variety of causes or underlying conditions, both of which contribute to training (OLIVER, 1990).

Organizations can establish interorganizational relationships motivated by various combinations of contingencies. Contingencies are related to pressures from higher authorities, the scarcity of resources, the exercise of power, collaboration, the relationship between costs and benefits, environmental uncertainty and institutional conditions.

Table 1: Implications of the determinants of interorganizational relationships.

Determinants	Implications in interorganizational relationships
Need	The scarcity of resources and/or the decision to increase authority generate the need to access and exchange tangible and intangible resources.
Asymmetry	The scarcity of resources causes asymmetry of power, influence or control between organizations.
Reciprocity	The scarcity of resources leads to reciprocity between cooperating organizations to achieve common goals.
Efficiency	The requirement to reduce costs and increase returns leads to improved efficiency in transactions.
Stability	The scarcity of resources and the limited availability of environmental information generate uncertainty, thus causing a search for stability.
Legitimacy	Uncertainty and institutional environmental pressures cause a quest for increased legitimacy.

Source: Developed by the authors.

3. RESEARCH METHOD

This research used a qualitative approach to identify the factors determining the formation of interorganizational relationships in the context of science and technology parks. Using that approach, the research was conducted through a multiple case study (YIN, 2005). We selected two scientific and technological parks, one situated in Brazil, the other in Portugal. As a criterion for case selection, we considered scientific and technological parks with a high level of relevance to the Brazilian and Portuguese contexts and that are located in the metropolitan areas of Porto Alegre (Brazil) and Lisbon (Portugal). We chose the following parks:

a) Case 1: Tecnosino—Technological Park of São Leopoldo (Brazil). This park was created in 1996. It is located in São Leopoldo, in the metropolitan region of Porto Alegre. In 2010, it was named best technology park by Associação Nacional

de Entidades Promotoras de Empreendimentos Inovadores (ANPROTEC);

b) Case 2: Taguspark—Science & Technology Park (Portugal). This park was created in 1991. It is located in the municipality of Oeiras in the metropolitan region of Lisbon and is considered to be Portugal's largest science and technology park.

Both the selected cases, which have similarities and differences, emerged in the 1990s and remain in operation. The similarities between the cases relate to their share of university, business and government organizations, to social objectives that include the development of a favorable environment for innovation and to relevance in the local and regional contexts.

The differences between the cases relate to the establishment of the fund manager, to the intensity of university, enterprise and government coordination and to the work areas of the parks. These similarities and differences contribute to the case analysis and the understanding of the determinants and conditions of the formation of interorganizational relationships in the context of science and technology parks.

4.   DATA COLLECTION

Data were collected from multiple sources, using data collection techniques such as interviews, direct observations and documents. The use of multiple sources of evidence aims to develop converging lines of inquiry, enabling a process of data triangulation and an increase in the reliability and validity of the surveyed data (YIN, 2005).

The data collection procedure occurred in two phases. The first one involved the secondary data (documents) and took place in September/October 2012, and the second involved the primary data (interviews and direct observations) and took place in November/December 2012 and January/February 2013.

Next, we proceeded to read external documents, such as theses, dissertations, sectoral studies, legislation, magazines and newspapers to assist in understanding the cases. Then, we consulted the records contained in the website files of the parks, institutions and public agencies involved. At the same time, we consulted internal documents available on websites and from libraries, including statutes, regulations, resolutions, manuals and reports.

The secondary data revealed important aspects of the studied cases, such as their origins, evolution, and characteristics, among others. Those data corroborate our understanding of the evidence from other sources. Thus, external documents served as the basis for identifying various aspects related to the surveyed cases, especially to confirm the direction of the theoretical foundation. A substantial part of the external documents was academic documents (theses and dissertations) that aimed to study both the Brazilian and Portuguese cases.

After the secondary data had been collected, the primary data were collected for confirmation purposes through the use of interviews and direct observation. Thus, termination of secondary data collection represented the beginning of the process of selecting companies (from existing databases on the websites of the parks) to participate in interviews. This selection was conducted randomly and considered the availability of the companies to participate in the interviews.

The interview was established as the primary source of evidence of the surveyed cases (YIN, 2005). An interview script was developed for the interviews, whereas a roadmap was drawn up for the direct observations.

The preparation of the interview followed a pattern of open and comprehensive questions, which had to be deepened with follow-up questions based on the answers provided during the interview. Respondents answered questions related to the formation of interorganizational relationships

of the firm, such as "What reasons led the company to settle in the park?". Depending on the answers, the question was thoroughly followed up with other questions to obtain an understanding of more specific aspects, such as "What kinds of resources were acquired through this relationship with other organizations?". Therefore, the interview, through the previously prepared script, enabled the researcher to make direct contact with the respondent, to follow a conversation-oriented chain of evidence, and to formulate new questions from the interviewee's answers.

Accordingly, after scheduling the interviews by email and confirming them by telephone, the interviewees received copies of the interview guide in advance so that they could disclose the information and data that would inform and/or be made available to the researcher. Each interview was conducted by the researcher based on the interview guide. With the consent of the interviewee, the interview was recorded. Upon completing the interview, the researcher conducted a site visit at the premises and the park, making direct observations during the course of the scripted visit.

In Taguspark, the interviews were conducted in November/December 2012. Interviews were conducted with managers of the previously selected companies that had agreed to participate. Four interviews were conducted: two at incubated companies and two at companies located in the park. The duration of the interviews ranged from 31 minutes to 1 hour and 23 minutes with a mean of 58 minutes.

In the case of Tecnosinos, the interviews were conducted in January/February 2013. Interviews were conducted with managers of the previously selected companies that had agreed to participate. Four interviews were conducted: two at incubated companies and two at companies located in the park. The duration of the interviews ranged from 21 minutes to 1 hour and 20 minutes with a mean of 38 minutes.

5. DATA ANALYSIS

In the data analysis, the transcripts of the interviews were conducted and stored electronically in a database, and later reports of the interviews were subjected to content analysis (BARDIN, 2006). The analysis of the secondary data served as a support to corroborate the evidence obtained from the primary data, offering subsidies to achieve data triangulation (MARTINS, 2006).

The content analysis involved organization of the primary and secondary data collected, categorization of that data based on the factors that determine the formation of interorganizational relationships and interpretation of the data according to our theoretical orientation. The cases were analyzed individually, and the reports of the various interviewees and other sources of corroborating evidence were considered when drafting the description of each of the studied cases. Thus, data triangulation involved the convergence of evidence from different sources to explain the empirical evidence.

5.1. Case one: Tecnosinos

Tecnosinos was founded in October 1996 by a group of information technology companies interested in establishing operations in proximity to a university. That started a process of interaction between those enterprises and the Associação Comercial, Industrial e de Serviços de São Leopoldo (ACIS), which sought a partnership with the city government of São Leopoldo and Universidade do Vale do Rio dos Sinos (Unisinos). Tecnosinos was officially created through the enactment of Law No. 4420 on October 31, 1997, which named the facility Polo de Informática de São Leopoldo. On November 13, 2009, the facility was renamed Tecnosinos—Technological Park of São Leopoldo.

Tecnosinos is installed in São Leopoldo, which is located in the metropolitan region of Porto Alegre

and has a total area of 250,000 m². The park hosts 75 companies that operate in various market segments. These segments are organized into five action areas in a multi-agency setting. Most of the companies—such as surveyed companies E1, E3 and E4—operate in the area of information technology, whereas E2 operates in the area of communication and digital convergence.

E1 is an information technology company that develops aviation simulators as education and training solutions, having performed innovation activities in cooperation with other companies in the park to complement its designs. E2 is a digital agency that creates promotional stock; in the park, it works in the field of communication and digital convergence.

E3 is an information technology company that develops projects and provides consulting and auditing information security services. Thus, E3 cooperates with other companies to complement their projects, linking security with viewing and joining service portfolios. E4 is an information technology company that develops technology for design, design automation, and manufacturing process engineering.

The surveyed companies are located both in the business incubator and in the park (Table 2). Companies established in the incubator joined when their projects hatched and where selected, whereas the companies located in the park initially entered it either through the incubator or directly.

According to the data presented, the age of the companies ranges from five to twenty-four years. The oldest company, created twenty-four years ago, created the park, and all of the other companies were created in its incubator. Thus, the majority of the surveyed companies were created and developed in the park.

The number of employees of the companies surveyed ranges from three to one hundred and twenty nine, revealing that the companies are small and seek support from the park for their activities. Furthermore, the three companies are considered to be small, with an average of seven employees.

In Tecnosinos, the formation of interorganizational relationships is based on a need to obtain resources such as information, knowledge, infrastructure and services. Accordingly, "the local pool of the surrounding universities' resources is a critical factor for companies setting up in Tecnosinos, together with a good support structure and infrastructure" (Interview T1).

That notwithstanding, other determinants have been identified, such as reciprocity and legitimacy (Table 3). Reciprocity was evidenced by cooperation with other companies and with the institution (Unisinos), whereas legitimacy was manifested by the feeling of belonging characterized by the

Table 2: Characteristics of the surveyed Tecnosinos companies.

Company	Company data			
	Incubated	Foundation	Jobs	Area of operations
E1	Yes	2008	5	Information technology
E2	Yes	2010	3	Communication and digital convergence
E3	No	2010	13	Information technology
E4	No	1989	129	Information technology

Source: Developed by the authors.

Table 3: Determinants of interorganizational relationships in Tecnosinos.

Determinants	Implications in interorganizational relationships
Need	E1 = information, knowledge, infrastructure and services E2 = information, knowledge, infrastructure and services E4 = information, knowledge, infrastructure and services
Reciprocity	E1 = cooperation with companies and institutions E3 = cooperation with companies and institutions E4 = cooperation with companies and institutions
Legitimacy	E2 = status, prestige and credibility to company

Source: Developed by the authors.

status and prestige that the company receives for belonging to the park, together with the credibility that comes from involvement in Tecnosinos.

Thus, an analysis of the manager interviews identifies the factors determining the involvement of the companies in establishing interorganizational relationships in (or with) Tecnosinos. These factors indicate that the need for resources and information and scientific and technological knowledge is critical to a business's success.

The need for information and knowledge is perceived from the first contacts related to joint project development. According to one manager, "We have projects that include the company [A] at the front of the hall, the company [B] here downstairs and the company [C] here in front of us" (Interview E1). At another point, the same manager notes: "we have a project and we need to develop hardware that incorporates their knowledge and our experience [...],the synergy of being able to exchange knowledge is fantastic" (Interview E1).

The need for infrastructure and services for business installation and project development were also noted in the interviews. "The proximity of the university and the airport are key issues for companies settling in the park" (Interview G1). One company also notes that "we put our house in order and managed to restore the company's entire internal administrative structure because the incubator has partially supported our financial management" (Interview E2). Another company notes, "certainly, the accessibility that we have here in the incubator is the main point [...], we have always had enough [...] support in administration, sales and marketing from courses and subsidized consultancies in partnership with Sebrae [Brazilian Micro and Small Business Support Service]" (Interview E1).

Moreover, reciprocity has been instrumental in cooperative relationships with other companies and with the institution (Unisinos). A company

manager states, "We had programming development throughout the company. After a while [...], we moved to this park with company [F] to conduct all of our operations" (Interview E2). Additionally, "we have performed a great deal of development for the university" (Interview E2) because the company is involved in a cooperative relationship not only with other companies in the park but also with Unisinos.

Therefore, companies show that the presence of numerous companies and institutions in Tecnosinos creates a positive image, hence conferring legitimacy upon all involved. "To be in the park shows that you are not a garage company, you are a startup improving your status [...], and you have these companies [D and E] next to you [...], which gives you credibility" (Interview E2). Moreover, with respect to Tecnosinos, the park "has an impact on the identity of the region, [...] an identity marked by achievements such as better technology [...], which will generate a positive impact" (Interview T1).

5.2. Case two: Taguspark

Taguspark was founded in 1991 by an initiative of the Portuguese government through the Council of Ministers Resolution No. 26/91, which defined the creation of science parks and technology in the metropolitan areas of Lisbon and Porto. The legal-institutional model established was private and involved the participation of privately originated resources that would progressively assume a more important role, along with public resources for scientific and technological infrastructure.

Taguspark has a total area of 3,500,000 m², with 110 companies operating in various market segments. It is situated in the municipality of Oeiras, which is located in the metropolitan region of Lisbon. The market segments represented at Taguspark are organized into eight areas of activity and involve a multi-agency setting. Most

of the companies—such as enterprises E1, E2 and E3—are active in the area of information technology, whereas the enterprise E4 operates in the area of energy.

E1 is an information technology company that develops software for smart homes and buildings. E2's area of expertise in the park is also information technology: the company specializes in panoramic photography and focuses on innovation and internationalization through computer technologies associated with digital imaging and design.

E3 is another information technology company; it develops fleet management and remote equipment access control points and technology. Thus, the company cooperates with educational and research institutions. E4 acts within the energy area of the park and develops cutting-edge technology to develop energy based on photovoltaic system.

The surveyed companies are located in Taguspark and its business incubator (Table 4). E1 and E2 were installed as incubator companies that entered from the selection of its business projects to pre-incubation, whereas E3 entered the park directly, and E4 initially joined the incubator and subsequently entered the park.

Table 4: Characteristics of the companies surveyed in Taguspark.

Company	Company data			
	Incubated	Foundation	Jobs	Area of work
E1	Yes	2008	8	Information technology
E2	Yes	2011	3	Information technology
E3	No	1988	40	Information technology
E4	No	2006	22	Energy

Source: Developed by the authors.

It was found that the average age of the firms is approximately ten years, with a range from two to twenty-five years. The twenty-five-year-old company

was spun off from the Instituto Superior Técnico (IST), and the other companies were created in the incubator Taguspark, i.e., developed in the park.

Moreover, it was observed that the number of employees of the surveyed companies ranges from three to forty, corresponding to an average of eighteen. Generally, the surveyed companies are small and seek to consolidate their markets.

Interorganizational relationships in Taguspark have been determined by the need for resources, the need for reciprocity and the search for legitimacy (Table 5). The need for resources—e.g., skilled human resources—was a motivator for companies to establish relations with the educational institution in the park. "The important thing was to be close to the IST because we have researchers and laboratories that adjoin it. However, we have all of the benefits of the incubator because the incubator helps make the plan work and introduces us to customers and investors." (Interview E1)

Table 5: Determinants of the interorganizational relationships in Taguspark.

Determinants	Implications in interorganizational relationships
Need	E1 = information, knowledge, human resources and services E3 = information, knowledge, human resources and infrastructure
Reciprocity	E2 = cooperation with institution E3 = cooperation with company and institution E4 = cooperation with company and institution
Legitimacy	E1 = credibility and visibility for the company E3 = visibility and prestige for the company

Source: Developed by the authors.

Another company notes that "the infrastructure of the park is very important, the facilities are good and the exchange of information and knowledge with IST complements our innovation activities" (Interview E3). Furthermore, there is evidence of reciprocity and "the qualified personnel at IST enable project partnerships" (Interview E4).

Businesses realize the availability of park resources because "they have qualified staff at IST, which is considered to be the best engineering school in Portugal" (Interview E3). "IST is very important because [...] all of our company's employees came from IST" (Interview E1). "Companies come here because IST has a laboratory and qualified human resources" (Interview T1).

Additionally, companies seek legitimacy by settling in Taguspark, which enjoys a positive image in Portugal as a high-tech environment. "Having a company in Taguspark is very good because it is a center where there are well-known companies, where there is development. The Tagus has a name. It gives you a great deal of visibility" (Interview E1).

Ultimately, "The facilities at Taguspark have prestige, because people know that if we were somewhere else, it would not be the same. A technology park has a component of prestige" (Interview E3). Thus, legitimacy is characterized as a determinant in the formation of interorganizational relationships at Taguspark.

6. RESULTS AND DISCUSSION

According to the empirical evidence, the two analyzed cases have similarities in the factors that determine the formation of interorganizational relationships between companies and/or institutions, whether with scientists or the technological park itself. Thus, it is observed that the companies of Tecnosinos and Taguspark both have and need to obtain resources such as information, knowledge, skilled personnel, infrastructure and services, all of which constitute essential attributes for survival. Therefore, the need for these resources is explained by the business parks' high level of technology and development of innovation activities.

The need to obtain resources was a key factor in the formation of interorganizational relationships at Tecnosinos and Taguspark. Initially,

companies showed a need to obtain funds through knowledge and information exchange with other companies and through the required infrastructure and services that are available in the park. Next, companies reported a need for resources such as information, knowledge and the qualified staff of other companies and educational and research institutions, with the required infrastructure and services provided by the park.

In this sense, companies establish exchanges because of resource scarcity in the environment (LEVINE; WHITE, 1961). The need for external resources results from environmental pressure and hence this external dependence takes into account the importance of the resource for business continuity (PFEFFER; SALANCIK, 1978).

Moreover, reciprocity between organizations, whether companies or institutions, results from cooperation motivated by the collective gains that originate in resource exchange. In Tecnosinos, interactions among firms prevail, whereas in Taguspark, most interactions occur between companies and educational and research institutions. However, in both parks, an interest in exchanging information and knowledge is essential for R&D.

Reciprocity between companies and institutions was also another determinant for the formation of interorganizational relationships in Tecnosinos and Taguspark. Reciprocity was a factor present in cooperation between companies and cooperation with institutions for the development of products and services that would result in collective gains. The scarcity of resources in both parks has led to cooperation between companies to complement their competencies.

Cooperation and/or collaboration between organizations are intended to achieve common objectives, interests or mutual benefits (ASTLEY; FOMBRUN, 1983). Thus, it has been assumed that the process of interorganizational relationship formation is based on balance, harmony, equity and mutual support.

The legitimacy sought by companies at the two parks shows that companies have been influenced by environmental pressures. Legitimacy is a response to environmental uncertainty and allows a company to adapt to its environment (ZUCKER, 1987), in this case, primarily because the firms at Tecnosinos and Taguspark are small businesses.

The quest for legitimacy is characterized as another determining factor in the formation of interorganizational relationships in both Tecnosinos and Taguspark. Although legitimacy is a low-level influence in both cases, we note the competitive environmental pressures in both countries. These pressures force companies to seek legitimacy through the establishment of interorganizational relationships in the parks, with the aim of establishing a positive image in their environment.

Status, prestige, credibility and visibility are the results sought by Brazilian and Portuguese companies attempting to establish links that increase their legitimacy in the business environment. This environment generally influences organizations, which are conditioned to seek legitimacy through institutional pressures (ZUCKER, 1987).

Thus, organizations make a strategic choice to establish interorganizational relationships, even if that choice is driven by environmental pressures (PROVAN; SYDOW, 2008). Those inter-relationships can be understood as a response to environmental pressures to obtain collective gains that would be difficult to achieve through individual action (BALESTRIN; VERSCHOORE, 2008).

Therefore, the need for reciprocity and legitimacy are identified as key determinants in the formation of interorganizational relationships in the parks (Table 6), highlighting that some factors simultaneously contributed to motivate companies to acquire new resources, share resources and seek legitimacy. It becomes clear that necessity and reciprocity were the strongest determinants in both parks, followed by legitimacy.

Table 6: Determinants of interorganizational relationships in the parks.

Tecnosinos	Taguspark
Need (information, knowledge, infrastructure and services)	Need (information, knowledge, human resources, infrastructure and services)
Reciprocity (cooperation with companies and institutions)	Reciprocity (cooperation with companies and institutions)
Legitimacy (status, prestige and credibility)	Legitimacy (credibility, visibility and prestige)

Source: Developed by the authors.

The results are similar to those found by Balestrin and Verschoore (2007) for reciprocity and legitimacy in the context of the Polo de Informática de São Leopoldo (currently known as Tecnosinos). Moreover, those authors' results are different in that their study does not identify how to determine necessity. It is worth mentioning that ten years separate that study and this one and that the companies analyzed are not the same; therefore, the motivations found tend to be different.

However, it appears that the empirical evidence corroborates the results of Balestrin and Verschoore (2007) and Babiak (2007), considering that the determinants of the formation of interorganizational relationships advocated by Oliver (1990) are proven empirically. Oliver's (1990) theoretical evidence is explained by the empirical evidence found in this study, which demonstrates that analysis in the context of science and technology parks.

7. CONCLUSION

The evidence corroborates and provides empirical support for the theoretical evidence found by Oliver (1990), showing that the determinants of the formation of interorganizational relationships are explained by internal and/or external factors. These determinants can be summarized according to six

critical contingencies: necessity, asymmetry, reciprocity, efficiency, stability and legitimacy (OLIVER, 1990).

The primary conclusions of this research are represented by the theoretical and empirical evidence found in the context of science and technology parks. The need for reciprocity and legitimacy proved critical to the formation of interorganizational relationships. Although these determinants match the primary theoretical and empirical evidence, there are other elements that may influence the relationship, including cultural aspects, environmental uncertainty, risk aversion and mistrust. Moreover, despite the fact that the empirical evidence indicates the factors that determine the formation of the interorganizational relationships analyzed in the parks, it is not implied that other parks are governed by the same factors or the existence of interorganizational relationships.

Thus, this study fills an important gap in the literature of interorganizational relationships; in particular, it fills the gap related to the grounds (contingencies) that lead organizations to promote the formation of such relationships. Although there is an increasing amount of literature on interorganizational relationships, few studies explore the reasons for their formation (BABIAK, 2007). The empirical evidence is advanced in discussions of the literature, hence corroborating other studies (BALESTRIN; VERSCHOORE, 2007; BABIAK, 2007) and the application of that evidence in other contexts.

This study also presents a theoretical contribution in that it investigates the reasons for the formation of interorganizational relationships in the context of science and technology parks in emerging countries (e.g., Brazil) and in peripheral countries of the European community (e.g., Portugal). In this sense, this study follows other studies on the investigation with other settings involving interorganizational networks (BALESTRIN; VERSCHOORE, 2007) and serves as a resource for comparison in other emerging countries.

Conversely, the contribution of this study is supported by empirical evidence showing multilateral interactive relationships—i.e., relationships among three or more organizations (CROPPER et al., 2008.)—, going beyond the conceptual framework proposed by Oliver (1990), which is evidenced by relationships involving an interactive dyadic—i.e., relationships between two organizations. Likewise, the empirical evidence is similar to that found in other studies (DAS; TENG, 2002; TODEVA; KNOKE, 2005; BALESTRIN; VERSCHOORE, 2007), which show that firms that establish ties with other companies to improve their image in the community acquire valuable resources and exchange knowledge and information.

The implications for management practices arise out of an understanding of the factors that may facilitate or hinder the formation of interorganizational relationships. Managers can glean insights into how the empirical evidence benefits their practice by using information strategically to shape the structure, governance and resource allocation of their collaborative relationships based on their partners' reasons for forming interorganizational relationships. Moreover, if managers understand the factors that determine relationship formation, they may be able to maximize the benefits of their relationships.

The investigations contain some limitations, particularly because the generalizability of this study's results is limited: this is a case study of a single type of context, which can reduce the possibility of using the theoretical and empirical evidence to explain the interorganizational relationship phenomenon in other contexts. There are also limitations on the research method used because the case study method does not allow for the generalization of its results.

In future research, it is suggested to apply other methods and research techniques to highlight new findings or complementary results. Moreover, it would be timely to understand the occurrence of

longitudinal effects in an analysis of the maintenance of interorganizational relationships. The results show advantages in their formation. On the other hand, we notice a growing number of relationships between firms, indicating restrictions on companies such as competition for scarce environmental resources. In other words, the formation of interorganizational relationships appears to be somewhat contradictory because they are complementary to the companies involved: interorganizational coordination (LITWAK; HYLTON, 1962; WHETTEN, 1981),

can provide advantages such as the efficient use of resources, better access to resources, increased competitiveness, an increased ability to solve problems and the ability to innovate (GRANDORI; SODA, 1995; PROVAN; KENIS, 2008). These aspects need to be explored in future research.

Another suggestion might be perceived by the following question: what is the degree to which these determinants influence the decisions of the organization to form interorganizational relationships?

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