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### Article

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## Article

# The Structure and Nature of Social Capital in the Relationship between Spin-Offs and Parent Companies in Information Technology Clusters in Brazil and Spain

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**Abstract:** The objective of this research is to determine how proximity between organizations promotes the intensity of relationships and facilitates the exchange of information and knowledge in the relationship between the parent firm and the spin-off and its influence on organizational performance. Therefore, four constructs related to business competitiveness are integrated: networks, social capital, spin-offs, and innovation. The loci of the research were two clusters of Information and Communication Technology, with a sample of 166 companies in Brazil and 66 in Spain. Structural Equation Modeling was applied. The results indicate that geographical proximity between organizations promotes the intensity of relationships and facilitates the exchange of knowledge between the parent firm and the spin-off, but it cannot be said that geographical proximity impacts innovation for the parent firm. Furthermore, because the parent firm relates to its spin-off, the parent firm did not perform better than the nonparent companies with other companies. This study improves the understanding of companies that are in a business cluster, and its results have both institutional and business implications for the Information and Communication Technology (ICT) sector.

**Keywords:** spin-off; business cluster; structural equation modeling; Information and Communication Technology



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## 1. Introduction

The present study addresses the environments in which Information and Communication Technology (ICT) impact interorganizational and work relationships. This is particularly important due to the growing demand for innovations and the incentive for the formation of new companies (Wallin 2012). In these environments, according to the literature on entrepreneurship, many new businesses arise from other companies (Parhankangas and Arenius 2003), and this phenomenon is called spin-off in the literature (Wallin 2012; Bagley 2019b; Furlan and Cainelli 2020). The justification for the choice of subject was that there are few studies on the relationship between the parent firm and the spin-off, especially regarding what happened between the two after the separation, which is important for studies of spin-offs, due to its relevance to the regional economy and national level (Wallin 2012) and also for studies of inter-organizational relations of cooperation and trust, as well as social capital (Oudenotis and Tsobanoglou 2022).

This relationship can occur in several types of contexts in the ICT sector. One of them is that of clusters, defined as an environment where economic and social relations are mixed (Molina et al. 2008; Torres et al. 2021). It is not uncommon for social capital to emerge in

industrial clusters (Molina-Morales et al. 2013). Social capital is an important construct for explaining the probability of survival and success of new ventures, as well as individual access to external knowledge through social networks to develop the ability to recognize and explore new ventures (Audretsch et al. 2011).

This research aims to determine whether geographic proximity<sup>1</sup> between organizations promotes the intensity of relationships and facilitates the exchange of information and knowledge in the relationship between the parent firm and spin-off and its influence on organizational performance. For this purpose, an adaptation was made to the theoretical model developed by (Molina et al. 2008), as this study aimed to fill the following gap: conducting research in another economic sector, different from the ceramic sector, and choosing ICT. Additionally, the study contributes by discussing the subject of social capital in the interorganizational relationship between parent companies and spin-offs and by making a comparison between two countries, Brazil and Spain. In methodological terms, the use of structural equation modeling favors a more integrated and comprehensive understanding of different constructs (Hair et al. 2005), going beyond the original proposal by Molina et al. (2008).

## 2. Social Capital, Innovation, and Spin-Off in Clusters: Theoretical Proposal and Hypotheses

Territorial clusters (or clusters) have been studied in various economic sectors, including in the area of technology (Kerr and Robert-Nicoud 2020; Eiriz and Barbosa 2022). Clusters of ICT companies correspond to the largest number of related investigations (Stam and Elfring 2008; Wallin 2012; Bagley 2019a, 2019b). ICT clusters are characterized by the formation of Small and Medium-sized Enterprises (SMEs), such as Silicon Valley and Route 128 in the USA (Saxenian 1996) and 22@Barcelona in Spain (Viladecans-Marsal and Araujo-Carod 2012).

ICT companies generally have the potential for innovation development and knowledge accumulation, which is rooted in their human capital, that is, employees or owners (Agarwal et al. 2004). When individuals working in clusters leave their parent companies to form a new company (spin-off), they take their knowledge and contacts, becoming part of the initial resource base of the new company (Agarwal et al. 2004). By preserving the link with the parent firm, the spin-off can use some of the assets of the parent firm, safeguarding some advantages in a network relationship. In addition, compared with other new companies, spin-offs are born with a competitive advantage, as they may have gained from previous experiences and the relationships built (McKendrick et al. 2009; Bagley 2019a; Furlan and Cainelli 2020; Juhász 2021).

In the theoretical body of research on organizational networks, several approaches (Zaheer et al. 2010) have identified three levels of relationships: the dyad (between two actors), the interorganizational set (double, one organization with others), and interorganizational networks (all organizations united by relationship bonds). In this study, relationships at the dyad level are adopted because they are relationships between two organizations: one is the parent firm, and the other is its respective spin-off (Fryges et al. 2014).

The ties can be strong or weak (Granovetter 1983). Strong ties tend to unite similar people in long-term relationships. In contrast, weak ties are superficial or casual and are characterized by little emotional investment. The strength of ties is defined as the intensity and diversity of relationships based on a combination of four criteria: the frequency of contact, the intensity of the emotional relationship, the degree of intimacy, and the reciprocal commitments between the actors (Granovetter 1983), that each of them is independent of the other but intracorrelated. Although studies have demonstrated the advantages and importance of weak ties (Granovetter 1983), other authors consider that both weak and strong ties play important roles in relationships (Hite 2003). Thus, the bond is a relevant variable in networks, and for this reason, the following hypothesis is proposed:

**H1.** *The interrelationship between the parent firm and its spin-off in the clusters determines a dense structure and strong ties.*

Research suggests that frequent and repeated links between two organizations increase trust between them and engender future ties (Oudenotis and Tsobanoglou 2022; Soda and Zaheer 2012). Greater trust in interorganizational relationships reduces transaction costs and allows greater benefits from these relationships (Zaheer et al. 2010), improving firm performance (Soda and Zaheer 2012). In particular, the interorganizational relationships between parent companies and their spin-off companies generate exchanges of resources (McKendrick et al. 2009), such as specialized knowledge (Fryges et al. 2014).

Information and knowledge are terms that can have several definitions depending on the perspective researched and the authors who studied them, yet they are interconnected (Stenmark 2002). However, the aforementioned author defines information as something objective, independent, with a reality on the basis of content, and that needs knowledge to be interpreted. Knowledge, on the other hand, requires confidence, beliefs, values, experiences, skills, and insights, among other attributes, which can be tacit or explicit.

Technological know-how is usually incorporated into human capital, where skills and techniques are easily transferred as they are embedded in specialized work (McKendrick et al. 2009). When separating, the founders of new ventures often take advantage of their knowledge and skills or routines, which usually form the core of their activities (McKendrick et al. 2009; Juhász 2021). These bonds can support the transmission of knowledge between companies, which often occurs through employee mobility. Hence, the second research hypothesis is as follows:

**H2.** *The interrelationship between the parent firm and its spin-off in the clusters promotes the exchange of quality information and knowledge through strong ties.*

Social relationships influence economic action, which can result from the decision-making process of an individual, taking into account both personal and social factors (Granovetter 1983). Based on these relationships, social networks are created. Social networks can have various definitions in the organizational sphere and, in a broader sense, are a set of actors (individuals or organizations) connected by a certain type of relationship built through the identification of ties (formal or informal) where exchanges take place between tangible and intangible resources (Anand et al. 2002). Some authors argue that social networks can become the means by which the managers of organizations acquire knowledge from outside the firm (Anand et al. 2002; Nahapiet and Ghoshal 1998).

Social capital comprises norms, values, and social relationships embedded in the structures of groups in society that allow people to coordinate actions to achieve desired goals. People in companies are part of the different social groups that determine attitudes, beliefs, and values, as well as access to resources, opportunities, and power (Molina-Morales et al. 2013). In addition, social capital can be considered the set of available resources incorporated in the environment and derived from a network of relationships that an individual or an organism has (Molina-Morales et al. 2013). The central proposal of these definitions is that relationship networks are a valuable resource, both for the individual and for the organization (Padilla-Meléndez et al. 2012).

A parent firm that develops spin-offs while maintaining ties with them takes more advantage of the new knowledge created and the exploration of new ideas due to the possibility of complementarity in their activities (Bagley 2019b; Agarwal et al. 2004). These network structures, managed by the parent firm, can reduce the high volatility of rents arising from the exploitation of new ideas. Thus, spin-offs allow the parent firm to preserve its property rights and, at the same time, maintain social networks (López-Iturriaga and Martín-Cruz 2008). Therefore, the following hypothesis is proposed:

**H3.** *The relationships between the parent firm and its spin-off in business clusters produce norms and values that regulate the exchange of knowledge between them.*

The essence of social capital lies in the structure and content of the social actions of each actor, and its impact derives from the amount of information, influence, and cooperation

that is made available to each actor (Oudeniotis and Tsobanoglou 2022; Anand et al. 2002). According to the aforementioned authors, social capital acts as a driver in the formation of cooperative organizational alliances due to interactions among its members.

These social interactions are important for the creation and diffusion of innovation, so that individuals linked to others will improve their ability to share knowledge and thus create new knowledge and innovate (Padilla-Melendez et al. 2012). In their study in Silicon Valley, (Audretsch et al. 2011) reported that the production of knowledge and innovations offers opportunities for the development of social capital, which is necessary for the creation of new companies.

However, (Molina et al. 2008) believe that excessive interaction between the same actors within a cluster can reduce the efficiency of their economic relations from a certain point onward. This argument is supported by (Nooteboom 2006), who considers clusters to hinder perceptions of external changes due to the strong relationships between actors internally. (Glasmeier 1991) exemplifies what happened to the Swiss watch industry, which went into decline in the 1970s due to the low flow of new external information.

(Molina et al. 2008) proved that the positive effect of social interactions is not necessarily linear. According to the latter authors, initially, the new contacts that are formed generate positive effects, but then a reduction in these benefits or even antagonistic effects is expected. This can be found in the literature as evidence that the relationship between the benefits of strong ties and returns may even be negative as the relationship grows in a cluster (Nooteboom 2006). Thus, the fourth research hypothesis is presented:

**H4.** *The strong ties in the social relationships between a geographically grouped parent firm and its spin-off produce a decrease in results after a certain point or level of intensity.*

From a sociological point of view, social and professional ties and networks, trust, relationship length, and values and rules are factors identified as important for business clusters (Hite 2003; Nadvi 1999). The economic relationships between firms occur within a web of social relationships in which institutionalized social norms and values internalized by economic actors tend to influence the emergence of interfirm relationships (Granovetter 1983; Nadvi 1999).

The organizations seek to emphasize cooperation and coordination among themselves rather than domination, power, and control. However, the environment imposes pressure on organizations to justify their activities and results, which motivates them to increase their legitimacy so that agreements with norms, rules, beliefs, or expectations of external constituents appear (Oliver 1990). The legitimacy of actors' actions is associated with the fulfillment of these agreements, reducing uncertainties, as interactions share meanings that are altered or reproduced among participants in a process of constant interpretation of reality (Nadvi 1999).

Furthermore, (Molina et al. 2008) argue that even in cases where the benefits obtained from dense networks are important, the obligations—in terms of trust, reciprocity, solidarity, etc., as well as the difficulties of companies in trying to minimize these obligations—reduce their capacity to obtain new business opportunities. For the aforementioned authors, the effort and time spent by companies to maintain these relationships negatively influence their results. Based on these arguments, the fifth research hypothesis is proposed:

**H5.** *Common norms and values generate obligations between the parent firm and its spin-off and produce decreasing returns after a certain point or level.*

Performance usually refers to the economic and financial aspects of a company, such as an increase in the company's market value (Chesbrough 2003), investments in R&D (Fryges et al. 2014), or revenue growth (Sapienza et al. 2004). Some studies also use the number of spin-offs that the parent firm has as a performance measure (Klepper 2011), and others use the company survival time as a performance indicator (Agarwal et al. 2004).

Innovation plays an important role in the relationship between parent companies and spin-offs, especially in the information technology sector (Agarwal et al. 2004). Innovation is measured in several ways, including by the number of patents, the intensity of investment in R&D (Andersson et al. 2012), or the development of new products (Fryges et al. 2014).

For this study, the performance construct was constructed with measures related to innovation, using a combination of indicators adapted from (Molina et al. 2008): the number of patents or legal protection rights, the number of R&D contracts, the number of new products/services, the number of distinct technologies introduced by the company, the number of quality marks, awards or some type of certification that the firm won, the introduction of new production/service control systems, the company's level of innovation compared with its competitors, the level of investment in R&D, the speed of developing new products/services compared with competitors, and the customers' evaluation of the innovations that the firm develops.

According to the study by (Dahlstrand 1997), technology-based spin-off companies perform better than nonspin-off companies do in clusters. According to this author, these better results are attributed to their relationship with the parent companies. Some authors, such as (McKendrick et al. 2009), have studied what happens to a parent firm after it has a spin-off. They found that there is a positive relationship with the technological performance of the parent firm, with its market realignment, and with having a spin-off. Thus, the sixth research hypothesis is presented:

**H6.** *The interrelationship between the parent firm and its spin-off produces greater levels of innovation for the parent firm than for nonparent companies with other companies.*

Several authors point to evidence that local institutions impact the results of companies in territorial clusters (Hoffmann et al. 2014). A study by (Saxenian 1996) comparing Silicon Valley and Route 128 highlights the importance of local institutions as potential drivers of the formation of business clusters. According to (Molina et al. 2008), the notion of a community of people who predominate in clusters can be seen as a homogeneous system of values and social norms because they have the same expectations, forms of conduct, language, etc., which are spread throughout the cluster.

Within the clusters, there are local, public, and private institutions, such as universities, public officials, and business and professional associations, that provide their services to territorially agglomerated companies (Molina et al. 2008). According to (Hoffmann et al. 2014), these local institutions play a key role in clustering because, in addition to benefiting from the agglomeration of companies in a particular sector, they are responsible for the flow of knowledge and the attraction of qualified personnel to the geographical area (Molina-Morales et al. 2013).

Notably, the relationships of companies with local institutions can also affect innovation (Molina et al. 2008). According to (Hoffmann et al. 2014), public institutions and local government support are essential for the establishment of public policies that encourage technological innovation by companies. Based on these empirical contributions, the following hypothesis is proposed:

**H7.** *Local institutions act as intermediaries, providing clusters with a variety of knowledge resources that lead to higher levels of innovation in the parent firm.*

Originating in the area of strategy, entrepreneurial orientation (EO) is understood as entrepreneurship at the organizational level, portraying processes, methods, and management styles used to create new ventures (Miller 1983; Lumpkin and Dess 1996; Lee et al. 2001; Parga-Montoya and Cuevas-Vargas 2023). Several researchers have devoted efforts to studying the relationship between EO and organizational performance. Their results indicate that entrepreneurial orientation can positively influence performance, highlighting the fact that organizations with higher EO tend to be more successful than organizations with lower EO (Wiklund and Shepherd 2005) and are more involved with innovation.

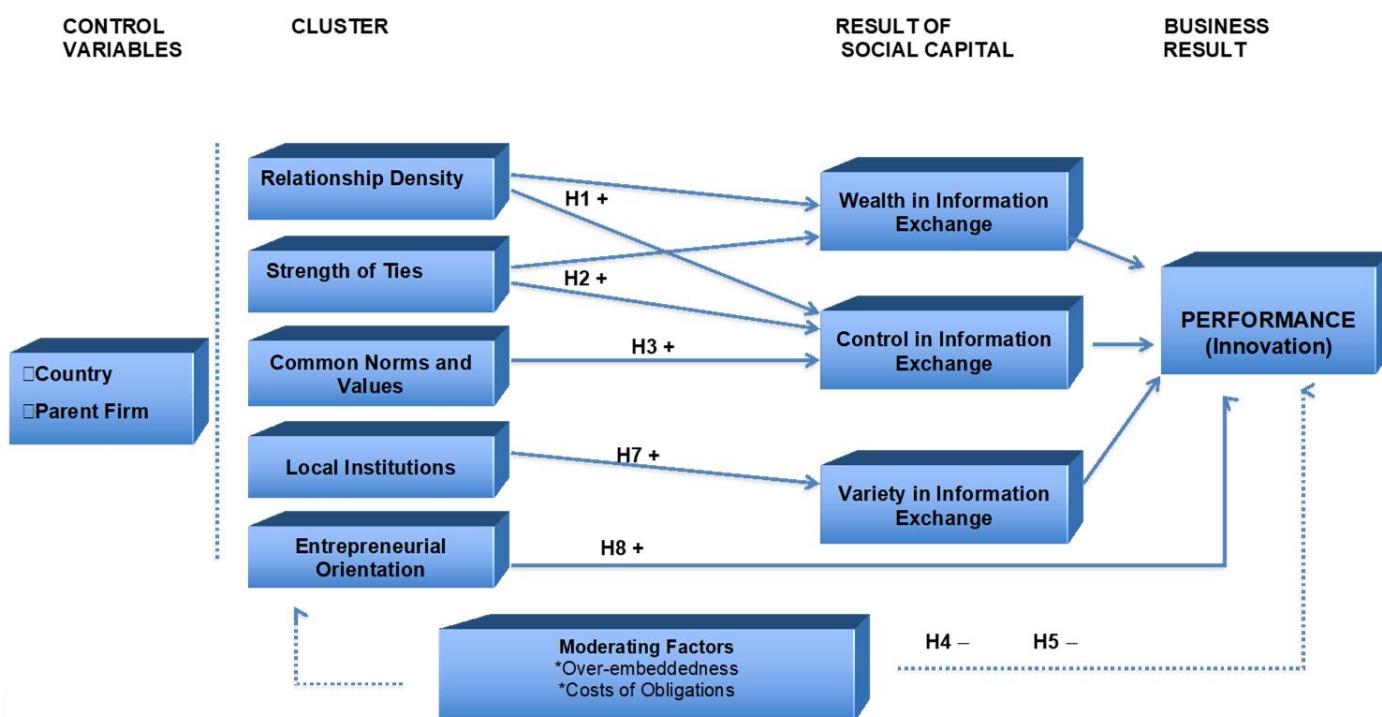
Conceptually, (Lee et al. 2001) distinguish three dimensions of EO: innovation capacity, propensity to take risks, and proactivity. In the study by (Venkatraman 1989), the three dimensions were investigated using primary data, asking company managers about their perceptions of them.

The first dimension is innovation capacity, which reflects a firm's propensity to engage in a new generation of ideas, experiences, and R&D activities, resulting in new products, services, and processes (Lumpkin and Dess 1996). In the second dimension, companies exhibit a propensity for risk-taking behaviors, in which they seek to invest resources in high-risk activities and in businesses with high returns. This dimension assesses the ability to perceive new businesses or their propensity to take risks in uncertain ventures (Lee et al. 2001). The last dimension of EO is proactivity, which refers to a company's willingness to explore market opportunities and to pioneer the introduction of new products/services (Lumpkin and Dess 1996; Venkatraman 1989).

Entrepreneurship is responsible for the creation of new companies (Andersson et al. 2012), and the phenomenon of giving rise to another firm can also be the formation of a spin-off. If the company that gave rise to another (parent firm) has an entrepreneurial orientation, this will reflect on the relationship with its spin-off through the exchange of resources and knowledge, which may reflect the performance of the parent firm. The eighth hypothesis of this study is as follows:

**H8.** Compared with those of nonparent companies, the entrepreneurial orientation of parent companies in business clusters results in greater levels of innovation.

According to (Molina et al. 2008), the results point in the direction of initial expectations that companies in clusters have high density in their relationships; consequently, they have shared norms and values and benefit from access to quality information, which can contribute to access to new knowledge. These findings support the idea of relating the structure and nature of interorganizational links to the innovation capacity of companies. To address the gaps noted in the conclusions of the studies by (Molina et al. 2008), this study proposes adapting the model of the aforementioned authors, as shown in Figure 1.



**Figure 1.** Theoretical Research Investigation Model. Source: Authors' study based on the original study by Molina et al. (2008).

### 3. Materials and Methods

To better understand the phenomenon to be investigated, a descriptive study with a quantitative approach was adopted. As in the study by Molina et al. (2008), a survey was administered. The sample collected in this study was nonprobabilistic, voluntary, and convenient.

Data collection was performed in two clusters. The choice of the cluster of the State of Santa Catarina in Brazil is because the ICT sector of Santa Catarina has stood out both in the Brazilian and global scenarios. In Spain, the ICT cluster of the Province of Barcelona was chosen because of its importance for Spain and Europe, as it stands out as a knowledge and innovation economy (Barcelona City Council 2012). The Brazilian government, through the Ministry of Development, Industry and Foreign Trade—MDIC/Brazilian Observatory of Local Productive Arrangements, defines the Santa Catarina ICT cluster as integrated by several cities such as São José, Joinville, Blumenau, Lages, Brusque, Palhoça, Jaraguá do Sul, Penha, Chapecó, and Criciúma, among others, with Florianópolis as the hub city ([http://icts.unb.br/jspui/bitstream/10482/42226/1/2021\\_RoseNofal.pdf](http://icts.unb.br/jspui/bitstream/10482/42226/1/2021_RoseNofal.pdf), accessed on 22 August 2015). In this way, the study in Santa Catarina involved the cities of Florianópolis (capital and hub), Joinville, Blumenau, and Brusque. The justification is given by the presence of the main associations of companies in the ICT cluster of Santa Catarina, which are ACATE (Florianópolis), BLUSOFT (Blumenau), and SOFTVILLE (Joinville). For the Brazilian Government and the State of Santa Catarina, these regions are considered a single geographic territory for the ICT cluster. In Spain, due to the lack of official data, an aggregate number of companies from all the studied clusters was not found. Thus, based on the number of companies that each business center reports on their websites or in their yearbooks, 2000 companies were estimated in the ICT cluster of the Province of Barcelona in the following business centers: 22@Barcelona, Parc Tecnologic del Vallès, Esadecreapolis, BarcelonaTech, Fundació b\_Tec, Orbital 40, Parc Científic de Barcelona, Parc de Recerca UAB, TecnoCampus Technological Park, and Technova Barcelona. In the same way as in Brazil, these business centers are understood as a single ICT cluster.

To reach the companies surveyed, records were obtained from AMETIC (Multi-sector Association of Electronics, Information and Communication Technologies, Telecommunications and Digital Content Companies) and 22@Barcelona in Spain and from ACATE (Santa Catarina Technology Association) and Oficina da Net in Brazil. Thus, the sample collected in this research was characterized by being non-probabilistic, and for convenience, that is, despite work being carried out to raise awareness of the importance of the study, the individual responded to the questionnaire optionally. A pretest was applied to five companies in each ICT cluster (Brazil and Spain), and the final questionnaire was sent through Google Docs to the 540 companies registered in Barcelona and 560 in Brazil. After 30 days, telephone interviews were conducted via Google Docs with companies that did not respond. The final sample consisted of 160 companies in Barcelona (29.63% return) and 66 companies in Brazil (11.79% response rate), for a total of 226 questionnaires answered, for a return rate of 20.55%.

The variables used were adapted from the study by Molina et al. (2008), according to Table 1.

The scale underwent a new validation due to the inclusion of the variable “entrepreneurial orientation,” and tests of internal consistency and reliability of the measurement scales were performed using Cronbach’s alpha with multi-item scales (Molina et al. 2008). All the constructs had indices greater than 0.7, which is considered appropriate (Lattin et al. 2011). In addition to the variables in Table 1, control variables were used, with dummy variables indicating whether the respondent was a parent firm or not or another country of origin. Regarding the outliers, the few cases that emerged were maintained for theoretical reasons related to the innovation construct (Hair et al. 2005).

Structural Equation Modeling (SEM) was used as the data analysis technique. The maximum likelihood (ML) method was chosen as the estimation technique because it is the most widely used method and is appropriate for samples from more than 100 observa-

tions (Hair et al. 2005; Marôco 2014; Gu et al. 2023); additionally, all the methodological assumptions were met for this study.

**Table 1.** Research variables.

Variables	Indicators
<b>Density of the relationship (Density)</b>	Degree of knowledge and information overlap; degree of interconnection and dependence that the firm has on this network to obtain these resources.
<b>Strength of ties (Strength)</b>	Intimacy (proximity of contact); frequency (number of times of contact); to the extent that managers and workers have already worked in other companies in the same area of the cluster.
<b>Rich exchange of information and knowledge (Rich)</b>	Quality information and tacit knowledge; organizational learning; information more relevant and detailed than that of the market.
<b>Common norms and values (norms)</b>	Trust, reputation, reciprocity, and conflict resolution without legal proceedings and no contractual regulation between companies.
<b>Local institutions (institutions)</b>	Number of positions or important positions in the associations; importance for obtaining information and knowledge; and for innovation.
<b>Entrepreneurial orientation * (Orientation)</b>	Innovative capacity, proactivity, and risk-taking.
<b>Innovation (Performance)</b>	Number of patents and other property rights; contracts; number of new products; technologies used; number of product or firm certifications and introduction of improved processes; evaluation of innovation in relation to its competitors.

\* Source: (Lumpkin and Dess 1996; Perlines 2014).

#### 4. Results and Discussion

Table 2 presents the descriptive statistics (mean, median, standard deviation, kurtosis, and asymmetry) and the standardized variables. Missing data were filled in by the mean of each of the observable variables, and the number of respondents for all questions was equal to 226.

In Table 2, for the confidence interval of this research, the value 4 was taken as a reference, which is the center of the scale from 1 to 7. Thus, situations in which the number 4 is between the lower limit and the upper limit indicate neutrality. Upper limits below this level indicate non-agreement with the statement (Kline 2011).

For univariate analysis, measures of central tendency, mean, and median were used. In the constructs “Density of the Relationship,” “Rich Exchange of Information and Knowledge,” “Common Norms and Values,” all observable variables have a mean and median greater than 4, that is, approaching the maximum value of the scale. In the “Strength of Ties” construct, only the variable P3\_4 presents a mean lower than 4, but the mean of the construct as a whole is 4.51. The same occurs with the constructs “Performance/Innovation” and “Entrepreneurial Orientation,” which have some variables below 4 (global means of 4.12 and 4.64, respectively). Only the “Local Institutions” construct presents a global mean of 3.36, but, despite being lower than 4, it is close to it. In the work of Molina et al. (2008); (Molina et al. 2008), only the “Innovation” construct presented a mean lower than the central value of the scale.

**Table 2.** Descriptive statistics of the observable variables of the constructs.

Construct	Observ. Variable	Min. *	Max. *	Inf. Lim. **	Mean	Upper Limit **	Mn	Stand. Dev.	Kurt.	Asym.
Density of the Relationship	P2_1	-1.86	1.58	4.02	4.25	4.48	4	1.74	-0.273	-0.939
	P2_2	-1.99	1.30	4.39	4.63	4.87	5	1.82	-0.460	-0.958
	P2_3	-1.99	1.49	4.21	4.44	4.66	5	1.72	-0.280	-0.908
	P2_4	-2.09	1.54	4.24	4.46	4.67	5	1.65	-0.346	-0.818
Strength of Ties	P3_1	-2.73	1.11	5.07	5.27	5.47	6	1.56	-1.086	0.581
	P3_2	-2.22	1.26	4.60	4.82	5.05	5	1.72	-0.568	-0.719
	P3_3	-2.22	1.39	4.47	4.69	4.91	5	1.67	-0.634	-0.314
	P3_4	-1.07	1.75	2.99	3.27	3.55	3	2.13	0.426	-1.223
Rich exchange of Information and Knowledge	P4_1	-2.06	1.50	4.25	4.47	4.69	5	1.69	-0.374	-0.896
	P4_2	-1.94	1.53	4.12	4.35	4.58	5	1.73	-0.315	-1.002
	P4_3	-2.07	1.49	4.27	4.49	4.71	5	1.68	-0.350	-0.793
	P4_4	-1.84	1.41	4.16	4.40	4.64	5	1.84	-0.290	-1.191
Common norms and values	P5_1	-3.33	1.03	5.40	5.58	5.76	6	1.38	-1.371	1.883
	P5_2	-2.49	1.16	4.88	5.09	5.31	6	1.65	-0.852	-0.165
	P5_3	-4.00	1.04	5.60	5.76	5.91	6	1.19	-1.704	3.871
	P5_4	-4.42	0.99	5.55	5.72	5.89	6	1.29	-1.889	4.515
Performance	P6_1	-0.63	2.06	2.12	2.41	2.70	1	2.23	1.234	-0.124
	P6_2	-0.70	1.90	2.31	2.61	2.91	1	2.31	1.025	-0.596
	P6_3	-1.32	1.91	3.21	3.45	3.70	3	1.86	1.044	-0.454
	P6_4	-1.27	1.57	3.41	3.69	3.97	3	2.12	0.550	-1.165
	P6_5	-1.63	1.39	3.99	4.25	4.51	4	1.99	-0.025	-1.151
	P6_6	-0.93	1.99	2.65	2.92	3.18	3	2.05	0.698	-0.645
	P6_7	-1.80	1.81	3.24	3.50	3.75	4	1.94	0.131	-1.108
	P6_8	-3.20	1.35	5.05	5.22	5.40	5	1.32	-0.642	0.049
	P6_9	-3.25	0.99	5.42	5.60	5.79	6	1.42	-1.333	1.382
	P6_10	-2.10	1.74	4.08	4.28	4.49	4	1.56	-0.254	-0.496
	P6_11	-2.95	1.52	4.78	4.96	5.13	5	1.34	-0.551	0.028
	P6_12	-2.81	1.60	4.65	4.83	5.00	5	1.36	-0.577	0.066
	P6_13	-4.39	1.10	5.65	5.80	5.94	6	1.09	-1.524	3.544
Local institutions	P7_1	-1.31	1.93	3.19	3.43	3.67	3	1.85	0.346	-0.496
	P7_2	-0.67	2.53	2.01	2.26	2.50	1	1.88	1.204	0.169
	P7_3	-2.16	1.50	3.88	4.13	4.38	4	1.91	-0.243	-1.081
	P7_4	-1.98	1.94	3.31	3.54	3.77	4	1.79	0.171	-1.017
	P7_5	-1.96	2.10	3.16	3.38	3.61	3	1.72	0.138	-0.991
	P7_6	-1.98	2.05	3.21	3.44	3.67	3	1.74	0.239	-0.844
Entrepreneurial orientation	P8_1	-2.77	1.15	5.03	5.23	5.44	6	1.53	-0.935	0.117
	P8_2	-2.31	1.43	4.50	4.71	4.92	5	1.61	-0.486	-0.676
	P8_3	-2.64	1.30	4.82	5.02	5.22	5	1.52	-0.785	-0.067
	P8_4	-3.27	1.15	5.26	5.44	5.62	6	1.36	-0.963	0.329
	P8_5	-3.54	1.17	5.34	5.51	5.68	6	1.28	-1.077	0.835
	P8_6	-2.66	1.25	4.88	5.08	5.29	5	1.54	-0.735	-0.161
	P8_7	-1.86	1.85	3.80	4.01	4.22	4	1.61	0.030	-0.895
	P8_8	-2.02	1.68	4.06	4.27	4.49	4	1.62	-0.239	-0.739
	P8_9	-1.48	2.11	3.26	3.48	3.70	3	1.67	0.312	-0.736
	P8_10	-1.97	2.04	3.75	3.95	4.15	4	1.50	0.102	-0.635
	P8_11	-2.06	1.46	4.29	4.51	4.74	5	1.71	-0.259	-1.040
	P8_12	-2.58	1.50	4.60	4.79	4.98	5	1.47	-0.427	-0.568
	P8_13	-1.55	1.61	3.70	3.95	4.19	4	1.90	-0.025	-1.264
	P8_14	-2.87	1.39	4.86	5.04	5.23	5	1.41	-0.693	0.162

Note. Source: Own preparation. \* Standardized score. \*\* 95% confidence interval. Mn: Median.

These values indicate that the surveyed companies agreed that these characteristics are associated with social capital and are present in the clusters of Brazil and Spain (Cardoso et al. 2019). In other words, the indicators of the constructs obtained a mean of responses

that suggest, in this first descriptive evaluation, that these latent variables influence the interorganizational relationships studied. An interorganizational relationship is a relationship of interdependence that involves the exchange of resources, and this is at the heart of the relationships between economic subjects (Håkansson and Snehota 2006). These interactions lead to partnerships that seek solutions to common problems and produce mutual guidance and commitment (Håkansson and Snehota 1995; Andrighi et al. 2011). Interorganizational relationships and the flow of resources between organizations also occur in clusters (Hoffmann et al. 2014). Since the studies of Granovetter (MS Granovetter 1973; Mark Granovetter 1985; Nahapiet and Ghoshal 1998) and Maurer and Ebers (2006), the role of the density of relationships and common norms and values has been highlighted as facilitators of the exchange of information and knowledge between actors. This result is in line with that reported in the study by Molina et al. (Molina et al. 2008).

The standard deviation values of the observable variables shown in Table 1 suggest that there are no major discrepancies in the responses of the survey participants. This result presents the first evidence that the country effect did not influence the sample investigated (Cardoso et al. 2019). Some studies in more than one country, such as those by Parhankangas and Landström (Parhankangas and Landström 2006) and (de Figueiredo et al. 2013), did not reveal differences between samples from different countries. However, the literature indicates that there are differences between countries that can affect the results between the countries surveyed (Hofstede 1983; d'Iribarne 2009).

The normality of the data was verified in Table 1 by analyzing the values of the skewness and kurtosis measures, which were calculated for the observable variables of the evaluated structural model. According to Marôco (2014), it can be assumed that if a set of variables presents univariate normality, then the conditional distribution of the variables is multivariate normal. According to the aforementioned author, some normality tests are more sensitive to small deviations, such as Kolmogorov–Smirnov and Shapiro–Wilk tests, and are not available in Structural Equation Modeling (SEM) software. This is because they are likely to commit a type I error (concluding that the variable does not have a normal distribution when the distribution is normal) in the case of large samples.

Thus, Marôco (2014) suggests that it is common to use measures of distribution shape, asymmetry (Sk), and flatness or kurtosis (Ku) to assess the normality of variables. Kline (2011) suggests that only values of  $|Sk| > 3$  and  $|Ku| > 10$  indicate conditions of extreme violation of normality, in which the quality of the adjustment indices and parameter estimates are questionable. Thus, it can be observed in Table 1 that only the variables P5\_3, P5\_4, and P6\_13 presented values for (Sk) above the limits suggested by Kline (2011), but in a non-significant way, that is, slightly above 3. In the case of (Ku), no value was exceeded for the variables used in the original and final models tested in this study.

The original model was adapted from (Molina et al. 2008), and an acceptable level of relationship between the items and the respective constructs was observed, expressed as factor loadings above 0.4, eliminating the variables that presented lower factor loadings. The global measurement model was confirmed after the second adjustment. This model has nine latent variables and 35 observable variables. The quality of the model was assessed by evaluating the model fit (Marôco 2014), as indicated in Table 3.

In Table 3, all the models estimated in this study presented values considered good for  $\chi^2/gL$  and RMSEA, and only the original model (0.082) could be classified as a mediocre fit. Regarding the CFI, the 2nd adjustment (0.854), 2nd Country Adjustment (0.810), and 2nd Classification Adjustment (0.735) models presented indices considered good, although they did not reach values greater than 0.90, according to Byrne (2010) and Marôco (2014). For the TLI, all the estimated models presented values within the acceptable range. Thus, based on the results presented, the 2nd adjustment in the model (Figure 2), as well as the 2nd adjustment country and classification, exhibited better quality than did the original model (Arbuckle 2013; Byrne 2010).

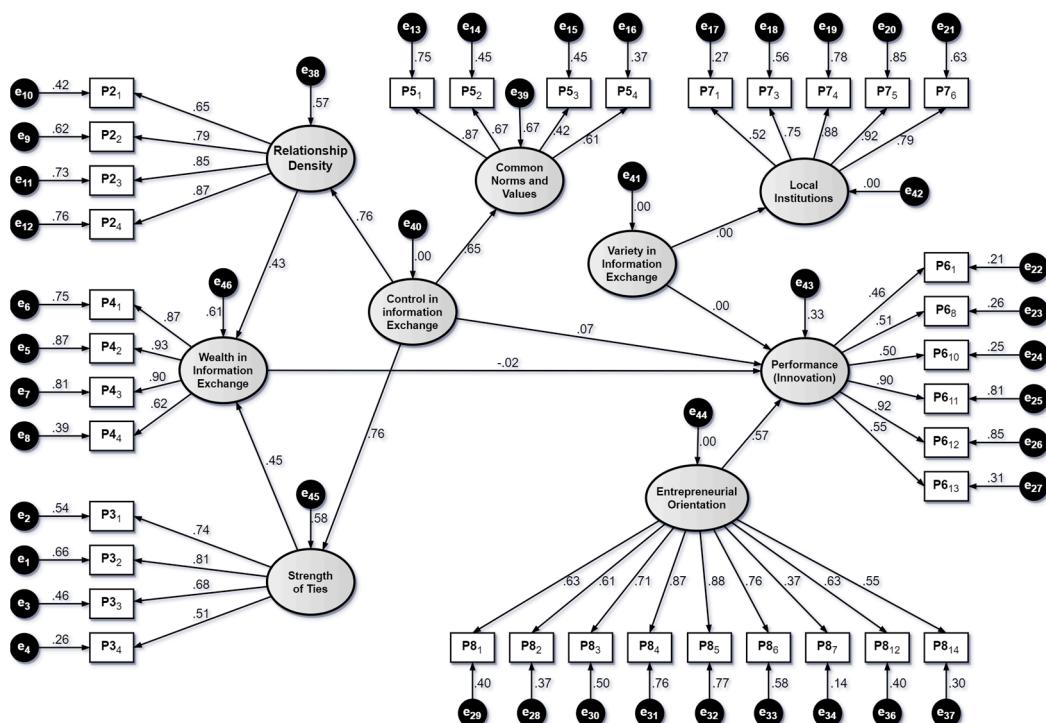
The studies conducted by (Stam and Elfring 2008) in technology companies found results considered optimal for the fit of their model, following the recommendations of

([Byrne 2010](#); [Marôco 2014](#); [Arbuckle 2013](#)), and are close to those results of this study after the 2nd adjustment (Figure 2).

**Table 3.** Fit indices of the estimated models.

Models	Index						
	X	GL	$\chi^2/$ GL	CFI	RMSEA	RMSEA90 *	TLI
Original	2843.309	1124	2.530	0.693	0.082	0.078–0.086	0.679
2nd Adjustment	1184.449	557	2.126	0.854	0.071	0.065–0.076	0.844
Original Country	4672.108	2248	2.078	0.629	0.069	0.069–0.072	0.612
2nd Grant Country	2025.786	1114	1.818	0.810	0.060	0.056–0.065	0.797
2nd Class Assistance	2341.999	1114	2.102	0.735	0.070	0.066–0.074	0.717
Reference Values	-	-	1 a 5	Closer to 1. the better.	$\leq 0.08$	-	Closer to 1. the better.

Note. Source: Prepared by the authors based on [Marôco \(2014\)](#), [Arbuckle \(2013\)](#), and [Byrne \(2010\)](#). (\*) 90% confidence interval for RMSEA index.



**Figure 2.** Final model with the 2nd fit. Source: Prepared by the author based on the survey data.

The evaluation of the measurement model was performed through the verification of internal consistency, convergent validity, and discriminant validity. One of the most widely used measures for assessing internal consistency is Cronbach's alpha ([Marôco 2014](#)). All the constructs presented coefficients above 0.7, the minimum recommended value ([Hair et al. 2005](#); [Lattin et al. 2011](#)). Convergent validity was tested via factor loadings above 0.30 ([Laros 2005](#)) and the fit measures of the model. In both tests, evidence of the convergent validity of the observable variables was obtained. Discriminant validity was assessed using confirmatory factor analysis (CFA) performed for pairs of constructs. The results obtained presented values less than 0.90, indicating that there is evidence of discriminant validity ([Hair et al. 2005](#); [Byrne 2010](#)).

Table 4 shows that of the ten relationships tested, six are significant. The density construct is associated with the exchange of resources and the strength of ties between

the actors involved, as noted by (Zaheer et al. 2010). According to (Nadvi 1999), the relationships in clusters are governed by norms, rules, and values that organize production so that knowledge is disseminated, allowing control of the exchange of information between their actors (Xavier Molina-Morales et al. 2013; Cardoso et al. 2019).

**Table 4.** Estimates of the 2nd model fit.

		Estimation	Standard Errors. IF	CR	p Value	Standardized Regression Estimation
Density	<--	Control	1.157	0.124	9.341	*** 0.757
Strength	<--	Control	1.17	0.119	9.858	*** 0.76
Wealth	<--	Density	0.447	0.088	5.099	*** 0.428
Wealth	<--	Bond	0.468	0.091	5.143	*** 0.451
Norms	<--	Control	0.853	0.1	8.509	*** 0.649
Performance	<--	Orientation	0.695	0.094	7.435	*** 0.57
Performance	<--	Variety	0	0.258	0	1 0
Institutions	<--	Variety	0	0.486	0	1 0
Performance	<--	Control	0.093	0.131	0.711	0.477 0.076
Performance	<--	Wealth	-0.018	0.074	-0.237	0.813 -0.023

Note. Source: Prepared by the authors based on data from the research sample. \*  $p \leq 0.1$ ; \*\*  $p \leq 0.05$ ; \*\*\*  $p \leq 0.001$ .

The constructs “Relationship Density”, “Control in Information Exchange”, “Strength of Ties”, “Wealth in Information Exchange”, and “Common Norms and Values” are specified by several authors as part of the social capital construct, such as Nahapiet and Ghoshal (1998); Molina et al. (2008) and Hoffmann et al. (2023). Similarly, the relationship between entrepreneurial orientation and performance was studied by (Wiklund and Shepherd 2005), which corroborates the findings of previous studies.

The results presented do not confirm H1; however, they do not reject H2. The relationship between the variables “Wealth in Information Exchange” and “Relationship Density” was not significant, whereas for “Wealth in Information Exchange” and “Strength of Ties,” it was significant. This result is not consistent with (Molina et al. 2008) and with the study by (Chen et al. 2020), who reported that a higher degree of interconnection contributes to a dense network and to obtaining spillovers of resources.

This result is consistent with the findings of Parhankangas and Arenius (2003); Sapienza et al. (2004); Stam and Elfring (2008) or Bagley (2019b) on companies in the ICT sector, in which the relationships between companies and mothers and spin-offs involve sharing resources. Thus, there is evidence that the association between spin-offs and parent companies results in better allocation of resources and faster learning than does the association between spin-offs and independent ventures.

The results do not support H3, as they were statistically significant for the relationships between the variables “Norms and Common Values” and “Control in Information Exchange,” indicating that there is a link between these constructs. In the literature, the production of common norms and values facilitates trust and cooperation in knowledge exchanges and favors the development of innovations (Nahapiet and Ghoshal 1998). However, for (Molina et al. 2008; Xavier Molina-Morales et al. 2013), obligations derived from trust, reciprocity, etc. reduce the ability to search for new opportunities, which indicates ambiguity. Regarding the relationship between parent companies and spin-offs in the ICT sector, norms, values, and social relationships are very important for the creation and diffusion of innovation (Padilla-Melendez et al. 2012).

Hypotheses 4 and 5 are linked to moderating factors and were not confirmed. In Table 5, the variables “Strength of Ties” and “Norms and Common Values” were tested as quadratic functions to verify whether the data fit an inverted “U.” To test H4, we investigated the existence of overembeddedness in the relationship between the parent firm and its spin-off firm in an ICT cluster. This result agrees with the studies by (Stam and Elfring 2008) on young companies in the ICT sector. Differences in sectoral and economic characteristics may explain the disparate results in the literature and with (Molina et al. 2008).

**Table 5.** Result model 2nd fit.

Variables		Parent Company		Nonparent Company		Comparation
		Estimate	p-Value	Estimate	p-Value	z Test
Density	<---	Control	0.407	0.133	1.114	***
Bond	<---	Control	0.42	0.153	1.104	***
Wealth	<---	Density	0.312	0.199	0.513	***
Wealth	<---	Bond	0.813	0.001 **	0.356	***
Norms	<---	Control	0.24	0.321	0.853	***
Performance	<---	Orietation	0.768	0.004 **	0.671	***
Performance	<---	Variety	-0.17	0.623	0.114	0.643
Institutions	<---	Variety	0.416	0.457	0.18	0.627
Performance	<---	Control	0.283	0.441	0.068	0.611
Performance	<---	Wealth	-0.257	0.21	0.012	0.875

Note. Source: Prepared by the authors based on data from the research sample. \*  $p \leq 0.1$ ; \*\*  $p \leq 0.05$ ; \*\*\*  $p \leq 0.001$ .

In H5, the quadratic relationship was not significant. In the studied sample, there was no evidence that, from a certain point on, the common norms and values in the parent firm and spin-off relationship negatively influence the development of innovations in the companies. According to (Zaheer et al. 2010), periodic communication or frequent contact between actors are opportunities for learning technologies and contribute to the reduction of transaction costs.

A comparative evaluation was performed for the second fit of the model. The estimates related to the classification (parent firm vs. nonparent firm) were not statistically significant, i.e., the fact that the parent firm relates to its spin-off did not present evidence of better performance than the relationships of the nonparent companies with other companies did. Thus, the results of the estimated models do not confirm H6. A possible explanation for this result lies in the characteristics of the sector itself, in which a relationship with strong ties could be almost as good as one with weak ties (Molina et al. 2008).

The comparative results found with the sample of this study differ from those found in the literature on spin-offs (McKendrick et al. 2009), as they examined the effects of spin-offs on the innovation capacity of the parent companies of ICT companies and found evidence that spin-offs benefit them. The study by (Sapienza et al. 2004) suggested that the parent firm and spin-off relationship, as long as there is an exchange of knowledge, can benefit both parties in the form of performance.

The results do not confirm H7 of this study. The results of the 2nd model fit were not significant for the associations between the variables “Local Institutions” and “Variety in Information Exchange.” This result is not consistent with the study by (Molina et al. 2008) (Hoffmann et al. 2023), who found that companies linked to local institutions are associated with higher levels of innovation production (performance).

The literature points out that associations create bonds in the relationships between their members and contribute to the exchange of knowledge and information that can lead to the production of innovations. The local institutions are in contact with other external circles and are also part of the cluster’s internal networks. This effect was also observed in the studies of (Hoffmann et al. 2014) in the furniture industry, (Hoffmann and Campos 2013) in the tourism sector, and (Chen et al. 2020) in the automotive industry.

Regarding H8, which states that the entrepreneurial orientation of the parent firm, compared with that of nonparent companies in business clusters, produces greater levels of innovation, this hypothesis is not confirmed because there is no significant difference between the variables for the two types of companies. The literature on entrepreneurial orientation indicates that this construct positively influences the performance of companies because those with an entrepreneurial attitude have the ability to prospect new opportunities and continuously promote the innovation of their products and services (Parga-Montoya and Cuevas-Vargas 2023; Wiklund and Shepherd 2005; Lazzarotti et al. 2015). This result behaved similarly when the country variable was evaluated. In both

countries, the relationships between the parent firm and its spin-off and between the nonparent firm and another firm were statistically significant when the entrepreneurial orientation and performance (innovation) constructs were compared. This shows that in the two dyadic relationships described above, entrepreneurial orientation contributes to the development of innovations in ICT clusters. In their study, (Stam and Elfring 2008) found that the links between established companies and new companies contribute to the association between entrepreneurial orientation and performance. The justification for this result may be associated with the nonprobability sample, which included mostly SMEs whose profile is typical of the ICT sector.

For the comparative analysis between the clusters of the two countries, the control variable country (Spain and Brazil) was used. Of the ten relationships tested, only three were significant in both models: relationship density and control in information exchange, strength of ties and control in information exchange, and entrepreneurial orientation and performance (innovation).

Several results are noteworthy regarding the 2nd country adjustment model because they are related to the dependent variable Performance (Innovation). The estimates related to this variable, Innovation, associated with the variables that were derived from the model by (Molina et al. 2008), such as Wealth in Information Exchange and Performance (Innovation), Variety in Information Exchange and Performance (Innovation), and Control in Information Exchange and Performance (Innovation), were not significant, and there were no significant differences between countries. A summary of the hypothesis test is shown in Table 6.

**Table 6.** Summary of the hypothesis tests.

H1	The interrelationship between the parent firm and its spin-off in the clusters determines a dense structure and strong ties.	Not confirmed
H2	The interrelationship between the parent firm and its spin-off in the clusters promotes the exchange of quality information and tacit knowledge through strong ties.	Confirmed
H3	The relationships between the parent firm and its spin-off in business clusters produce norms and values that regulate the exchange of knowledge between them.	Confirmed
H4	The strength of ties in the social relations between the geographically grouped parent firm and its spin-off produces a decrease in results after a certain point or level of intensity.	Not confirmed
H5	Common norms and values generate obligations between the parent firm and its spin-off and produce decreasing returns after a certain point or level.	Not confirmed
H6	The interrelationship of the parent firm and its spin-off produces higher levels of innovation for the parent firm than nonparent companies with other companies.	Not confirmed
H7	Local institutions act as intermediaries, providing the clusters with a variety of knowledge resources that lead to higher levels of innovation in the parent firm.	Not confirmed
H8	The entrepreneurial orientation of the parent firm compared with nonparent companies in business clusters produces higher levels of innovation.	Not confirmed

Source: Prepared by the authors.

As shown in Table 6, most of the hypotheses were not confirmed. This was a study involving ICT companies from two countries and specific regions within them, which were characterized as ICT clusters. However, this does not imply that the theory is wrong, but that for these specific cases, it was not confirmed. Hypotheses, by definition, are possible and provisional answers to the research problem.

## 5. Conclusions

The objective of this study was to determine how proximity between business organizations promotes the intensity of relationships, facilitates the exchange of information and knowledge in the interorganizational relationship between parent companies and spin-offs, and influences business results.

The theoretical model was adapted from (Molina et al. 2008). Based on the gaps identified by the aforementioned researchers, the aforementioned study was continued to assess the replicability of the findings. In this context, the model has explanatory power for the variables related to social capital. However, it does not have the same characteristic in regard to supporting institutions or performance when it is subjected to a reality different from the original one.

According to the original model by (Molina et al. 2008), the relationships studied were also in a cluster, but they were interorganizational and not dyadic. Thus, from a theoretical point of view, it is possible to affirm that social capital serves to explain different types of relationships, particularly in regard to business clusters, since in this study, it was used to explain dyadic relationships in cluster contexts, where relationships are usually interorganizational.

Regarding the role of institutions, it is clear that in the ICT sector, they may not properly motivate innovation, as this ends up occurring within the network of companies. In this case, local institutions can serve more as labor enablers than as knowledge generators; however, this individual-company-local institution contact also contributes to knowledge spillover. According to (Del-Corte-Lora et al. 2017), there are many ways in which knowledge and information can spillover, such as through courses, workshops, meetings, and seminars with class associations, local universities, and technical and research institutes, among others. This role is important in a cluster (Hoffmann et al. 2014) but is less common among companies. It follows that the importance of institutions will depend on the type of exchange that is performed between them and the companies or on the type of participation they have in the networks created to innovate.

A novel finding was the inclusion of the variable entrepreneurial orientation in the model by (Molina et al. 2008). This variable was shown to be significantly associated with the production of innovation when tested in the 2nd fit of the model. The fact that EO is linked to innovative performance, regardless of the type of company from a theoretical point of view, is noteworthy because a superior result would be expected for the parent companies. However, innovation in clusters is a process of collective action, as noted by (Halbert 2012; Wahyuni and Sara 2020), regardless of the type of interorganizational relationship. Thus, when the scope is innovative, the relationships between the parent firm and its spin-offs are no longer beneficial than the relationships between companies without this type of link. Thus, the parent firm–spin-off relationship is a type of relationship among the possible types within a cluster whose advantage in establishing itself would also be focused on innovation and is no different from that of other types of IIRs.

It is also concluded that entrepreneurial orientation does not have a discriminating force when evaluating a cluster of SMEs in the ICT sector. Thus, the size of the company ends up weighing in when evaluating this construct. Notably, one of the components of entrepreneurial orientation is the propensity to risk (Wahyuni and Sara 2020). Kim et al. (2010) established that in the ICT sector, companies are committed to meeting the constant needs of consumers for innovations. Thus, innovation must be constant in the sector, and it depends on an R&D process, which in turn involves varying doses of risk. It is concluded that when evaluating a sector with intense innovation, an entrepreneurial orientation will be present.

Although most of the hypotheses were not confirmed, this does not imply that the research with the theories studied is wrong or flawed. However, due to the local characteristics of the countries covered in the study and the type of interorganizational (dyadic) relationships, they may have influenced the non-confirmation of some of them. This could open up new perspectives and variables that could moderate the relationships studied.

Compared with those of Brazil and Spain, the data from these countries showed some differences. As the data from Brazil points to a propensity for being an entrepreneur three times greater than in Spain, it is concluded that there may be a relationship between the propensity for entrepreneurship and the generation of spin-offs in clusters of the ICT sector.

It is also concluded that in ICT clusters, the components of social capital have different configurations. Because the clusters surveyed differ in terms of age, it is possible that the age of the cluster itself and that of its companies and institutions may lead to different configurations of relationships. Thus, in a cluster where there are networks of different types created for the development of innovation, there will be social capital, but this capital will not have the same configuration. These two contributions of this study are related to the suggestions of (Molina et al. 2008). One of them was to conduct future research in a sector other than the ceramics sector; therefore, this study was conducted in the ICT sector. The other suggestion was to conduct a study in a different location in Castellón, Spain. The present study was conducted in a comparative manner at two locations and in two other countries (Barcelona, Spain; Santa Catarina, Brazil).

This study has several methodological and theoretical limitations, as mentioned above. The first of these was the non-use of a qualitative approach in the study. Another limitation is related to the generalizability of the results, as the study was conducted in one cluster of each country. Another limitation was the instrument for collecting primary data through questionnaires, which involves what is called common source bias in the literature. This occurs when the same respondent answers the questions regarding the independent and dependent variables, which may cause distortions in the results (Podsakoff et al. 2003). Finally, the cultural differences between Brazil and Spain were not evaluated in the model.

It is suggested that variables related to culture be included to verify whether there are differences between two countries. Another aspect that could serve as a future study would be the use of in-depth interviews to understand details that quantitative data cannot capture. A final suggestion is to replicate the theoretical model of this study in other ICT clusters or even test the same model in other economic sectors.

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**Institutional Review Board Statement:** At the time of conducting the research, in our National Legislation, it was not mandatory to obtain an authorization from the Ethics Committee.

**Informed Consent Statement:** Permission was received from all participants to guarantee the anonymity of their answers (Blank informed Consent).

**Data Availability Statement:** The data for this research were collected through questionnaires applied to entrepreneurs in the sector and also on government websites in both Brazil and Spain. The data sources are available at the link <http://repositorio2.unb.br/jspui/handle/10482/22904> (accessed date 1 July 2024).

**Conflicts of Interest:** The authors declare no conflict of interest.

## Notes

<sup>1</sup> Geographic proximity refers to the physical space in which a business agglomeration or cluster is defined (Balland et al. 2022).

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