

Inter-firm cooperation from the perspective of startups present in innovation environments in Rio Grande do Sul, Brazil

Cooperação interfirmas na perspectiva de *startups* presentes em ambientes de inovação gaúchos

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Abstract

The article aims to investigate the main inter-firm cooperation relationships (ICRs) established by startups present in Innovation Environments (IEs) in the state of Rio Grande do Sul, Brazil. The elected methodology was a survey carried out through a questionnaire administered by researchers. Procedures associated with descriptive statistics of data and statistical tests were used as the research technique. Of the 77% of startups that cooperate, 70% interact with companies outside IEs. The chi-square test of independence showed that there is no association between the number of ICRs and whether cooperation takes place inside or outside IEs. The regionalized character of innovation loses strength and gives way to networked organization.

Keywords: innovation environments; cooperation; startups.

Resumo

O objetivo deste artigo é investigar como se manifestam as principais relações de cooperação interfirmas (RCIs) estabelecidas por startups em Ambientes de Inovação (AIs) do Rio Grande do Sul. A metodologia utilizada foi uma survey realizada por meio de questionário aplicado com acompanhamento de pesquisadores. Como técnica de pesquisa, utilizaram-se procedimentos associados à estatística descritiva dos dados e testes estatísticos. De 77% startups que cooperam, 70% interagem com empresas externas aos AIs. O teste de qui-quadrado de independência demonstrou que não há associação entre o número de RCIs e o fato de a cooperação ocorrer dentro ou fora dos AIs. O caráter regionalizado da inovação perde força e cede espaço à organização em redes.

Palavras-chave: ambientes de inovação; cooperação; startups.



Introduction

The entrepreneurial spirit present in innovation environments (IEs) (Anprotec, 2019a) is aimed specifically at a type of business model linked to startups. Recent studies note that startups are companies that emerge or host themselves, and develop their business within IEs, such as technology and science parks and incubators, and grow there in a synergistic environment that involves actors from the market, academia, and government (ABS, 2019; Etkowitz & Zhou, 2017).

Cooperation relations between scientific institutions and the private sector have been recurrently analyzed in these environments (Etkowitz, 2009; Ferrary & Granovetter, 2009; Saxenian, 2002) and outside the IEs (Tschanz et al., 2020; Varamäki & Vesalainen, 2010), but there are still few studies, especially in Brazil, dedicated to deepening the understanding of the nature and specificities of the interactions that occur from the firms installed in the IEs (Löfsten & Lindelöf, 2005; Neves et al., 2021; Sperindé & Nguyen-Duc, 2020; Zeng, Xie, Tam, 2010).

The purpose of this article is to learn about the initiative of startups installed in IEs and to understand to what extent and under what circumstances relations and cooperation strategies are considered relevant by companies and how they are carried out. The relationships between companies are established as a way not only to compete but also to form commercial and technological links (Ferrary & Granovetter, 2009).

Because of this, Interfirm Cooperation Relationships (ICRs) that occur inside and outside of IEs are verified. Therefore, interfirm

cooperation is understood as an economically motivated action from the relationship between companies through an action cognitively established about obtaining a gain with formal or informal cooperation, based on a degree of trust between the parties (Neves & Mocelin, 2016). These relationships are based on a trust parameter between agents and may indicate different economic intentions.

The basic premise for cooperating with another company may seem, a priori, only a cognitively economic action; however, there are needs extrinsic to this. The literature provides examples, such as the sharing of technical information, technologies, workspaces, or laboratories, with the strict objective of technical learning (Dewes et al., 2012; Sperindé & Nguyen-Duc, 2020). In addition, there are those motivations related to the anchoring of a startup's business by another, usually a larger company (Hagedoorn, Lokshin, Malo, 2018).

From the perspective of startups present in IEs, studies have been investigating the levels at which technology sharing occurs, the forms of learning that startups explore, what nature these ICRs are, whether there is technical cooperation, joint development of new products, processes, and services (Sperindé & Nguyen-Duc, 2020; Zeng, Xie, Tam, 2010).

In technology and science parks and incubators, startups are expected to relate to some degree with other companies, but there is not much information on the nature of these cooperative relationships (Neves & Mocelin, 2016). Research about the phenomenon of entrepreneurial networks is found to exist (Ferrary & Granovetter, 2009; Hagedoorn, Lokshin, Malo, 2018), but

there is still a literature breach about the nature of ICRs based on startups located in IEs (Liberati, Marinucci, Tanzi, 2013; Neves, 2021), indicating whether the organizations cooperate or whether there are purely commercial interactions.

Furthermore, there is a gap concerning the available data for the analysis of the theme: no databases specific to ICRs, involving startups in IEs, were found. To this end, it was applied an online questionnaire, which was answered by 241 entrepreneurs of startups based in IEs in the state of Rio Grande do Sul. Startups are concrete and typical cases of innovative entrepreneurship, but it is worth knowing some of the strategies they adopt for their commercial learning and technological development. Among these strategies, it stands out that the decision to cooperate with other companies, whether or not based in IEs, through which the main interfirm cooperation relationship established by these startups present in IEs in the Rio Grande do Sul manifests itself.

The present study was organized as follows: first, there were related approaches involving the theme of innovation studies, as well as a brief discussion about the geography of innovation. Furthermore, the theories were delimited concerning the approach of networks in the context of interfirm cooperation. Subsequently, a hypothesis was launched in the study about how RCIs develop from the point of view of the entrepreneurs of the startups participating in the research. Then, methodological procedures covering the strategy used and the types of statistical tests used in the study were presented. In the end, the analysis of the results was developed, followed by the final considerations.

Cooperation as a social relationship in the conception of innovation environments

The geography of innovation, for Asheim & Gertler (2006), leads to the territorial discussion in the field of innovation studies. The spatial dimension becomes relevant for specific reasons: the sharing of products and processes promotes interaction and exchange between actors, such as companies, academic institutions, and governments, thus the knowledge is shared through territorial proximity, and the second reason concerns knowledge spillovers, the circulation of knowledge and information produced in research and development activities.

For Ramella (2020), the systemic character of innovation is directed, firstly, to the analysis of the ecological type of the "context factors", that is, the arrangements of institutional order in regulating the allocation of goods and resources of the territorial area they serve; second and third, the role of agency and relational networks should not be overlooked: the actions and strategies brought to the field by actors, local or not, individual and collective. On the other hand, relational, interpersonal, and inter-organizational type actions refer to socio-economic networks and relational architectures. However, the author does not defend the geographical dimension (local or regional) as a decisive or determining factor for innovation.

Still, for the analysis of the set of approaches on the subject of innovation, the first fundamental element is the geographic dimension of innovation. The spatial dimension has a fundamental importance

in traditional productive sectors, as well as the ones considered modern. The centrality of knowledge and human capital, the second element, is necessary for the new global productive scenarios and becomes fundamental in the emergence of new ideas. The third element concerns the socio-institutional context and the presence of assets of a collective and local nature that generate external economies, tangible and intangible, which help maximize the innovative capacity of companies. Only the economic provisioning of the territory and, individually, of each firm, as well as R&D investments, are not enough to understand the phenomenon of local agglomeration (ibid.).

Lastly, the fourth element would be the systemic reticular dimension of innovation, i.e., relations between institutions in various areas, actors, individually and collectively, and public and private subjects. Innovation actors (entrepreneurs, researchers, and research institutions, among others) rely on relationships based on ties (weak or strong) that energize "cognitive resources of variety" and "normative of cohesion and trust". Behind these elements, the author also mentions that there are two underlying beliefs. The first is that tacit knowledge plays a crucial role in the generation of innovation and that this knowledge is sticky, or adherent, and therefore difficult to circulate; and the second is that the pivotal environments of innovation are territorially regionalized at the local level, for it is at this scale that fundamental knowledge, networks, and competitive advantages are most broadly developed (ibid.).

In discussing the regionalized context of Italian industrial districts, Becattini (2000) outlines some clues as to why there is a competitive advantage for firms located in the same district. The first would be what the author calls economies of specialization that relate to qualified suppliers and specialized industries. This would lead to the possibility for small and medium-sized companies to purchase machinery, products, and services locally. The second advantage concerns the labor market, due to both the specialized labor force and the culture formed by the traditions of local industry.

In conclusion, the third advantage is subdivided into two aspects. The first aspect refers to the circulation of information (in the sense of obtaining information about commercial exchanges, product quality, prices, and supplier reliability), which can reduce local transaction costs and the chances of opportunistic behavior. The second aspect encompasses knowledge spillovers, referring to the stock of specific knowledge and special skills that collaborate with the production of new ideas and the diffusion among small and medium companies. Such contextual knowledge is of tacit origin and informal nature, and it is only acquired and transmitted through long processes of socialization and sharing of local experiences (ibid.).

However, the social and relational dimensions coexist in local innovation systems or in high-tech districts, in which small, medium and large companies are found collaborating among themselves, organically, or mediated by an institution or

actor. These districts have some peculiarities concerning traditional districts: 1) access to research and the possibility of relationships with academic and scientific institutions; 2) availability of specialized suppliers of goods and services; 3) availability of areas with the necessary equipment or technology parks. Furthermore, by characteristic, these high-tech environments attract researchers, businessmen, entrepreneurs, and scientists (Trigilia, 2005).

The territorial relationship of high-tech districts is also distinct and is based on a "social construction of innovation, which is locally rooted". There is a less identification with the local community. The training trajectory of professionals and entrepreneurs tends to be longer, and local governance is based on intentional processes of cooperation between public and private actors. It requires public policies and intermediation organizations, which act as the interface between the production centers of new knowledge and local companies (ibid.).

As verified, innovation is based on procedural events permeated by relationships between the agents that promote it. IEs produce effects on products, processes, and services generated. Territorial location is no longer essential to the effects of innovation; however, it is still elementary in certain regions, in some types of business and industrial agglomeration, and in certain types of networks.

The networks that form interfirm cooperation

Recent contributions demonstrate that distance is also socialized. For Boschma (2010), there are five different dimensions: 1) cognitive proximity, related to the actors' knowledge bases; 2) organizational proximity, or the solutions for collaboration and knowledge exchange; 3) social proximity, referring to interpersonal ties and relationships; 4) institutional proximity, interconnected to the institutional field; and 5) geographical proximity (distance between actors).

In response to the main challenges and opportunities that companies face, entrepreneurial networks are consolidated in the most diverse structures of relationships. These structures are characterized as cooperation strategies, in the form of strategic alliances between competitors; resource acquisition, through interactive processes that allow one to overcome resource constraints; and associations in research and development, which have a collaborative character, allowing the sharing of competencies and generation of solutions to common problems (Hagedoorn, Lokshin, Malo, 2018).

This argument is reinforced by Powell, Packalen, and Whittington (2010), once they identify that the formation of inter-organizational networks encourages innovative initiatives in high technology clusters, especially when they involve a wide diversity

of companies and organizations that are competent in promoting and sustaining dense and complementary relationships between the parties. In studies about the so-called "creative economy", the need for complementarity is also verified, highlighting the connections that large and small companies establish with a plurality of other organizations, such as universities, governments, development agencies, public policies, and cultural entities.

Analyzing Silicon Valley, Ferrary & Granovetter (2009) argue that the network system can anticipate, learn, and innovate, reconfiguring itself to respond to both internal and external changes in the cluster. These social networks affect the performance of startups since they materialize in the circulation of knowledge and the encouragement or investment of entrepreneurial agents through the creation of cooperative ties between agents. The competitive advantage of innovation territories, such as Silicon Valley, would reside in the generation of startups at the technological forefront. Innovation would not be produced individually, but by the local system; it would derive from a network of social relations.

Thus, the question of how interfirm cooperation would enhance innovation must be grounded. In this way, both formal and informal collaboration networks between firms would form stimuli for innovative activities, facilitating the exchange of diverse knowledge and access to resources. Cooperation in innovative activities can be verified as a trade-off between spillovers ("overflows" of knowledge and technology across networks) (Hagedoorn, Lokshin, Malo, 2018; Sperindé & Nguyen-Duc, 2020).

In this way, formal and informal collaboration networks between firms would gather important stimuli for innovative activities, especially for smaller firms, because they facilitate the exchange of diverse knowledge and access to resources. In other words, firms generate and receive "overflows" or "spillovers" of knowledge and technology in their relationships with their partners. This can be a decisive factor in bringing small firms closer to large firms (Hagedoorn, Lokshin, Malo, 2018; Henriques, Sobreiro, Kimura, 2018; Tschanz et al., 2020).

Therefore, the bibliographic gap on the nature of the interfirm cooperation process in innovation environments could be filled concerning the discussion on how opportunities can be generated for the agents involved and if some degree of technical learning, creation of new sources of knowledge, and formation of competitive advantages can be observed, whether through technology transfer agreements or the creation of new businesses, exchange of organizational culture and innovation management, sharing of equipment, generation of jobs and income for the agents involved (Etzkowitz & Zhou, 2017; Löfsten & Lindelöf, 2005; Hagedoorn, Lokshin & Malo, 2018; Neves et al., 2021; Sperindé & Nguyen-Duc, 2020; Zeng, Xie, Tam, 2010).

By establishing strategic cooperative relationships, there is a chance for learning, knowledge exchange, or even technological drops (Neves, 2021). Once an IEs approach is defined, even in tenuous cooperative relationships, companies can cooperate, formally or informally, to some degree among themselves, either by exchanging ideas and

experiences, sharing resources and equipment, or providing services among themselves or to third parties.

Interfirm cooperation as a spontaneous form of relationship in innovation environments

The organic relationships developed between startups are evident. These relationships do not arise only from institutional gaps left by private initiative, government, and teaching and research institutions tied to these IEs (Anprotec, 2019a; Etkowitz & Zhou, 2017); they arise from interactions between companies that coexist in these environments (Neves, 2021).

However, in some circumstances, there is the propulsion of these interactions directed by IEs (Etkowitz & Zhou, 2017), and, more specifically, by innovation mechanisms (Anprotec, 2019a, 2019b; Coworking Brazil, 2020). These mechanisms are responsible for developing the startup's business model.

Both millennial and post-millennial generations (the centennial) have emerged as young entrepreneurs (Neves, 2021). IEs help ventures by providing not only an environment, with access to physical and immaterial resources, but also by providing means for the development of entrepreneurial ideas, provoking an aptitude for interaction and cooperation with other firms present in these environments (Anprotec, 2019a; Etkowitz & Zhou, 2017).

The nature of relationships among agents in this new innovation environment represents a high degree of spontaneity (Sperindé & Nguyen-Duc, 2020) and informality, sometimes not even having the formalization of contracts. Elements, such as the initial stage of companies and the age of the entrepreneurs, may reveal that these young people seek learning, especially knowledge about innovation management (Sullivan, Marvel, Wolfe, 2021).

At first, the peculiarities of these environment models are discussed as drivers of innovation and technologies, from the synergy between the actors; however, few data come to help managers of these environments, and even entrepreneurs, governments, and other stakeholders, make their decisions about the benefits, difficulties, and opportunities present in these systems (Anprotec, 2019a).

To this end, this article aimed to continue the search for answers about the existing scenario in the IEs linked to some educational institutions, universities, or technical, in the state of Rio Grande do Sul. In this sense, it sought to analyze the set of the main interactions that would promote one of the most spontaneous and synergistic types of relationship found in the literature: the interfirm cooperation relationship (Beckert, 2007; Löfsten & Lindelöf, 2005; Sperindé & Nguyen-Duc, 2020; Zeng, Xie, Tam, 2010) from firms present in these IEs (Liberati, Marinucci, Tanzi, 2013).

To answer the objective of the study was developed a hypothesis from the literature review, which can be verified in detail in Chart 1.

Chart 1 – Hypothesis

1) Cooperation tends to intensify between companies based in the IEs, given that they are the same learning condition and expectation of development of their respective businesses, thus:

H1: cooperative relationships occur in greater volume within the IEs.

Source: made by the author.

In general terms, it stands out the idea that startups based in IEs in the Rio Grande do Sul, following the trend observed in the literature on the subject, intensify cooperative relationships with other companies to obtain advantages for the development of their business.

Methodological procedures

A survey was conducted, structured through a data collection instrument (Neves, 2021), containing closed and open questions, which allowed one to describe and subsequently explain the observed phenomenon. The survey was applied between May 2019 and December 2020.

From this survey, it was possible to create a database composed of a set of variables that were analyzed using SPSS® software. As a research technique, procedures associated with descriptive statistics of the data and statistical tests were adopted.

We opt for a simple random sample comprising the state of Rio Grande do Sul and involving the population referring to 100% of startups in operation, during the collection period, in IEs linked to the Gaucha Network of Innovation Environments (Reginp),

that is, technology parks and incubators associated with the institution, and also the International Association of Science Parks and Innovation Areas (Iasp). The sample comprised 241 respondents from a population of 402 entrepreneurs, reaching a confidence level of 95% and an error rate of 5%.

Concerning both observation units and the research field, the analysis study units in the Rio Grande do Sul are the main interfirm cooperation relationships between startups located in the state's IEs and other companies, with whom they maintain these interactions. These startups are companies classified into three distinct phases: pre-incubated, incubated, or graduated. The informants are the managers (entrepreneurs, partners, and directors) of the startups.

The data collection process and the structure of the analysis

Five pretests were conducted in situ with partners and company directors in two IEs in the Metropolitan Region of Porto Alegre, using the snowball sampling technique (May, 2004). The IEs were defined as two examples of the most important IEs in the state and as belonging to both Reginp and Iasp.

The definition of the companies as startups was carried out in three ways, jointly: by information from the IEs' websites, by confirmation from the managers of these environments, and by the self-declaration of the managers of each startup. It is important to emphasize that a methodological precaution was taken to include in the study startups that have as characteristics what is stated in the classification of the Brazilian Startup Association (ABS, 2019).

The questionnaire was applied individually and accompanied by a researcher in 100% of the sample cases. Information was initially obtained through an individual and face-to-face questionnaire applied to 40 startups (16.6% of the sample). With the arrival of the Covid-19 pandemic in Brazil, in March 2020, data collection continued using virtual communication software, and part of the data collection was recorded, both in person and remotely.

The variables used to achieve the objectives of this article were selected and named as follows: "ICR location" (used to measure whether the ICRs occur inside or outside the IEs) and "ICR" (used to verify whether companies establish ICRs and in what quantity).

For data analysis, it was used procedures regarding descriptive statistics of the data and inferences about the variables. To this end, the normality test of the dependent variable used was performed, the chi-square association test, and Cramer's V test (a test that measures the strength of association between variables).

Statistical tests used

Data collected and organized into a database on ICRs in IEs were systematized into nominal qualitative variables. For P analyses, only values smaller than 5% (type I or α error) were accepted (Siegel & Castellan, 1988).

The normality test of the analysis-dependent variable mobilized to achieve the research objective, "ICR", from the Kolmogorov-Smirnov (KS) test was performed, with Lilliefors correction. As already signaled, the sample is heterogeneous, since the test showed $p < 0.005$; thus, it was used non-parametric tests.

For the hypothesis tests referring to the variables "ICR location" and "ICR", it was also performed the chi-square test of independence (for nominal variables). Since it does not support frequency with expected values less than 5, Fisher's exact test was also performed, by using the X^2 values. As it was found a $p < 0.05$, Cramer's V test was made.

The interfirm cooperation relationships inside and outside innovation environments

It was observed that about 23% of the companies in the sample do not cooperate, inside or outside these environments, while approximately 77% cooperate. Thus, Figure 1 presents the ICRs Map through which one can

verify the different movements of the agents in search or not of cooperation. Therefore, it is emphasized that the high sample level is related to companies that do not cooperate and startups that cooperate outside the IEs.

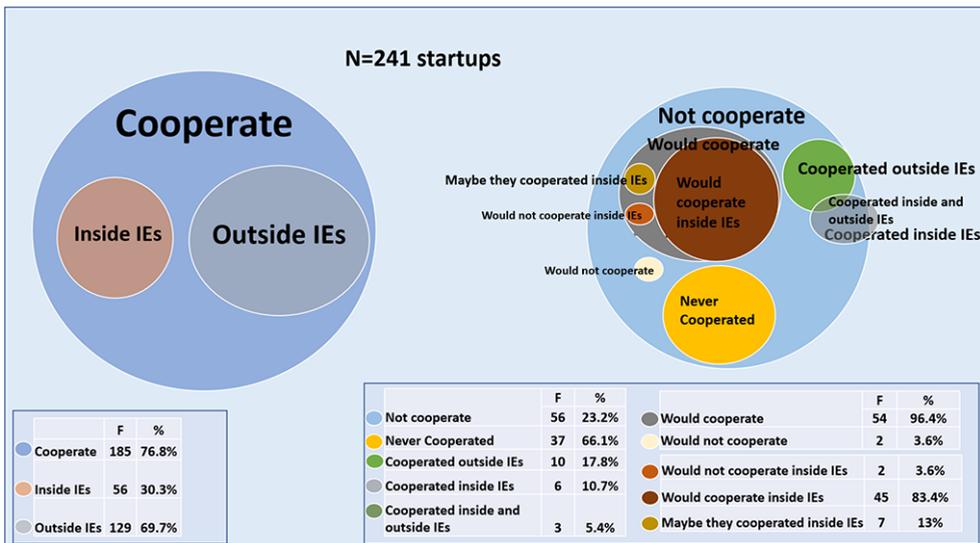
Among the high number of companies that cooperate, startups that have their main ICRs outside the IEs are observed, which represents about 70% of the cases presented. Therefore, only 30% of these ICRs occur internally to IEs.

Of the entrepreneurs who do not cooperate, about 66% of the respondents admit to never having cooperated, while around 18% have cooperated outside the IEs, 10.7% have cooperated inside the IEs, and 5.4% have cooperated both inside and outside of their respective IEs.

Furthermore, 96.4% of startups that do not cooperate would cooperate in the future, and only 3.6% signaled that they would not cooperate at all. Of the entrepreneurs who would cooperate, when asked if they would cooperate within their respective IEs, 83.4% said yes, 13% mentioned that they might cooperate, and 3.6% pointed out that they would not cooperate in IEs. These data reveal the potential likelihood that, if they had institutional support, or even local opportunities for the establishment of ICRs in IEs, they would initiate some kind of partnership.

The average age of the respondent entrepreneurs is 33 years old (generation Y or millennial, the so-called digital natives) and most of them (mode) is 18 years old

Figure 1 - Map of the ICRs



Source: based on Neves (2021).

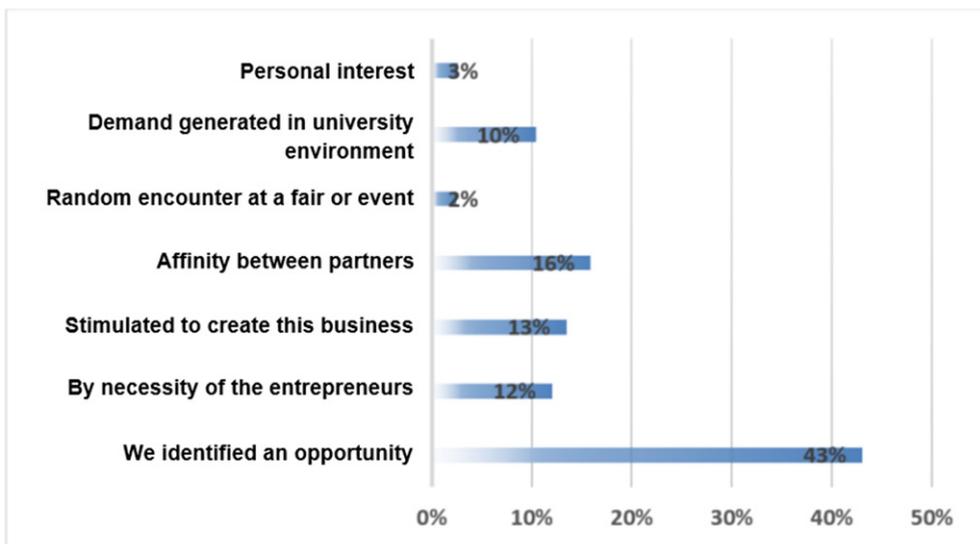
(Z generation, post-millennial (centennial)). This trend confirms the profile of young, tech-savvy and innovative entrepreneur profile, which establishes companies by entering these environments. According to GEM (2020), this profile of the age group of entrepreneurs also corresponds to the highest age means concerning the average age per total business activity in the initial stage in the country.

As can be seen in graph 1, most of the startups that make up the research sample (43%) began their activities because of a market opportunity; they identified a market gap, a promising business, a new technology on the rise, or even the emergence of a problem or market demand. In the global report on entrepreneurship monitoring

(ibid.), it is possible to verify this trend of entrepreneurship in Brazil (the identification of an opportunity), among entrepreneurs aged 18 to 64.

About 16% of the interviewees say they had an affinity with one or more partners. That is, the startup would have already started from a partnership, some affinity at work, or training and relational synergy between the partners. However, 13.5% of the students were stimulated to start the company by a professor, a family member, or even casual and informal conversations among friends and acquaintances in a mutual social space at the university. Only about 2.5% of entrepreneurs said they started the business due to a casual encounter at events or a specific personal interest (Graph 1).

Graph 1 – The business origin of the startup



Source: Neves (2021).

Once again, the influence of strong ties was a determinant for the startup activities, as Ferrary & Granovetter (2009) pointed out. Therefore, this can be said to be a characteristic of the sample. One justification could be the fact that these entrepreneurs, being young, would seek legitimacy in similar groups, i.e., they would be predisposed to listen to those they trust; not only rely on intuition or business acumen, analytical data, market research, or an opinion or a technical foundation from a representative of the business, market, or academia. This characteristic was also verified in the industrial districts analyzed by Ramella (2020), who highlighted the familiarization process of local networks and the importance of these ties in the sharing of local resources.

In addition to that, it can be stated that almost 60% of the startups participating in the research have their origin as a company incubated in parks or incubators (Table 1), corroborating the thesis that they are companies classified as startups, belonging to the main types of ecosystems and mechanisms for generating innovative ventures, as pointed out in the Anprotec report (2019a). Only about 26% entered these environments as residents.

Coworking spaces, highlighted as important and synergistic physical spaces of propagation, sharing, and exchange, as brought about by the Brazil Coworking Census (2020) and highlighted by Sperindé & Nguyen-Duc (2020) concerning the origin of only 2.5% of the companies in the sample.

Table 1 – Origin of the startups

Origin	Frequency	Percentage	Valid percentage	Cumulative percentage
Incubated	143	59.1	59.3	59.3
Resident	62	25.6	25.7	85.1
Pre-incubated	14	5.8	5.8	90.9
Other distance associations	11	4.5	4.6	95.5
Coworking	6	2.5	2.5	98.0
Graduate	3	1.2	1.2	99.2
Distance incubation	2	0.8	0.8	100.0
Totals	241	99.6	100.0	
Missing System	1	0.4		
Total	242	100.0		

Source: Neves (2021).

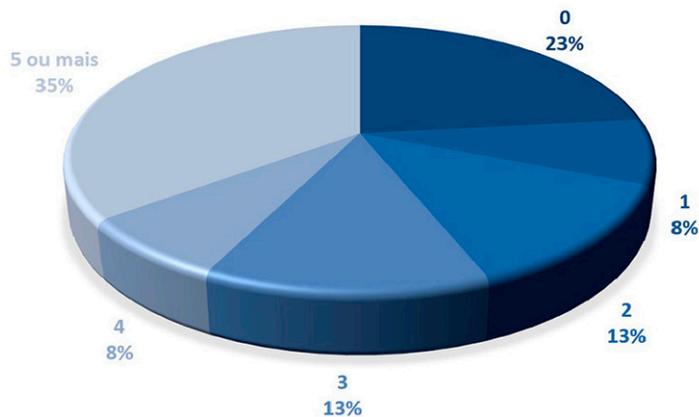
From the sample, it was also possible to observe that the high number of startups that have five or more cooperative relationships stands out (practically 35% – more than 1/3). The companies that cooperate two to three times add up to approximately 26% (Chart 2).

There are a smaller number of companies that have four cooperative relationships with other companies (8%), almost the same number of companies that have only a single relationship (about 8%).

Inside and outside the IEs, there is a predominance of five or more relationships, totaling approximately 41% of the internal cases to the IEs and 48% of the external ones (Table 2). This is an interesting fact to analyze, as companies that cooperate inside or outside the IEs tend to cooperate more.

This probably reveals itself as important data for the analysis of the types of firms that cooperate, establishing a possibility for a future hypothesis.

Graph 2 – Number of ICRs established by startups



Source: Neves (2021).

Table 2 – Number of ICRs per location

ICRs location		Quantify of ICRs					Totals
		1	2	3	4	5 or more	
Outside IEs	Frequency	11	23	19	14	62	129
	%	8.5	17.8	14.7	10.9	48.1	100.0
Inside IEs	Frequency	8	8	13	4	23	56
	%	14.3	14.3	23.2	7.1	41.1	100.0
Totals	Frequency	19	31	32	18	85	185
	%	10.3	16.8	17.3	9.7	45.9	100.0

Source: Neves (2021).

Sample normality test

The normality test performed for the dependent variable used in the study can be seen in Chart 2.

The sample is not normal and nonparametric, according to the result of the Kolmogorov-Smirnov (KS) test with Lilliefors correction, regarding the variable used ($p < 0.005$).

Hypothesis test

For the dependent variable analyzed, "ICR", results were presented referring to the chi-square association test concerning the independent variable "ICR location" (whether inside or outside the IEs). Additionally, for the case of $p < 0.05$, Cramer's V test was performed.

Thus, *Hypothesis 1 (H1)* is resumed: cooperative relationships occur in greater volume within the IEs. The chi-square test of independence showed that there is

no association between the cooperation relationship being inside or outside the IEs ("ICR location" variable) and whether firms establish ICRs, as well as its quantity ("ICR" variable), according to [$\chi^2 (4) = 4.147$; $p > 0.005$]. The degree of association for Cramer's V is 15%.

Therefore, there is no association between the number of cooperative relationships and the fact that the cooperation occurs inside or outside the IEs, even though the environment or physical proximity has been an element of relevance pointed out in the literature by Etzkowitz & Zhou (2017), and Saxenian (2002).

This condition gives way to the relational factor, an object of analysis in recent studies, as found by Ramella (2020) and highlighted by Guimarães & Azambuja (2010), and Mocelin & Azambuja (2017), as a conditioning aspect for the relationships between networked actors. Therefore, *H1* is rejected and *H0* is accepted, that is, we can say that there is no relationship between cooperation occurring, in greater numbers, within an IEs.

Chart 2 – Normality test of the variable

Normality test			
Variable	Kolmogorov-Smirnov*		
	Statistic	g/l	p
ICRs	.218	241	.000

* Lilliefors significance correlation.
Source: Neves (2001).

Final considerations

It is important to consider that innovation permeates the physical and relational means of contemporary society, and it is supposed to be closely related to the conception of scientific, technological, and economic cooperation between agents. It is not simply symbolic rhetoric, but a practical, interactional, and cooperative reality. As seen in OCDE & Eurostat (2018), higher rates of innovation and knowledge are associated with better levels of social and economic development, especially in developing countries such as Brazil. This theme presents itself as fundamental for the progress of a more prosperous and less unequal society.

IEs are fundamentally a "territory" for synergies to take place, but they are increasingly leaving the scope of technology and science parks and incubators, entering into self-managed clusters.

In this sense, it is verified, in the literature, according to the findings of Löfsten & Lindelöf (2005), Sperindé & Nguyen-Duc (2020), and Zeng, Xie, and Tam (2010), that disruptive innovation mechanisms, often informal (by association), accelerators, incubators, and coworking spaces have been gaining strength.

Although the environment or physical proximity no longer plays a primary role (even in the global context, marked by techno-scientific revolutions), an argument that can be enhanced in the situation of the Covid-19 pandemic: cooperation is still present and stands out in the foundation of entrepreneurship and innovation processes. As seen, important theorists argue that this

regionalized character of innovation has been losing strength and giving way more and more to an organization in networks.

The hypothesis of the study was rejected since startups cooperate in larger volumes beyond IEs. The potential for technical, technological, and economic cooperation now lies outside the geographic boundaries of parks and incubators.

Information and technology networks connect previously irreconcilable links, dissociate the causal parameters of social relations, and underpin teleological objectives. Predominantly, the millennial and post-millennial generations can enter this complex tangle of social synapses, locate and configure paths to entrepreneurship and cooperation, differently from agglomerations, clusters, productive arrangements, chains, industrial districts, innovation ecosystems, and other traditional innovation environments. As emphasized by Ramella (2020, p. 325), currently, "[...] the territory must be understood as a relational context, in which the social construction of innovation occurs".

New firm formats seem to mutate. Nascent knowledge and technology-based firms share information, while, in their evolution, they no longer create only physical proximities, but relationships, those host technologies and knowledge within specific, largely virtual, environments, and communities. As brought by Neves (2021), relational or multi-directionally established proximities, internal and external to the IEs, emerge from this situation.

Castells' theory (1999) found similar scenarios in the unstable phenomena occurring in the year 2021. Entrepreneurs shape their businesses according to their ideas

and lifestyles. Spaces have become ideas and the ideas themselves, ideals of life. Although many startups are established for being sold or taken over by larger firms, there is a new kind of agency here, and the locus is the firm and the ideals of the entrepreneur.

Substantially, cooperation gains space in this virtualized territory; not in the traditional way, but conceptually distinct, from relational networks that are sustained on digital technologies of information and communication. Cooperating is more than just using a system or software from a partner or sharing space or equipment, approaching another company; cooperating means technical, technological, and economic synergy. Far from romantic, this context is marked by mishaps, many times resulting from the little experience of startup entrepreneurs, bureaucratic overload – in the case of Brazil –, difficulty in obtaining public and private funding, limitations of science and technology policies, and the very vision of public managers about innovation.

There was a gap in the literature on science, technology, and innovation on the formation of RCIs from the startups present in IEs. In this sense, it is thought to have contributed to the study of cooperation in ecosystems and mechanisms to generate

innovative ventures. This article also served to help managers and government in the promotion of actions and public policies that help the development of innovative ventures, as well as other IEs in the country.

There was also a gap in specific data (especially concerning databases in the area) about the interactions of interfirm cooperation, from the startups present in IEs, even more from the organic point of view, as well as on the perception of the agent in this debate. It is thought that this article has contributed in this sense in some way.

As the main limitation, the study did not cover innovation environments in other Brazilian states and regions. As this is a country of continental dimensions, with countless characteristics and regional peculiarities, it would be interesting to research a larger geographic spectrum in the future. In addition, other non-parametric tests could also be applied to the sample.

For upcoming research, it is suggested to address the motivation for the large number of startups that do not cooperate (about 23% of the sample), as well as to deepen the main motivations that lead entrepreneurs of startups to cooperate in larger numbers outside of IEs, also considering subjective, institutional, and cultural aspects.

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References

- ABS (2019). “Fases de uma startup: conheça o que caracteriza cada fase”. In: ABSTARTUPS. Disponível em: <https://abstartups.com.br/fases-de-uma-startup-saiba-tudo-sobre-cada-etapa/>. Acesso em: 11 maio 2021.
- ANPROTEC – Associação Nacional de Entidades Promotoras de Empreendimentos Inovadores (2019a). *Ecossistemas de Empreendedorismo Inovadores e Inspiradores – relatório técnico*. Disponível em: https://d335luupugsy2.cloudfront.net/cms/files/52159/1591723666ECOSSISTEMAS_DE_ALTO_IMPACTO_Digital_3.pdf. Acesso em: 13 abr 2021.
- ____ (2019b). *Estudo Corporate Venturing no Brasil: co-inovando em rede – relatório técnico*. Disponível em: <https://anprotec.org.br/site/wp-content/uploads/2019/06/Corporate-Venturing-Anprotec-e-Sebrae.pdf>. Acesso em: 13 abr 2021.
- ASHEIM, B. T. e GERTLER, M. S. (2006). *The geography of innovation: regional innovation systems*. Disponível em: <https://doi.org/10.1093/oxfordhb/9780199286805.003.0011>. Acesso em: 12 maio 2021.
- BECATTINI, G. (2000). *Il distretto industrial*. Turim, Rosenberg & Sellier.
- BECKERT, J. (2007). *The social order of markets*. Colônia, Max Planck Institute for the Study of Societies (MPIfG).
- BOSCHMA, R. (2010). Proximity and innovation: a critical assessment. *Regional Studies*. Disponível em: <https://doi.org/10.1080/0034340052000320887>. Acesso em: 13 maio 2021.
- CASTELLS, M. (1999). *A sociedade em rede*. São Paulo, Paz e Terra.
- COWORKING BRASIL 2019 (2020). Censo resultados. Disponível em: <https://coworkingbrasil.org/censo/2019/>. Acesso em: 15 maio 2021.
- DEWES, F. et al. (2012). Ambientes e estímulos favoráveis à criatividade aplicada a processos de inovação de produtos. *Espacios*. Caracas, v. 33, n. 8, p. 6.
- ETZKOWITZ, H. (2009). *Hélice tríplice – universidade, indústria e governo: inovação em movimento*. Porto Alegre, EDIPUCRS.
- ETZKOWITZ, H. e ZHOU, C. (2017). Hélice tríplice: inovação e empreendedorismo universidade-indústria-governo. *Estudos Avançados*. São Paulo, v. 31, n. 90, pp. 23-48.
- FERRARY, M. e GRANOVETTER, M. (2009). The role of venture capital firms in silicon valley's complex innovation network. *Economy and Society*. Londres, v. 38, n. 2, pp. 326-359.
- GEM – Global Entrepreneurship Monitor (2020). Disponível em: <https://www.gemconsortium.org/report/gem-2019-2020-global-report>. Acesso em: 15 abr 2021.

- GUIMARÃES, S. M. K. e AZAMBUJA, L. R. (2010). Empreendedorismo high-tech no Brasil: Condicionantes econômicos, políticos e culturais. *Sociedade e Estado*. Brasília, v. 25, n. 1, pp. 93-121.
- HAGEDOORN, J.; LOKSHIN, B. e MALO, S. (2018). Alliances and the innovation performance of corporate and public research spin-off firms. *Small Business Economics*, v. 50, n. 4, pp. 763-781.
- HENRIQUES, I. C.; SOBREIRO, V. A. e KIMURA, H. (2018). Science and technology park: Future challenges. *Technology in Society*, v. 53, pp. 144-160.
- LIBERATI, D.; MARINUCCI, M. e TANZI, G. M. (2013). Science and technology parks in Italy: main features and analysis of their effects on hosted firms. *The Journal of Technology Transfer*. Roma, v. 41, n. 4, pp. 694-729.
- LÖFSTEN, H. e LINDELÖF, P. (2005). R&D networks and product innovation patterns academic and non-academic new technology-based firms on Science Parks. *Technovation*, v. 25, n. 9, pp. 1025-1037.
- MAY, T. (2004). *Pesquisa social: questões, métodos e processos*. Porto Alegre, Artmed.
- MOCELIN, D. G. e AZAMBUJA, L. R. (2017). Empreendedorismo intensivo em conhecimento: elementos para uma agenda de pesquisas sobre a ação empreendedora no Brasil. *Sociologias* (UFRGS). Porto Alegre, v. 19, n. 46, pp. 30-75.
- NEVES, F. M. (2021). *A cooperação interfirmas na perspectiva das startups: uma análise dos ambientes de inovação do Rio Grande do Sul*. Tese de doutorado. Porto Alegre, Universidade Federal do Rio Grande do Sul.
- NEVES, F. M. et al. (2021). “Nowhere firms: a cooperação na perspectiva das startups localizadas em ambientes de inovação”. In: SEMEAD 2021: XXIV SEMINÁRIOS EM ADMINISTRAÇÃO. *Anais*. São Paulo, Programa de Pós-Graduação em Administração FEA – Universidade de São Paulo, pp. 1-17.
- NEVES, F. M. e MOCELIN, D. G. (2016). Cooperação e relações entre grandes e pequenas empresas em parques tecnológicos. *Século XXI – Revista de Ciências Sociais*. Santa Maria, v. 6, n. 2, pp. 157-195.
- OCDE e EUROSTAT (2018). *Oslo Manual 2018*. Disponível em: <https://www.oecd-ilibrary.org/content/publication/9789264304604-en>. Acesso em: 20 abr 2022.
- POWELL, W.; PACKALEN, K. e WHITTINGTON, K. (2010). “The emergence of high-tech clusters in the life sciences”. In: PADGET, J. F. e POWELL, W. W. *Organizational and institutional genesis*. Princeton, Princeton University Press.
- RAMELLA, F. (2020). *Sociologia da inovação econômica*. Porto Alegre, Editora da UFRGS.
- SAXENIAN, A. (2002). Silicon Valley’s New Immigrant High-Growth Entrepreneurs. *Economic Development Quarterly*, v. 16, n. 1, pp. 20-31.
- SIEGEL, S. e CASTELLAN JR. N. J. (1988). *Nonparametric statistics for the behavioral sciences*. Nova York, McGraw-Hill.
- SPERINDÉ, S. e NGUYEN-DUC, A. (2020). “Fostering open innovation in coworking spaces: a study of norwegian startups”. In: NGUYEN-DUC, A. et al. (orgs.). *Fundamentals of software startups: essential engineering and business aspects*. Cham, Springer International Publishing.
- SULLIVAN, D. M.; MARVEL, M. R. e WOLFE, M. T. (2021). With a little help from my friends? How learning activities and network ties impact performance for high tech startups in incubators. *Technovation*, v. 101, pp. 1-15.

TRIGILIA, C. (2005). *Sviluppo locale: un progetto per l'Italia*. Roma; Bari, Laterza.

TSCHANZ, R. et al. (2020). "No Innovation without cooperation" - How Switzerland innovation promotes cooperation between industry, research and startups. *Chimia*, v. 74, n. 10, p. 755-757.

VARAMÄKI, E. e VESALAINEN, J. (2010). Modelling different types of multilateral co-operation between SMEs. *Entrepreneurship & Regional Development*, v. 2003, pp. 27-47.

ZENG, S. X.; XIE, X. M. e TAM, C. M. (2010). Relationship between cooperation networks and innovation performance of SMEs. *Technovation*, v. 30, n. 3, pp. 181-194.

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