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CONFIGURATIONAL ANALYSIS OF PROXIMITIES IN INNOVATION ALLIANCES

Análise configuracional das proximidades em alianças de inovação

Análisis configuracional de proximidades en alianzas de innovación

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ABSTRACT

Alliances have become a critical factor for innovation development. However, the lack of proximity between partners, which goes beyond the geographical facet, can influence alliance' outcomes. Despite this understanding, little is known about the interrelationship of proximities in innovation alliances. This research aims to underscore which proximities' combinations lead to exploration and exploitation alliances. To achieve this goal, we conducted a survey with 174 high-tech companies and adopted the method of Comparative Qualitative Analysis (QCA). The results underline the exploration alliances reliance on social, cognitive, or institutional proximity with physically close partners. Furthermore, exploitation alliances are dependent on cognitive and social proximity, in addition to the absence of organizational proximity. We conclude that alliances innovative orientation does not differ across all proximities dimensions and we highlight the relevance of social ties.

Keywords: Proximity, alliances, exploration, exploitation and innovation.

RESUMO

As alianças tornaram-se fator crítico para o desenvolvimento da inovação, contudo a falta de proximidade entre os parceiros, que vai além do aspecto geográfico, pode influenciar os resultados. Apesar desse entendimento, os estudos não avaliam a inter-relação das proximidades em alianças de inovação. Esta pesquisa busca compreender quais combinações de proximidades levam a alianças exploration e exploitation. Para perscrutar esse caminho, realizou-se um survey com 174 empresas de alta tecnologia; como método, adotou-se a Análise Qualitativa Comparativa (QCA). Os resultados encontrados destacam que, no contexto de parceiros próximos fisicamente, as alianças de exploration são dependentes de proximidade social, combinadas com proximidade cognitiva ou institucional. Já as alianças exploitation são dependentes de proximidades cognitiva e social, somada à ausência de proximidade organizacional. Tem-se como conclusão que a orientação inovadora das alianças não depende do desenvolvimento de todas as dimensões de proximidade e destaca-se, assim, a relevância dos laços sociais.

Palavras-Chave: *Proximidades, alianças, exploration, exploitation, inovação e ambidestridade.*

RESUMEN

Las alianzas se han convertido en un factor crítico para el desarrollo de la innovación, sin embargo, la falta de proximidad entre los aliados, que va más allá del aspecto geográfico, puede influir en los resultados. A pesar de esta comprensión, faltan estudios que evalúen la interrelación de la proximidad en las alianzas de innovación. Esta investigación busca comprender qué combinaciones de proximidad conducen a alianzas de exploration y exploitation. Para lograr este objetivo, realizamos una encuesta con 174 empresas de alta tecnología y adoptamos el método de análisis cualitativo comparativo (QCA). Los resultados encontrados resaltan que, en el contexto de aliados físicamente cercanos, las alianzas de exploración dependen de la proximidad social, combinada con la proximidad cognitiva o institucional. Mientras que las alianzas de explotación dependen de la proximidad cognitiva y social, además de la ausencia de proximidad organizacional. Concluimos que la orientación innovadora de las alianzas no depende del desarrollo de todas las dimensiones de proximidad y destacamos la relevancia de los lazos sociales.

Palabras clave*: Proximidades, alianzas, exploration, exploitation, innovación.*

INTRODUCTION

The competitiveness of companies does not only occur with internal resources and capabilities, which is why it is important to access external sources of knowledge (Martínez-Noya & Narula, 2018). Alliances enable access to new knowledge (exploration) and leverage existing knowledge (exploitation) (Kauppila, 2010), which is relevant for the survival of firms, which need to balance radical and incremental innovation, which is known as ambidexterity (Blindenbach-Driessen & Ende, 2014).

It is important to consider that there are tensions between efforts for radical (exploration) and incremental (exploitation) innovation, as they require different structures, processes, strategies, capabilities, and culture (He & Wong, 2004), but compete for the same organization's resources, as advocated by March (1991) and recently empirically proven (Li, Fu, Liu, 2020). Thus, alliances are particularly relevant in the search for innovation because they can compensate for the lack of internal resources needed to simultaneously explore new innovation trajectories and refine existing ones (Lavie, Stettner & Tushman, 2010).

The diversification of partners in alliances is considered an antecedent that can affect the performance of companies that innovate by exploration and exploitation (Ardito, Peruffo, & Natalicchio, 2019), however, there is a need to investigate this relationship from a more contingent perspective (Yang & Li, 2011), in which the same antecedents can work in a different way, although integrated (Liu, Wang & Li, 2019). Therefore, it is important to analyze in an intertwined way how different backgrounds of partners, such as size, age, type, and location (Leeuw, Lokshin, Duysters, 2014), support innovation (Benner & Tushman, 2003). Therefore, it is proposed to investigate how proximity integration can reflect in exploration and exploitation innovation alliances. However, proximity is not only limited to the spatial issue, as there are other antecedents that also influence inter-organizational relationships, such as: organizational, cognitive, social, and institutional (Boschma, 2005).

The proximity theme is relevant and aroused interest because, in scenarios of low proximity between partners there may be coordination, communication, and even conflict issues (Mattes, 2012), on the other hand, too much proximity can lead to stagnation and locked-in (Boschma, 2005). However, little is known to what degree of proximity alliances are more likely to maximize innovation (Martínez-noya & Narula, 2018), especially those of different types – exploitation and exploration. As a result, studies on the subject suggest the existence of interrelational compensation effects between types of proximities (Boschma, 2005; Hansen, 2015; Huber, 2011). In other words, it is not necessary to be close in all dimensions to achieve innovation results, but it is necessary to know which configurations of these proximities have the greatest impact for companies to innovate.

In this way, seeking to contribute to advances in literature, we analyzed the combinations of proximities in innovation alliances and sought to answer the following question: How does the interrelationship of proximities influence innovation alliances for exploration and exploitation? To meet the objective of this research, a Qualitative Comparative Analysis (QCA) was structured, which focuses on the combined effects of causal conditions, assuming that the causes of an

event are complex, interdependent, and holistic (Ragin, 2008). QCA was applied with data from a survey of 174 high-tech companies which carry out alliances for both exploitation and exploration. Finally, we emphasize the interrelationship of non-spatial proximities, which is still lacking in literature, as the focus in most works is geographic proximity (Steinmo & Rasmussen, 2016; Ardito et al., 2019).

Furthermore, this work contributes to the changes inherent and imposed by the COVID-19 pandemic. In a global context, in which everyone was forced to remain physically distant, understanding the behavior of other types of proximity can favor the maintenance of collaboration strategies. Furthermore, in times of economic crisis, companies with the capacity to innovate will survive, either through their individual competencies or through alliances. Thus, diving into the proximity approach, in the innovation alliances context, can be enriching for 21st century entrepreneurs.

INNOVATION AND PROXIMITIES

Research and development cooperation has become a central aspect of the innovation strategy of high-performance organizations (Martínez-Noya & Narula, 2018). They consist of processes that enrich the portfolio of resources, quality and timeliness of information, in addition to increasing knowledge about markets and technologies (Bouncken, Pesch & Kraus, 2015). Thus, companies that use alliances will be able to improve their innovation strategies and, above all, their pioneering capacity (Bouncken et al., 2015).

In this scenario, the importance of investigating the knowledge acquisition strategies of alliances and their impact on innovation results grows. There are two knowledge access strategies: exploration and exploitation. Exploration is associated with research, variation, risk taking, experimentation, flexibility, discovery, and innovation. Exploitation is related to refinement, choices, production, efficiency, selection, implementation, and execution (March, 1991). Exploration innovations are radical proposals that require new knowledge, which is different from those dominated by the company, therefore, fundamentally offering new products (Jansen, Vera, & Crossan, 2009; March, 1991). Exploitation innovations are increments that are based on existing knowledge, thus expanding the company's knowledge base and therefore, improving established products without changing the basic nature of skills, processes and structures (Jansen et al., 2009).

Alliance diversification is an antecedent of balance between exploration and exploitation, however, when companies excessively diversify their alliance portfolios, they may face difficulties due to the huge amount of knowledge they access, generating confusion and reducing the likelihood of seeking learning activities (Ardito et al., 2019). Many studies make an effort to understand the exploration and exploitation alliances with innovation, however, recently, research suggests the need to investigate this relationship from a contingent perspective (Yang & Li, 2011). For this, there are two most popular approaches: integration and differentiation. As denoted by the terms, integration considers exploration and exploitation as synergistic and intertwined strategies, while differentiation focuses on unique aspects that leverage exploration or exploitation

separately (Benner & Tushman, 2003). For this integrative view, it is taken into account whether the same antecedents can work in a distinct and integrated manner for exploration and exploitation.

In this context, we propose to investigate how proximity issues can contribute to exploration and exploitation innovations. Studies were developed to highlight the relevance of the multidimensional proximity structure for the analysis of collaborative innovation processes (Balland, Boschma & Frenken, 2015; Broekel & Boschma, 2012). Based on these theoretical advances, it was concluded that geographical proximity alone is neither a necessary nor a sufficient condition for learning to occur (Boschma, 2021). Cognitive, organizational, social, and institutional proximity is also necessary to the knowledge and innovation exchange (Broekel & Boschma, 2012).

Geographical proximity, the most discussed in the literature dimension, denotes territorial, spatial, local, or physical proximity between agents (Knoben & Oerlemans, 2006). Cognitive proximity is defined as similarities in the way actors perceive, interpret, understand and evaluate the world (Nooteboom, 2000). Furthermore, a cognitive overlap is necessary for the transfer or creation of new knowledge between allies. In this sense, cognitive proximity is likely to increase knowledge transmission, where the knowledge base of partners expands and overlaps (Balland et al., 2015). Similarity in organizational purposes, roles, and experiences are characteristics of organizational proximity (Steinmo & Rasmussen, 2016). According to Boschma (2005), organizational proximity is defined as the extension of relationships in an organizational arrangement, both intra and inter-organizational, thus involving autonomy and the control degree control that can be exercised in arrangements. Institutional proximity describes the extent of standards, habits, rules, and laws between economic agents, involving both formal and informal institutional aspects (Knoben & Oerlemans, 2006). Thus, the sense of this dimension includes the idea of organizations that share the same institutional rules and set of cultural habits and values (Boschma, 2005). Social proximity, in turn, indicates personal or relational proximity between peers (Schamp, Rentmeister, & Lo, 2004). This dimension exists when there is trust based on friendship, relationship, and previous experience among the actors (Boschma, 2005).

Although these proximity aspects are useful for analyzing learning and innovation, the debate on proximity did not explicitly consider the complexity inherent in the use and transfer of knowledge in different contexts (Mattes, 2012; Balland et al., 2015). Based on an empirical study promoted by Davids and Frenken (2018), the authors proved the importance of each proximity dimension depending on the type of knowledge (analytical and synthetic) that is being mobilized and produced. The results indicate that although analytical knowledge can be effectively produced over long distances, high cognitive proximity is required. The same does not apply to synthetic knowledge, which generally requires permanent co-location to overcome the lack of cognitive proximity.

Considering only the geographic dimension, Martin and Moodysson (2013) revealed that the exchange of knowledge in geographic proximity is especially important for industries that depend on a synthetic knowledge base because the interpretation of the knowledge they deal with tends to be different depending on the location. When the knowledge base is analytical, the geographical factor is less sensitive, as it is a scientific, abstract, and universal knowledge.

Therefore, the transfer of analytical knowledge is based on other reasons and not necessarily on the co-location of partners (Martin & Moodysson, 2013). Enkel and Heil (2014) not only focused on spatial distance, but also considered the cognitive proximity between partners to create potential absorptive capacity. The results highlighted that, when developing innovation for exploitation with long-distance partners, cognitive proximity is strengthened, also achieving exploration innovations (Enkel & Heil, 2014). Some studies have tried to understand the relationship of proximity at regional levels (Boschma, 2021). Thus, there is already confirmation that not only there is influence exerted by geographic proximity, but also that the technological similarity of the regions has a determining effect on the generation of innovations (Gonçalves & Fajardo, 2011).

The presented studies show that the role of proximity can change according to the orientation of innovation (Mattes, 2012; Steinmo & Rasmussen, 2016). However, the studies did not consider the multiple nature of proximity dimensions. If innovation for exploration allows the creation of new knowledge and exploitation supports the refinement and use of existing knowledge (March, 1991), it is expected that the established proximities will be different for different contexts. Finally, it was considered important to understand the complexity inherent to the knowledge transfer connected to the dimensions of proximity.

METHOD

For the population composition of this study, high technology companies were taken into account according to the OECD (Organization for Economic Co-operation and Development), aiming to find organizations with greater chances of innovation. In this way, companies from the information technology, pharmacochemical, and R&D sectors have participated. To select the companies that would be invited, the GPTW (Good Places to Work) classification was used, which provides the rank of companies by sector. Through LinkedIn, contact was made with innovation directors, coordinators or managers who were able to respond to the questionnaire, and only one representative per company was selected to participate. Despite these efforts, the sampling performed is considered non-probabilistic, that is, there is a dependence, in part, on the researcher's judgment for the selection of sample guests (Mattar, 2006).

As a data collection instrument, self-administered questionnaires were used, in which respondents assessed their level of agreement for each item using a five-point validated Likert scale, which ranges from "strongly disagree" to "strongly agree." The questionnaire was divided into four sections: i) Alliance context (Barbosa, 2018); ii) Proximities, in which cognitive and organizational proximity were investigated by five variables, and organizational and institutional proximity by four variables (Geldes, Heredia, Felzensztein & Mora, 2017); iii) Partnership innovation intention analyzed by 12 variables (Lubatkin, Simsek, Ling, & Veiga, 2006); iv) Characterization of the company and the interviewee. 174 validated questionnaires were collected from December/2019 to February/2020.

Despite the efforts to control common method bias, the results may still be susceptible to this problem. In order to test this possibility, the Harman one-factor test was performed by inserting all dependent and independent variables into an EFA (Exploratory Factor Analysis).

Based on the Eigenvalue greater than one criterion, four factors emerged in the analyses, the first being responsible for only 30.57% of the explained variance (Tiwana, Jijie, Keil, & Ahluwalia, 2007). Therefore, there are no signs of serious problems. A CFA (Confirmatory Factor Analysis) version was performed, in which all items were allocated in a single factor that would represent all the effects of the method. The results confirmed the presence of the five proximities and the two innovations, with at least three items each and with Cronbach's α, which ranged between 0.538 and 0.812, acceptable values according to Hair et. al. (2012). The estimated correlations between these factors were all above 0.7, confirming the discriminant validity of the study's constructs.

From the survey, it was adopted the FsQCA (fuzzy-set Qualitative Comparative Analysis), which aims to analyze the configurational causality of relationships (Ragin, 2008). This method identifies configurations considering the principle of equifinality, observing different paths that lead to the same result, and asymmetry in relationships, in which the presence or absence of a causal condition can generate the same result (Ragin, 2008). In FsQCA, attributes (proximities in this study) and results (exploration and exploitation here) are seen as sets, in which each case can be a member, thus, a certain condition is necessary if, whenever the result is present, the condition is also present, that is, the result cannot be performed without the presence of the condition (Marx, Rihoux, & Ragin, 2014). A given condition or set of conditions is sufficient for a result when it, by itself, produces a given result (Marx et al., 2014).

To apply the FsQCA, initially, the data was calibrated to associate empirical information with pre-defined categories (Schneider & Wagemann, 2013). For the cognitive, social, organizational, institutional, and exploration and exploitation innovations constructs that were measured by the Likert scale, it was established that the original values 5 and 1 belong to the complete association (1.0) and non-complete association (0.0), respectively (Pickernell, Jones & Beynon, 2019). For geographic proximity: it was adopted that partners from the same state are fully associated (1.0), whereas partners that are within Brazil, but in different states, are cross associations (0.5), and international alliances are non-complete associations (0.0). A constant of 0.001 was added to all cross-associations (0.5) so that they were not automatically eliminated during the analysis.

During the analysis process, it is necessary to establish two parameters for calculating the solution: consistency and coverage. Consistency measures the degree to which a combination of causal conditions (solution) is reliably associated with the outcome of interest, that is, how much those settings have predictive power in the analysis (Fiss & Peer, 2011) and recommendations are that the results are close to 0.75 (Ragin, 2008), however, for large samples (greater than 50 cases) lower consistencies are accepted, as the possibility of inadequate case selection is minimized (Schneider & Wagemann, 2013). Coverage indicates the percentage of cases that follow a given recipe for the result (Fiss & Peer, 2011), or, in other words, exposes the number of cases that are explained by a given configuration (Ragin, 2008). Thus, in the present study, a consistency of 0.7 and a frequency of five cases per solution was adopted as a limitation. Finally, using the Quine-McCluskey algorithm, the output of the intermediate solution for the analyzes was obtained (Fiss, 2011).

RESULTS

In this section, data is presented and interpreted from the intermediate solution produced by the FsQCA software in Tables 1 and 2 of configurations. The consistency of the configurations ranged between 0.89 and 0.93, which are values close to those practiced in other studies, such as Alves, Ficher, Vonortas and Queiroz (2018) and Fiss (2011). The raw coverage found in the configurations are between 0.4 and 0.61 values, which are results similar to those practiced in Pickernell et al. (2019).

We start the analysis by presenting the proximity settings for the innovation outcome alliances for exploration in Table 1.

Table 1. Sufficient configurations for Exploration

Outcome	Exploration		
Configurations	1	2	3
Geographic	●	●	
Cognitive		⬤	⬤
Social	●	●	●
Organizational			●
Institutional	⬤		⬤
Consistency	0.92	0.91	0.93
Raw coverage	0.58	0.60	0.55
Unique coverage	0.05	0.07	0.08
Overall consistency of the solution	0.73		
Overall coverage of the solution	0.89		

Notes:
⬤ =presence of an essential condition; ● =presence of peripheral condition; ⊗ =absence. Blank spaces indicate "irrelevant".
Real parameters adopted: raw coverage=0.93; PRI consistency=0.83.

Configuration 1 brings institutional proximity as central, supported by the geographical and social as periphery. This first configuration allows us to reflect on the relevance of the similarity of regulations, culture, values and habits between the allies for achieving radical results. Companies that seek innovation strategies for exploration take more risks, invest more in research, experimentation, and discovery (March, 1991) and tend to have culture, values, and regulations aimed at more aggressive R&D practices (Jansen et al., 2009). In addition to institutional proximity, social proximity is needed. Friendship, trust, reputation, and previous relationships play an important role in minimizing opportunistic behavior through the intensification of personal relationships (Gulati, 1995). There is also the presence of geographic proximity. Being physically close favors more frequent face-to-face contacts, therefore, facilitates knowledge sharing. It is important to highlight that this is a configuration in which organizational and cognitive proximity are irrelevant. Thus, it is often observed that it is neither rigid contractual bonds nor the overlapping of the knowledge base that guarantee the success of a partnership, but trustworthy social relations, face-to-face contact, and alignment of institutional values.

In Configuration 2, cognitive proximity appears as a central condition, and geographic and social proximity as peripheral. In this configuration, which seeks to extrapolate existing fields of knowledge and propose radical innovations (Lubatkin et al., 2006), there is a central need for a common knowledge base, technologies, and experiences in the area. Social and geographic proximity are also needed. Social proximity, once again, has been strengthening the relationship through trust and friendship (Molina-Morales, Belso-Martínez, Más-Verdú, & Martínez-Cháfer, 2015). With this, it is inferred that even though two partners have a solid and aligned knowledge base, if there is no personal relationship between them, the innovation for exploration will not occur. Finally, the physical proximity between those in line ensures greater frequency of face-to-face meetings, increasing the connection of those involved.

When comparing Configurations 1 and 2, a substitution relationship between institutional and cognitive proximity is observed. When there is cognitive proximity, there is no mandatory presence of the institutional dimension and the reciprocal is true, considering that they are geographically close cases and with irrelevance of organizational proximity. The opposite scenario also favors innovation for exploration. In partnerships where there is institutional proximity, the obligatory existence of overlapping knowledge between the partners is minimized.

Configuration 3 is the most traditional and supports preliminary discussions of the proximity approach (Boshma, 2005). According to this configuration, when there is cognitive, social, institutional, and organizational proximity, the geographical becomes indifferent, that is, no matter where the partner is positioned, the result of innovation will be achieved. Interestingly, geographic proximity only presents itself as irrelevant when there is proximity in all other dimensions.

For exploitation innovations, there are two configurations of "neutral permutations," that is, the solutions share the same central condition and differ in their peripheral conditions, therefore, the nomenclature of the configurations is 1A and 1B in Table 2.

Table 2. Sufficient configurations for Exploitation

Outcome	**Exploitation**	
Configurations	1A	1B
Geographic		●
Cognitive	⬤	⬤
Social	●	●
Organizational	●	⊗
Institutional	●	
Consistency	0.89	0.91
Raw coverage	0.61	0.40
Unique coverage	0.29	0.07
Overall consistency of the solution	0.88	
Overall coverage of the solution	0.69	

Notes:
⬤ =presence of an essential condition; ● =presence of peripheral condition; ⊗ =absence. Blank spaces indicate "irrelevant".
Real parameters adopted: raw consistency=0.89; PRI consistency=0.75.

Configuration 1A is formed by central cognitive proximity, combined with peripheral social, organizational, and institutional dimensions. Even for incremental innovations, focused on improvements and based on existing knowledge (Lubatkin et al., 2006), cognitive proximity stood out. This first configuration evidence that allies need similarity in the knowledge base, common technological experiences, and overlapping competences for exploitation. Once again, the social proximity that permeates relationships and favors the achievement of results is seen. The congruence of institutional intentions is also important. Organizational proximity plays a relevant role, in which the presence of a command structure can facilitate the achievement of incremental results. Geographic proximity is irrelevant, meaning partners can be geographically close or distant. Based on this configuration, it can be concluded that when there is proximity in all non-geographic dimensions, it does not matter the location of the partner, as the innovation for *exploitation* will be achieved.

In Configuration 1B, it is observed that when there is geographic proximity, cognitive and social proximity are necessary, in addition to the absence of organizational proximity. Cognitive proximity, once again, is central to exploitation relationships. Social proximity was presented as a peripheral factor, but relevant for all exploitation configurations. The highlight aspect of Configuration 1B is the absence of organizational dimension. If organizational proximity is related to the command structure, autonomy and regulation of the relationship, the absence of this dimension points to the reflection that partnerships with rigid command structures will hardly be able to innovate together incrementally. Thus, for co-located firms, a softer command relationship will more effectively ensure short-term incremental innovation results.

Comparing configurations 1A and 1B in Table 2, it is noted that when there is geographic proximity, the alliance is based on less formal aspects, such as friendship, trust, previous experiences, technical language, and presence, highlighted by the dimensions of Configuration 1B. When there is the possibility of physical distance, (Configuration 1A), in addition to these proximities, more formal structural aspects are needed, such as regulations, organizational structure, cultural and values alignment.

Regarding the need analysis, which seeks to identify whether the causes separately are necessary for the result, that is, if a certain condition needs to be present for the result to happen (Fiss, 2011), only social proximity presented a relevant need factor (0.9 threshold), both for the exploitation and exploration occurrence. This result was already expected, as this dimension was present in all configuration results. However, despite the fact that social proximity is fundamental for achieving innovation results, it is not a sufficient condition, since in no configuration it was able to generate innovation results alone.

DISCUSSION AND IMPLICATIONS

In highly dynamic environments and with alliances that have different characteristics, it is very limited to consider that all relationships rely on the same proximity aspects to develop innovation for exploration and exploitation. The results highlighted that it is the combination

of proximities, that is, their interrelationship, that guide different innovation purposes. Thus, the study contributes with four advances in literature.

Firstly, there is not only one 'prescription' of proximity for alliances that want to innovate, thus, depending on the context, partners can seek closer relationships in different dimensions. The results showed that exploration alliances can rely on three proximity combinations. When there is geographic proximity, indispensably, the alliance needs cognitive and social proximity or institutional and social proximity for the result to be achieved. On the other hand, in a geographic distance context, social, cognitive, organizational, and institutional dimensions need to be present. Innovation alliances for exploitation, in turn, are characterized by two configurations: when there is an absence of geographic proximity, it is necessary to align social, cognitive, institutional, and organizational proximity; when the relationship is geographically close, social and cognitive proximity is necessary, with an absence of organizational proximity.

These results show, therefore, that there is not only one way to achieve innovation results. From these resulting combinations, it is observed that the only configuration that was present in both types of innovation is the one that combines geographic distance with all other non-geographic proximities studied. Companies seeking to design ambidexterity strategies, that is, seeking to develop exploitation strategies to ensure current viability and, at the same time, invest in exploration in order to achieve future viability, must develop all non-geographic proximities (cognitive, social, organizational and institutional), regardless of the partner location.

Secondly, there is an interrelationship between proximities, that is, none of the dimensions is sufficient on its own, since in all configurations, at least three proximities are necessary for the effectiveness of the result. Furthermore, it is concluded that there is a relational asymmetry, in which not necessarily all five proximities need to be present for the positive innovation performance, comparing the preliminary proximity studies (Boschma, 2005; Knoben & Oerlemans, 2006), which highlighted the importance of many proximities. The configurations that present irrelevant dimensions or, still, in the configuration of exploitation alliances, in which the absence of organizational proximity is necessary are evidence of this. Therefore, analyzing the proximities considering only the net effect of the regression, as previously pointed out by Geldes et al. (2017) and Hansen (2014), may be limited as it does not consider a relational perspective of dimensions. A methodological technique such as fQCA may be more suitable for studying organizational configurations and equifinality, in which there are several possible paths to achieve the same desired end result (Fiss & Peer, 2011).

In addition to analyzing proximities in a configurational way, one of the purposes of this study was to investigate whether the proximities change according to the alliance's innovation orientation. The in-depth analysis of these results regarding the relationships of each dimension with the type of innovation (exploit or explore) enables advances in the current knowledge on the subject. Regarding cognitive dimension, a certain absence of this proximity in exploration alliances was expected, as some studies indicate that for the creation of new knowledge, a certain degree of dissimilarity between agents is important, that is, low cognitive proximity (Boschma, 2005 ; Huber, 2011).

However, of the three exploration configurations, two presented cognitive proximity as central. This shows that radical innovations can be achieved even when there is an overlap of knowledge between partners, not depending just on access to new sources of knowledge. Despite the surprising result, there is support in a study on university-industry partnerships that highlights the importance of cognitive proximity for innovation as a substitute for geographic proximity, that is, when partners are geographically distant, cognitive proximity overcomes physical distance barriers for radical innovations (Garcia, Araujo, Mascarini, Gomes dos Santos, & Costa, 2018). Alternatively, this result can be explained by the interrelationship between proximities, since intense (social) contact is essential for the development of mutual (cognitive) understanding between companies and their university partners (Lauvås & Steinmo, 2019). When it comes to innovation for exploitation, results were congruent with those highlighted in the studies by Hansen (2014) and Huber (2011), in which the need for cognitive proximity is pointed out, so that results can be achieved in a shorter period of time. These positive results from collaboration with cognitively close sources are observed for both product and process innovation (O'Connor, Doran, & McCarthy, 2020). Therefore, as expected, in all configurations in the innovation alliances for exploitation, cognitive proximity is central (Huber, 2011).

There was also a substitution relationship between cognitive and institutional proximity in exploration alliances. It is interesting to note that cultural, habit, and value differences (institutional) can be overcome by an alignment in the knowledge base (cognitive). Somehow, this result corroborates what was observed by Broekel (2015), who shows, in the long term (usually necessary for innovation in exploration), cognitive and institutional proximities co-evolving, as institutional changes generate cognitive changes in organizations. The opposite scenario also favors innovation for exploration, in partnerships where there is institutional proximity, the mandatory existence of overlapping knowledge between partners is minimized.

Organizational proximity proved to be irrelevant for innovation for both exploration and exploitation when partners are physically close and there is the presence of other dimensions. The highlight is the requirement for the absence of organizational dimension for innovation for exploitation, in a geographic, cognitive and social proximity context. This result confirms that in exploitation alliances, having an accentuated command line hinders the achievement of innovation results, so an autonomous relationship between parties is more appropriate (Gonzales & Melo, 2018). Additionally, organizational proximity was only necessary when geographic proximity appeared to be irrelevant. This solution is consistent with the study by Hansen and Mattes (2018), who emphasize that when there is greater autonomy among those involved, there is less dependence on physical proximity. In this scenario, the relationship of control and autonomy needs to be better defined, regardless of the desired innovation results.

The third contribution is the emphasis that social proximity had in the configurations obtained in this research. Social proximity was expected to be present in exploit relationships, based on already consolidated knowledge, as pointed out by Steinmo & Rasmussen (2016), or even only when the allies were geographically close, according to Huber (2011). However, the results highlight that trust, friendship ties, and prior relationships are important in all proximity

configurations, both for exploration and exploitation. By establishing personal relationships of trust, cultural differences, rules and work models are more easily understood and overcome. Furthermore, when there is trust between the partners, the chance of important information being inappropriately disclosed is reduced (Molina-Morales, 2015). Although no proximity alone is enough, social proximity was the only causality dimension identified as necessary to achieve performances, that is, any alliance needs to create and foster social ties between those involved.

Although some studies already recognize the importance of social proximity for innovation, the geography of social networks and the way they contribute to the strengthening of innovation are still little explored, especially in developing countries (Xu, Yang & Xue, 2019). The present study advances in literature by analyzing the social dimension in geographically distant and close relationships, from the perspective of companies predominantly based in Brazil. The traditional view of territorial innovation models states that spatial proximity is highly related to social proximity, to the fact that the first facilitates the second (Boschma, 2005) or almost automatically leads to it (Huber, 2011). Nevertheless, results point to the construction of social proximity both in close and physically distant relationships. This highlights the fact that social proximity can be maintained over long distances and does not require permanent spatial proximity.

Finally, the fourth contribution is related to geographic proximity. Studies inspired by economic geography share the emphasis that companies' innovative activities show a "spatial adherence" and, for this reason, location is a primary determinant of the competencies that an alliance possesses (Iammarino & McCann, 2006). Hinzmann, Cantner and Graf. (2019) even show that the need for geographic proximity increases when knowledge is new, and the innovation effort is more radical (exploration). Because of this evidence, much research has focused on investigating only the effects of physical proximity on relationships (Bishop, D'Este & Neely, 2011; Huber, 2011). However, the results show that the spatial distance of the allies is not an impediment to exploration and exploitation innovations. The findings even reinforce that the role of geographic proximity is peripheral in alliances.

Thus, the concern with the lack of face-to-face contact can be minimized as long as cognitive, institutional, social, and organizational proximities are present. Therefore, it becomes evident that analyzing alliances exclusively from a geographic perspective is not enough, as organizations need to pay more attention to establishing and intensifying non-geographic proximities so that innovation can happen. Added to this, preliminary studies have already highlighted that geographic proximity acts as a facilitator of other dimensions (Boschma, 2005; Hansen, 2015; Mattes, 2012). Therefore, the statements are reinforced, since in configurations where there is geographic proximity, there was a need for a smaller number of non-geographic proximity. In fact, when partners are physically close, allies need to be less concerned about fostering all proximities, although at least two more dimensions are required, depending on the innovation motivation.

As managerial implications, we highlighted that for alliances to reach their innovation goals, proximity between partners is necessary. There is no need for proximity in all dimensions, but it is important to have a combination of at least three distinct proximities, depending on the desired innovative orientation. Thus, preventively, allies can investigate the existing proximities even before establishing the alliance. In short, in alliances where those involved do not have

a minimum of proximity, it will be difficult to achieve innovation results. The opposite is also true, companies do not necessarily need to have proximity in all dimensions to have a successful partnership. It also reinforces the importance of companies to build social networks, since innovation results will hardly be achieved by the alliance if there is no social proximity.

When there is social proximity, many barriers to innovation are minimized, since trust sometimes transposes the mechanisms of legal regulation, lack of cultural alignment, and even the absence of overlapping knowledge. Finally, we highlight that geographic positioning is irrelevant, as long as there are other proximities between the allies, reducing the importance given by many entrepreneurs in seeking co-located partners.

CONCLUSION

Throughout this study, an investigation of the influence of proximities on innovation alliances for exploration and exploitation was carried out. This study premise was that the proximity between partners is important for innovation, but it is the combination of them that will lead to different results. We observed that proximity is not necessary in all dimensions for the achievement of innovation results, as the distance in one dimension can be compensated by the existence of proximity in others, however, no isolated proximity is able to promote innovation alliances.

We concluded that proximities influence in different ways the alliances' innovation orientation. In the context of physically close partners, exploration alliances are dependent on social proximity, combined with cognitive or institutional proximity. The exploitation alliances, on the other hand, are dependent on cognitive and social proximity, added to the absence of organizational proximity. It is noteworthy that when geographic proximity is irrelevant, all non-geographic proximity dimensions are necessary for both exploration and exploitation. These findings reinforce that geographic proximity is a facilitator for reaching innovation, but being physically distant is not an impediment for innovating, as long as there are other proximities present. Finally, it is worth to highlight the relevance of social proximity in alliances. This is indispensable in all configurations, without trust, no alliance will achieve its goals. Therefore, it is evident that close personal relationships can serve as efficient strategies for crossing boundaries in the knowledge base, command line, cultural alignment, and even physically distant relationships.

As theoretical implications, there are advances with the studies of alliances, highlighting that geographic proximity is less relevant than what studies in the area suggest and that the focus of the alliances analysis should be the non-geographic proximities. As managerial contributions, we noted that at least three proximities are necessary for the exploration and exploitation alliances to carry out. It is reinforced that geographic distance is not a barrier to the alliance relationship and that the focus must be given to social, institutional, cognitive, and organizational alignment. Finally, entrepreneurs and managers seeking to build alliances for exploration and exploitation innovations should strengthen their social networks, as this is an indispensable dimension for any relationship and, also, it is a decisive factor for the beginning of the alliance.

This research has limitations that may lead to further improvements. A methodological limitation is related to analyzing the results of the alliance considering only the perspective of one of the partners. Thus, we suggest, for future research, analyzing the innovation perspective of everyone involved in the alliance. Another limitation is related to the investigation of innovation projects in dyad; however, the company can develop other proximity mechanisms with other partners, which were not considered. Further analysis of the proximity aspects considering the company's network can be a great contribution. Finally, geographic proximity was investigated considering national and international relationships. Considering that the results suggest an irrelevance of this matter, future research can advance in literature analyzing a geographic dimension within a same country.

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AUTHORS' CONTRIBUTIONS

Jessâmine Salvini and Simone Galina worked on the conceptualization and theoretical-methodological approach. The theoretical review was conducted by author Jessâmine Salvini, with support and guidance from author Simone Galina. Data collection was coordinated by Jessâmine Salvini. Finally, the authors Jessâmine Salvini and Simone Galina participated in the data analysis. All authors participated in the writing and final review of the manuscript.