# INTERORGANIZATIONAL RELATIONSHIPS IN THE HEALTH FIELD: A QUALITATIVE ANALYSIS ON THE CONSTITUTIVE ELEMENTS OF A HEALTH INNOVATION ECOSYSTEM IN PASSO FUNDO

## AS RELAÇÕES INTERORGANIZACIONAIS NO CAMPO DA SAÚDE: UMA ANÁLISE QUALITATIVA DOS ELEMENTOS CONSTITUTIVOS DE UM ECOSSISTEMA DE INOVAÇÃO DE SAÚDE DE PASSO FUNDO

## RELACIONES INTERORGANIZACIONALES EN EL CAMPO DE LA SALUD: UN ANÁLISIS CUALITATIVO DE DOS ELEMENTOS CONSTITUTIVOS DE UN ECOSISTEMA DE INNOVACIÓN EN SALUD DE PASSO FUNDO

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**ABSTRACT**

**Objective**: Characterizing the health innovation ecosystem in Passo Fundo, a municipality in the north of the state of Rio Grande do Sul, aimming to identify some of the constitutive elements of an innovation ecosystem.
**Methodology**: It is characterized as empirical in an applied nature, with a qualitative approach and as for the technical procedures, as descriptive. The analysis categories used were: density, fluidity, connectivity and diversity, according to the model by Stangler and Bell-Masterson (2015). A data collection with actors considered ecosystemic was carried out. The analysis and interpretation of the data, used the content analysis, supported by the NVIVO® software.
**Results**: The existence of a potential health innovation ecosystem was found to be in its initial phase. Among the identified characteristics of the health innovation ecosystem, density and connectivity stand out, with the diversity and fluidity categories in need of greater attention.
**Originality:** In Brazil, some initiatives have been mapping different innovation ecosystems, such as in São Paulo with the launch of "*Mapa SP Conecta* (Investsp, 2016)" and in Minas Gerais with the creation of "*Mapa da Inovação* (SIMI, 2020)". However, a gap has been observed in studies focusing on the characterization of health innovation ecosystems due to the importance that the sector represents in terms of employment, income and quality of life for the population.
**Limitations:** The results found reflect the vision of a group of actors, not their totality, and the use of a single analysis model to characterize the health innovation ecosystem, being that the joint use of other models and/or other categories of analysis, perhaps can show another configuration of this ecosystem

**Keywords**: Innovation Ecosystem. Interorganizational relationships. Health.

**RESUMO**

**Objetivo**: Caracterizar o ecossistema de inovação de saúde de Passo Fundo, município do norte do Estado do Rio Grande do Sul, com vistas identificar alguns dos elementos constitutivos de um ecossistema de inovação.
**Metodologia**: Caracteriza-se como empírica de natureza aplicada, com abordagem qualitativa e quanto aos procedimentos técnicos, como descritiva. Utilizou-se as categorias de análise: densidade, fluidez, conectividade e diversidade, segundo o modelo de Stangler e Bell-Masterson (2015). Realizou-se a coleta de dados junto aos atores considerados ecossistêmicos. A análise e interpretação dos dados utilizou-se a análise de conteúdo, apoiado pelo *software* NVIVO®.
**Resultados**: Constatou-se a existência de um ecossistema de inovação de saúde em potencial, em fase inicial. Dentre as características do ecossistema de inovação de saúde identificadas, destaca-se a densidade e a conectividade e que as categorias diversidade e fluidez carecem de maior atenção.
**Originalidade:** no Brasil, algumas iniciativas vêm mapeando diferentes ecossistemas de inovação, como em São Paulo com o lançamento do Mapa SP Conecta (Investsp, 2016), Minas Gerais com a criação do Mapa da Inovação (SIMI, 2020). Contudo observa-se uma lacuna em estudos com foco na caracterização de ecossistemas de inovação de saúde pela importância que o setor representa em termos de emprego, renda e qualidade de vida da população.
**Limitações:** os resultados encontrados refletem a visão de um grupo de atores, não sua totalidade e a utilização de um único modelo de análise para caracterizar o ecossistema de inovação de saúde, sendo que a utilização conjunta de outros modelos e/ou outras categorias de análise, talvez possa mostrar outra configuração desse ecossistema.

**Palavras-Chave**: Ecossistema de Inovação. Relações Interorganizacionais. Saúde.

**RESUMEN**

**Objetivo**: Caracterizar el ecosistema de innovación en salud en Passo Fundo, municipio del norte del estado de Sur, a fin de identificar algunos de los elementos constitutivos de un ecosistema de innovación.
**Metodología**: Se caracteriza como empírica, de carácter aplicado, con enfoque cualitativo y en cuanto a los procedimientos técnicos, como descriptiva. Se utilizaron las categorías de análisis: densidad, fluidez, conectividad y diversidad, según el modelo de Stangler y Bell-Masterson (2015). La recolección de datos se realizó con los actores considerados ecosistémicos. El análisis e interpretación de los datos utilizó el análisis de contenido, apoyado en el software NVIVO®.
**Resultados:** Se comprobó la existencia de un ecosistema de innovación en salud con potencial de desarrollo, en una fase inicial. Entre las características identificadas del ecosistema de innovación en salud, se destacan la densidad y la conectividad, y que las categorías de diversidad y fluidez necesitan una mayor atención.
**Originalidad:** en Brasil, algunas iniciativas vienen mapeando diferentes ecosistemas de innovación, como en São Paulo con el lanzamiento del Mapa SP Conecta (Investsp, 2016), Minas Gerais con la creación del Mapa de Innovación (SIMI,

2020). Sin embargo, existe un vacío en los estudios con enfoque en la caracterización de los ecosistemas de innovación en salud, debido a la importancia que representa el sector en términos de empleo, ingresos y calidad de vida de la población.
**Limitaciones**: los resultados encontrados reflejan la visión de un grupo de actores, no en su totalidad y la utilización de un solo modelo de análisis para caracterizar el ecosistema de innovación en salud, considerando la utilización de un conjunto de otros modelos y/u otras categorías de análisis, quizás pueda mostrar otra configuración de este ecosistema.

**Palabras llave**: Ecosistema de Innovación. Relaciones Interorganizacionales. Salud.

## 1 INTRODUCTION

Technological innovation and entrepreneurship have been identified as the main mechanisms for promoting economic and social development (OCDE, 2018). It is the context of economic transformation, for an informational economy, based on knowledge, technological development and interaction of different actors (Castells & Halls, 1995).

Regarding relationships among organizations, the formation of innovation ecosystems stands out, where the concept was defined for the first time in the field of biology, which proclaimed the connection and interdependence among the elements of the system. The ecosystem approach is a metaphor that has been used in the literature in organizational theory with practical applicability since the mid-1990s by Moore (1993) and, since then, the use of the term has been amplified. In recent years, it has been applied in the most diverse areas and scientific fields (Adner, 2017; Adner & Kapoor, 2010; Audy, 2017; Autio & Thomas, 2014; Bodin, 2017; Piqué & Audy, 2016; Teece, 2007; Thomas & Autio, 2012), whenever the study involves an interaction among actors, structure and environment.

The survival of companies and other organizations in the context of the ecosystem is due to coevolution (complex interrelationship among coopetitive strategies), based on intense cooperation and alliances in a systemic strategic consideration (Kapoor & Lee, 2012; Moore, 1996; Teece, 2007).

Innovation ecosystems are seen as conducive to innovative entrepreneurship and the continuous development of innovations. Places that foster spaces for collective learning, knowledge exchange, productive practices and innovative processes, which involve the exercise of creativity, the ability to generate and integrate knowledge and the ability to develop and disseminate new products and services (Spinosa & Krama, 2014).

Adner (2006) states that belonging to an innovation ecosystem can provide the company with value creation and growth, emphasizing that the endogenous potential of the territory and the willingness to innovate are the aspects that encourage the growth and development of the business ecosystem . In this way, the relationship and interdependence existing among companies, as well as the importance of their interorganizational alliances, located or not in the same territory, create a favorable environment for investors to be induced by the force of the market to become productive actors, with the ability to transform the economy, generating productive clusters with a tendency to form an innovation ecosystem (Adner, 2006).

Therefore, the innovation ecosystems comprise the alignment structure of a multilateral set of partners that need to interact for a focal value proposition to be materialized (Adner, 2006), they refer to a group of heterogeneous organizations that co-evolve capabilities in the co-creation of value (Adner & Kapoor, 2010; Autio & Thomas, 2014; Moore, 1993).

In a more contemporary view, an innovation ecosystem is considered the evolving set of actors, activities and artifacts, and the institutions and relationships, including complementary and surrogate relationships, that are important to the innovative performance of an actor or a population of actors (Granstrand & Holgersson, 2020).

From the studies of Moore (1993) the term began to gain prominence within research on organizational management and theories on regional development, suggesting that a business ecosystem evolves over time through an interaction of interdependence, orchestrated through the interorganizational relationships that generate collaboration and strategic alignment among its participating actors. Research in the area is still recent due to its innovative and dynamic character, making the perspective of an innovation ecosystem a promising approach that deserves to be deepened, especially in regional environments, as studies in this context are scarce (Asheim, Lawton, & Oughton, 2011; Marchi & Grandinetti, 2013; Han & Ko, 2017).

In the current scenario of fierce global competitiveness, countries have sought to improve their long-term Science, Technology and Innovation strategies. Regardless of the level of development, initiatives aimed at consolidating innovation

ecosystems are considered a priority by governments and businessmen, who have increased investments in R&D and infrastructure (Brasil, 2016).

In this context, studies such as those by Engel (2015), Lain et al. (2017), Surie (2017) and Vasconcelos (2017), have been mapping different innovation ecosystems around the world, such as Silicon Valley, Quartier de L'Innovation, India and Switzerland. In Brazil, there are also some initiatives that seek to map the innovation ecosystem with the aim of developing actions for orchestration and activation, such as in São Paulo with the launch of "*Mapa SP Conecta* (Investsp, 2016)", in Minas Gerais with the creation of "*Mapa da Inovação"*, as a support for "*Sistema Mineiro de Inovação* (Simi, 2020)" and in Rio de Janeiro with the initiative to map innovation and technology institutions present in the state ecosystem (Rio Info, 2018). However, it is observed that studies aimed at characterizing the health innovation ecosystem are scarce and require greater attention, mainly due to the importance that the sector has in terms of employment, income and quality of life for the population.

The health sector, like other sectors of productive activity, is exposed to the dynamics and complexity of the economic context, enhancing the importance of accelerating the pace of innovations, in order to sustain increasing levels of competitiveness in these environments, despite the need of organizational survival (Moustaghfir & Schiuma, 2013). Researching the health sector highlights its relevance for Brazil's economic development. With the aim of boosting innovation through the growth and development of service production, IPEA has included this topic in its research agenda (Kon, 2016).

As for the practical contribution, in the view of Spinosa, Schlemm & Reis (2015), the implementation of innovation ecosystems can generate numerous advantages for its actors, according to their interests. For governments, this is a strategic choice for development, as it involves a clean industry (knowledge industry). There is an increase in income and, consequently, in taxes, reconcilable with the production of high added value, in addition to providing opportunities for the generation of direct high-level jobs. For universities and scientific and technological institutions, they offer improvements in the quality of teaching and research, based on real and applied problems. Quality research and teaching culminate in an increase in the demand for higher education, one of the factors responsible for its survival. For companies, it generates competitiveness gains due to the fact that it continuously generates innovation.

In this context, the objective of this article is to characterize the health innovation ecosystem of Passo Fundo, a municipality in the north of the state of Rio Grande do Sul, with a aiming to identify some of the constituent elements of an innovation ecosystem. In order to meet the objective of this study, a qualitative research was chosen. The categories of analysis used were: density, fluidity, connectivity and diversity, according to the model by Stangler & Bell-Masterson (2015). Data collection was carried out with the actors considered ecosystemic, selected with the non-probabilistic technique of the intentional type by judgment. As for data analysis and interpretation, content analysis was adopted, supported by the NVIVO® software.

This study is divided into five sections, the first being the introduction. The second section presents the theoretical foundation addressing the Health Innovation Ecosystem and the categories of analysis that guided the study; section 3 details the methodological procedures; section 4 presents the results; and finally, section 5 presents final considerations, limitations and directions for future research.

## 2 INNOVATION ECOSYSTEMS

The term "Ecosystem" was used for the first time in a debate about the nature of biological communities, by the British ecologist Arthur G. Tansley, in 1935 (Christian, 2009). Since then, the term has gained strength and has been heavily used in the field of management studies. Regarding the definition of ecosystem, there are antagonistic concepts among the authors, however, it is a consensus that it is a community of living organisms, living in conjunction with abiotic components (such as water, air, soil minerals), in constant interaction.

The term innovation ecosystem was used to describe networks of organizations connected to a key organization with the aim of evolving and gaining competitive advantage through complementary actions (Moore, 1993). Since in the organizational context, innovation ecosystem consists in the set composed of economic agents and relationships, and non-economic parts such as technology, institutions, sociological and cultural interactions, which aims the development of innovation within a region (Mercan & Götkas,2011).

From the perspective of Moore (1993) firms evolve together around an innovation, forming an innovation ecosystem, producing competitively but also cooperatively, with the aim of developing new products that satisfy the consumer in the market. Thus, Moore (1993; 1996) defines an innovation ecosystem as a set of actors, who seek to

survive in the group and at the same time foster, encourage, create, develop and disseminate innovation through a network (Chesbrought, 2012; Mintzberg, Ahlstrand & Lampel, 2000).

Innovation ecosystems are seen as conducive to innovative entrepreneurship and the continuous development of innovations. Places that foster spaces for collective learning, knowledge exchange, productive practices and innovative processes, which involve the exercise of creativity, the ability to generate and integrate knowledge and the ability to develop and disseminate new products and services (Spinosa & Krama, 2014).

In the definition of the Ministry of Science, Technology, Innovation and Communication (2019), an innovation ecosystem is the space that adds infrastructure and institutional and cultural arrangements, which attract entrepreneurs and financial resources and constitute places that enhance the development of the knowledge society. The concept of innovation ecosystem reinforces the systemic aspect of companies' innovative activity, emphasizing the co-evolution among agents, which characterizes this process (Xú & Maas, 2019).

In this sense, the sector of health services provision gains prominence, which from the 1980s onwards is seen as a business and becomes part of a highly complex and competitive market, largely due to the appearance of private companies in this field, these activities began to have a greater economic dimension and gained the status of an economic and industrial health complex (Gadelha, 2003). They are considered economic activities that generate employment and income, because health care activities are highly labor-intensive and socially desirable, as they cause positive externalities (SICSÚ et al., 2006)

The health sector is part of a broader process of productive restructuring, within what many have been calling the “Knowledge Economy”. In this direction, the health sector constitutes, simultaneously, an important space for innovation and capital accumulation, with the convergence of sectors, activities, companies, public and private institutions and civil society, for a certain economic space for investment generation , consumption, innovation, income and employment (Gadelha, 2003).

According to Gadelha (2003) the health industrial complex is inserted in a political and institutional complex, which ends up conditioning and being conditioned by its evolutionary dynamics. Due to its intensity in knowledge and technology, the relations between the industrial health complex and science and technology institutions are the key to the success of the complex, thus constituting an essential source of technological innovation and production, which is revealed to be a factor of paramount importance for the competitiveness in the industrial segment.

The productive dynamics of the health complex is directly linked to universities, which are capable of producing knowledge to civil society, which is the destination of the industrial production from the complex, and to the State, which has an active role in the formulation and regulation of policies and incentives, and it also assumes the role of the largest consumer of goods and services generated by the complex, through the Unified Health System (Gadelha, 2003).

In this bias Battistella et al. (2013) and Xu et. al. (2018) state the importance of characterizing an innovation ecosystem, as it can help to identify the components and relationships among the various actors involved, providing a holistic view of the system and examining a pattern of behavior and impact mechanisms, as well as monitoring their evolutionary trends.

In this sense, the authors Stangler & Bell-Masterson (2015), in their study, proposed four elements to characterize an innovation ecosystem: (i) density; (ii) fluidity; (iii) connectivity and; (iv) diversity.

Density is defined by Stangler & Bell-Masterson (2015) as the number of new and young firms in a given area, along with their level of employment and distinguished by industry affiliation. According to the study by Stam (2018), the density of the ecosystem raises the level of confidence of other ecosystem actors, promoting the region to other entrepreneurs in search of new opportunities.

Stangler & Bell-Masterson (2015) state that the connections between ecosystem actors are as important as the actors themselves. Connectivity is important for actors, as it helps them solve problems, find talent, attract funding and build relationships that translate into networks of cooperation, expanding opportunities that alone would not be possible.

The term fluidity is used to refer to the reallocation of people and resources Stangler & Bell-Masterson (2015). The empirical study by Stam (2018) highlighted the level of fluidity of a drug company that successfully recruited new talent from other geographic areas, given that its region had significant shortages. Therefore, the fluidity category advocates that the ecosystem must be fluid so that entrepreneurs can reallocate available resources, which are often scarce, in order to enable innovation.

Finally, diversity, which is associated to the fact that it is good for an ecosystem not to be too dependent on just one industry or organization, as well as the diversity of people that the ecosystem contributes to. For Stangler & Bell-Masterson (2015) diversity includes economic diversification, immigration and income mobility.

These four categories proposed by Stangler & Bell-Masterson (2015) were designed to characterize an entrepreneurial ecosystem, as can be seen. This study, uses these same categories of analysis to verify the existence or not of a health innovation ecosystem, in view of the similarity of purposes of the organizational arrangements that characterize both entrepreneurial ecosystems and innovation ecosystems, namely, existence of economic and non-economic relations, inter-institutional relations with the aim of developing innovations in the same region, spaces for collective learning, exchange of knowledge, dissemination of technologies, spontaneous and induced initiatives by entrepreneurs and innovators in the same territory to enhance new products, services and markets (Spinosa & Krama, 2014; Spinosa, Schlemm & Reis, 2015; Xú & Maas, 2019).

## 3 METHODOLOGY

To meet the objectives proposed for this study, empirical research was used through qualitative research. Research with a qualitative approach is appropriate when referring to the investigation of organizational processes and their informal and non-structural connections (Deslauriers & Kerisit, 2008; Marhall & Rossman, 2014). Through qualitative research, the aim is to understand, based on qualifiable data, the reality of certain phenomena, based on the perception of the various social actors (Cervo & Bervian, 2002; Gil, 1999).

The object of study is composed by organizations and institutions associated to the Industrial Commercial Association of Services and Agribusiness (ACISA), belonging to the municipal health sector. The selection of research subjects was based on the non-probabilistic technique of the intentional type by judgment. The research subjects refer to managers with strategic positions (directive core), in command and coordination positions, whose decisions influence their organizations, as well as the ecosystem dynamics. Therefore, 12 (twelve) ecosystem actors were interviewed, who, for the purposes of data analysis and interpretation, will be coded as follows: CA (company actor), GA (government actor) e UA (university actor). Table 1 presents the 12 ecosystem actors, research subjects, and their respective positions and represented institutions, as well as the duration of the interviews.

**Table 1**
Research subjects

| Ecosystem Actor | Organization | Position | Interview duration |
|---|---|---|---|
| UA1 | University A | Director | 2,30 hs |
| UA2 | University B | Coordinator | 1,45 hs |
| UA3 | University C | Coordinator | 2,10 hs |
| CA1 | Laboratory | Proprietário | 1,10 hs |
| CA2 | Hospital A | Director | 2,15 hs |
| CA3 | Hospital B | Director | 1,55 hs |
| CA4 | Pharmaceutical Industry | Manager | 2,35 hs |
| CA5 | Diagnostic Clinic | Coordinator | 1,45 hs |
| CA6 | Trade Association | Director | 2,13 hs |
| GA1 | State | Secretary | 1,50 hs |
| GA2 | State | Secretary | 1,20 hs |
| GA3 | State | City Councilor | 1,55 hs |

Source: elaborated by the author (2022)

The collection of data from this type of research is also based on documentary research on websites, minutes and other records considered useful for achieving the proposed objectives (Vergara, 2004). The data collection instrument was created by the researchers and its development was related to the objectives of this study, based on the conceptual outline presented throughout the theoretical framework.

In this sense, a group of questions was elaborated based on the categories proposed by Stangler & Bell-Masterson (2015): density; fluidity; connectivity; and diversity, as explained in the theoretical framework of this study. The interviews were individual, in online format, using Microsoft Teams®, recorded and later transcribed in full for data analysis. Each interview lasted, on average, two hours per interviewee. The interview period was from February to April 2021.

Conducting data analysis covers several steps, so that meaning can be given to the collected data (Alves-Mazzotti & Gewandsznajder, 1998; Minayo, 2020). Regarding the different phases inherent to content analysis, authors differ in the use of terminologies, however, they have certain similarities (Triviños, 1987). Considering such diversity, but still, terminological approximation, it was decided to adopt as a guide, for this study, the steps of the technique proposed by Bardin (2019), these steps are organized into three phases: 1) pre-analysis, 2) exploration of the material and 3) treatment of the results, inference and interpretation.

Bardin (2019) states that the first phase, pre-analysis, is developed to systematize the initial ideas posed by the theoretical framework and establish indicators for the interpretation of the collected information. The phase comprises the general reading of the material chosen for analysis, in the case of analysis of interviews, these must already be transcribed. In general, the organization of the material to be investigated is carried out, such systematization serves so that the analyst can conduct the successive analysis operations (Bardin, 2019).

Once the first phase, described above, is completed, the material is explored, which constitutes the second phase. Thus, Bardin (2019) declares that the exploration of the material consists in the construction of coding operations, considering the clipping of texts in record units, the definition of counting rules and the classification and aggregation of information into symbolic categories or themes. Bardin (2019) defines codification as the transformation, through clipping, aggregation and enumeration, based on precise rules about textual information, representative of the characteristics of the content.

The third phase comprises the treatment of results, inference and interpretation and consists on capturing the manifest and latent contents contained in all the collected material (interviews, documents and observation). The comparative analysis is carried out through the juxtaposition of the different categories existing in each analysis, highlighting the aspects considered similar and those that were considered different (Bardin, 2019).

In the data analysis, the content analysis technique was used, which, according to Bardin (2019), has as its object of study the record itself, present in a text, a document, a speech, or a video. In order to support the content analysis, the NVIVO®11 software was used, which helped compile the theoretical basis and transcribe the interviews, with the aim of relating theory to empirical analysis (Teixeira & Becker, 2001).

## 4. RESULTS PRESENTATION

The focus of the studies under the ecosystemic perspective is concentrated on the forms of articulation, cooperation and learning among individual firms and with other actors, such as government, business associations, development institutions, teaching and research, both regarding the production system and the process of innovation and learning. The dynamics inherent to innovation ecosystems requires that the actors involved play multiple roles in the different stages of the ecosystem (Rabelo & Bernus, 2015).

Regarding the connectivity category, most ecosystem actors point out that due to the high level of competitiveness among actors in the health sector, the connectivity is partial. A polarity was identified, with the formation of groups in the health sector. This fragmentation of groups is identified in the following statements by the interviewees:

> *What people do is a much more "defensive" logic in the last attempt to create a cluster in the health sector, people sat down at the table, but they are defending themselves the whole time... so far I can provide the information... there I can't." I'd better try to do it myself". because I don't trust the guy next to me....so it's a low trust environment....(UA1)*

However, it was also observed that the ecosystem actors perceive the existence of connectivity, even if in a less partial way, as pointed out in the speech of the interviewed actors:

> *We also worked at the state level, so meetings with the state SEBRAE, meetings there at the state development department, meetings with the hospitals there, like the rest of the organizations they have a regional character here, they had no "arm" outside, it was normal to have a "dispute" of who represented the region there with the state government. (UA1)*

For Teixeira, Trzeciak & Varvakis (2017), the infrastructure of an innovation ecosystem requires connections that include mobility and transport, communications, education, services, financial resources, culture and entertainment, public safety, human resources (talent), public policies, governance and ecosystem management, specialized services, market,

innovation environments, relationship networks. These contradictions and divergences pointed out go against the evidence of solid connectivity highlighted in the literature for the configuration of an innovation ecosystem.

It is important to mention that the infrastructure of an ecosystem facilitates the operationalization of activities, as well as the interaction among actors. Stangler & Bell-Masterson (2015) are complementary in stating that in order to characterize an innovation ecosystem, one must take into account the density and heterogeneity of actors in interaction.

In this regard, the reports below point to the perception of the actors interviewed about the density and heterogeneity of companies in the innovation ecosystem, the object of investigation. Such evidence indicates an incipient degree of density and diversity of companies interacting in the health innovation ecosystem in the city of Passo Fundo.

> *In an attempt to organize the health ecosystem of Passo Fundo, we brought together the presidents of the companies, the rectors of the universities, plus a group of other actors. We expanded the group from nine to about thirty companies, which would participate in the project... actors around a table and choose together which would be the axes of the strategic planning of the innovation ecosystem...questions like this started to come up...some of the actors had not completely opened up their strategies, due to the lack of trust in the other actors.. From then on, we were unable to properly complete this phase, and the project died... (CA2)*.

However, it is important to consider that the ecosystem actors partially agree on the existence of negative density and heterogeneity in the health innovation ecosystem, object of study, as can be seen in excerpts taken from the speeches of the ecosystem actors:

> *Our work began with a survey of who the actors would be. We look at commerce (what are the companies), education (what are the universities, research institutes), government institutions, which is the political part, the State. So, entities come in, right, in '.org'. It's... class institutions, in short, companies, universities, research institutes and the State, right? And each of them has actors that connect in some way within this ecosystem. (UA2.)*

As for the fluidity category, Stangler & Bell-Masterson (2015) state that an ecosystem must be fluid so that entrepreneurs can reallocate available resources, which are often scarce, in order to enable innovation. This fluidity appears only subliminally in interorganizational relationships, whether in the acquisition of equipment and instruments necessary for operations in the field of health, or in institutional relationships arising from the social and political articulations of the actors, as observed in the highlighted speeches:

> *We acquire ophthalmic diagnostic equipment arising from market needs and due to the high cost of the equipment, we carry out a joint action with other physicians, both for acquisition and for a better return on investment.* (CA2).

The vision of the concept of innovation ecosystem by Adner & Kapoor (2010), goes beyond the perspective of a regulated business environment, the authors deepen the discussion, for increasingly complex environments, with network mechanisms involving sellers and buyers. For those mentioned above, the innovation ecosystem would be more associated with a large network, with interdependent actors and with a clear common objective, which would be the development of innovation. In this way, the challenge of innovating is not only the result of a company's individual interest, but of the symbiosis involving the synergy among the various actors in the innovation process.

From the interviews carried out, it is possible to indicate the existence, even partial, of interorganizational relationships, where connectivity is perceived, however, not as a common and orchestrated practice, but through deliberate actions of some actors.

With regard to density and heterogeneity, the actors perceive these categories to be present in the health innovation ecosystem. In some speeches it is possible to perceive that this density of companies puts the innovation ecosystem in the spotlight, due to this element.

Fluidity as an element to characterize the health innovation ecosystem is perceived by most ecosystem actors, however it is possible to observe, in the interviews, that there are deficiencies in interorganizational relationships that allow the reallocation of sufficient resources to meet the demands of the sector.

In this way, considering these four categories of analysis by Stangler & Bell-Masterson (2015), the health innovation ecosystem in the city of Passo Fundo, still presents weaknesses in order to conclude that it is an arrangement of initial interorganizational relationships, requiring advances for its consolidation.

## 5. FINAL CONSIDERATIONS

The objective of this article is to characterize the health innovation ecosystem in Passo Fundo, a municipality in the north of the state of Rio Grande do Sul, with aiming to identifying some of the constituent elements of an innovation ecosystem, based on the categories: connectivity, diversity, density and fluidity.

Bearing in mind the challenges that the health sector has been facing in terms of competitiveness, the research recognizes the complexity and importance of the interactions of the different actors in the innovation process. For this reason, the system needs to create particular dynamics that allow the set of actors to become more collaborative in terms of their ability to create work processes, services and innovative infrastructures, capable of jointly making the health ecosystem more competitive and developed. On the other hand, the study also enabled the actors to understand and better comprehend the importance of collaboration for the constitution of an ecosystemic environment.

The interviews with ecosystem actors revealed that density and connectivity were the two categories within the Stangler & Bell-Masterson (2015) model that were most significant from the interviewees' point of view. In this study, density refers to the number of companies within the innovation ecosystem. Ecosystem actors value density, as the existing dynamics within the innovation ecosystem enables new opportunities for interaction and exchange of knowledge, resources and experiences.

Connectivity is defined as the connections between elements of the innovation ecosystem. The interviews confirm that connections are important as they help actors to solve common problems, such as cost reduction, talent training and retention, investment attraction, public policies, etc. For most actors, building strong inter-organizational relationships translates into new customers, new markets and leverages the innovative performance of the innovation ecosystem.

However, the diversity and fluidity categories need more attention, for the interviewees, the entry of new actors in the innovation ecosystem would be extremely important to reduce the sector's dependence on importing inputs from other regions and countries. As for fluidity, the reallocation of resources is perceived in an incipient way, its development would enable gains for the ecosystem, thus providing an increase in the innovation capacity of the entire ecosystem.

From a practical point of view, the conclusions of this study recognized the complexity and importance of the interorganizational relationships necessary for the formation of a strong health innovation ecosystem capable of bringing greater levels of competitive advantage to the actors. In the same way, it presented to the ecosystemic actors, a possibility of greater reflection on the existing relationships and the existing opportunities in this configuration of interorganizational arrangement. In this context, this study presented a methodology and approach to the topic with a practical focus on better understanding an innovation ecosystem. It was possible to verify that the results allow the analysis and dissemination of elements for the formulation of relationship and articulation strategies. One of the implications of the work carried out is to move forward in the discussion of the contours of a theoretical and practical framework in innovation ecosystems, combining analytical perspectives capable of favoring organizational strategies.

It is also necessary to consider that this study has some limitations. Among them, it is highlighted that the results of the present study reflect the vision of a group of actors that represents the top management of the organizations involved in the ecosystem and, still, part of them, not its entirety. Therefore, the results found concern the reality and context of this group of actors, therefore, they are perceptions of this group specifically and the set of organizations that make up the sample. Certainly, the expansion of the study, also considering other levels of ecosystem actors and a greater scope of the complete set of organizations and institutions that integrate the health innovation ecosystem of Passo Fundo, may show other evidence not contemplated here regarding a better characterization of this ecosystem.

Another limitation also present in the study refers to the option of using a single analysis model to characterize the health innovation ecosystem, object of study. The joint use of other models and/or other categories of analysis, in addition to those used, may perhaps show another configuration of this ecosystem.

In view of these limitations, the suggestion for future research is to involve actors at different levels of decision and operation of the set of organizations that integrate these interorganizational arrangements that can characterize an ecosystem, as well as the expansion of categories of analysis, in addition to the aspects related to connectivity, diversity, density and fluidity, in order to contemplate other dimensions that this study did not consider in the characterization of the health innovation ecosystem.

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