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Science and technology parks as a quadruple helix nucleus: a proposal for regional development of Mato Grosso - Brazil

Parques de ciência e tecnologia como núcleo da quádrupla hélice: uma proposta para o desenvolvimento regional de Mato Grosso - Brasil

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Abstract
Science and technology parks are structures for promoting regional development based on the interaction between innovation actors. Through the establishment of knowledge flows, which subsidize the creation of innovations, they act as a nucleus of the quadruple helix between university, business, government, and society in innovation ecosystems. This study aimed to propose actions for the development of the Mato Grosso Technological Park based on the quadruple helix model. A case study strategy was used, which included documental research, in-depth interviews, and a focus group. Data were interpreted through content analysis in the deduction. The results pointed out the absence of a "strong player" for the establishment of the innovation ecosystem. For this, some actions were suggested considering aspects of the region, to allow the park to occupy a privileged space in the quadruple helix.
Keywords: innovation ecosystem; quadruple helix; Mato Grosso technological Park.

Resumo
Os parques de ciência e tecnologia são estruturas para promoção do desenvolvimento regional a partir da interação entre atores da inovação. Por meio do estabelecimento de fluxos de conhecimento, que subsidiam a criação de inovações, atuam como núcleo da quádrupla hélice entre universidade, empresa, governo e sociedade nos ecossistemas de inovação. Este estudo teve como objetivo propor ações para o desenvolvimento do Parque Tecnológico Mato Grosso a partir do modelo de quádrupla hélice. Empregou-se uma estratégia de estudo de caso, que contou com pesquisa documental, realização de entrevistas em profundidade e um grupo focal. Os dados foram interpretados a partir de análise de conteúdo. Os resultados apontaram a ausência de um "jogador forte" para o estabelecimento de um ecossistema de inovação no território. Para isso, algumas ações foram sugeridas considerando os aspectos da região, de modo a permitir ao parque consolidar uma ação mais integrada entre os membros da quádrupla hélice.
Palavras-chave: ecossistema de inovação; quádrupla hélice; Parque Tecnológico Mato Grosso.

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1 Introduction

In a knowledge-based economy, collaboration was never so important. To Etzkowitz and Zhou (2018), innovation has been transformed from linear processes based on industry to nonlinear processes, in a society increasingly intensive in knowledge. Universities, research organizations, and governments are acting to promote the innovation process (COMPAGNUCCI; LEPORE; SPIGARELLI, 2021). Moreover, they form a Triple Helix innovation process (ETZKOWITZ; LEYDESDORFF, 2000), henceforth denominated as TH in innovation ecosystems (HEATON; SIEGEL; TEECE, 2019).

Helix model, hatched in the United States, shows how cooperation among different parts propels innovation and entrepreneurship (ETZKOWITZ; ZHOU, 2017). Afterward, the Society was included as a part of Quadruple Helix, denominated in this article as QH. In this approach, it is understood that civil Society, formed by creators, users, and providers (MACHADO; LAZZAROTTI; BENCKE, 2018), based on media and culture, acts as an innovation enforcer (CARAYANNIS *et al.*, 2018). The involvement between governments, established companies, universities, and the third sector may promote entrepreneur ecosystem development (SCARINGELLA; RADZIWON, 2018) and regional development (ETZKOWITZ; ZHOU, 2017).

In the triple and quadruple helix context, science and technology parks (STPs) "constitute a point of contact between the scientific community and the innovation community, especially as they include all the agents present in the innovation system in their spaces" (ADÁN, 2012, p. 89). STPs are ventures formed by research laboratories and companies to create new products and services related to research from local universities (ETZKOWITZ; ZHOU, 2018). Several countries have used a strategy of establishing STPs to promote socioeconomic development. These hybrid structures directly impact the positive effect of innovation (JONGWANCH; KOHPAIBOON; YANG, 2014) and drive technological development (MACHADO; LAZZAROTTI; BENCKE, 2018).

Considering that STPs development involves joint efforts between university, industry, government, and society (ETZKOWITZ; ZHOY, 2018), it is understood that the quadruple helix model is relevant to analyzing the actions that can consolidate them. In a QH innovation model, a STP is an intermediate among its components (ETZKOWITZ; ZHOU, 2018; JONGWANICH; KOHPAIBOON; YANG, 2014), facilitating collaboration between the innovation actors (COMPAGNUCCI; LEPORE; SPIGARELLI, 2021) and the coordination of the Research and Development collaboration (P&D) (JONGWANICH; KOHPAIBOON; YANG, 2014).

Thus, it is argued that Science and Technology Parks may be the core of QH. While the ecosystem innovation actor's collaboration spaces allow encouraging culture and innovation in the region, the joint competencies development and the emergence of new components. In literature, the use of helix models was applied in many ways. However, studies that use these structures to support the STPs development are still scarce (BENCKE *et al*., 2019, CHAMPENOIS; ETZKOWITZ, 2018).

This study is part of the assumption that QH is a model capable of injecting a systemic and collaborative vision among STPs and innovation ecosystems. It is asked, then, "which actions contribute to STPs being implemented to develop and promote innovation ecosystems?". In this sense, the article proposes the employment of a QH conceptual model to consolidate a STP being implemented. Therefore, the Mato Grosso Technological Park (MTTP). Located in a region with no technological and industrial tradition, MTTP was launched as a state government strategy to promote local development. From the use of the case

study strategy, we sought to propose a plan of action for the development of the referred park from the QH model. For this, contextual issues of the region were investigated, as well as the challenges for the development of a regional innovation ecosystem.

2 Literature review

This section summarizes the literature that guided the construction of the research, as well as concepts and models that guided the collection and interpretation of data. From the approach of innovation ecosystems, the QH model was chosen to guide the dialogue between the technology park and local actors.

2.1 Innovation ecosystems

The term ecosystem, originally proposed in ecology by Tansley (1935), was used to represent the set of relationships between physical and biological components in the environment (ANKER, 2002). Although it faced resistance from the community of the area in its early years (WILLIS, 1997), the formulation is considered one of the most important domains of ecology (KATO; MARTINS, 2016). In the area of Management, the concept was transposed by Moore (1993) under the domain of business ecosystems, inspired by the symbiotic relationships between animals, plants, and the environment to refer to a new logic of competition between companies. Years later, innovation ecosystems were invoked to illustrate the arrangements by which different companies organize themselves to jointly create value through a customer solution (ADNER, 2006).

In recent years, the production of knowledge in the field of innovation ecosystems has grown exponentially (FOGUESATTO *et al*., 2021), which reveals the maturing of the field. Proof of this is that a unified definition of what innovation ecosystems still seem far from being achieved. Several theoretical studies and literature reviews have made efforts to form a more integrated understanding of what is behind the transposition of the concept of ecology to the area of management and business (ADNER, 2017; FOGUESATTO *et al*., 2021; GOMES *et al*., 2018, 2021; GRANSTRAND; HOLGERSSON, 2020; HOU; SHI, 2021; PHILLIPS; RITALA, 2019). In addition, several criticisms were presented regarding the pertinence of the term, such as its metaphorical use and low theoretical depth (OH *et al*., 2016).

It is assumed in this study that the prefix “eco” is relevant for several reasons. Ritala and Almpanopoulou (2017) state that the use of transpositions of biology is common in the field of management, exemplified by Evolutionary Economics and organizational ambidexterity. Martins *et al.* (2019), based on a biomimetic approach, employed fundamentals of ecology to reveal how the attributes of biological ecosystems can correspond to innovation ecosystems. These authors observed that innovation ecosystems correspond to a set of agents related by economic and non-economic factors, geographically limited and that co-evolve in an interdependent way.

This perspective, in addition to revealing how the prefix “eco” injects dynamism into systems from the emphasis on interdependence relationships, differs from classic innovation literature, such as the national and regional innovation system (COOKE, 1992; NELSON, 1993), given that these emphasize system actors through top-down policies (THOMAS; FACCIN; ASHEIM, 2021). To correspond to the unit of analysis of the study, supported by the distinction between the business innovation ecosystem and the regional innovation ecosystem (FENG; LU; WANG, 2021), a broader definition of innovation ecosystems was adopted. They represent “an 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, p. 1).

A regional innovation ecosystem approach emphasizes how a territory's co-evolved capabilities and governance mechanisms allow different actors to increase their innovative performance through value creation (HEATON; SIEGEL; TEECE, 2019; THOMAS; FACCIN; ASHEIM, 2021). The quadruple helix structure (CARAYANNIS; CAMPBELL, 2009), an evolution of the triple helix, was chosen to decompose the innovation ecosystem.

2.2 Science and Technology Parks as the core of the Quadruple Helix

Companies, laboratories, and research groups have been connecting through STPs. Science and technology parks are environments usually articulated by a governance committee represented by university, government, and company (ETZKOWITZ; ZHOU, 2018). According to these authors, the university, in addition to providing trained people and basic knowledge, plays a role as a source of business formation and regional progress. On the other hand, the government contributes through changes in the regulatory, fiscal, and public investment spheres. To achieve the common goal of knowledge-based economic and social development, TH provides a flexible organization to conduct efforts, starting from multiple actors (ETZKOWITZ; KLOFSTEN, 2005).

Subsequently, with the inclusion of Society as part of the QH, the need arose to train and integrate the ecosystem's value creators, being users of innovative products or services (CARAYANNIS *et al*., 2012; KIMATU, 2016). These can even assume a participatory role as co-creators of innovations, whether they are inventors, artists, entrepreneurs, and other profiles that collaborate to collaborate in proposing solutions (CARAYANNIS; RAKHMATULLIN, 2014). The inclusion of the fourth helix is also related to art, creative industry, social communication, lifestyle, culture, and values. The rationale for this composition is reported as:

> [...] culture and values, on the one hand, and how "public reality" is being constructed and communicated by the media, on the other hand, influence all national innovation systems. The proper innovation culture is key to promoting an advanced knowledge-based economy. Public discourses, transported through and interpreted by the media, are crucial for a society to assign top priorities to innovation and knowledge (research, technology, education) (CARAYANNIS; CAMPBELL, 2009, p. 219).

The QH model has been associated with regional development as it turns to strategies, partnerships, and collaborations that aim to share costs and distribute risks, in addition to expanding the range of actors that innovate (MACGREGOR *et al*., 2010). More than that, it is highlighted that each actor plays a role that culminates in a value creation chain for the others involved, especially Society (HASCHE; HÖGLUND; LINTON, 2019).

In this sense, the participation of society and its impact at the regional level was the focus of some studies. Roman *et al.* (2020) observed that society's participation in community development projects resulted in increased openness and collaboration between different QH actors. In addition, such participation allowed attracting new actors to territorial development activities and developed a better understanding of stakeholder roles. Finally, the projects served as a reference model for implementing greater QH collaboration in regional R&D processes (ROMAN *et al*., 2020).

Society can establish interaction with STPs by generating jobs in the territory, increasing the number of local suppliers, and forming networks and contracts with local companies, cultural, sports, and scientific activities (CARAYANNIS *et al*., 2012). Therefore, science and technology parks act as relevant environments in innovation ecosystems, acting as aggregators

of public and private actors from different spheres with complementary objectives (MACGREGOR *et al*., 2010).

To be successful, a STP must be able to attract tenants, funders, and specialist partners (COMPAGNUCCI; LEPORE; SPIGARELLI, 2021). It also needs critical components, which, according to Etzkowitz and Zhou (2018), involve approaching resources for research; trained managers with a systemic view of science parks; sufficient space with attractive facilities and infrastructure for people to approach and/or install companies in the park, including inviting cultural, social and environmental environments; efficient political support from the government and the university; access to venture capital resources; significant amount of new ventures and potential entrepreneurs interested in joining the park.

2.3 Science technology parks and the regional development

The scientific-technological revolution has directly impacted the forms of production and the social relationships that are shaped (BARREIRO; RAMALHO, 2016). The ability of territories to promote sustainable economic growth has increasingly been linked to their ability to innovate, especially through the capitalization of technologies derived from research (SOENARSO *et al*., 2013).

The literature has not established a general model for the performance of STPs. That is, there is no universal formula capable of guaranteeing the success of parks. Studies refer to the synergy resulting from the ability of these habitats to cluster innovative technology companies, knowledge-based companies, universities, and research centers (LÖFSTEN; LINDELÖF, 2003; MYOKEN, 2011; ETZKOWITZ; ZHOU, 2017; FURLANETTI, 2017).

Regarding the terminologies associated with these habitats, the most common being "Scientific Parks", "Technological Parks", "Science Parks" and "Science and Technology Parks" (STP), it is noted that they differ in terms of focus:

> Technological parks have a greater focus on technology-based companies, being able to offer incubation and/or other processes in addition to tools to support their development. On the other hand, science parks are more focused on research, science, and technology, directly linked to laboratories and research institutes, with structure and support from the university actor. Science and technology parks cover the most varied actors in the ecosystem, seeking a balance between laboratories, private companies, and the government. (TEIXEIRA; TEIXEIRA, 2018, p. 127).

Thus, with the consensus among researchers that the investment strategy in science and technology contributes to social and economic development (BARREIRO; RAMALHO, 2016), the STPs are being integrated into the portfolio of strategies for regional development in several countries, showing results in the promotion of innovation and entrepreneurship, in the growth of knowledge-based companies, and in other factors that positively reflect local development (SOENARSO *et al.,* 2013; NAUWELAERS, 2014; DOBROSAVLJEVIĆ; ŽIVKOVIĆ, 2018).

In such innovation habitats, the combination of elements of different natures has objectives that transcend the actors themselves, covering aspects of regional levels. Hauser *et al.* (2019) reinforce this concept, as cities have resumed the function of a productive center to the detriment of the then dominant mass production, and it is in this that parks offer advantageous conditions for companies in more innovative sectors.

When companies are in a place where there are actors from different areas of scientific and technological innovation the potential for adding value to products or services increases.. Thus, they become able to keep up with the growing competitiveness generated by globalization and allow their territory to become more competitive and able to follow regional and global

economic trends (SOENARSO *et al*., 2013; JACOSKI *et al*., 2015; BARREIRO; RAMALHO, 2016).

Nevertheless, the importance of developing STPs without separating them from the regional context is emphasized. Most parks seek to operate in line with the strategic development of the regional innovation ecosystem, reflecting the opportunities and priorities of the territory in which they are located (ETZKOWITZ; ZHOU, 2017). Jongwanich *et al.* (2014) point out that parks not only have a significantly positive impact on regional patenting but also play a key role in coordinating R&D collaboration, indirectly contributing to technological improvement.

Besides traditional benefits, such as obtaining cooperation in the areas of technologies related to parks, companies can carry out projects and develop techniques that they would not be able to implement alone (DOBROSAVLJEVIĆ; ŽIVKOVIĆ, 2018). Other positive influences of STPs in the localities are also highlighted. They have impacted the locations by supporting the visibility and attractiveness of the territory by providing technological development capacity. This not only can generate more jobs but also allows retaining talent that would tend to migrate to other locations, in addition to providing a series of services and products that include high technology and financing of innovation companies (NAUWELAERS *et al*., 2014; DOBROSAVLJEVIĆ; ŽIVKOVIĆ), 2018). In Brazil, the Porto Digital experience exemplifies the ability to attract and retain talent that would be lost to more developed regions (ETZKOWITZ; ZHOU, 2017).

3 Methodological path

This section presents the definitions, choices, and processes that guided the methodological course of the research. The Mato Grosso Technological Park corresponded to the unit analyzed in the case, investigated from the use of different research techniques.

3.1 Research context

Located in the Center-West region of Brazil, the state of Mato Grosso is the third largest in terms of territorial extension in the country, although it has one of the lowest population densities (MATO GROSSO, 2020). Commonly called the “breadbasket of the country”, it occupies a relevant position in the national agricultural production, despite the occupation of the inhabitants being predominantly urban (IBGE, 2020). The state capital is Cuiabá, which together with three other cities, forms the Metropolitan Region of Vale do Rio Cuiabá, with approximately one million inhabitants.

In 2020, the capital occupied the 61st position in the total consideration of the 100 most populous cities in Brazil in the report on Brazilian entrepreneurial cities (ENDEAVOR, 2020). In the next edition of the report, released in 2022, it rose to 10th position (ENAP; ENDEAVOR, 2022). The main factors considered by the index are shown in Table 1.

Table 1 - Cuiabá in the Entrepreneurial Cities Index for 2020 and 2022

Dimension	Capital position in 2020	Capital position in 2022
Regulatory environment	34ª	3ª
Infrastructure	72ª	86ª
Market	54ª	58ª
Capital Access	19ª	17ª
Innovation	57ª	51ª
Human capital	22ª	29ª
Culture	24ª	30ª

Source: elaborated from Endeavor (2020) and Enap and Endeavor (2022).

One of the relevant dimensions for composing the results is the capacity for local innovation. The study revealed the reduced production of registered intellectual properties, as well as the low intensity of applied research and technological innovation in the region (ENDEAVOR, 2020). Also, considering only consolidated parks up to the year 2018, the binary unit of technological infrastructure was considered zero. Table 2 quantifies these data based on the 2022 report.

Table 2 - Variables of the dimension "Innovation"

<table>
<tr><td colspan="5">"Innovation" dimension – Cuiabá values</td></tr>
<tr><td colspan="5">Innovation index: 5,9363</td></tr>
<tr><td colspan="3">Inputs index: 6,4159</td><td colspan="2">Outputs index: 5,4675</td></tr>
<tr><td>Proportion of Masters and Doctors in S&T in 2019 (midships/thousand companies)
11,19</td><td rowspan="2">Average investments by BNDES and Finep in 2020 (amount invested/company)
21.137,81</td><td>Technological infrastructure according to MCTIC in 2018 (no unit/binary)
0</td><td>Patents at INPI in 2019 (patents/thousand companies)
2.63</td><td>Size of the creative economy in 2019 (% companies)
0.62%</td></tr>
<tr><td>Proportion of employees in S&T in 2019 (% of employees)
4,18%</td><td>Concession contracts at INPI in 2016 and 2017 (contracts/thousand companies)
101,04</td><td>Size of the innovative industry in 2019 (% companies)
0,66%</td><td>Size of ICT companies in 2019 (% companies)
0,47%</td></tr>
</table>

Source: elaborated from Enap and Endeavor (2022).

Given the context, efforts were made by local entities to create collaborative relationships with a focus on entrepreneurship and innovation in the region. In 2020, the Inova MT Network was launched. Although established in that year, the network has a history that dates back to 2006, when an organization of incubators funded by the Ministry of Science and Technology was organized in the state (REDE INOVA MT, 2021). In 2016, the demand for the institutionalization of a local innovation network was highlighted in a study carried out by the CERTI Foundation, culminating in the launch of the Inova MT Network four years later (REDE INOVA MT, 2021).

The leadership of the Inova Network is composed of representatives of the Mato Grosso State Secretariat for Science, Technology, and Innovation (SECITECI) and the Mato Grosso State University (UNEMAT). The group "companies, innovation centers, technology parks or centers, clusters, governmental agencies or entities, companies, non-governmental organizations or individuals whose objective is research, entrepreneurship, innovation [...]" may be part of the group. (REDE INOVA MT, 2021, p. 1). Following the structuring, the MTTP was conceived as "an important mechanism in the process of technological innovation in Mato Grosso, especially because it can promote the development of companies based on ideas and technologies generated in teaching and research institutions" (MATO GROSSO TECHNOLOGICAL PARK, 2021a, p. 1).

The MTTP integrates a technological, service, and scientific park (MATO GROSSO TECHNOLOGICAL PARK, 2021b). During the period of preparation of this study, the physical structure was under construction in the municipality neighboring the capital, Várzea Grande. SECITECI is the representative of the state government in the management of the implementation of the MTTP, regulation of real estate and condominium activity, and the operation of the innovation center (SECITECI, 2021).

3.2 Research approach

Given the exploratory and qualitative nature of the research, which aims to propose an action plan for the development of MTTP based on the QH model, the case study strategy was used. Case study research has been considered in the literature from various perspectives, such as methodology (CRESWELL, 2014), a research strategy (YIN, 2010), or choice of study unit (STAKE, 1995). In addition to being indicated for research questions that begin with "how" and "why" (YIN, 2010), case studies related to integrated actions between technology parks and actors in the innovation ecosystem are scarce, which reveals the relevance of choice.

There are several procedures indicated for conducting the case study approach, which generally varies according to the epistemological conceptions of the project (eg EISENHARDT, 1989; LANGLEY; ABDALLAH, 2011). In summary, case studies offer a detailed view of a delimited system from multiple evidence and information sources, considering the contextual conditions for the phenomenon of interest from one or multiple cases (CRESWELL, 2014; YIN, 2010).

Given the research question "what actions contribute to STPs being implemented to develop and drive innovation ecosystems?", the MTTP was selected as the unit corresponding to the researched case. At the time of writing this work, the MTTP is being implemented, as a result of a policy to boost innovation and entrepreneurship in a region with low levels of applied research and technological innovation. Such characteristics revealed the park's eligibility for the case study.

3.3 Data collection

Several collection sources indicated the research evidence. Sources of secondary material, predominantly documentary, provided a rich set of information, revealing aspects of the trajectory and phases of the MTTP's constitution. This served to locate key points of the researched context so that from them, actions could be proposed. Additionally, reports on local entrepreneurship and innovation identified the region's strengths and weaknesses.

Exploratory interviews and a focus group were carried out. Following the phases of planning, conducting, and analyzing the data in focus groups (RIBEIRO; DEMO; SANTOS, 2021), representatives of actors that compose the four helixes were invited to participate in the group conducted during the research. The invitations were made in advance, via telephone or email, informing the guests about the topic, objectives, and those responsible for the research. Six representatives responded to the invitation and participated in the focus group on the established date. Due to the public health emergency caused by the COVID-19 pandemic, the focus group was translated into a synchronous online format, which required modifications. It is noteworthy that online and synchronous focus groups have opened several possibilities to researchers (BORDINI; SPERB, 2011) due to their advantages, such as accessibility.

The use of the format proved to be adequate for the case study, since the questions returned a vast set of information regarding the interactions between the actors of the QH, in addition to highlighting gaps for integration actions with the MTTP. The first question was about the integration between the institutions, being preceded by inquiries about positive and negative issues that accelerate or restrict a collaborative and more synergistic action between the actors and the technologic Park. The focus group was conducted by the first author, with support from the second and third. A senior researcher followed the discussions and collaborated punctually, raising questions that helped to deepen points that needed further clarification. During the group, a visual scheme was built on the Mural.co collaborative interface was projected onto the screen so that the informants could score observations, visualize relationships and clarify differences. The resulting visual map supported the interpretation in the data analysis stage.

Before and after the focus group was held, in-depth interviews were conducted with the park representative. The first was carried out before the focus group. No roadmap was pre-defined, given the need to obtain a deeper understanding from the perspective of the MTTP manager. The second interview was semi-structured, carried out after the focus group, based on a script composed of questions based on the categories deduced from the theoretical-conceptual basis. The focus group and the interviews were recorded with the informants' permission and later transcribed. Finally, the first two authors participated in a virtual meeting, held on December 4, 2020, when the Inova MT Network was presented, of which MTTP is a founding member. In Table 3 it is possible to verify the distribution of data collection with the informants.

Table 3 – Summary of the carried-out interviews

Interviewed	Linking	Date	Duration
I1	Park	04/11/2020	45 min 11 sec
I1	Park	13/11/2020	1 hour 12 min 50 sec
I2	Technological Innovation Center (TIC)		
I3	Incubator		
I4	Accelerator / startup community		
I5	Manufacturing Laboratory (FabLab)		
I6	Private non-profit social service entity		
I1	Park	09/12/2020	52 min 06 sec

Source: elaborated by the authors.

3.4 Data analysis

The technique used was content analysis, involving pre-analysis, material exploration, and treatment, widely known for Bardin's protocol (2012). In addition to being a reliable method (MOZZATO; GRZYBOVSKI, 2011) when applied in conjunction with other procedures, it favors triangulation, a reliability technique commonly used in case studies (YIN, 2010). The contraposition of data through the triangulation of sources of evidence, researchers, and collection methods allows a more objective understanding of the phenomenon (BRUNING; GODRI; TAKAHASHI, 2018).

The transcription of the interviews allowed relevant information not to be lost, in addition to being essential in the analysis of the focus group data (RIBEIRO; DEMO; SANTOS, 2021). Considering that the conduction of the research was guided by the theoretical-conceptual basis presented above, deductive categories were established. These categories were the interaction between components of the QH (1) and the challenges of implementing science and technology parks (2).

Additionally, inductive categories were obtained from the interviews. These categories dealt with the factors that hinder the integrated action between the analyzed park and the other components of the QH. Thus, each interaction is composed of one of the categories, treated as axes of action during the construction of the actions indicated for the development of the park. The categories, in turn, were decomposed into subcategories, related to the identified challenges, and translated as action objectives in Table 9. From the integration between the deductive and inductive categories, a set of macro actions was established, identified in Table 4.

Table 4 – Deductive and inductive analysis

Block	Inductive category	Subcategory	Macro actions
Complicating factors	Park-university	Academic Community	Open innovation Integrated agenda Education for innovation
		Knowledge applicability	
		Innovation culture on campus	

			tour park Junior Company + park Innovation and entrepreneurship notices University + park
	Park-company	*Startups attraction*	Prospection Attraction policies Representation entities
		Traditional business	
		Engagement	
	Park-government	Institutional Support	Innovation Board Parliamentary front Shared vision Hearings Park council
		Public policies	
	Park-society	Communication	Mobilization of the press site New generations Park + School Open doors Communitarianism Internationalization
		Talent attraction and retention	
		Park defense	

Source: elaborated by the authors.

To meet the validity of the research, the results of the work were presented to the interviewees through a virtual public event, held in December 2020. No corrections were indicated in the suggested proposals.

4 Results presentation

The obstacles were categorized into structuring axes, following the proposed model. Evidence related to the structuring axes is summarized in the tables below.

Table 5 - Structuring axis Park-University

Description	There are two main challenges identified in the park-university relationship. The first concerns the distant agenda between university management and the academic community with the park. The other refers to the innovation culture in the institutions below, which implies the creation of collaborative networks with the park.
Evidence	[...] we still see a lot of lack of culture, both internal, this institutional innovation culture. (I2) It is not a self-management in which everyone works in a very connected way, I believe that there is a lack of a person responsible for this action, for connecting the ecosystem. (I3) We need a way to learn how to work in a network so that it is really strong and we are recognized as a strong ecosystem. (I1) [...] we need culture, an innovation culture, we need to communicate and even integrate [...] talking about entrepreneurial culture and technological innovation and having actions during graduation, I see that we go there in the crib, we go there in the curricular guidelines, of the course,". (I1)

Source: research data (2021).

For Etzkowitz and Klofsten (2005), defining the strategic vision is just the beginning of the consolidation of an entrepreneurial university. Thus, if there is no culture for entrepreneurship and innovation in universities and research institutes, their integration with the MTTP may be limited. The case of the 22@Barcelona district, a park located in Spain, is an example of a habitat that illustrates an arrangement in which each helix has its internal agenda. "Universities take a long-term view, the government has the election schedule on its agenda, and the industry pays salaries every month and shows the results annually" (PIQUÉ;

MIRALLES; BERBEGAL-MIRABENT, 2019, p. 20). Table 6 identifies the challenges related to the structuring axis Park-Company.

Table 6 – Structuring axis Park-Company

Description	The difficulties collected refer to the engagement of the productive sector with the park, which, as reported, does not even know its existence. Other speeches dealt with the limited innovation capacity of the local production environment.
Evidence	The biggest problem, in my point of view, is that there is only one innovation hub [...], we would have to have other innovation hubs in the state to achieve is..., bring even more views from other sectors [...] so we need more acceleration programs, other branches of innovation, that focus on other segments. (I4) I think it's urgent that we need to promote and also worry about the other facets of the ecosystem, we are not only agro. (I1). There is an innovation culture even within the industrial sector, when you need, for example, to rethink your product, for example, in an extreme case such as a pandemic, or when you already have a product, there is effectively no awareness, clarity about the potential of innovation to improve its product, diversify its products. (I5)

Source: research data (2021).

The data highlights the problem of engaging the business sector. For example, although the state stands out in the economic sector of agribusiness, it has poor levels of technological innovation (ENVEAVOR, 2020). In this sense, the business sector must be closer to the MTTP in overcoming the region's challenges.

In turn, as indicated in Table 7, the absence of political articulation oriented towards innovation, and mainly related to the development of the park, seems to hinder a shared agenda between the park and the Government. The development of the MTTP may dependnot only on financial and structural aspects but also on institutional factors.

Table 7 – Structuring axis Park-Government

Description	The obstacles encountered between the development of the park and the government are centered on the absence of institutionalized commitment from the legislative and executive powers, lack of articulation, and political engagement.
Evidence	There is no leader, state, or Department of Science, Technology, and Innovation that brings everyone together and maps it out. (I2) Regarding the leadership of each actor in this ecosystem, the first one is the turnover of these leaderships, I believe that this does influence our connections until the person enters the position again, learns everything they have to do, establishes new connections, then soon she will leave that place, and then she has to reestablish these connections. (I3) [...] government changes disadvantage us, at first because when the team is not disbanded, we have to clarify, and defend a project, which is not a secretariat project, it is not a government project, is a state project. (I1)

Source: research data (2021).

Finally, Table 8 summarizes the main evidence related to the integration of MTTP and Society. Insufficient communication between the park and social interest organizations has resulted in an agenda-free from common goals.

Table 8 - Structuring axis Park-Society

Description	There is a gap in the park's relationship with society. The community's lack of knowledge of the park's purpose hinders interaction. In addition, they may imply the difficulty for the territory to attract and retain talent.

Evidence	Our community needs to strengthen itself in this sense to understand what its role is and how it can impact or articulate with the other actors in this ecosystem. (I4) I think people don't believe in the ecosystem's potential, we look outside a lot and don't look inside. (I6) For society, we need to communicate, we need to tell people and especially for generations that are undergoing training at our universities that they do not need to migrate from here in our region, that here there are jobs, technology, science, opportunities [...]. (I1)

Source: research data (2021).

Based on the evidence collected, an action plan for integration between the PTMT and the QH actors was indicated. The plan was oriented from objectives per axis, each one representing one of the helices. Table 9 reveals the objectives that imply the proposed actions.

Table 9 - Objectives of the action plan axes

Axis	Objectives
Park-University	● Bring the academic community closer to the innovation and entrepreneurship environments to be installed at MTTP ● Propose applicability of knowledge and technology, based on research and technological extension, supported by MTTP ● Support the development of a culture of innovation in the academic community
Park-Company	● Favor the attraction of startups and the development of technology companies ● Support traditional companies to develop innovation capabilities ● Participate in the organization of a territory innovation ecosystem
Park-Government	● Articulate political support for MTTP development ● Search for innovation and entrepreneurship policies and favor an appropriate business environment
Park-Society	● Publicize the actions and capacity of regional development by the MTTP ● Attract and retain innovative talent and businesses in the territory ● Engage the Society for the defense of MTTP

Source: elaborated by the authors.

From these objectives, a set of actions are indicated. Such actions aim to integrate not only the indicated actors but also to encourage the emergence of MTTP in the agendas of each helix. Table 10 summarizes the actions according to the structuring axes previously informed.

Table 10 – Description of the proposed actions ordered by axes

Axis	Macro action	Description
Park-University	Open innovation	Program to support open innovation, oriented towards academic community and incubators
	Integrated agenda	A common agenda of actions and objectives between the park and universities, is to institutionalize partnerships.
	Education for innovation	Dialogue with departments, collegiate bodies, and structuring teaching core of universities, aiming to support the curricularization of research and technological extension.
	Park-*tour*	Events, caravans, and visits by the academic community on the park's premises, in addition to an interactive online environment for virtual exhibitions.
	Junior enterprise + park	Training events aimed at junior enterprises and the university entrepreneurial community.
	Innovation and entrepreneurship notices	Public notices for the development of innovation and entrepreneurship projects in the park's five areas of operation.
	University + park	Transfer/creation of headquarters for incubators and Technological Innovation Centers at the Innovation Center.
Pa rk-	Prospection	Enable the occupation of the park by national technology companies in the park's areas of operation, as well as anchors in the service park.

	Attraction policies	Based on the definition of the park's operating model, support political-economic solutions for the park's attractiveness and competitiveness.
	Representation entities	Cooperation and representation through partnerships with associations, chambers, and federations, among other entities in the second sector.
Park-Government	Innovation Board	Raise awareness of the need to set up an innovation council in the region.
	Parliamentary front	Encourage the formalization of a political front (executive and legislative) for project proposals to support innovation and entrepreneurship.
	Shared vision	Common agenda of objectives, goals, actions, and strategies among Governments to support the innovation ecosystem and park development.
	Hearings	Encourage the calling of public hearings to strengthen the movement on the subject.
	Park Board	Institute participatory management, through the integration of the other helixes in the decision-making structure.
Park-Society	Press mobilization	Publicize the park and its benefits through a mobilization with traditional press vehicles (radio/television/newspaper).
	Site	Website suitable for communication with different members of the quadruple helix, in addition to being multilingual.
	New generations	Repercussion of the park with the young community from digital media, local influencers, and transmedia approaches.
	Park + School	Program oriented to the reception of students of basic education in the park, among other oriented actions.
	Open doors	Availability of physical space for the realization of external events consistent with the activities, values, and mission of the park.
	Communitarianism	Allowing community experience on the park's premises, from the offer of spaces for leisure, contemplation, and living.
	Internationalization	The international atmosphere from membership in international associations, cooperation agreements, and events, encourages academic mobility and attracts talent.

Source: elaborated by the authors.

5 Results discussion

This section offers a discussion of the results, analyzing the integration of innovation actors that are components of the studied region, as well as the proposed actions for the development of MTTP from the QH.

5.1 Integration for an innovation ecosystem in the territory

The analysis of the results made it possible to identify the difficulties of interaction between the components of the QH to kick-start the innovation ecosystem, which does not yet exist. According to Heaton, Sigel and Teece (2019), innovation ecosystems evolve through stages, namely: the initial stage, development stage, and renewal stage. Converging with the results of the indicators collected in the documentary research, unsurprisingly, the interviewees mentioned the low density of the collaboration network, potentially limited by scarce and ad hoc links. In addition, the reports indicated redundant activities, while critical actions are left without an evident responsible.

It is inferred that there is still no “strong player” capable of taking the lead in creating a common vision. The case study showed that the MTTP, under implementation, can bring together conditions to start the “kick of the ecosystem”. Thomas, Faccin and Asheim (2021) identified, when analyzing a university-led innovation ecosystem, that one of the first stages of ecosystem orchestration occurs when a leader works to build a shared sense. In the case

analyzed, actions to integrate the park with the actors of the quadruple helix can contribute to the formation of this sense.

5.2 Discussion of proposed actions

In the Park-University axis, it is inferred that the integration with the main higher education institutions in the state (UFMT, IFMT, UNEMAT) is still incipient. The actions presented were considered a priority, given the need for the park, from its conception, to be part of the Research and Extension agenda of these institutions. Neglecting this integration can be harmful to the consolidation of the park's objectives, at the risk of depleting research activities. This explains the failure of some STPs, which employed exogenous strategies based on a strong physical structure to the detriment of an adequate organizational, institutional, and cultural foundation (ETZKOWITZ; ZHOU, 2018). Successful technology parks have established conditions for collaboration between human and physical capital and an adequate regional innovation system (JONGWANICH; KOHPAIBOON; YANG, 2014).

Actions that stimulate the experience of the academic community in the park, through open innovation programs, the institutionalization of processes that support partnerships, support for the curriculum construction of research and technological extension and promotion of innovative-based entrepreneurship, such as public notices for financing projects oriented to the areas of the park are suggested.

Such approximation underlies the establishment of collaborative actions between university administrations and the academic community. Spin-offs, innovation and technological extension projects, service provision, intellectual property registrations, and the establishment of a learning network are likely benefits of an integrated university action. As an example, the Aliança para Inovação, a partnership of the three main universities of Rio Grande do Sul, has allowed the transformation of the city of Porto Alegre into a high-impact innovation ecosystem from the integration of QH (THOMAS; FACCIN; ASHEIM, 2021). Universities associated with park management favor the emergence of a participatory sense, as they represent the interest of the community (BENCKE *et al*., 2019). Additionally, STPs located in remote regions will be more likely to thrive when supported by an entrepreneurial university (ETZKOWITZ; ZHOU, 2018).

Given the MTTP implementation project, there was a significant interaction with the Government, since the park's conception. However, integration with companies is considered incipient. Unlike other implementation models, in this case, the business sphere did not permeate the creation of the park. Therefore, the proposals for the Park-Company axis form a set of actions for prospecting technology-based companies, as well as service providers. Anchor companies, namely multinationals (Dell and HP), were key players in the establishment of the PUCRS Science and Technology Park (BENCKE *et al*., 2019). In China, the international projection of parks is related to the inclusion of foreign companies and foreign direct investment (COMPAGNUCCI; LEPORE; SPIGARELLI, 2021).

Any prospecting strategy must involve clarity on the categories of companies eligible for MTTP occupation. Chinese STPs employ strict criteria to determine the qualifications of their tenants (JONGWANICH; KOHPAIBOON; YANG, 2014). Not only with the support of the Government, consistent policies capable of promoting the attractiveness of the territory, via local capacities, must be organized.

For example, in China, the massive presence of parks built around its main universities has made it possible to promote the development of inland regions with no industrial history (COMPAGNUCCI; LEPORE; SPIGARELLI, 2021). For these authors, the involvement of the Chinese government, through policies of incentives, preferences, and tax exemption, confirms the need for support not only in the creation of parks but in their consolidation.

The formation of partnerships for dissemination, integration, and collaboration with entities of social representation, such as associations, chambers, and federations of agriculture, industry, and commerce was proposed as an opportunity. The low participation of the corporate sphere in the constitution of the MTTP converges to the difficulties of numerous technology parks, a reflection of the difficulty of attraction, lack of knowledge of the park's role, and inattention to research and innovation as business activities (BENCKE *et al*., 2019).

The creation of the MTTP took place in a progressive linear model (ETZKOWITZ; ZHOU, 2018) since it was triggered by an initiative of the state government. Therefore, its performance may depend too much on the actors that make up the Government. The research findings suggest that this can be reinvigorated, as local public policies capable of supporting the development of the park still need to be operationalized, through, for example, the establishment of municipal and state political councils and the direct action of a political front for science, technology, and innovation in the state. Other actions can also be stimulated by aiming at the appropriation of the theme by the local political class, such as the institution of public hearings. Emblematic initiatives, such as the Pacto Alegre, implemented by the city of Porto Alegre (THOMAS; FACCIN; ASHEIM, 2021), are examples of how governments can act in an integrated manner with other QH actors. In Mato Grosso, the establishment of the Inova MT Network is a relevant initiative.

In the last axis, Park-Society, actions were suggested that stimulate the approximation of the MTTP with organized civil society, as well as the local community. It started from the understanding that Society, as part of the QH, has an active role in the generation of new knowledge and innovations (CARAYANNIS *et al*., 2018). However, the evidence reveals a gap between such realities. This may be related to the need for social capital as an active ingredient for the consolidation of a STP.

Political, business, and university leadership, seen as a community, was considered the fourth helix for the constitution of science parks in the Rio Grande do Sul (BENCKE *et al*., 2019). In Mato Grosso, it is expected that the actions presented will trigger a shared and lasting vision, based on bonds of trust, continuous commitment, and the formation of new leadership. Organized civil society can act as an advocate for the development of the MTTP. This action can mitigate possible omissions by other actors, as well as ruptures caused by political transitions. Therefore, it is expected that Society will support the establishment of a clear vision, which understands the development of the MTTP as a State policy and not just a Government policy.

Actions that encourage the approximation of the community and the park, based on communitarianism, the sensitization of young talents, and on a balanced policy of open doors, made up the work's propositions. Another point involves media support. In Pacto Alegre, the engagement of a local communication group through the transmission of communications to strengthen the project's identity at no cost was important for mobilizing the actors (THOMAS; FACCIN; ASHEIM, 2021).

Finally, the synergistic action between universities, companies, and the government allows companies located in parks to take advantage of local skills and talents (COMPAGNUCCI; LEPORE; SPIGARELLI, 2021). The suggested actions to encourage international action were based on successful cases documented in the literature. Chinese technology parks are recognized for their global presence, which enables the projection of the country's industries (COMPAGNUCCI; LEPORE; SPIGARELLI, 2021). As they did in that country, it is suggested to emerging SCPs, such as the MTTP, that affiliation with international entities, such as the International Association of Science Parks (IASP), can establish networks, events, and cooperation agreements and benefits from a presence global.

At MTTP, contact with international representatives, via embassies and participation in international fairs, were the first actions for an international agenda. It is also recommended to

maintain a multilingual website, suitable for communication with different actors (COMPAGNUCCI; LEPORE; SPIGARELLI, 2021). As defended by Etzkowitz and Zhou (2018), a STP is not enough to promote development. It needs strong cohesion between the university, government, business, and society.

6 Final considerations

Based on the identification of the MTTP trajectory, this work proposed actions for the development of the park based on the quadruple helix model. In this way, it was successful in the proposed objective. As a contribution, it joins other studies that used QH to support the establishment of STPs. There is a need for more approaches of this nature.

From the evidence collected, macro actions were proposed that may allow the park to occupy a privileged space as the core of the QH. These actions were suggested by taking into account the aspects of the region, which contributed to avoiding "canned" solutions, alien to the context and the endogenous perspective of regional development.

The evidence revealed the need for greater integration of the park with Universities, Companies, Government, and Society in the region. As it is an initiative planned by the public sphere, it was understood that the government is more integrated into the MTTP than the other propellers. Even so, it is worth highlighting the need for political engagement, not only through financing its implementation but mainly through incentive policies.

As the helix model values, joint action not only generates positive effects between different actors but also transforms them. The consolidation of the park is a reason for universities to act in an integrated way with each other, not just with the MTTP. The success of this innovation habitat will be mainly related to the engagement of the local academic community, which has not yet happened. The actions also guided a renewed approach with companies. In the coming years, the occupation of real estate land will be carried out and, for that, it will be necessary to institute clear strategies to identify the profile of the desired projects. Prospecting and attracting developments should not be seen only as an exclusive responsibility of park management. Without creating an adequate atmosphere of integration, this action, considered one of the most complex, will have little chance of success. Finally, the results confirm the importance of Society's involvement, which can occur in different ways, making evident the need for renewed communication.

As it is a specific context, the actions cannot be taken as a prescription for other contexts. Such limitations imply the emergence of studies that analyze how STPs are renewed throughout the life cycle of the ecosystem. As practical implications, the research elucidates some integration actions, which can frame the park as a center of local innovation. It also reveals some known problems inherent to the challenges of innovation in Brazil. The research is expected to encourage collaboration and integration to take the place of individual and dissociated actions between the actors of innovation in the region.

References

ADÁN, C. El ABC de los parques científicos. **Seminarios de la Fundación Española de Reumatología**, v. 13, n. 3, p. 85-94, 2012.

ADNER, R. Match your innovation strategy to your innovation ecosystem. **Harvard business review**, v. 84, n. 4, 2006.

ADNER, R. Ecosystem as Structure: An Actionable Construct for Strategy. **Journal of Management**, v. 43, n. 1, p. 39–58, 2017.

BARDIN, L. **Análise de Conteúdo**. São Paulo: Edições 70, 2012.

BARREIRO, E. R. N.; RAMALHO, A. M. C. A importância dos PCTs para o desenvolvimento local e territorial: a experiência do Parque Tecnológico da Paraíba. **Revista Política e Planejamento Regional**, Rio de Janeiro, v. 3, n. 1, janeiro/junho 2016, p. 19-38, 2016.

BENCKE, F. F.; DORION, E. C. H.; PRODANOV, C. C.; OLEA, P. M. Community leadership and the Triple Helix model as determinants of the constitution of science parks: A Brazilian experience. **Benchmarking**, v. 27, n. 1, p. 21–40, 2019.

BORDINI, G. S.; SPERB, T. M. Psicologia em Estudo. **Psicologia em Estudo**, v. 16, n. 3, 2011.

BRUNING, C.; GODRI, L.; TAKAHASHI, A. R. W. Triangulação em estudos de caso: incidência, apropriações e mal-entendidos em pesquisas da área de administração. **Administração: Ensino e Pesquisa**, v. 19, n. 2, p. 277–307, 2018.

CARAYANNIS, E. G.; GRIGOROUDIS, E.; CAMPBELL, D. F.; MEISSNER, D.; STAMATI, D. The ecosystem as helix: an exploratory theory-building study of regional co-competitive entrepreneurial ecosystems as Quadruple/Quintuple Helix Innovation Models. **R&D Management**, v. 48, n. 1, p. 148–162, jan. 2018.

CARAYANNIS, E. G.; BARTH, T. D.; CAMPBELL, D. F. The Quintuple Helix innovation model: global warming as a challenge and driver for innovation. **Journal of innovation and entrepreneurship**, v. 1, n. 1, p. 1-12, 2012.

CARAYANNIS, E. G.; CAMPBELL, D. F. J. 'Mode 3'and'Quadruple Helix': toward a 21st century fractal innovation ecosystem. **International journal of technology management**, v. 46, n. 3-4, p. 201-234, 2009.

CARAYANNIS, E. G.; RAKHMATULLIN, R. The quadruple/quintuple innovation helixes and smart specialization strategies for sustainable and inclusive growth in Europe and beyond. **Journal of the Knowledge Economy**, v. 5, n. 2, p. 212-239, 2014.

CHAMPENOIS, C.; ETZKOWITZ, H. From boundary line to boundary space: The creation of hybrid organizations as a Triple Helix micro-foundation. **Technovation**, v. 76–77, p. 28–39, ago. 2018.

COMPAGNUCCI, L.; LEPORE, D.; SPIGARELLI, F. Exploring the Foreign Exposure of Chinese Science Parks in a Triple Helix Model. **Forum for Social Economics**, v. 50, n. 3, p. 330-354, 2021.

COOKE, P. Regional innovation systems: Competitive regulation in the new Europe. **Geoforum**, v. 23, n. 3, p. 365–382, jan. 1992.

TEIXEIRA, M. C.; TEIXEIRA., C. S. Parques e suas tipologias: tecnológico, científico e tecnológico científico. In: DEPINÉ, A.; TEIXEIRA, C. S. **Habitats de Inovação**: conceito e prática. São Paulo: Perse, 2018, p. 115-131. Disponível em: https://via.ufsc.br/wp-

content/uploads/2018/05/HABITATS-DE-INOVACAO-conceito-e-pratica.pdf. Accessed 05 fev 2021.

CRESWELL, J. W. **Investigação Qualitativa e Projeto de Pesquisa:** Escolhendo entre Cinco Abordagens. Porto Alegre: Penso Editora, 2014.

DOBROSAVLJEVIĆ, A.; ŽIVKOVIĆ, Ž. Potential impact of the science-technology park on the regional development. **Serbian Journal of Management**, v. 13, n. 2, p. 215-232, 2018.

EISENHARDT, K. M. Building Theories from Case Study Research. **The Academy of Management Review**, v. 14, n. 4, p. 532, out. 1989.

ENAP; ENDEAVOR, 2022. **Índice de Cidades Empreendedoras 2022.** Disponível em: https://repositorio.enap.gov.br/bitstream/1/6880/1/ICE2022_Atualizado-com-errata.pdf. Accessed 27 jul 2022.

ENDEAVOR, 2020. **Índice de Cidades Empreendedoras 2020.** Disponível em: https://endeavor.org.br/ambiente/ice-2020/.. Accessed 05 fev 2021.

ETZKOWITZ, H.; KLOFSTEN, M. The innovating region: toward a theory of knowledge-based regional development. **R&D Management**, v. 35, n. 3, p. 243-255, 2005.

ETZKOWITZ, H.; LEYDESDORFF, L. The dynamics of innovation: From National Systems and "mode 2" to a Triple Helix of university-industry-government relations**. Research Policy**, v. 29, n. 2, p. 109–123, 2000.

ETZKOWITZ, H.; ZHOU, C. Hélice Tríplice: Inovação e empreendedorismo universidade-indústria-governo. **Estudos Avançados**, v. 31, n. 90, p. 23–48, 2017.

ETZKOWITZ, H.; ZHOU, C. Innovation incommensurability and the science park. **R and D Management**, v. 48, n. 1, p. 73–87, 2018.

FENG, L.; LU, J.; WANG, J. A Systematic Review of Enterprise Innovation Ecosystems. **Sustainability**, v. 13, n. 10, p. 5742, 20 maio. 2021.

FOGUESATTO, C. R., SANTINI, M. A. F., MARTINS, B. V., FACCIN, K., DE MELLO, S. F.; BALESTRIN, A.. What is going on recently in the innovation ecosystem field? A bibliometric and content-based analysis. **International Journal of Innovation Management**, v. 25, n. 07, 2021.

FURLANETTI, T. Uma introdução aos Parques Científicos e Tecnológicos. **Via Revista**: Parques Científicos Tecnológicos e de Inovação: Novas configurações extramuros, ano 2, n. 2, p. 12, 2017.

GOMES, L. A. V.; FLECHAS, X. A.; FACIN, A. L. F.; BORINI, F. M. Ecosystem management: Past achievements and future promises. **Technological Forecasting and Social Change**, v. 171, n. November 2020, p. 120950, 2021.

GOMES, L. A. DE V.; FACIN, A. L. F.; SALERNO, M. S.; IKENAMI, R. K. Unpacking the innovation ecosystem construct: Evolution, gaps and trends. **Technological Forecasting and Social Change**, v. 136, p. 30–48, 2018.

GRANSTRAND, O.; HOLGERSSON, M. Innovation ecosystems: A conceptual review and a new definition. **Technovation**, v. 90–91, p. 102098, 2020.

HASCHE, N.; HÖGLUND, L.; LINTON, G. Quadruple helix as a network of relationships: creating value within a Swedish regional innovation system. **Journal of Small Business & Entrepreneurship**, v. 32, n. 6, p. 523-544, 2020.

HAUSER, G.; CAMPOS, H. A.; SOUZA, D. O.; SALVADORETTI, A. Parques Tecnológicos e centralidades urbanas: o caso do Tecnopuc Região Metropolitana de Porto Alegre. *In*: Encontro Nacional da Associação Nacional de Pós-graduação e Pesquisa em Planejamento Urbano e Regional, 18., 2019. Natal. **Anais...** Natal, 2019, p. 1-21.

HEATON, S.; SIEGEL, D. S.; TEECE, D. J. Universities and innovation ecosystems: A dynamic capabilities perspective. **Industrial and Corporate Change**, v. 28, n. 4, p. 921–939, 2019.

HOU, H.; SHI, Y. Ecosystem-as-structure and ecosystem-as-coevolution: A constructive examination. **Technovation**, v. 100, n. September, p. 102193, 2021.

IBGE, 2020. **Mato Grosso.** Disponível em: https://www.ibge.gov.br/cidades-e-estados/mt.html. Accessed 05 fev. 2021.

JACOSKI, C. A.; FONTANELA, C.; PIRES, D. D. S. J.; CARLESSO, L.; HOSS; R. A. W. Regional development strategy-the case of the "Scientific and Technological Park Chapecó@". **REBRAE**, v. 8, n. 3, p. 356-370, 2015.

JONGWANICH, J.; KOHPAIBOON, A.; YANG, C. H. Science park, triple helix, and regional innovative capacity: Province-level evidence from China. **Journal of the Asia Pacific Economy**, v. 19, n. 2, p. 333–352, 2014.

KATO, D. S.; MARTINS, L. A.-C. P. A "sociologia de plantas": Arthur George Tansley e o conceito de ecossistema (1935). **Filosofia e História da Biologia**, v. 11, n. 2, p. 189–202, 2016.

KIMATU, J. N. Evolution of strategic interactions from the triple to quad Helix innovation models for sustainable development in the era of globalization. **Journal of Innovation and Entrepreneurship**, v. 5, n. 1, p. 1-7, 2016.

LANGLEY, A.; ABDALLAH, C. **Templates and Turns in Qualitative Studies of Strategy and Management**. Research methodology in strategy and management, v. 6, p. 105-140, 2011.

LINDELÖF, P.; LÖFSTEN, H. Science park location and new technology-based firms in Sweden–implications for strategy and performance. **Small business economics**, v. 20, n. 3, p. 245-258, 2003.

MACGREGOR, S. P.; MARQUES-GOU, P.; SIMON-VILLAR, A. Gauging readiness for the quadruple helix: a study of 16 European organizations. **Journal of the knowledge economy**, v. 1, n. 3, p. 173-190, 2010.

MACHADO, H. V.; LAZZAROTTI, F.; BENCKE, F. F. Innovation models and technological parks: Interaction between parks and innovation agents. **Journal of Technology Management and Innovation**, v. 13, n. 2, p. 104–114, 2018.

MARTINS, B. V.; FACCIN, K.; ESPINDULA, E.; BALESTRIN, A. Understanding innovation ecosystems: a biomimetic approach. **Revue Internationale d'Intelligence Economique**, v. 11, n. 2, 2019.

MATO GROSSO, 2020. **Geografia**. Disponível em http://www.mt.gov.br/geografia. Accessed: 05 fev. 2021.

MOORE, J. F. Predators and prey: a new ecology of competition. **Harvard Bus. Rev.**, v. 71, n. 3, p. 75–86, 1993.

MOZZATO, A. R.; GRZYBOVSKI, D. Análise de conteúdo como técnica de análise de dados qualitativos no campo da administração: potencial e desafios. **Revista de Administração Contemporânea**, v. 15, n. 4, p. 731–747, ago. 2011.

MYOKEN, Y. Science parks and Triple-Helix innovation in UK and Japan. **International Journal of Technoentrepreneurship**, v. 2, n. 3-4, p. 261-274, 2011.

NAUWELAERS, C.; KLEIBRINK, A.; STANCOVA, K. The role of science parks in smart specialisation strategies. **S3 Policy Brief Series**, n. 08, p. 1-21, 2014.

NELSON, R. R. **National Systems of Innovation**: a comparative study. Oxford: Oxford University Press, 1993.

OH, D. S; PHILLIPS, F.; PARK, S.; LEE, E. Innovation ecosystems: A critical examination. **Technovation**, v. 54, p. 1–6, 2016.

PARQUE TECNOLÓGICO DE MATO GROSSO, 2021a.**Parque Tecnológico de Mato Grosso**. Disponível em: <https://parquetecnologicomt.com.br/> Accessed: 05 fev. 2021.

PARQUE TECNOLÓGICO DE MATO GROSSO, 2021b. **Modelo Conceitual**. Disponível em: https://parquetecnologicomt.com.br/modelo-conceitual/. Accessed 05 fev. 2021.

PHILLIPS, M. A.; RITALA, P. A complex adaptive systems agenda for ecosystem research methodology. **Technological Forecasting and Social Change**, v. 148, p. 119739, nov. 2019.

PIQUÉ, J. M.; MIRALLES, F.; BERBEGAL-MIRABENT, J. Areas of innovation in cities: the Evolution of 22@ Barcelona. **International Journal of Knowledge-Based Development**, v. 10, n. 1, p. 3-25, 2019.

REDE INOVA MT, 2021. **Inova MT Rede de Inovação de Mato Grosso.** Disponível em: https://www.redeinovamt.com.br/institucional/. Accessed: 06/12/2020.

RIBEIRO, A. C.; DEMO, G.; SANTOS, C. D. DOS. Grupo focal: aplicações na pesquisa nacional em administração. **PRETEXTO**, v. 22, n. 2, p. 108–128, 2021.

RITALA, P.; ALMPANOPOULOU, A. In defense of 'eco' in innovation ecosystem. **Technovation**, v. 60–61, n. February, p. 39–42, 2017.

ROMAN, M.; VARGA, H.; CVIJANOVIC, V.; REID, A. Quadruple Helix models for sustainable regional innovation: Engaging and facilitating civil society participation. **Economies**, v. 8, n. 2, p. 48, 2020.

SCARINGELLA, L.; RADZIWON, A. Innovation, entrepreneurial, knowledge, and business ecosystems: Old wine in new bottles? **Technological Forecasting and Social Change**, v. 136, p. 59–87, nov. 2018.

SECITECI, 2020. **Plano de Negócios Parque Tecnológico de Mato Grosso**: inovação tecnologia estratégia negócios.

SOENARSO, W. S.; NUGRAHA, D.; LISTYANINGRUM, E. Development of science and technology park (STP) in Indonesia to support innovation-based regional economy: Concept and early stage development. **World Technopolis Review**, v. 2, n. 1, p. 32-42, 2013.

STAKE, R. **The art of case study research**. Thousand Oaks: Sage, 1995.

TANSLEY, A. G. The Use and Abuse of Vegetational Concepts and Terms. **Ecology**, v. 16, n. 3, p. 284–307, jul. 1935.

THOMAS, E.; FACCIN, K.; ASHEIM, B. T. Universities are orchestrators of developing regional innovation ecosystems in emerging economies. **Growth and Change**, v. 52, n. 2, p. 770–789, 17 jun. 2021.

WILLIS, A. J. The ecosystem: An evolving concept viewed historically. **Functional Ecology**, v. 11, n. 2, p. 268–271, 1997.

YIN, R. K. **Estudo de Caso: Planejamento e Métodos**. Porto Alegre: Bookman, 2010.

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