

Critical Issues for an Analytical Framework in the Relationship Between Academic Spin-offs and Their Incubators

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Abstract

The academic spin-off has an important role in regional, social, and economic development. Therefore, it is relevant that this process has its flow of activities delimited from its peculiarities. However, little has been documented on the support networks for innovation structured by universities, companies, and government (triple helix) when a spin-off effort runs on universities. This study aimed to draw an international panorama on the relationship between academic spin-offs and universities through a systematic literature review of existing scientific publications. In the study, the importance of the triple helix and support policies for partnerships for academic spin-offs was identified. Literature also points to a demand for a deep understanding of resource allocations' best time by business incubators and technology transfer offices. There is a research gap concerning the operational mechanisms that connect universities and spin-offs to potentialize their relations under a win-win perspective.

Keywords

Innovation; University Spin-offs; Business Incubators; Technology Transfer; Triple Helix.

1. Introduction

The spin-off is a new organizational form (Dentoni et al., 2019) and one of the most common ways of promoting innovation and entrepreneurship due to its high efficiency, according to Luc et al. (2002). Spin-offs promote the transfer of technology, that is, the transfer of knowledge to the market, according to Mustar et al. (2006). This knowledge can originate in an institution of science, technology, and innovation when it is called an academic spin-off; or a company established in the market, receiving the corporate spin-off name (Luc et al., 2002).

The academic spin-off occurrence is related to the triple helix model proposed by Etzkowitz (2003), which discusses the relationship between the company, government, and university to promote innovation. Academic spin-offs are the results of these relationships, constituting the economic exploitation of knowledge acquired, developed, or elaborated in an academic environment, according to Karnani (2012).

The academic spin-off assumes an important role in the economic and social development of a region, according to Asterbo and Bazzazian (2011) and Montiel-Campos (2018). However, even with universities' importance for academic spin-offs, little has been documented on how this relationship is or should be (Bezerra et al., 2017). Recent studies suggest that "different attitudes and support-practices of universities not only affect the propensity to spin-off or the rate of new business creation, but they play an important role in shaping the spin-off behavior and consequently in

influencing their performance and growth trends" (Baroncelli and Landoni, 2017). That is the focus of this study, especially regarding policies to support entrepreneurship and innovation.

According to Gomes and Salerno (2010), it is relevant that the academic spin-off process has its flow of activities delimited from its peculiarities since this contributes to the economic development of the region and the country. Thus, the amount of documentation on this process's specificities doesn't fit the current criticality of technology spin-offs for innovation.

In this sense, this study proposes to perform a bibliometric search using descriptors defined through the research theme in a peer-reviewed database. The most cited research was analyzed to understand if, in the existing publications in the area, it is possible to build patterns to construct a spin-off model for serving as a reference for actions of the academy and actors interested in constituting triple helix environments on university incubators. Despite having a literature pattern, we identify the main issues for having win-to-win mechanisms for the relationships between spin-offs and university business incubators. The next section presents our theoretical referential, and after our methodology, results, discussions, and the concluding remarks.

2. Theoretical background

2.1. Innovation

Schumpeter (1984) was the first to discuss the concept of innovation, stating that it can change the market equilibrium forever, requiring adjustments so that stability is restored. For the author, innovation is linked to the creation of combinations with forces and elements within our reach. As said, innovation can unbalance the market and cause a new economic cycle to be established. In this way, innovation ensures that capitalism is always in motion (Schumpeter, 1984).

Staying at the top of the market in several business cycles is a challenge that Christensen (2012) claims can be overcome by embedding innovation as a corporate culture, which involves knowledge management. Similarly, Davila et al. (2007) characterize innovation as a critical element for the maintenance and development of organizations in the current competitive environment. Varandes Júnior et al. (2014) argue that innovation is key for generating value and business sustainability for local, regional, national, and globalized companies. Martínez et al. (2019) suggest that technology-based companies can potentialize social-economic sectors, such as culture, sports, and the local economy in general.

Innovation is an event that causes change and a process that generates improvement and changes the competitiveness of the market. This concept is in line with the theory of economic cycles, as Schumpeter (1984) interpreted. Thus, innovation cannot be understood as a one-off event but rather as a management process that pervades the organization as a whole, even under a high-disruptive context as the current technology dynamism (Barbalho et al., 2018). Therefore, for innovation management to take place effectively, it is important to map the areas' internal relations and implement routine procedures that optimize the innovative activity (Tidd et al., 2008), such as the technology transfer process.

2.2. Technology transfer

The transfer of technology is a formal process of transferring the innovations developed in the academic sphere to the productive sector, valuing the relations between scientific and technological institutions with companies (Stevens et al., 2015). This process formalizes the transfer of knowledge and its marketing rights to another organization, according to Bozeman (2000).

In this sense, the transfer of technology is advantageous for the company to market products, processes, and services (knowledge) without necessarily participating in the initial development stages. For academia, which is generally focused on research and is not commonly involved in commercial processes (Hung and Tang, 2008), technology transfer can be another way of funding new research endeavors. According to Giles et al. (2009), the technology transfer process may occur through the formal channels mentioned in Table 1.

Table 1. Transfer of Technology Channels

Technology transfer channel	Description
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Temporary employment of an academic	A company employs a temporary academic
Research Consortium	A company participates in a research consortium of more than one university or a research institute and more than one other company
Minority capital of a spin-off company	A company buys part of an academic spin-off but does not have majority control.
Consulting and mentoring	A company consults an academic in their knowledge about a specific question.
Joint venture for research	A company establishes a research joint venture with a university or a research institute and set up an independent research entity.
P&D Contract	The company pays for a required job at the university or a research institute.
Fund for research	The company funds exploratory research from the university or a research institute.
Acquisition of rights of a license/patent	The company acquires rights to use a license or patent from a university or a research institute.

Source: Formal channels of transfer of technology (Giles et al., 2009).

As presented in Table 1, the spin-off is one of the formal channels of transferring technology, which counterpart the university with equity (Giles et al., 2009). According to Pirnay et al. (2003), this can be defined as the process of creating a company based on knowledge generated in universities from research developed in their environment. Shane (2004) emphasizes that an academic spin-off is a company created to exploit the intellectual property obtained through research developed in the academic environment.

The spin-off concept is often confused with start-ups because both organizations are associated with companies with innovative ideas launched in the market. However, according to Clarysse (2005), the difference is at the origin of the idea. While spin-offs depart from a parent organization that normally develops the incubator function, the start-ups come from an independent entrepreneur.

However, a start-up can become a spin-off case when the first one needs the resources to finance its development and uses a more consolidated company to obtain them through partnerships, contracts, or rights assignment. Thus, according to Luc et al. (2002), a company buys the start-up idea and invests financial resources in its development, starting to make profits on them.

The academic spin-off is the result of this relationship, constituting the economic exploitation of knowledge acquired, developed, or elaborated in an academic environment, according to Karnani (2012). Thus, the academic spin-off assumes an important role in the economic and social development of the region, according to Asterbo and Bazzazian (2011). However, even with universities' importance for academic spin-offs, little has been documented about how this relationship is or should be, especially regarding the policies and mechanisms to support entrepreneurship and innovation. The recent study of Montiel-Campos (2018) points out that TTOs have little impact on spin-off creation in Latin America, contrasting to Iacobucci et al. (2021) approaches European countries. The universities' roles in spin-off creation and growth are open questions that can be studied under the triple helix model.

2.3. Model of the triple helix

Thus, the concept of an academic spin-off is related to the triple helix model proposed by Etzkowitz (2003), which discusses the relationship between the company, the government, and the university for promoting innovation it involves the interests of these three actors. For the author, although independent, the three institutions involved work in cooperation and interdependence for the generation and dissemination of knowledge (Stal and Fujino, 2005).

According to the model, strengthening between the university and the business sector is advantageous for both, in which the former promotes academic knowledge for social and economic development without having to engage in business relationships, while the other innovates without the need for extensive research and development structures (Marcovitch, 1999). In this movement, the government regulates and legislates such interactions, besides defending society's objectives (Plonski, 1995). For Mota (1999), the government is also responsible for promoting public

policies that support innovation and the financing of research that enables the generation of knowledge, supporting the relationship between universities and the business sector.

Bezerra et al. (2017) stated that the triple helix relationship promotes infrastructure, training, and financing for academic spin-offs, being very important to them. Thus, there are still business incubators in this scenario, which may come from one or more of these three institutions and, therefore, are considered interinstitutional arrangements that provide an environment to stimulate and facilitate entrepreneurship (Medeiros, 1998). For Ribeiro et al. (2005), business incubators stimulate the transfer of technology from the university to the business sector, fomenting technological innovation's local ecosystems.

The triple helix model also strengthens the role of universities as promoters responsible for innovation, according to Etzkowitz (2003). Over the years, these structures have been prominent in innovation providers and local and regional policymakers aimed at an entrepreneurial approach to science within scientific and technological institutions (Cooke et al., 2007).

2.4. The Brazilian context

In Brazil, Law 10,973 / 2004 (Brazil, 2004), better known as the Law of Innovation, was a milestone for innovation in the country since it fostered a cooperative environment for scientific, technological, and innovation production and strengthened the areas of research and production of knowledge [28]. Thus, the Law aimed to bring closer ties between the institutional relationship between Science and Technology and companies, strengthening intermediary institutions' performance, promoting entrepreneurship and innovation, according to Barbalho et al. (2019).

However, according to Barbalho et al. (2019), the advantages proposed by the Innovation Law were little used, causing the university and company partnership to remain below expectations. The Law also formalized structures that foster universities' innovation in regulating their activities, creating legal means for scientific and technological institutions to encourage research on the productive sector and the economy (Arbix and Consoni, 2011).

However, the Law was insufficient to break the established research dynamics (Barbalho et al., 2019). In general, the knowledge developed within universities does not follow the interests of the productive sector yet. The author also points out that the decree regulating the Law did not impact other laws that stifled the innovation process, making the new publication weak and provoking legal instability.

Given the difficulties faced, in 2015, a House Bill was proposed to revise the Innovation Law (Brazil, 2016). The new legal framework of the Innovation Law (n° 13.243 of 2016) aimed to clarify some points of the first version and stimulate innovation even more (Barbalho et al., 2019). In short, the legal framework provides more clarity and legal certainty regarding the application and operation of the Law, as well as strengthens the tools to encourage innovation in the scope of the university-company relationship by associating some activities to the productive sector, such as business incubation (Brazil, 2016).

The Brazilian Innovation Laws are examples of how the government should support the university-company relationship and promote entrepreneurship triggers, among other innovation mechanisms (Barbalho et al., 2019). However, according to Bezerra et al. (2017), little has been documented on the university networks and detailed procedures for supporting innovation, neither real cases of triple helix relations. In this way, it isn't easy to understand how this relationship should be and what should be taken to guide new endeavors.

Therefore, this study has undertaken an analysis of the existing literature to understand the context in which these academic spin-offs occur and the support they receive from incubators. The final purpose is to propose an analytical framework to capture the relationship between the incubator and its spin-offs. This framework will be posteriorly used for building a model to guide these relations considering the Brazilian legal context.

3. Methodology

The present study has the exploratory objective (Gil, 2008) to keep the knowledge about relations between spin-offs and their origin universities to identify existing best practices and build a framework for empirical research in this area. As Triviños (1987) described, this research is descriptive since it explores academic spin-offs' reality.

So, as described in the introduction, based on an analysis of the current literature on academic spin-offs, this study intends to answer the following questions: how is the relationship between these academic spin-offs with incubators? Is there a most recommended relationship model between spin-off and universities? What is? If there isn't a recommended model, which elements must be considered to build one?

The study's methodology involved a bibliometric analysis using the descriptors "spin-off" and "incubator" in the database of peer-reviewed publications of SCOPUS. The results obtained were filtered to be considered only scientific and open access articles. Finally, the most recent publications were analyzed. These articles were read, and we applied bibliometric techniques and qualitative classificatory analysis to identify critical issues of incubators' relations with their spin-offs.

Initially, the geographical distribution of the publications between the countries was analyzed. The authors' origin universities were verified. An analysis of the authors and then the years of the publications were carried out. This information was not largely explored in this paper. Finally, to answer the suggested questions, a qualitative analysis of the topics covered was carried out to identify the current relationship models and the main constructs that must compose a framework for analyzing the University-Spin-off relationships in Brazil.

4. Results and discussion

As described in the methodology, the first search obtained 110 publications without any filter and only the descriptors, which from selecting only scientific articles reduced to 77 items found. From there, only those with open access were separated, which was 61 publications. The most recent was selected, resulting in 37 restricted access scientific papers published since 2012, which have the terms "spin-off" and "incubator" in their abstracts.

Based on these 37 published scientific articles, it is initially perceived that 13 countries publish on the subject, three of which correspond to 47% of the publications being Italy (21%), the most published, followed by Switzerland (14%), and Brazil (12%). Another important highlight is that 12 of these 17 countries, or 70% are European countries, Brazil, Mexico, The United States, Botswana, Japan, and South Korea, being the countries from other continents.

There is a European predominance in the publications. Still, Brazil's representativeness stands out that has three publications discussing the context of supporting and fostering innovation and entrepreneurship in the context of university incubators (Bezerra et al., 2017; Borges and Filion, 2013; Quintal et al., 2014). Both the Brazilian and European publications emphasize that the networks of partnerships come from the triple helix and must guarantee administrative support, training in entrepreneurial skills, material resources, and especially funds.

Besides, there is still a balance in publications that consider university and non-university incubators, 67% for the first (Bezerra et al., 2017; Borges and Filion, 2013; Quintal et al., 2014; Conceição et al., 2017; Pallotta et al., 2018; Corsi and Prencipe, 2016; Ruijter, 2015; Berbegal-Mirabent et al., 2015; Minguillo and Thelwall, 2015; Fernandez-Alles et al., 2014; Rogova, 2014; Kim, 2020; Iacobucci et al., 2021) and 33% for the second (Hannibal, 2017; Cantù, 2017; Venturini and Verbano, 2017; Peterkova and Wozniakov, 2016; Peterkova and Wozniakov, 2015; Burckhardt, 2014; Jenni, 2014; Caiazza, 2014; Fabel et al., 2013; Bourellos et al., 2012). However, analyzing the type of incubator with the country that publishes verified that Brazil, The United States, and Italy discuss these two types. In general, the publications approach public universities.

The role of universities in supporting and promoting spin-offs is dealt with within 70% of the publications analyzed, i.e., 26 of them. Such information emphasizes that universities have a relevant role in the spin-off process, whether through incubators, faculty members (Scagnelli et al., 2019), or other mechanisms. This importance corroborates the triple helix model described in the introduction, establishing a relationship between universities, business, and government, as more discussed later.

Regarding the content of the publications, it was verified that 48% of them talk about policies to encourage partnerships (Bezerra et al., 2017; Cantù, 2017; Venturini and Verbano, 2017; Soetanto and Jack, 2016; Corsi and Prencipe, 2016; Peterkova and Wozniakov, 2015; Quintal et al., 2014; Bourellos et al., 2012; Kim, 2020; Haan et al., 2020; Yoshioka-Kobayashi, 2019; Baroncelli and Landoni, 2017; Donegan, 2019; Soetanto and van Geenhuizen, 2019; Vesperi and Gagnidze, 2019; Teixeira and Ferreira, 2019; Khodaei et al., 2021). The low representativeness of the incentive policy approach weakens the triple helix model. The relationship between the company and the scientific and technological institution is supported by the government, which, through incentive policies, regulates and fosters

innovation and entrepreneurship. This percentage suggests an intermediate maturity of existing policies and the lack of a model that guides how to make them in general.

Another relevant factor that the systematic literature analysis pointed out is the low incidence of the spin-offs' relationship mechanisms with incubators among the subjects approached. The spin-off can be understood as an investment for the incubator, reaping future efforts' rewards. However, it is of the utmost importance for this to be possible that this relationship's format and the parties' rights and obligations be clear. It is not found in the literature review. An exception is Teixeira and Ferreira's (2019) work analyzing the practices of intellectual property of Portuguese TTO over the competitiveness of universities' spin-offs. The authors found that informal protection mechanisms, such as lead time and trade secrets, foster competitiveness. In contrast, formal protection mechanisms, such as patents, trademarks, and geographical indications, negatively impact competitiveness.

Moreover, it was verified that only nine (Quintal et al., 2014; Berbegal-Mirabent et al., 2015; Bourellos et al., 2012; Kim, 2020; Iacobucci et al., 2021; Haan et al., 2020, Yoshioka-Kobayashi, 2019; Baroncelli and Landoni, 2017) from the 37 analyzed publications discuss the subject studied here. It can be affirmed that this is poorly researched and scientifically documented, according to our applied methodology. Correlating the two analyzes carried out, it is noteworthy that from these nine publications, six (Quintal et al., 2014; Bourellos et al., 2012; Kim, 2020; Haan et al., 2020, Yoshioka-Kobayashi, 2019; Baroncelli and Landoni, 2017) discuss the incentive policies for innovation partnerships. Thus, it can be stated that these mechanisms of relationship and partnerships are barely elucidated. We found almost nothing about the "how" issues of these relationships and few regarding the university incubators' investment return.

Among the publications that discuss relationship mechanisms, eleven publications consider the academic spin-off model where the university holds part of the spin-off capital, receiving a return on the investment (Quintal et al., 2014; Berbegal-Mirabent et al., 2015; Khodaei et al., 2021). It is a reasonable model to be considered. It guarantees the return on financial resources of the investment made while maintaining the definition of activities to be developed with such resources under the command of the university incubator. With this reward, the business incubator can reinvest in other spin-offs, a far different approach from Sweden's experiences, for example (Bourellos et al., 2012).

Still discussing this return on investment, the study indicated that only ten (27%) papers argument about obtaining financial resources (Borges and Filion, 2013; Quintal et al., 2014; Fernandez-Alles et al., 2014; Venturini and Verbano, 2017; Peterkova and Wozniakov, 2015; Fabel et al., 2013; Baroncelli and Landoni, 2017; Zapata-Guerrero et al., 2020; Donegan, 2019; Khodaei et al., 2021). Among the publications on obtaining resources, six talks about policies to support partnerships (Quintal et al., 2014; Venturini and Verbano, 2017; Peterkova and Wozniakov, 2015; Haan et al., 2020, Yoshioka-Kobayashi, 2019; Baroncelli and Landoni, 2017), and only five of them deal with these support mechanisms for spin-off funding (Quintal et al., 2014; Haan et al., 2020, Yoshioka-Kobayashi, 2019; Baroncelli and Landoni, 2017; Donegan, 2019).

Considering the 37 publications analyzed in this study, only five deals with policies to support the partners, mechanisms of the relationship of the spin-offs with the incubators, and the obtaining of financial resources simultaneously (Quintal et al., 2014; Haan et al., 2020, Yoshioka-Kobayashi, 2019; Baroncelli and Landoni, 2017; Donegan, 2019). Therefore, we can affirm that there are scarce discussions about the relations between the universities' incubators and their spin-offs regarding financial issues.

There are undiscussed questions about whether business incubators guarantee resources for academic spin-offs in a sustainable way or the return on their investments. This finding contrasts with the practical contexts in which universities have difficulties in financing their business incubators. Sometimes it is difficult to justify for universities' central boards the importance of this commonly unreturnable investment. Baroncelli and Landoni (2017) suggest that the universities' endowment capacity is directly related to incubation and spin-off programs' justification. According to the authors, "... In top-academic institutions, the availability of services and incentives to facilitate patent rights ownership, university equities, and venture capital is more likely to be found. In contrast, in lower-ranked universities, spin-offs mostly rely on incubators services to overcome capital limitations." This view is corroborated by Zapata-Guerrero et al. (2020).

The analysis also highlighted the triple helix approach's recurrence as a spin-off creation background, often discussing partnerships between science and technology institutions with the business sector and the government, as Etzkowitz

(2003) discussed. According to Montiel-Campos (2018), the universities' entrepreneurial orientation positively influences university spin-offs in Latin America. The use of this theme predominates over those that discuss the entrepreneurial profile of the founders of spin-offs that pass through incubators in a Schumpeterian analysis (Schumpeter, 1984) since the founders' theme is present in only three of the articles analyzed in the study. An interesting insight from Yoshioka-Kobayashi (2019) results from his study at the University of Tokyo. The author points to a demand for a different triple helix model more suitable for public universities. According to his academic and commercial bicultural culture, it is a reasonable solution to fulfill these universities' traditional expectations and achieve innovations.

The publications that discussed triple helix partnerships and the obtaining of funding describe that the support can be differentiated by the spin-off moment. Except for the Botswana case (Schutte and Direng, 2019), for the less mature (initial stages), the support should be offered to focus on the team training, which is related to the deepen the entrepreneurial profile of the founders (Borges and Filion, 2013; Venturini and Verbano, 2017; Peterkova and Wozniakov, 2015; Fabel et al., 2013). While in the later stages, when the spin-off is more mature, it is important that the incubator focuses on support marketing activities and promote these companies for them to gain credibility for their consolidation in the market (Fernandez-Alles et al., 2014; Venturini and Verbano, 2017; Khodaei et al., 2021).

The academic spin-off is one of the most common (Giles et al., 2009) and effective (Yoshioka-Kobayashi, 2019) technology transfer mechanisms for innovation. Still, few about the technology transfer relations among the spin-off and their university were found. Literature only states that licensing and equity as the major mechanisms of technology transfer among the university and spin-offs (Bergebégal-Mirabent et al., 2015), a what-type of question. Quintal et al. (2014) present the bureaucratic context of university business incubators in Brazil under their nucleus of technology innovation, which was started mandatorily by the Law mentioned above (10,973 / 2004). Kim (2020) points to the negative effects of universities' external collaboration and the personnel sizes at their technology licensing offices to create technology-based spin-offs. Besides, Iacobucci et al. (2021) point reinforcing a direct effect of TTO size over spin-offs creation, but not over their growth in Italy. In general, barely discussions about how-issues are found, except the work mentioned above of Teixeira and Ferreira (2019), who elucidates interesting guidelines for TTO when licensing to universities' spin-offs.

Finally, according to the theoretical data gathered on the subject, a few more articles are focusing on discussing the networks of partnerships to support mature spin-offs (Corsi and Prencipe, 2016; Berbegégal-Mirabent et al., 2015; Minguillo and Thelwall, 2015; Fernandez-Alles et al., 2014; Cantù, 2017; Venturini and Verbano, 2017; Soetanto and Jack, 2016), than on analyzing the incentives received in the initial stages of the process (Bezerra et al., 2017; Conceição et al., 2017; Pallotta et al., 2018; Fernandez-Alles et al., 2014; Hannibal, 2017; Jenni, 2014). Neither, only three studies (Haan et al., 2020; Baroncelli and Landoni, 2017; Khodaei et al., 2021) analyzed a kind of process through which the incubator suggests an organizational structure or even guidelines to the spin-off growth. As these endeavors tend to behave more technical-based founders (Barbalho et al., 2009; Dyer et al., 2011) than business people (Dyer et al., 2011), organizing and structuration are always barriers (Khodaei et al., 2021). The discrepancy between these publications indicates a research gap whose investigation focus should contribute to the maturation of spin-offs in the market.

The results presented corroborate with Bezerra et al. (2017) assertion that few publications on innovation networks, policies, and procedures support academic spin-offs. In this way, important insights were raised to design these relationships and strengthen the triple helix relations summarized in Table 2.

Table 2. Summary of findings

Topic/framework elements	Description
Predominance in publications	European countries
The role of Universities for academic spin-offs	Focus on training for first stages, or market entrance and networks for later stages
Mechanisms of relationships between business incubators and academic spin-offs	Not documented in the scientific literature
Spin-off creation	More a result of the university's policies and activities than because of the entrepreneurial profile of its founders

Technology-transfer	Licensing or equity. Informal licensing methods can drive better spin-off competitiveness
Policies to encourage partnerships between business incubators and spin-offs	Not documented in the scientific literature
Return of investment	Not discussed or equity

Source: Authors.

The findings summarized in Table 2 show that the lack of mechanisms to regulate the relationship between the business incubator and the academic spin-offs is highlighted. When we also see no discussion regarding setting up the necessary partnerships, we can extract elements to answer our research questions. The issues regarding incubators' roles, their mechanisms and policies to support spin-offs, and the technology transfer strategies, and finally, investment returns mechanisms are critical issues for an analytical framework to study Brazilian spin-offs experiences.

Our literature analysis also found experiences with an entirely different way of doing technology-based spin-offs (Haan et al., 2020; Yoshioka-Kobayashi, 2019), connecting post-doctoral programs entrepreneurship initiatives. These experiences set an integral connection among teaching, research, and innovation as objectives of the academy—another question to guide future analysis.

5. Conclusion

The present study proposed performing a bibliographic analysis of publications involving spin-offs and incubators to identify research gaps and posterior empirical research issues. The study looked for patterns and insights on the incubators' relations with the spin-off they support.

For this, a search was performed on a peer-reviewed database using the descriptors defined according to the research topic. The bibliographical analysis pointed the main demands from spin-offs are administrative support, training in entrepreneurial skills, access to university infrastructure, material, and funds at the beginning of the business, but especially networking and marketing support when the spin-off is being mature.

There is a distinct difference among literature depending on its origin country. Countries like the Czech Republic, Russia, and Botswana present an initial discussion regarding entrepreneur culture. Consequently, they put effort into how business incubators can work for training and stimulate new entrepreneurs. On the other side, the United Kingdom, the United States, and Sweden have more discussion about business models and funding, and venture capitalists access to new business. In general, a few discussions about integration mechanisms and especially on how university incubators can do business with spin-offs to sustain their investment in incubation.

The bibliographical analysis used emphasized the importance of the triple helix model for spin-offs. It suggests that the triple helix explains this kind of business more than Schumpeterian models based on entrepreneurs' characteristics. As a common knowledge transfer mechanism for innovation endeavors, it was supposed to find guidelines and best practices on the researched literature, but there are scarce guidelines. Issues as typical technology transfer contracts, typical royalties according to the technology disruption promise lack in literature. Moreover, questions such as if there were bids and calls for selecting spin-offs groups, the origin of spin-off teammates if they worked on the labs where the technology was developed, and the relations among professors who developed the technology spin-off itself are also under-discussed.

Few specific discussions were found when we think about our research questions, suggesting a good research topic, such as mechanisms of the spin-off relationship with the incubator, obtaining financial resources, and discussing the interinstitutional relationship under a triple helix background. These issues are suggested to be researched to build a framework of technology development under incubator-spin-off partnerships. The Brazilian Law advanced on providing knowledge transfer mechanisms from universities to spin-offs, such as professors' participation in the company board, opening universities' laboratories to support spin-offs, flexibility for intellectual property contracts, and incubation. These possibilities can be incorporated into an analytical framework complementing the findings we had in this study.

Nowadays, venture capitalist and international ventures are starting up funds for investing in new, promising companies. These funds come across the concept of business accelerators, a private-based support company for new start-ups. They are commonly working in low-technology intensive new business. But for the spin-off model, where a strong scientific-based technical background and research structure is mandatory, how can an actor articulate university labs, incubators, spin-off teammates, business accelerators, and venture capitalists is an open question. Scientifically and also from a practitioner's point of view. In this way, it is possible to build an academic spin-off model that promotes mutual benefit among the actors and has greater potential for success. This research is a starting point for that, but with the limitation of only a theoretical analysis.

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