

The Innovative Capacity of Incubated Companies in Brazilian Technology-Based Business Incubators

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Abstract

TBCs are ventures formed by entrepreneurs whose core is technical knowledge and which are sometimes accompanied by business incubators. It is estimated that the earnings of TBCs incubated in Brazil are more than R\$550 million and that they generate around 14 thousand jobs. Thus, given the importance of TBCs for a country's social and economic development, this research is justified, which aims to measure the innovative capacity of TBCs linked to incubators of Brazilian technology-based companies. The chosen methodology was a descriptive research, of quantitative nature, whose data collection technique uses the Innovation Radar questionnaire. The sample of this study had the participation of 62 incubated in the incubation stage in 22 incubators located in the states of Goiás, Mato Grosso, Mato Grosso do Sul, Minas Gerais, and Distrito Federal. Among other results, the study showed that, in a sectorial analysis, mining companies in the service sector are not very innovative and the other occasional innovators, as well as that the industries of Mato Grosso do Sul are not very innovative and the other occasional innovators. Finally, in comparison, all TBCs that participated in the research are occasional innovators, that is, in general, the entire sample was characterized as an occasional innovator.

Palavras-chave: innovation; Innovation Radar; innovation capacity; Technology-Based Companies; incubated companies.

1. Introduction

When a hamburger launches a new sandwich on the market it is innovating (product innovation). The vehicle manufacturer that optimizes its production time from 08 to 06 minutes per vehicle is innovating (process innovation). When Havaianas Company repositioned its products on the market, changing its image before consumers, it innovated (position innovation). The introduction of low-cost airlines by airlines is also an innovation (paradigm innovation) (Tidd, Bessant, & Pavitt, 2008).

From the examples, it is observed that innovation is something fundamental and common in organizations, being simple or complex, given its different dimensions. One of them refers to the types of innovation; it can be the product, process, marketing and organizational (Organization for Economic

Cooperation and Development [OECD], 2006) or, in the view of Tidd et al. (2008), of product, process, position and paradigm (the “4 Ps” of innovation). From another perspective, there is a dimension related to the degree of novelty involved, which can be radical or incremental (OECD, 2006; Tidd et al., 2008). Finally, there is a dimension that shows the extent of innovation: something new for the company, new for the market, or new for the world (Tidd et al., 2008).

Innovation, in general, brings numerous benefits to those who practice and/or use it. In this sense, technological innovation stands out, considered an indispensable resource for the economic and social development of a country (Carayannis & Zedtwitz, 2005; M. Mcadam & R. Mcadam, 2008), since its applicability is of great relevance for any sector of the economy (Stal, 2010) and, above all, for Technology-Based Companies - TBCs (Sanches & Machado, 2014).

TBCs are enterprises formed by entrepreneurs whose core is technical knowledge, coming from the area of science in which they operate (Barbalho, Amaral, Kernbichler, Richter, & Torres, 2009; Perussi Filho & Escrivão Filho, 2012; Silva & Reis, 2015). In general, these companies present certain difficulties in the initial and business development phases, with emphasis on shortage of financial resources (Antolín-López, Céspedes-Lorente, García-de-Frutos, Martínez-del-Río, & Pérez-Valls, 2015; Costa & Torkomian, 2008) and difficulties in accessing these resources (Hueske, Endrikat, & Guenther, 2015); entrepreneurs with little management knowledge (Barbalho et al., 2009; Perussi Filho & Escrivão Filho, 2012) and an inefficient network of contacts (Carayannis & Zedtwitz, 2005).

Aiming at the development of these ventures, Innovation Support Agents (ISAs) were created, such as Technology-Based Business Incubators - TBBIs and, recently, Business Accelerators (BAs), whose mission is to support the development of TBCs (Silva, Gonçalves, Silva, & Venâncio, 2018).

The support provided to TBCs by ASIs generally comprises the provision of the physical structure and basic services (Iacono, Almeida, & Nagano, 2011; J. M. Silva, C. E. S. Silva, Batista, & Bitencourt, 2012); access to a relevant network of contacts (Bollingtoft, 2012; M. Mcadam & R. Mcadam, 2008); acculturation offer (Bollingtoft, 2012), which concerns participation in managerial training and business plan development (Bollingtoft, 2012; Silva & Reis, 2015) and; access to subsidized financing (Iacono et al., 2011).

Given the importance of TBCs for a country's social and economic development, the discussion on the trajectory and direction of these companies about their innovation processes becomes relevant (Iacono et al., 2011). Therefore, the general objective of this study is to measure the innovative capacity of companies linked to Brazilian TBBIs.

1.1. Business Incubators

Innovation Areas are the Innovation Areas and the Mechanisms for the Generation of Enterprises, which act with a high degree of interaction (Aranha, 2016). The Innovation Areas are spaces strategically created with the function of attracting human talents and knowledge-intensive businesses, for the sustainable economic development of the region where they are installed (National Association of Entities Promoting Innovative Enterprises [ANPROTEC], 2019). Examples of Innovation Areas are Science and Technology Parks, Smart Cities, and Innovation Communities. The Enterprise Generation Mechanisms, in

turn, support the creation, development, and consolidation of new businesses (ANPROTEC, 2019), such as accelerators and incubators (Aranha, 2016).

Concerning incubators, it has its origin in the mid-twentieth century, in the United States and England, as a result of adverse economic phenomena (economic crises) or as initiatives of large companies. Initially, the objective of these environments was to provide physical space and infrastructure for the development of nascent businesses (ANPROTEC, 2019).

In the current concept, incubators offer, in addition to the aforementioned benefits, a range of advantages for incubated companies, such as management support, acculturation, networks of contacts, among others; with the mission of transforming innovative ideas into successful businesses (ANPROTEC, 2019).

In Brazil, the emergence of incubators is recent, with reports from the 1980s, in cities such as São Carlos (SP), Campina Grande (PB), Florianópolis (SC), and Rio de Janeiro (RJ) (ANPROTEC, 2019). From there, several economic and legal factors contributed to the expansion of these environments (ANPROTEC, 2019).

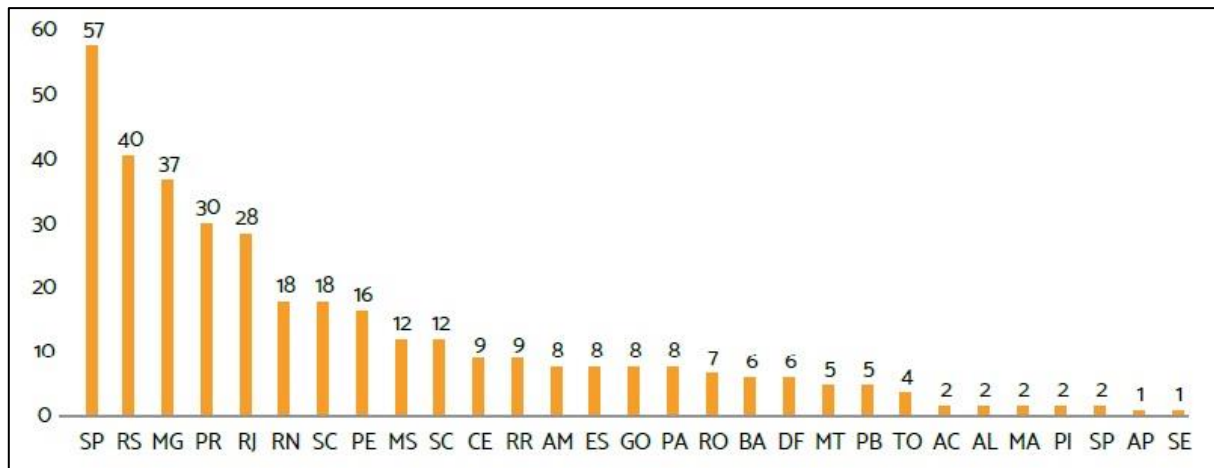
Among the economic factors, the opening of the Brazilian market in 1990, the fall and stabilization of inflation in 1994, and advances in the area of information and communication technology stand out. This situation was favorable for the emergence of new businesses and, consequently, for the development of Brazilian incubators (ANPROTEC, 2019).

At the same time, the legal apparatus related to innovation began to be thought about, created, and improved. Composing this regulatory structure, there are: the creation of the National Support Program for Business Incubators - PNI in 1998; the creation of the Innovation Law in 2004; the creation of the Lei do Bem in 2005; the establishment of Constitutional Amendment 85, in 2015; of Law No. 13,343, in 2016 (BRASIL, 2016), known as the Science, Technology and Innovation Code and the New Legal Framework for Science, Technology, and Innovation, with Decree 9,283, in 2018 (ANPROTEC, 2019; BRASIL, 2018).

Commonly, the incubation process comprises the stages of pre-incubation, incubation, and post-incubation. The pre-incubation, or project hotel, consists of the period before the company enters into the incubator when the enterprise is in the design and constitution phase (Tumelero, 2012). In the incubation, the company uses the physical facilities and other services provided by the incubator. It is a critical step in terms of adding value. Therefore, the incubator focuses too much on the orientation, monitoring, and evaluation of the incubated company. Post-incubation is made up of companies that have gone through the incubation period and that have already reached maturity. In this phase, the company is called a graduate but continues to have a link with the incubator, with access to its services. The objective of this step is to mitigate the impact of untying the incubator (Iacono et al., 2011).

Between 2017-2019, 405 incubators were accounted for in Brazil, of which 363 were active and the remainder without operation. In the geographical distribution shown in Graph 1, it can be seen that there were 08 TBBI in Goiás (GO), in Mato Grosso (MT) 5, in Mato Grosso do Sul (MS) 12, in the Distrito Federal (DF) 6 and Minas Gerais (MG) 37 (ANPROTEC, 2019).

Graph 1 - Number of TBBIs by Brazilian State



Source: ANPROTEC (2019)

Regarding TBCs linked to incubators, the study conducted by ANPROTEC (2019) pointed out, in 2017, the number of 3,694 companies, which generated 14 thousand direct jobs, revenues of R\$550 million, and payment of R\$110 million in taxes.

According to Autio (1994), the international literature points out that TBCs, in addition to boosting the economy with the launch of new products and services of greater added value in the market, also play an essential role in the transfer of technology by absorbing scientific production. of Science and Technology Institutions - ICT, and transform it into technologies that will be offered to the market, accelerating their commercialization.

Other positive aspects of TBCs are market orientation; flexibility; ability to respond quickly to market opportunities and demands (Santos apud Inácio Júnior, Carvalho, & Gariva, 2012) and performance in high-risk market nests, in which large organizations are unable to operate (Marcovitch, Santos, & Dutra apud Inácio Júnior et al., 2012).

2. Methodology

This is a descriptive study - in which the facts (variables) are observed, analyzed, and correlated, without the interference of the researcher (Rampazzo, 2011) - with a quantitative nature, which was approved by the Ethics Committee, through the Plataforma Brasil, on 04/01/2019.

The population - set of beings that have at least one characteristic in common (Marconi & Lakatos, 2016) - in this study was made up of TBC owners in the incubation stage in Brazilian TBBIs, more specifically in the states of GO, MT, MS, MG, and DF.

To identify the population of this study, the following step-by-step was performed:

- 1) Request and access to the database of TBBIs existing in the states of GO, MT, MS, MG, and DF with ANPROTEC;
- 2) Manual validation of this database through online searches with the names of TBBIs or through state incubator networks and, subsequently, making calls to the identified telephone contacts to obtain the following information:

- i) If the incubator exists;
- ii) If it meets the previous criterion, if it is characterized as technological or mixed, provided that one of the aspects is technological;
- iii) If it meets the previous criteria, if it is in operation;
- iv) If it meets the previous criteria, if it has TBCs in the incubation stage (resident or non-resistant);
- v) If it meets the previous criteria, how many are these TBCs, and who they are (name, entrepreneur, contact)?

After this process, 42 TBBIs were identified in the states that comprise the scope of this study, as shown in Table 1. However, the number of active TBBIs (in operation) is 39 and the number of TBBIs that have enterprises in the incubation phase is 28. From these data, it was identified that the total number of TBCs that make up the population of this study is 153.

Table 1 - Quantity of TBBIS and TBCs accounted for

	Number of TBBIs found	Number of TBBIs in operation	Number of TBBIs with TBCs in the incubation	Number of TBCs found
Goiás	11	10	6	23
Distrito Federal	3	3	1	3
Mato Grosso	2	2	1	3
Mato Grosso do Sul	6	5	4	12
Minas Gerais	20	19	16	112
TOTAL	42	39	28	153

Source: Prepared by the authors (2020)

The sample – the portion of the population selected for the study (Marconi & Lakatos, 2016) - was calculated on the website OpenEpi® version 3.0.1 (2013), from 50% anticipated frequency, 95% confidence level, 10% absolute precision, and sample design effect by clusters (DEFF) de 1.0. The result consisted of a sample of 60 companies. Considering a possible loss of data, there was an increase of 5% in the sample, resulting in 63 companies in the incubation stage.

The type of sampling chosen was non-probabilistic for convenience. Therefore, of the 153 TBCs found, 64 participated in the survey. However, 02 entries were excluded, due to incorrect questionnaire filling. Therefore, 62 companies participated in the survey. It is important to note that participation in the research was carried out with one of the company's owners voluntarily, with consent and guidance through the Free and Informed Consent Form.

As a data collection technique, the Innovation Radar questionnaire, proposed by Sawhney, Wolcott, and Arroniz (2006), and adapted by Bachmann and Destefani (2008), was used; chosen due to its use in scientific studies published in national and international journals that aimed, as well as this research, to analyze the Innovation Index (II) of companies through the Innovation Radar. Among these studies are that

of Chen and Sawhney (2010); Néto and Teixeira (2014); Oliveira, Cavalcanti, Paiva Júnior, and Marques (2014) and Carvalho, Silva, Póvoa and Carvalho (2015).

The Innovation Radar consists of 03 (three) questionnaires, 01 for companies in the trade sector (comprising 35 questions), 01 for the industrial sector (with 40 questions), and 01 for the services sector (with 39 questions) (Zanirato, 2017). This Innovation Radar seeks to analyze 13 constructs, namely: Offer, Platform, Brand, Client, Solution, Relationship, Value-Adding, Processes, Organization, Supply Chain, Presence, Network, and Innovative Ambience. It is noteworthy that in addition to the issues mentioned, another 26 sociodemographic questions were elaborated.

Cross-sectional data collection took place from 9/2/2019 to 3/5/2020. Initially, calls were made to the owners of the identified TBCs explaining the survey and, subsequently, sending the questionnaires through the Google Forms tool to their e-mails or WhatsApp.

The data collected were systematized in Microsoft's Excel software, version 2013; being that the quantitative variables were analyzed in measures of central tendency, more specifically in averages, to calculate the average II of the surveyed companies.

All questions in the Innovation Radar questionnaire have 03 closed answer options, in decreasing order. Therefore, each answer was assigned a score ranging from 1 to 5. Always, the first answer option is equivalent to 5, the second to 3, and the third to 1.

After calculating the mean of the constructs, companies that scored between 1 and 2.9 ($II < 3$ and $II \geq 1$) are considered to be little innovative, occasionally innovative to those that scored between 3.0 and 3.9 ($II < 4$ and $II \geq 3$) and systemic innovators TBCs that scored 4.0 or higher ($II \geq 4$), demonstrating that they have a systematic culture of innovation management. Visually, the farther the centerline is from the center of the graph, the greater the company's innovative capacity concerning the analyzed dimension and vice versa (Néto & Teixeira, 2014).

3. Results

Initially, the sample profile is demonstrated. The participants, predominantly, are between 20 and 39 years old, since 46.8% are between 30 and 39 years old and 27.4% between 20 and 29 years old. A portion of the sample (about 13%) is between 40 and 49 years old. The rest (12.9%) are aged between 50 and 72 years.

79% of individuals are male and most respondents are married (59.7%). Singles represent 29% of the sample, 8.1% are dating and 3.2% are divorced.

The level of education of these entrepreneurs is diversified: about 13% are taking an undergraduate course and 24.2% have completed it; approximately 34% are specialists; 3.2% (02 people) are studying for a master's degree and 8.1% (05 individuals) are already masters. There are also respondents with PhDs (11.3%) and other Ph.D. students (6.5%).

When asked about the number of hours per day they dedicate to the company, about 31% said they dedicate themselves from 9 to 12 hours; 29% of the sample from 05 to 08 hours daily; 27.4% from 01 to 04 hours and 4.8% from 13 to 16 hours. It is noteworthy that 01 respondents said he did not dedicate himself

to TBC - as a result of being an investing partner - and 04 (6.5%) affirm that they spend 20 to 24 hours a day in the business, showing that all their time is spent in the company.

About 77.4% of respondents have some partner. Of these, 45.8% have only one partner and the remaining 02 or more. Another important fact is that 22.6% of the sample in this study has other companies.

As for the number of employees, about 40% of the sample said they did not have them; another 34% have 1 to 2 employees; 11.3% have 3 to 4; 9.7% from 5 to 8, and the rest have 10 to 15 employees.

Another question was about the monthly billing obtained in 2018. For 3.2% of the sample, monthly billing was below R\$1,000.00; for 17.7% it ranged from R\$1,001.00 to 10 thousand reais; 21% answered that it was from R\$ 10,001.00 to 100 thousand reais; 4.8% obtained from R\$100,001.00 to 200 thousand reais and 01 (1.6%) company said to have obtained revenue greater than R\$200,000.00, this being an industry located in the municipality of Itajubá (MG), which has a link with the INCIT incubator. Another 40% stated that they had no revenue in the aforementioned time - partly due to formalizing the deal only in 2019 - and 11.3% did not inform.

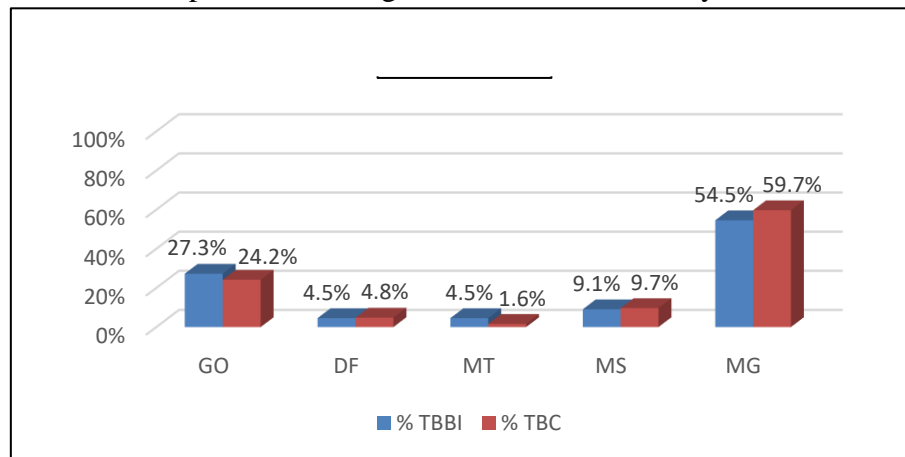
Also analyzing the profile of the sample, the relationship between researched TBCs and TBBI was investigated. Thus, it was found that the majority of the incubated established links with the TBBI in the years 2019, 2018, and 2017, with 38.7%, 27.4%, and 21%, respectively. The 6.5% link between TBCs and incubators was agreed upon in 2015 and the rest (6.5%) entered into a partnership in 2011, 2012, 2014, and 2016, in a 1:1 ratio. That said, it became clear that 79% of these links were established as incubated resident companies and the remainder, 21%, as non-residents.

The values of the incubation fees paid by the TBCs to the TBBI ranged from R\$0.00 to about 1.2 thousand, being: 9.7% do not pay; 3.2% pay from R\$100.00 to R\$199.00; 58% pay from R\$200.00 to R\$499.00; 9.7% from R\$500.00 to R\$599.00; 8.1% from R\$600.00 to R\$799.00; 8.1% from R\$800.00 to R\$899.00 and a company pays R\$1,168.00. It should be noted that one company did not reveal the amount paid.

Among the reasons that led the incubated to establish a link with the incubators is the infrastructure of the TBBI (about 32%), followed by the specialized services (29%), the notoriety of the incubator and its maintainer (16.1%), and network of contacts (about 13%). Other reasons, unknown, were the response of 9.7% of respondents.

The study consisted of 62 TBCs in the incubation phase, which were linked to a total of 22 incubators, according to the geographical distribution shown in Graph 2. It is observed that the largest portion of the sample (approximately 60%) is contained in the state of MG and that about 24.2% in GO. There was low participation of TBCs in the other states that make up the analyzed territorial range, such as MT, with only 1.6%.

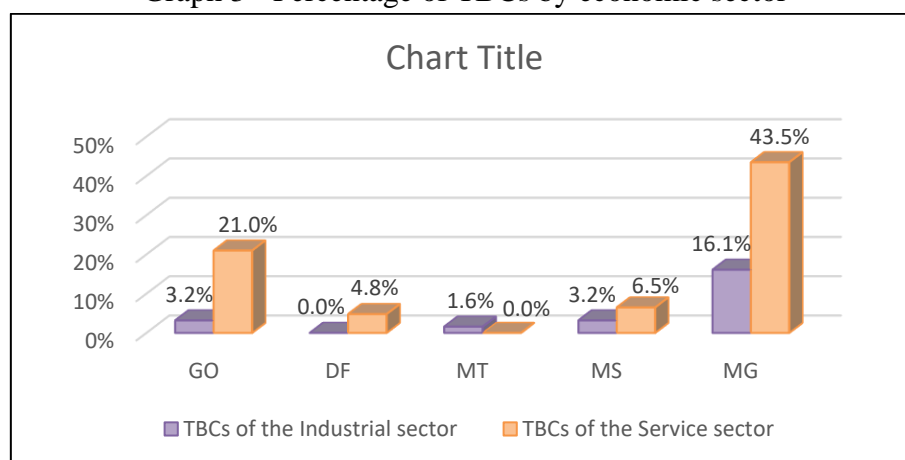
Graph 2 - Percentage of TBBIs and TBCs by State



Source: Prepared by the authors (2020)

As shown in Graph 3, the largest portion of the companies analyzed belongs to the services sector (47 companies) and there were no participants in the trade sector. It is also noted that 100% of the TM sample belongs to the industrial sector and that, in the DF, 100% of the respondents are from the services sector. However, these results do not show a great impact, since the relative number of respondents in each of these states is very small.

Graph 3 - Percentage of TBCs by economic sector



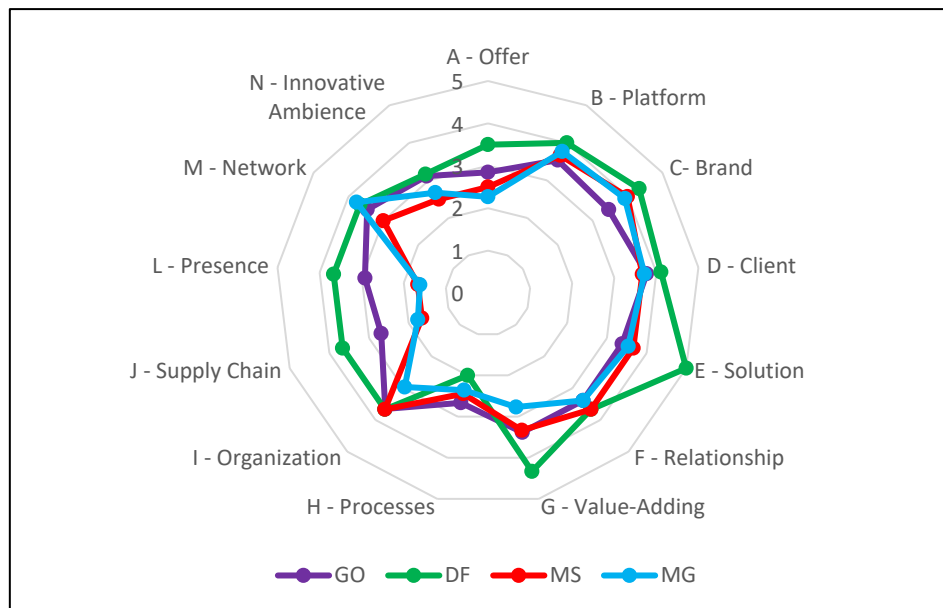
Source: Prepared by the authors (2020)

Regarding issues related to the Innovation Radar, the results were combined in two aspects: by sector of the economy and by state.

47 companies comprised the sample of the service sector, being 13 companies from Goiás, 3 from Brasília, and 27 from Minas Gerais. Thus, analyzing the Innovation Radar presented in Graph 4, it can be seen that in Goiás none of the dimensions scored above 4 points, however, most of them (9 of 13 dimensions) had a good score: Platform, Brand, Customers, Solution, Relationship, Value-Adding, Organization, Network, and Innovative Ambience. The others (Supply, Processes, Supply Chain, and Presence) had a low score, pointing out that these constructs are the most conducive to the emergence of bottlenecks and, therefore, should be the first to be analyzed and worked on, to overcome barriers existing

(Néto & Teixeira, 2014). Such data, together with the Average II, of 3.25, indicate that the service companies from Goiás analyzed are occasional innovators.

Graph 4 - II of the TBCs of the Service sector



Source: Prepared by the authors (2020)

The Brasilia service providers that were analyzed make up the entire population of TBCs in DF, which are linked to the CDT incubator (the only incubator in the Distrito Federal in operation and with incubated companies). About them, it can be seen that the dimensions of the Innovation Radar are well developed - except the Processes dimension - and that their Average II was 3.75, characterizing them as occasional innovators, close to reaching the level of systemic innovators.

Analyzing the service companies in Mato Grosso do Sul, through Graph 4, it was identified that there are constructs with a very low score, such as Presence and Supply Chain. However, the dimensions with a good score are the majority, with emphasis on Brand, with 4 points. As their Average II was 3.03, they were defined as occasional innovators.

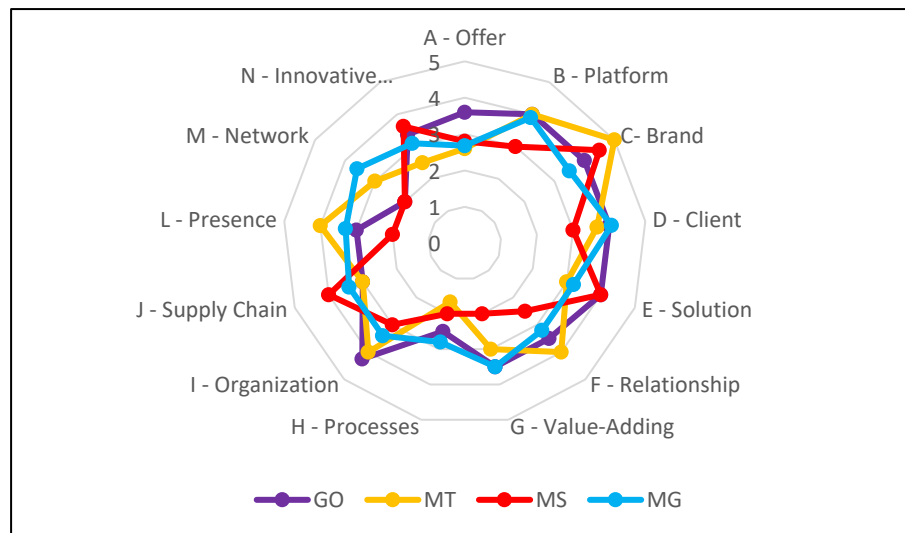
In MG, the ability to innovate TBCs in the service segment is very similar to the state of MS, since there is a contrast between the scores, that is, some with very low scores and others with scores close to 4. Including, the similarity was also about the dimensions because as in MS, the lowest scores were Supply Chain and Presence and the highest was Brand. The average II of the companies was also similar, with a difference of only 0.07 between MG (with 2.96) and MS (with 3.03). Therefore, the conclusion is that these companies are not very innovative.

In a macro analysis of Graph 4, it was observed that the dimensions of the service providers that stood out were Solution (5.0), followed by Value-Adding (4.33) and Customers (4.11). The areas that received the lowest score were Presence (1.62), Supply Chain (1.77), and Processes (2.0), all with scores below or equal to 2 points. The average II of the service companies was 3.25, showing that, in general, they are occasional innovators.

Regarding the trade segment, it is important to note that no participants were representing it. Next, follow the results of the industrial sector.

The companies that make up the industrial sector had, except for Minas (10 companies), low participation in the research. In GO, for example, there were only 02 respondents, as well as in MS. In MT there was one participant.

Graph 5 - II of the TBCs of the Industrial sector



Source: Prepared by the authors (2020)

The industries in Goiás, according to Graph 5, presented 10 dimensions with scores between 3 and 4 points, showing a good result. The maximum score was for Organization, with 4.25 points. The lowest score was in the Network area, with 2 points. With these data in mind and analyzing the Average II (3.44), it can be seen that GoT's TBC in the industrial sector are occasional innovators.

In MS, there was heterogeneity in the results of the dimensions of the industries, that is, a significant variation in the scores. The best results were obtained in the dimensions Brand (4.5), Solution (4.0), and Supply Chain (4.0), while the dimensions Value-Adding, Processes, Presence, and Network - all with 2.0 points - obtained the lowest averages. At the same time, the average II of these companies was 2.96, showing that these companies are not very innovative.

MT, in turn, had the participation of only 01 TBC, which is from the industrial sector, and presented disparate scores in the analyzed constructs, as well as MS. The highest score was obtained in the Brand dimension, which reached the ceiling (5 points). The lowest score was in Processes, with 1.7 points. Concomitantly, the average II of this company was 3.34, that is, an occasional innovator (see Graph 5).

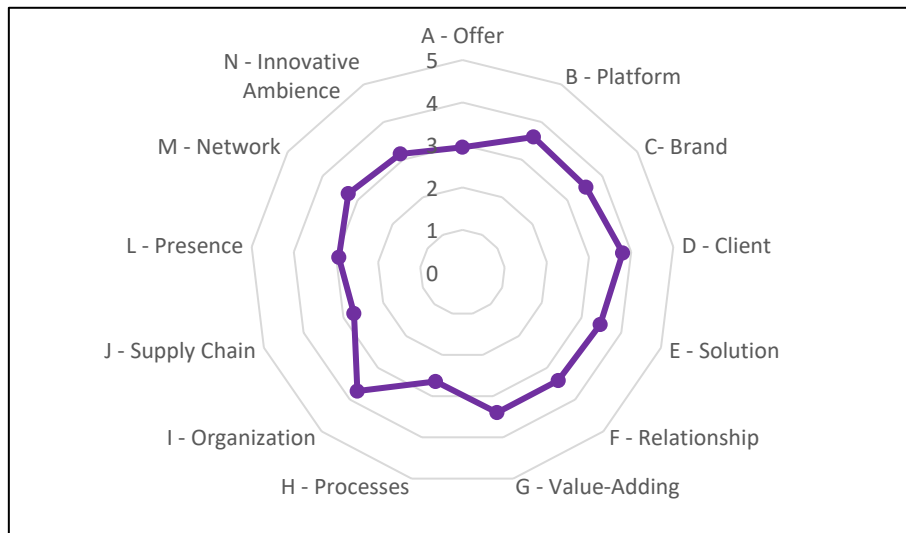
The industrial mining TBCs had only 02 dimensions (Supply and Processes) with a score lower than 03 points. All other dimensions were scored with 03 or more points, with a notoriety for Customers, who obtained the highest score, with 4.1 points. Allied to this information, there is the Average II of these TBCs, which was 3.4, demonstrating that these companies are occasional innovators.

In a comparison of the industry segment, as shown in Graph 5, it was observed that only the state of MT had an industry with a dimension - Brand - equal to 5, demonstrating that the company uses this construct in a very positive way. Simultaneously, the lowest score obtained in a given dimension is also

MT, which obtained 1.7 points in Processes. The average II of companies in the industrial sector was 3.27, showing that they are also occasional innovators.

Once the analysis by sector of the economy is finished, TBCs capacity for innovation by the state is demonstrated. Graph 6 shows that TBCs that have links with incubators in Goiás had, in general, a good score (between 3 and 4 points) in dimensions, except 04 areas (Supply, Processes, Supply Chain and Presence), which scored below 3 points. The Average II was 3.28, showing that the TBCs in Goiás are occasional innovators.

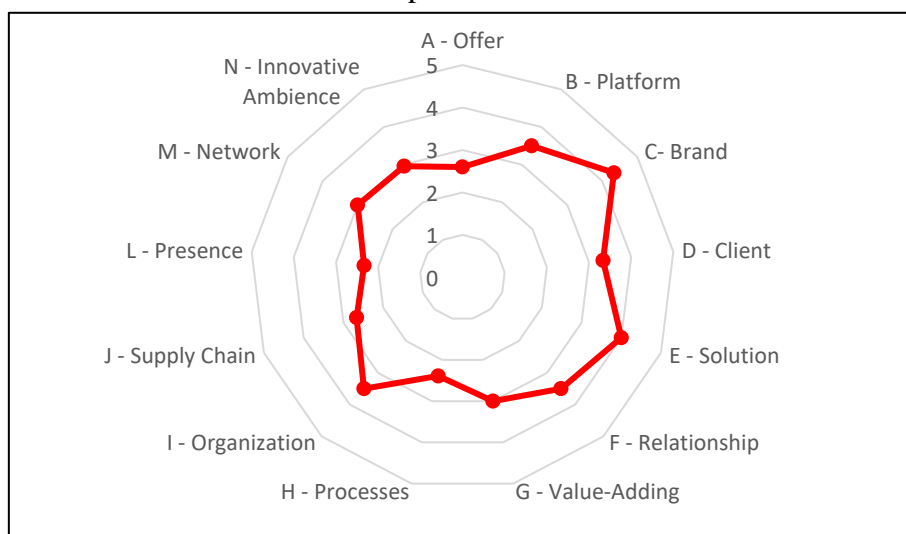
Graph 6 - Goiás II



Source: Prepared by the authors (2020)

Graph 7 shows that the TBCs participating in the state of MS stood out in the dimensions Brand (4.33) and Solution (4.0). Some dimensions scored below 3 points, but none below 2 points. By consulting the Average II of these TBCs (3.16), it appears that they are occasional innovators.

Graph 7 - MS II

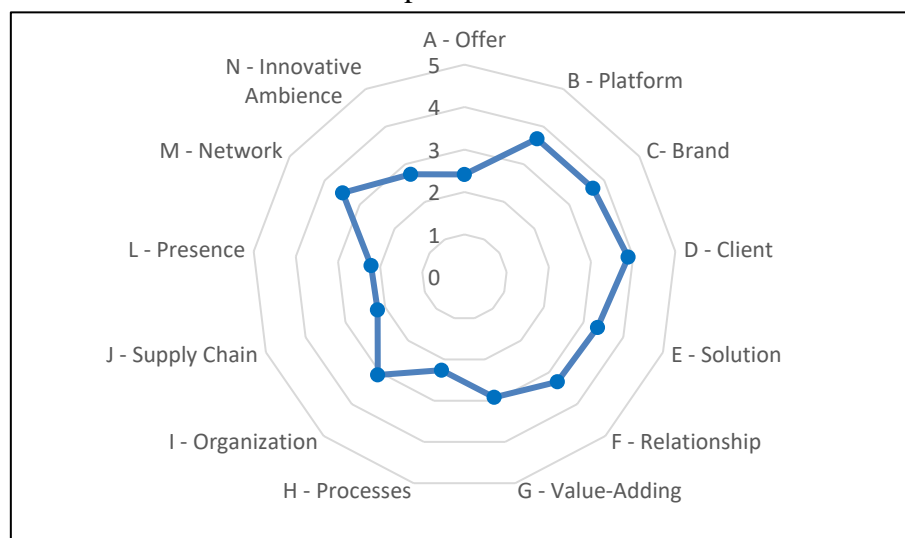


Source: Prepared by the authors (2020)

The analysis of the Distrito Federal will not be demonstrated here because it was presented in Graph 4 since the population and sample of DF are composed only of companies in the service sector. It is worth mentioning that the IG was 3.75 points. The same occurs with MT analysis, which has already been presented in Graph 5 since only 01 companies in the industry sector made up the sample.

Analyzing Graph 8, which shows the Innovation Radar of the TBCs of Minas, it is clear that none of the constructs obtained a score greater than or equal to 4. A good portion of the dimensions analyzed reached scores between 3 and 4 points. At the same time, another portion - formed by the dimensions of Offer, Value-Adding, Processes, Supply Chain, Presence, and Innovative Ambience - scored between 2 and 3 points. Such market positioning, together with the Average II of 3.01, demonstrated that these companies are occasional innovators.

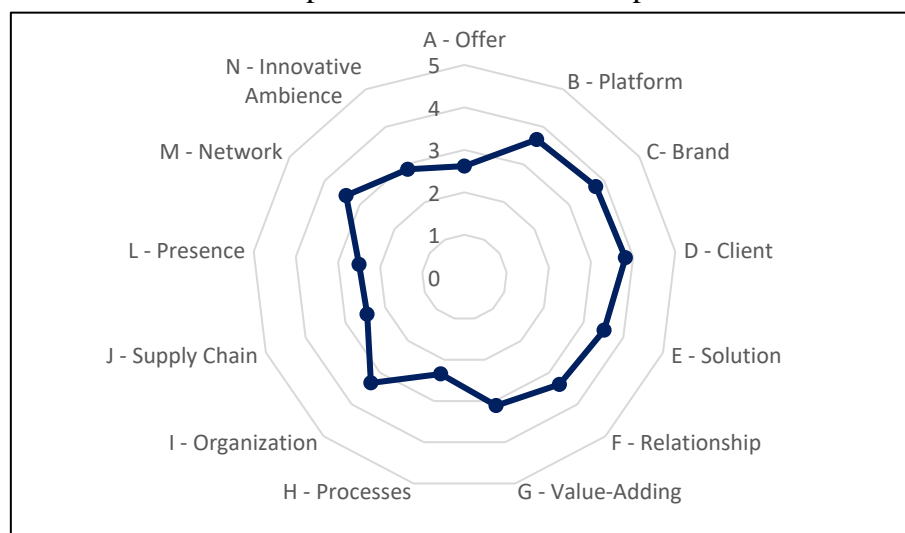
Graph 8 – MG II



Source: Prepared by the authors (2020)

Graph 9 presents the scores obtained by the 62 companies that constituted the sample of this study in each of the thirteen dimensions. It appears that there were no dimensions with a score equal to or greater than 04.

Graph 9 - II of the entire sample



Source: Prepared by the authors (2020)

The Customers, Brand, Platform, Solution, Network, Relationship, Organization, and Value-Adding dimensions, respectively, had a good score (equal to above 3 and below 4). The others had a low score (below metric 3). The average II of all companies was 3.13, showing that, systemically, the analyzed TBCs are characterized as occasional innovators.

4. Final Considerations

Altogether, 62 TBCs were researched, in the incubation phase, linked to 22 incubators installed in the states of GO, DF, MT, MS, and MG. Of those surveyed, about 60% is contained in the state of MG and about 24% in GO. The other states had low participation. Also, the majority of companies belong to the service sector (76%).

From this study, it was possible to identify that those surveyed are predominantly adults (aged between 20 and 39 years old) and male. Most of them are married (about 60%) and the level of education is diverse, from undergraduates to doctors.

Most respondents dedicate 5 to 12 hours a day to their businesses, have partners to manage them, and have no other companies on their behalf.

A portion (40%) of the TBCs surveyed do not have employees and those that usually have 1 to 2 employees. In all, the TBCs surveyed generate 134 jobs.

Regarding the monthly invoicing obtained by these companies in 2018, it was found that 40% had no invoicing and that, for the rest, the revenue was quite diversified (from R\$300.00 to R\$200,000.00). Analyzing the data provided by the companies, it was found that the monthly revenue obtained by these companies in 2018 was 1.2 million reais.

The study in question also sought to analyze the relationship between TBCs and incubators. Therefore, it was identified that most of the companies surveyed are resident companies, which pay, in most cases, from R\$200.00 to R\$499.00 of incubation fee.

Among the reasons that led the incubated to establish a link with the incubators is the infrastructure of the TBBI, the specialized services, the notoriety of the incubator and its maintainer, network of contacts, among others.

Regarding the innovation capacity of the analyzed TBCs, 3 types of analysis were carried out, namely: i) analysis by sector of the economy (service and industry); ii) analysis by state; iii) analysis of the entire sample. Such analyzes are condensed in the table below.

Table 1 - Analysis of the Innovation Capacity of TBCs

Service Sector Analysis					
State	Number of TBCs	Highest Innovation Index	Lower Innovation Index	Average Innovation Index	Innovation capacity
GO	13	Client (3,77)	Processes (2,67)	3,25	Occasional Innovator
DF	3	Solution (5,0)	Processes (2,0)	3,75	Occasional Innovator
MS	4	Brand (4,0)	Supply Chain, and Presence (with 1,7)	3,03	Occasional Innovator
MG	27	Brand (3,9)	Presence (1,6)	2,96	Little Innovator
Industry Sector Analysis					
State	Number of TBCs	Highest Innovation Index	Lower Innovation Index	Average Innovation Index	Innovation capacity
GO	2	Organization (4,25)	Network (2,0)	3,44	Occasional Innovator
MT	1	Brand (5,0)	Processes (1,7)	3,34	Occasional Innovator
MS	2	Brand (4,5)	Value-Adding, and Processes (2,0)	2,96	Little Innovator
MG	10	Client (4,1)	Offer (2,7)	3,4	Occasional Innovator
State Analysis					
State	Number of TBCs	Highest Innovation Index	Lower Innovation Index	Average Innovation Index	Innovation capacity
GO	15	Client (3,8)	Processes (2,64)	3,28	Occasional Innovator
DF	3	Solution (5,0)	Processes (2,0)	3,75	Occasional Innovator
MT	1	Brand (5,0)	Processes (1,7)	3,34	Occasional Innovator

MS	6	Brand (4,33)	Processes (2,39)	3,16	Occasional Innovator
MG	37	Client (3,88)	Processes (2,26)	3,01	Occasional Innovator
Analysis of the Entire Sample					
State	Number of TBCs	Highest Innovation Index	Lower Innovation Index	Average Innovation Index	Innovation capacity
GO, DF, MT, MS, MG	62	Client (3,82)	Processes (2,34)	3,13	Occasional Innovator

Source: Elaborated by the authors (2020)

Analyzing Table 1, which represents a synthesis of the results obtained in this research, it appears that about the service sector, the TBCs of DF was the most innovative, with 3.75 points, and those of Minas Gerais was the least innovative, with 2.96, which are characterized as not very innovative. Based on the industrial sector, the result was different, with the incubated companies in Goiás being the most innovative, with 3.44 points, and the least innovative MS companies (also classified as not very innovative).

In an analysis by state, it was observed that, unlike analyzes by sector of the economy, all states were characterized as occasional innovators, with the TBCs of DF with the highest score and Minas with the lowest. From a more comprehensive perspective, it was found that the entire sample was, in general, identified as an occasional innovator, with II of 3.13 points.

Regarding the dimensions, it was found that the Process dimension was, in general, the one that received the lowest score, demonstrating that TBCs have some difficulty in developing actions related to this construct. This dimension encompasses the most varied types of changes in the company's internal environment, aiming at gains in competitiveness.

Still, about dimensions, Brand and Client were, in general, the most cited as those that obtained the highest scores, demonstrating that the companies have acted more present in these constructs.

The limitations of this work include the difficulty and slowness in accessing the population defined for the present study, which made it impossible to conduct a study with a wider geographical scope, as well as the use of stratified sampling. Therefore, suggestions for future work include similar studies with stratified sampling; with other Brazilian states or regions; at Brazil and, perhaps, international level.

Other suggestions include conducting similar surveys with TBCs at time "0" when the company enters into a bond with the incubator and at the time "1", which can be months or years, to assess the development of this incubated business over time.

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7. References

ANPROTEC – Associação Nacional De Entidades Promotoras De Empreendimentos Inovadores. (2019). *Mapeamento dos mecanismos de geração de Empreendimentos Inovadores no Brasil*. Brasília, DF: ANPROTEC.

Antolín-López, R., Céspedes-Lorente, J., García-de-Frutos, N., Martínez-del-Río, J., & Pérez-Valls, M. (2015). Fostering product innovation: Differences between new ventures and established firms. *Technovation*, 41-42, 25-37. Available from: <<https://www.sciencedirect.com/science/article/pii/S0166497215000127>>. Access on: 01 sept. 2019.

Aranha, J. A. (2016). *Mecanismos de geração de empreendimentos inovadores: Mudança na organização e na dinâmica dos ambientes e o surgimento de novos atores*. Brasília, DF: ANPROTEC. Disponível em: <<https://www.feevale.br/Comum/midias/e46b2a7c-b1a5-4f15-b49f-b961901a2cee/anprotec-mecanismos-geracao-de-inovacao.pdf>>. Acesso em: 15 jan. 2020.

Autio, E. (1994). New, technology-based firms as agents of R&D and innovation: an empirical study. *Technovation*, 14(4), 259-273. Available from: <<https://www.sciencedirect.com/science/article/pii/0166497294900108>>. Access on: 25 feb. 2020.

Bachmann, D. L., & Destefani, J. H. (2008). *Metodologia para estimar o grau das inovações nas MPE*. Curitiba. Disponível em: <<http://www.bachmann.com.br/website/documents/ArtigoGraudeInovacaonasMPE.pdf>>. Acesso em: 09 mai. 2019.

Barbalho, S. C. M., Amaral, D. C., Kernbichler, T. S., Richter, E. H., & Torres, L. (2009). Rompendo obstáculos para a implantação de escritório de projetos em empresa de base tecnológica. *Revista Gestão & Produção*, 16(3), 435-449. Disponível em: <http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0104-530X2009000300010&lng=en&nrm=iso>. Acesso em: 20 jul. 2019.

Bessant, J., & Tidd, J. (2009). *Inovação e empreendedorismo*. Porto Alegre: Bookman.

Bollingtoft, A. (2012). The bottom-up business incubator: Leverage to networking and cooperation practices in a self-generated, entrepreneurial-enable environment. *Technovation*, 32(5), 304-315. Available

from: < <https://www.sciencedirect.com/science/article/pii/S0166497211001672>>. Access on: 02 sept. 2019.

Brasil. *Lei nº 13.243, de 11 de janeiro de 2016*. Dispõe sobre estímulos ao desenvolvimento científico, à pesquisa, à capacitação científica e tecnológica e à inovação. Disponível em: <http://www.planalto.gov.br/CCIVIL_03/_Ato2015-2018/2016/Lei/L13243.htm#art2>. Acesso em: 20 jun. 2019.

Brasil. *Decreto nº 9.283, de 7 de fevereiro de 2018*. Regulamenta a Lei nº 10.973, de 2 de dezembro de 2004. Disponível em: <http://www.planalto.gov.br/ccivil_03/_Ato2015-2018/2018/Decreto/D9283.htm>. Acesso em: 20 jun. 2019.

Carayannis, E. G., & Zedtwitz, M. von. (2005). Architecting gloCal (global-local), real-virtual incubator networks (G=RVINs) as catalysts and accelerators of entrepreneurship in transitioning and developing economies: Lessons learned and best practices from current development and business incubation practices. *Technovation*, 25 (2), 95-110. Available from: <<https://www.sciencedirect.com/science/article/pii/S0166497203000725>>. Access on: 01 sept. 2019.

Carvalho, G. D. G. de, Vieira da Silva, W., Santos Póvoa, A. C., & Gomes de Carvalho, H. (2015). Radar da Inovação como ferramenta para o alcance de vantagem competitiva para Micro e Pequenas Empresas. *INMR - Innovation & Management Review*, 12(4), 162-186. Disponível em: <<http://www.revistas.usp.br/rai/article/view/101898>>. Acesso em 3 fev. 2020.

Chen, J., & Sawhney, M. (2010). Defining and measuring business innovation: The innovation radar. *Kellogg School of Management working paper*. Available from: <https://www.researchgate.net/profile/Jiyao_Chen/publication/308174360_Defining_and_Measuring_Business_Innovation_The_Innovation_Radar/links/57dc608c08ae72d72ea690f2/Defining-and-Measuring-Business-Innovation-The-Innovation-Radar>. Access on: 22 jan. 2020.

Costa, L. B. da, & Torkomian, A. L. V. (2008). Um estudo exploratório sobre um novo tipo de empreendimento: os spin-offs acadêmico. *Revista de Administração Contemporânea*, 12(2), 395-427. Disponível em: <http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1415-65552008000200006&lng=en&nrm=iso>. Acesso em: 14 jul. 2019.

Hueske, A.-K., Endrikat, J., & Guenther, E. (2015). External environment, the innovating organization, and its individuals: A multilevel model for identifying innovation barriers accounting for social uncertainties. *Journal of Engineering and Technology Management*, 35, 45-70. Available from: <<https://www.sciencedirect.com/science/article/pii/S092347481400054X>>. Access on: 03 sept. 2019.

Iacono, A., Almeida, C. A. S. de, & Nagano, M. S. (2011). Interação e cooperação de empresas incubadas de base tecnológica: Uma análise diante do novo paradigma da inovação. *Revista de Administração Pública*, 45(5), 1485-1516. Disponível em: <http://www.scielo.br/scielo.php?script=sci_abstract&pid=S0034-76122011000500011&lng=en&nrm=iso&tlng=pt>. Acesso em: 15 ago. 2019.

Inácio Júnior, E., Carvalho, R. Q., & Gavira, M. (2012). Proposição de um novo método de seleção de Micro, Pequenas e Médias Empresas de Base Tecnológica (MPEBT). *Revista de Empreendedorismo e Gestão de Pequenas Empresas*, 1(2), 3-32. Disponível em: <<http://www.spell.org.br/documentos/ver/30740/proposicao-de-um-novo-metodo-de-selecao-de-micro--pequenas-e-medias-empresas-de-base-tecnologica--mpebt->>. Acesso em 05 fev. 2020.

Marconi, M. de A., & Lakatos, E. M. (2016). *Fundamentos de Metodologia Científica* (7a ed.). São Paulo: Atlas.

Mcadam, M., & Mcadam, R. (2008). High tech start-ups in University Science Park incubators: The relationship between the start-up's lifecycle progression and use of the incubator's resources. *Technovation*, 28(5), 277-290. Available from: <<https://www.sciencedirect.com/science/article/pii/S0166497207000971?via%3Dihub>>. Access on: 01 sept. 2019.

Néto, A. T. S., & Teixeira, R. M. (2014). Inovação de micro e pequenas empresas: mensuração do grau de inovação de empresas participantes do Projeto Agentes Locais de Inovação. *Brazilian Business Review*, 11(4), 1-29. Disponível em: <<http://www.spell.org.br/documentos/ver/32127/inovacao-de-micro-e-pequenas-empresas--mensuracao-do-grau-de-inovacao-de-empresas-participantes-do-projeto-agentes-locais-de-inovacao>>. Acesso em: 28 fev. 2020.

OCDE - Organização Para a Cooperação e Desenvolvimento Econômico. (2006). *Manual de Oslo: diretrizes para a coleta e interpretação de dados sobre a inovação tecnológica* (3a ed.). Finep. Disponível em: <<https://www.finep.gov.br/images/apoio-e-financiamento/manualoslo.pdf>>. Acesso em: 20 mai. 2019.

Oliveira, M. R. G. de, Cavalcanti, A. M., Paiva Júnior, F. G. de, & Marques, D. B. (2014). Mensurando a inovação por meio do Grau de Inovação Setorial e do Característico Setorial de Inovação. *Innovation and Management Review*, 11(1), 115-137. Disponível em: <<http://www.spell.org.br/documentos/ver/29913/mensurando-a-inovacao-por-meio-do-grau-de-inovacao-setorial-e-do-caracteristico-setorial-de-inovacao/i/pt-br>>. Acesso em: 12 jan. 2020.

Perussi Filho, S., & Escrivao Filho, E. (2012). Processo de criação de estratégia em pequenas empresas de base tecnológica: um modelo de fases evolutivas para o setor médico-odontológico. *Revista Gestão & Produção*, 19(1), 173-188. Disponível em:

<http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0104-530X2012000100012&lng=en&nrm=iso>. Acesso em: 14 ago. 2019.

Rampazzo, L. (2011). *Metodologia científica: para alunos de cursos de graduação e pós-graduação* (6a ed.). São Paulo: Loyola.

Sanches, P. L. B., & Machado, A. G. C. (2014). Estratégias de inovação sob a perspectiva da Resourced-Based View: análise e evidências em empresas de base tecnológica. *Gestão e Produção*, 21(1), 125-141. Disponível em: <http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0104-530X2014000100009&lng=en&nrm=iso>. Acesso em: 02 ago. 2019.

Sawhney, M., Wolcott, R. C., & Arroniz, I. (2006). The 12 different ways for companies to innovate. *MIT Sloan Management Review*. 47 (3), 75-81.

Silva, J. M. da, Silva, C. E. S. da, Batista, G. D. M., & Bitencourt, M. P. (2012). Impacto das funções desempenhadas pelos gerentes nos resultados da incubadora: Survey realizada na rede mineira de inovação. *Production*, 22(4), 718-733. Epub November 21, 2011. Disponível em: <http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0103-65132012000400006&lng=en&nrm=iso>. Acesso em: 14 ago. 2019.

Silva, S. E., & Reis, L. P. (2015). O Processo de Estruturação de Recursos no Contexto de uma Empresa de Base Tecnológica de Origem Acadêmica (EBTA). *INMR - Innovation & Management Review*, 12 (2), 153-179. Disponível em: <<http://www.revistas.usp.br/rai/article/view/100337>>. Acesso em: 20 jul. 2019.

Silva, S. E., Gonçalves, C. A., Silva, J. R., & Venâncio, A. I. O. (2018). Os Papéis dos Agentes de Suporte a Empresas de Base Tecnológica. *Revista de Administração Contemporânea*, 22(2), 201-225. Disponível em: <http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1415-65552018000200201&lng=en&nrm=iso>. Acesso em: 20 jul. 2019.

Stal, E. (2010). Internacionalização de empresas brasileiras e o papel da inovação na construção de vantagens competitivas. *INMR - Innovation & Management Review*, 7(3), 120-149. Disponível em: <<http://www.revistas.usp.br/rai/article/view/79184>>. Acesso em: 16 ago. 2019.

Tidd, J., Bessant, J., & Pavitt, K. (2008). *Gestão da Inovação* (3a ed.). Porto Alegre: Bookman.

Tumelero, C. (2012). *Sobrevivência de empresas de base tecnológica pós-incubadas: Estudo da ação empreendedora sobre a mobilização e uso de recursos* (Dissertação de Mestrado). Faculdade de Economia, Administração e Contabilidade, Universidade de São Paulo, São Paulo, Brasil. Disponível em: <<https://www.teses.usp.br/teses/disponiveis/12/12139/tde-26092012-132929/pt-br.php>>. Acesso em: 12 fev. 2020.

Zanirato, C. F. (2017). *Avaliação da Capacidade de Inovação das Empresas Incubadas na Região Centro-Oeste do Brasil* (Dissertação de Mestrado). Centro Universitário Alves Faria, Goiás, Brasil.

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