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Evaluation of entrepreneurial behavior of technology-based companies in stages of the business life cycle

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Abstract

Purpose: The purpose of this paper is to evaluate the entrepreneurial behavior of managers of technology-based companies in specific stages of the business life cycle.

Design/methodology: Structured questionnaire based on the entrepreneurial behavior characteristics was applied to the thirty-one managers of the technology-based companies mapped for the paper. The collected data were processed by the Hierarchical Process Analysis (AHP) technique in a multicriterial approach to measure the entrepreneurial behavior according stages of the business life cycle.

Findings: The results of the paper show that the level of entrepreneurial behavior of managers follows the development of the company. Managers working in technology-based companies at later stages of the business life cycle showed more entrepreneurial characteristics. The results showed that the experience that the manager acquires as the company evolves influences his or her behavior and consequently the company's performance. Moreover, certain characteristics could be related to the particularities of each stage of the business life cycle.

Originality/value: The results of this paper can provide managers with understanding of how entrepreneurial behaviors diversify according to the stage of the technology-based company. Since both entrepreneurial behavior and the stages of the business life cycle influence the performance of technology-based companies, the results provide important knowledge for managers to improve their businesses. These managers can use the contributions of the paper as a management practice throughout the stages of their existence, which may provide the adoption of more appropriate strategies, being a connection between the theory studied and the business practices.

Keywords: Entrepreneurial Behavior, Technology-based companies, Business life cycle

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1. Introduction

Entrepreneurship has proven to be fundamental to the evolution of industries and society, and it has demonstrated contributions to economic growth, job creation, and advances in technology (Obshonka, Hakkarainen, Lonka and Salmela-Aro, 2017). Entrepreneurial behavior proves relevance by presenting a series of characteristics present in successful managers, which relate to capacities of initiative, creativity, and autonomy (Tena & Bustelo, 2016). In this context, business success that is influenced by entrepreneurial behavior is attributed in part to human capital, which is addressed within the concept of intangible capital, and can be developed by education or by the situations that a business presents to the entrepreneur (Arias, Restrepo & Restrepo, 2016; Tripathi, Oivo, Liukkunen & Markkula, 2019).

Managers are subject to behaviors that can determine the performance of companies. These behaviors include emotional intelligence, developing resilience, understanding the business purpose and risk tolerance (Blass, 2018; Bockorny & Youssef-Morgan, 2019). In this context, globalization and technological advances influence cause changes in the business environment and define the reality of companies (Stone & Deadrick, 2015; Amable, Santandreu-Mascarell & Marin-Garcia, 2019), imposing skills and entrepreneurial behaviors on company managers.

Managers' behavior is susceptible to change when facing different moments experienced by companies. Gripa and Carvalho (2020) emphasize that organizations develop according to a business life cycle that influences entrepreneurial behavior and strategic management. Knowledge of the stage of the business cycle life experienced by the company enables managers to make decisions that condition the permanence in the market and the increase in the organization's performance. Thus, the behavior of managers depends on the stage of the business life cycle. In this same context, Wang and Singh (2014) state that the stages of the business life cycle related to the development of companies tend to follow a predictable pattern, which is characterized by progressive steps and changing factors. Although there is the ability to predict the particularities of the business life cycle stages, the behavior of the managers must also present itself according to the stage that the company develops.

Technology-based companies are known for the use of high technology and demand attitudes that seek the advancement of innovation, moving between internal focus of the company and external development of the business (Kaplan & Vakili, 2015). According to Abbasi, Motavasseli, Zali, Faghih and Meigounpoory (2019) there are different types of technologies that involve different occurrences of innovation, these being: to provide a new product/process to new and existing users, creation of new needs by innovation, to establish new causal relationship between means and ends, to develop the knowledge of the causal relationship between things and human needs, to convert the things attributes and create useful things, and to change the features of existing products/processes. The technology-based companies are organizations that depend on innovative and technological activities for development, and in this sense, the manager's entrepreneurial behavior is relevant for the unfolding of strategies and actions that involve the particularities of these companies.

The development of this paper starts from the knowledge that manager behavior varies depending on the stage of the company. Furthermore, the importance of evaluating the behavior of the manager in businesses that use innovation and technology as main aspects is highlighted. The purpose of this paper is to evaluate the entrepreneurial behavior of managers of technology-based companies in specific stages of the business life cycle. To achieve the objective of this paper, a research instrument will be applied to managers of technology-based companies involving the concepts of entrepreneurial behavior (McClelland, 1987) and business life cycle (Fisk, 2009). The Analytic Hierarchy Process method will perform the calculations of the data from the application of the research instrument.

This paper evaluates the entrepreneurial behavior of managers of technology-based companies, this being a specific niche of companies. The influence of the stages of the business life cycle on the development of companies demonstrates that entrepreneurial behavior differs according to the characteristics presented during the life of the business. Thus, this paper presents the following research problem: "How does entrepreneurial behavior diversify across business life cycle stages?". Understanding the behavior of the manager when facing

the stages experienced by the company can help broaden the strategic diagnosis, generating information that is relevant for increasing performance of companies.

The results of this paper can provide scientific researchers and managers with an understanding of how entrepreneurial behaviors diversify according to the stage of the technology-based company. Since both entrepreneurial behavior and the stages of the business life cycle influence the performance of technology-based companies, the results provide important knowledge for strategic management. The company managers can use the contributions of the paper as a management practice throughout the stages of their existence, which may provide the adoption of more appropriate strategies, being a connection between the theory studied and the business practices. Furthermore, the contributions of the paper benefit the scientific literature, since they analyze relevant data for future studies and have different results than other studies. For example, the study of García-Ochoa, Pablos-Heredero and Jiménez (2020) analyzed the perspective of accelerators programs and how it is possible to develop dynamic capabilities. On the other hand, this study showed each entrepreneur's point of view in each business life cycle. On Nguyen, Nham and Takahashi (2019), the research is more focused on the creativity of companies in small and medium companies, defined by corporate social responsibility, where this study has a broader perspective on entrepreneurship abilities.

Researchers who develop studies on entrepreneurial behavior, business life cycle or technology-based companies can extract important information that align these themes.

The development of this paper was divided in six steps. Step 1 presents the introduction that justifies the relevance of the study and presents the objectives to be achieved. Step2 presents the Theoretical background, which clarifies the concepts of entrepreneurial behavior of McClelland (1987) are demonstrated, as well as Fisk's (2009) concepts on business life cycle. In step 3, Method development demonstrates the structuring of the research instrument, the metrics used, the sample of interviewees and Analytic Hierarch Process (AHP). Step 4 presents the discussion of the results, demonstrating the analyses performed according to the entrepreneurial behavior of the technology-based companies according to the life cycle stage of each one. In step 5, Theoretical and Management Implications, which emphasizes how the results and discussions of the paper can enhance the scientific literature in future studies and contribute to the knowledge of managers of technology-based companies. Step 6 presents the final considerations, highlighting the main results and providing the conclusions that can be drawn from the development of the paper.

2. Theoretical background

To support the development of the paper, theoretical information about entrepreneurial behavior and business life cycle are presented, described below.

2.1. Entrepreneurial behavior

Managers who develop entrepreneurial behavior characteristics use experience to create innovative ideas and motivate employees (Tripathi et al., 2019). Figueiredo and Paiva (2019) affirm that entrepreneurship is a multidimensional phenomenon and, therefore, it generates many contributions to the environment. The authors state that entrepreneurial behavior generates influence on the performance of companies, being an important attribute for organizations that achieve business growth.

Minello, Burger and Kruger (2017) describes the entrepreneur as the individual who creates and develops something innovative, accepting the risk and failure of actions, from the ability to organize and reorganize the social and economic mechanisms that the company has at its disposal to transform resources and situations into practical benefit. Besides, some authors present other entrepreneurial behavior characteristics such as innovation, leadership, moderate risks, independence, creativity, energy, tenacity, originality, optimism, results orientation, flexibility, initiative, long-term involvement, self-confidence, aggressiveness, sensitivity to others, tendency to trust people, money as a performance measure.

McClelland (1987) found that people who seek for accomplishments devote more time to challenging tasks that involve risk, also places the segmentation of entrepreneurial characteristics. Researches on businessmen in society and their contributions to the economic development of nations show that entrepreneurial people are

more confident and courageous to take risks and often make decisions that bring valuable experiences. This courage promotes a positive approach that leads to life satisfaction to pursue purpose and motivation in their entrepreneurial activities (Bockorny & Youssef-Morgan, 2019).

Theoretically, entrepreneurial behaviors are defined by the United Nations Conference on Trade and Development (UNCTAD) as a set of ten attributes identified by McClelland (1987) as the most present in entrepreneurs from organizations that have been successful in different countries. UNCTAD is a global organization that belongs to the UN (United Nations), and that promotes studies and projects aimed at using trade, investment, finance, and technology as vehicles for inclusive and sustainable development (UNCTAD, 2021).

Cantner, Cunningham, Lehmann and Menter (2021) state that the entrepreneurial ecosystem depends on individuals who possess entrepreneurial characteristics and who know how to make decisions when facing the different stages of the business. The authors highlighted that, throughout the development of companies, there are opportunities to be explored at all stages of the business life cycle, and how managers behave when facing these different opportunities is what defines the growth of companies. As well as opportunities, there are different challenges at different stages of the market life cycle (Adizes, Rodic & Cudanov, 2017).

Facing the different realities found in business, managers need to take different attitudes according to the stage the company is going through. The ability to develop dynamic characteristics contributes to entrepreneurial behavior and assists in the growth of company (Vu, 2020). Thus, entrepreneurial behavior expresses different characteristics according to the stage of the company's business life cycle.

In view of this, McClelland (1987) realized that managers who demonstrate entrepreneurial characteristics have the ability to optimize the company's performance. Since entrepreneurial behavior can be presented differently depending on the business life cycle stage, one can assess how entrepreneurial behavior diversifies across business life cycle stages.

2.2. Business life cycle

The life cycle of a business goes through several stages, beginning with its creation and progressing to consolidation or exit from the market. The business life cycle stage that the company is going through affects not only its financial results, but also the managers' behavior (Michelin, Minello, Siluk, Santos, Gerhardt & Stieler, 2021). Adizes et al. (2017) states that the stages of the business life cycle are predictable and repeatable, assisting in understanding interpersonal reactions, as well as the accumulation and dispersion of capital. Thus, knowledge of the organization's position in the business life cycle allows it to take preventive measures in advance, either addressing future problems or avoiding them altogether (Freire, 2016).

The stages of a business cycle have different denominations, but their concepts are similar (Adizes et al., 2017; Primc, Slabe-Erker, Dominiko & Ogorevc, 2020). After researching authors who analyze the business life cycle, it was observed that Fisk (2009) addresses the stages that companies experience dynamically throughout their trajectory. Furthermore, Fisk's (2009) concepts are widely used in the practical environment of companies. As reported by the author, there are seven steps in a business cycle that are displayed in Figure 1.

Fisk (2009) explains that the curve of the stage between moments of growth, in which innovation and expansion are important, followed by periods where the company needs to regroup to build a new platform for the next growth stage. In this way, it is understood that the focus and culture of the company end up differing according to the business life stage and that there are challenges in every change, including the posture and behavior of the person who leads and manages.

According to Kesidou and Carter (2018), managers demonstrate different leadership according to the company's business life cycle stage. Initially, business visions reflect the leaders' personal desires. But progressively as the business develops, collective perceptions grow and leadership reflects in more dynamic group attitudes. The business life cycle of the companies demonstrates different situations that reflect in the changing behavior of managers, either in terms of leadership or in terms of the management of their group.

The evolution of companies involves changes that may be at the level of strategy, people, activities, leadership, and even corporate control. The purposes of the life cycle stages also change as well as the approach (Fisk, 2009). The decisions made by managers depend on the stage of the company's life cycle. Thus, the understanding of managers regarding the moment the company is going through is important for decision-making from the company's strategic point of view.

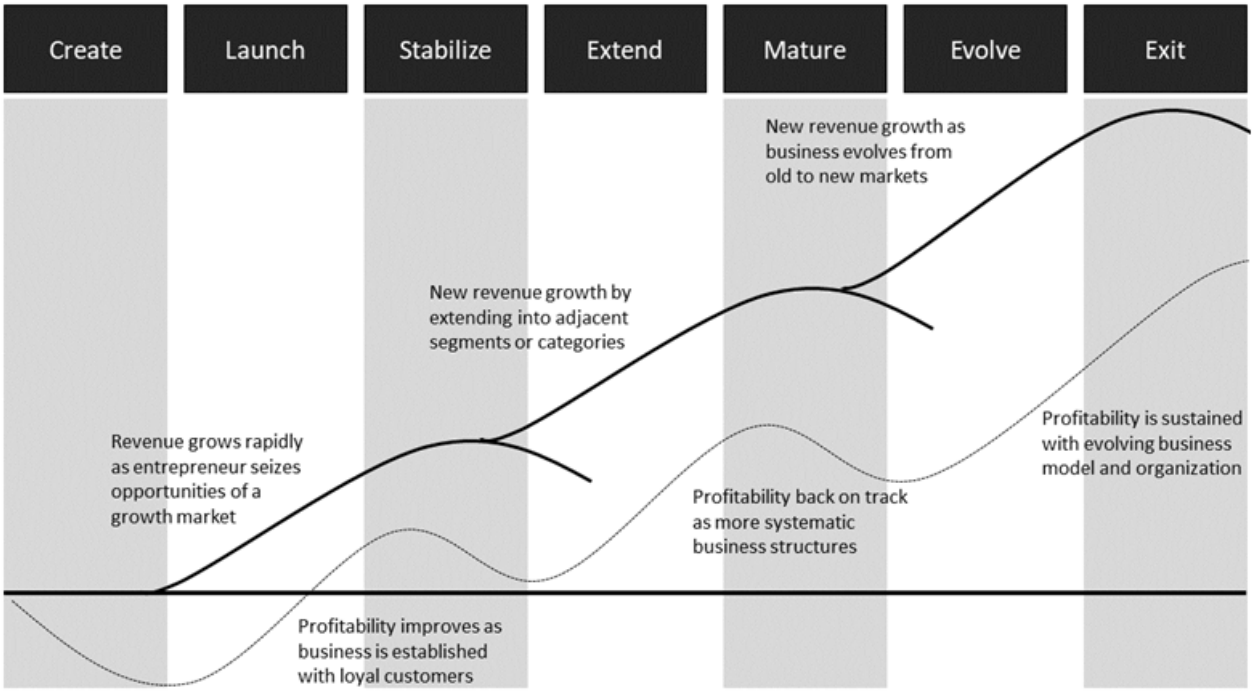

Figure 1. Business life cycle (Fisk, 2009)

3. Method development

To develop the paper's method, a research instrument was developed to be applied with managers of technology-based companies. The research instrument first identified the stage of the business life cycle in which each company was experiencing. After this, questions were applied to understand the entrepreneurial behavior of the managers. The answers to the questions represented scores that were later calculated and converted into a final score by the Analytic Hierarchy Process method.

This paper developed a research instrument based on two understandings. First, the instrument was based on Fisk's (2009) perception to identify the business life cycle stage that each technology-based company was developing. After this understanding, the research instrument used McClelland's (1987) perception to identify entrepreneurial behavior of the managers of the technology-based companies. Thirty-one managers of technology-based firms responded to the research instrument according to Likert scale semantics. A Decision Tree was developed that presents a hierarchical structure based on the concepts of Fundamental Points of View (FPV), Critical Success Factors (CSF) and Key Performance Indicators (KPI). Thus, the mathematical calculations for processing the managers' answers were performed by the Analytic Process Hierarchy method.

Sections 3.1 and 3.2 explain in detail the development of the research instrument and the method used to perform the mathematical calculations.

3.1. Research instrument

The interviewed managers work in technology-based companies. The research instrument was applied in the southern region of Brazil. The geographical location of the companies contributed to the application of face-to-face interviews. For the identification of the companies, the following criteria were defined: all technology-based

companies should be inserted in incubators within educational institutions and all incubators should have information available on the internet. These criteria helped the researchers to identify the technology-based companies according to the information available from the incubators.

Following the criteria for identification of the technology-based companies to be interviewed, the universe to be researched refers to the total of 170 managers of technology-based companies installed in the southern region of Brazil. Thirty-one managers responded to the research instrument, that represents 18.24% of the population investigated.

Among the segments of technology-based companies, enterprise software stands out, representing 26% of the companies, followed by 13% of engineering services and projects, 10% of sustainable solutions, 10% of hardware projects, and 6% of application development. The others, representing 3% each, are divided into others such as: robotics, online delivery system, technological solutions for the chemical industry, automation, production (filming with drones), software and consulting for buying and selling real estate, technological solutions for precision cattle breeding, projects and installations of photovoltaic solar energy systems, and educational systems and management.

In relation to the profile of the managers interviewed, all of them have a college degree and have the support of incubators inserted within educational institutions. Furthermore, all of them affirm having characteristics directed towards the management of technological ventures. Most of the managers are male, aged between 20 and 30 years. According to Younas and Bari (2020), people born during the 1980s until approximately the end of the century represent the Y generation. The authors state that this generation has a different way of seeing the market, contributing with technological knowledge and understanding from a multicultural perspective. Table 1 presents the profile of the interviewed managers

Table 1 presents the profile of the interviewed managers.

Gênero		**Age**	
Male	**Female**	20 to 30 years	20 managers
29 manager	02 manager	31 to 40 years	6 managers
		41 to 50 years	1 manager
		51 to 60 years	3 managers
		Over 60 yearsold	1 managers

Table 1. Profile of the interviewed managers

The unit of analysis refers to managers of technology-based companies since the objective of the paper is analyze the entrepreneurial behavior of these managers at different stages of the business life cycle. The research instrument was applied face-to-face, understanding that this would be the best way to approach the proposed questions.

First, the research instrument had the purpose of identifying the business life cycle stage that each company was experiencing. Thus, only one question was applied to the managers of these companies. The question used Fisk's (2009) business life cycle concept. The manager should only mark in which stage his company was experiencing. An explanation of the characteristics of each business life cycle stage was prepared according to Fisk (2009), so that the managers could be sure of their answer. Table 2 represents the first question of the research instrument.

What stage of the business life cycle is your company currently experiencing?						
Create( )	Launch( )	Stabilize( )	Extend( )	Mature ( )	Evolve ( )	Exit( )

Table 2. Business life cycle question according to Fisk (2009)

The information concerning the stages of the business life cycle according to Fisk's approach (2009) was inserted into the research instrument. Thus, each of the managers indicated the stage of the business life cycle that encompasses the current moment of their company. Table 3 shows the number of technology-based companies according to each stage of the business life cycle.

Business life cycle stage	Number of technology-based companies
Create	8
Launch	5
Stabilize	9
Extend	3
Mature	1
Evolve	5
Exit	0

Table 3. Number of technology-based companies according to Fisk's (2009) business life cycle

Once the stages of the business life cycle in which each of the technology-based companies is developing were defined, the questions regarding the managers' entrepreneurial behavior were developed.

The questions about entrepreneurial behavioral of managers followed the Dimensions, Characteristics and Behaviors proposed by McClelland (1987). McClelland (1987) was one of the pioneers in studies on human motivation, developing several studies that seek to understand the main aspects of entrepreneurial behavior. Although his study was published many years ago, McClelland's (1987) concepts remain current. McClelland's (1987) theories have been cited over the years by the scientific literature and global organizations such as UNCTAD, demonstrating fundamental importance for measuring the entrepreneurial behavior of managers from different companies (UNCTAD, 2021).

Table 4 shows in the "Behaviors" column, the explanation of the behaviors that are addressed in each Characteristic proposed by McClelland (1987). These Characteristics are encompassed in the Dimensions, which represent the main attributes that an entrepreneur must present.

Dimensions	Characteristics	Behaviors
Realization	Opportunity Search and Initiative	It does things before it is requested, or before it is forced by circumstances; Acts to expand business to new areas, products or services; Take advantage of unusual opportunities to start a business, get financing, equipment, land, work or assistance.
	Take calculate drisks	Evaluates alternative and calculates risks deliberately; Acts to reduce risks or control results; It puts you in situations that involve moderate challenges or risks.
	Persistence	Acts in the face of a significant obstacle; Acts repeatedly or changes strategy in order to meet a challenge or overcome an obstacle; Make a personal sacrifice or make an extraordinary effort to complete a task.
	Quality and Efficiency requirement	Find ways to do things better, faster, or cheaper; It acts in ways that do things that meet or exceed standards of excellence; Develops or uses procedures to ensure work is completed on time or that work meets pre-agreed quality standards.
	Commitment	Takes personal responsibility for the performance required to achieve goals and objectives; Collaborate with employees or put themselves in their place if necessary, to finish a job; It strives to keep customers happy and puts long-term goodwill above short-term profit first.

Dimensions	Characteristics	Behaviors
Plan	Establish goals	Set goals and objectives that are challenging and have personal meaning; Defines long term goals, clear and specific; Sets measurable and short-term goals.
	Information Search	It is personally dedicated to obtaining information from customers, suppliers and competitors; Investigate personally how to manufacture a product or provide a service; Specialist consultation for technical or commercial advice.
	Planning and Systematic Monitoring	Plan on splitting large tasks into time-bound subtasks; Constantly reviews its plans, taking into account the results obtained and circumstantial changes; Maintains financial records and uses them to make decisions.
Power	Persuasionand Network	Uses deliberate strategies to influence or persuade others; Uses key people as agents to achieve their own goals; It acts to develop and maintain business relationships.
	Independence and Self-Confidence	Seeks autonomy from norms and controls of others; It maintains its view even in the face of opposition or initially disappointing results; It expresses confidence in its own ability to complete a difficult task or to face a challenge.

Table 4. Characteristics of entrepreneurial behavior (McClelland, 1987)

The research instrument used was developed by McClelland (1987) and consists of five assertions that represent the Behaviors of each Characteristic. Thus, the instrument involved fifty entrepreneurial behavioral assertions that are distributed into ten Characteristics and three Dimensions. Table 5 shows the first five questions of the research instrument, which address the Opportunity Search and Initiative Characteristic.

Dimensions	Characteristics	Behavior Questions
1. Realization	1.1 Opportunity Search and Initiative	1.1.1 I am committed to accomplishing the things that must be done.
		1.1.2 I do the things that must be done without others having to ask me.
		1.1.3 I like challenges and new opportunities.
		1.1.4 I prefer to perform tasks that I master perfectly and feel safe.
		1.1.5 I challenge myself to do new and different things from the past.

Table 5. Research instrument questions (Opportunity Search and Initiative)

The research instrument proposes that managers answer whether use each of the fifty entrepreneurial behaviors according to the Likert scale, guided by the following semantics: 1 = never, 2 = rarely, 3 = sometimes, 4 = often, and 5 = always. This same scale was adjusted to the AHP methodology.

In the research instrument was adopted a score to support the analyzes to demonstrate the intensity of the characteristics of entrepreneurial behavior in managers, as shown in Table 6.

Levels	Description	Intensity of the characteristic
1	0% a 50%	Inexistent
2	50.01% a 62.50%	Low
3	62.51% a 75.00%	Medium
4	75.01% a 87.50%	High
5	87.51% a 100%	Full

Table 6. The intensity of the Characteristics Levels of Entrepreneurial Behavior (Minello & Scherer, 2014)

The quantitative data from the collection instrument were answered and the tabulation was performed in the Excel®.

The categories used a priori in the AHP model were established in the aim of constructing the decision tree from reference frames that were based on the paper objective. In the model, each assertion corresponds to a KPI (Key Performance Indicators), and each of them has a weight corresponding to the CSF (Critical Success Factor) that corresponds to the FPV (Fundamental Point of View). The decision tree of the proposition is introduced in Figure 2, which represents the hierarchical structure for measuring the entrepreneurial behavior of managers of based-technology companies.

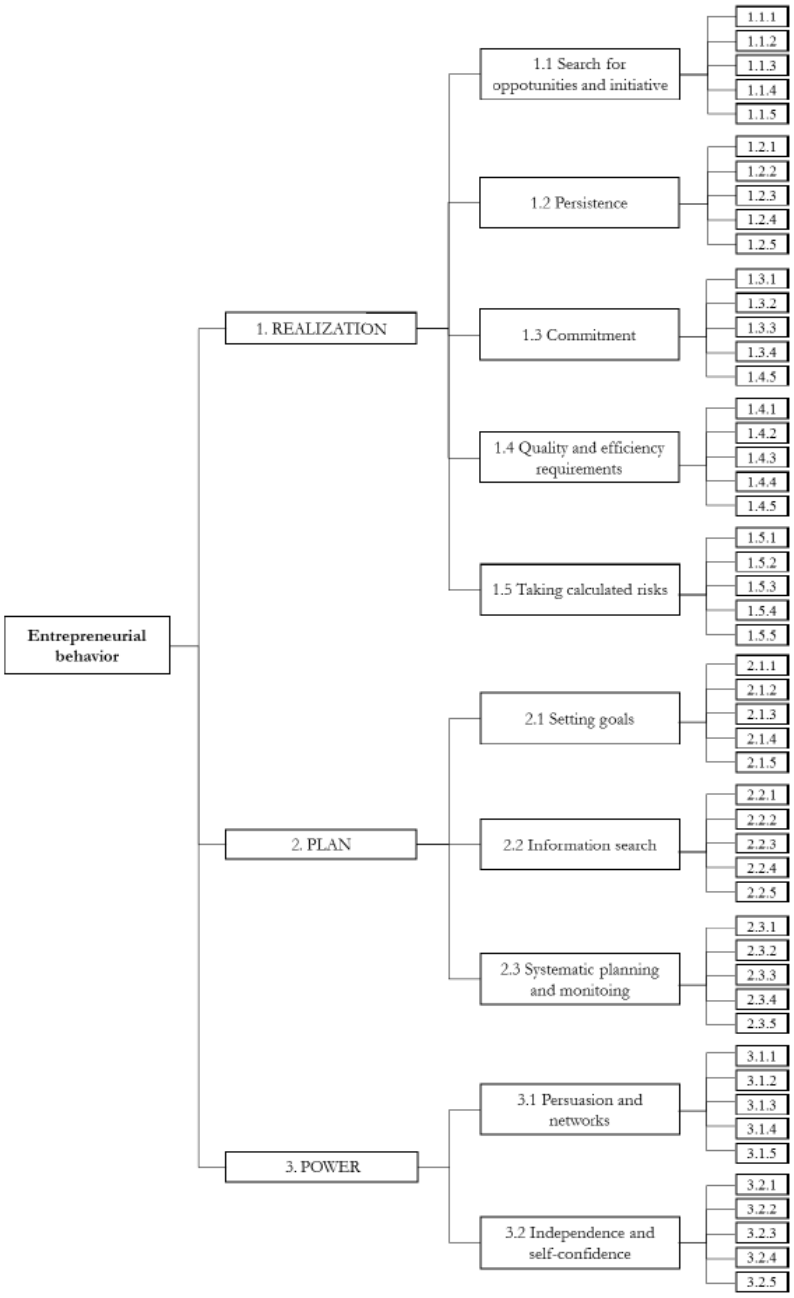

Figure 2. Decision Tree with the Hierarchical Structure (adapted from Saaty (1991), based in McClelland (1987))

The hierarchical structure that was developed to respond to the purpose of evaluating the entrepreneurial behavior of managers of technology-based companies in specific stages of the business life cycle is evaluated permeating dimensions (FPV), characteristics (CSF) and behaviors (KPI). The data processed in the modeling were separated by stages of the cycle, demonstrating that in each of them the performance is different.

The Dimensions of Entrepreneurial Behavior (FPVs) score was evaluated. The scores for Entrepreneurial Characteristics (CSFs) and Behaviors (KPIs) represent information for analyzing the final results. The evaluations have always considered the stage of the life business cycle in which based-technology companies are.

According to the definition of the CSF surveyed and the hierarchical tree, it was necessary to construct the evaluation scales to be able to measure the entrepreneurial behavior. The first step in this construction was the understanding of each of CSF to avoid possible dubious interpretations by respondents. The second step was to symbolize each CSF into five possible response levels, wherein each case the "level 1" corresponds to the worst possible competitive situation, while the "level 5" the more favorable. The midpoint "level 3" express the overall average performance. The Analytic hierarchy process (AHP) was used to perform the calculations referring to the managers' answers.

3.2. Analytic Hierarchy Process (AHP)

To perform the calculations in this paper, the Analytic hierarchy process (AHP) contributes as a method of simple application and efficiency for the decision process (Mohammed & Daham, 2021). Moreover, the method can be applied with measurable and intangible criteria from several areas, providing greater competence for decision making when quantitative and qualitative aspects need to be considered (Marinis & Sali, 2020).

This last step in the construction of evaluation instruments is part of the steps suggested by Saaty (1991) when using the AHP method, so it is a protocol that follows among the various existing elements of multicriteria analysis. The Entrepreneurial Characteristics Questionnaire by McClelland (1987) was defined as the AHP multicriteria elements within the modeling. The instrument was not elaborated because it already exists in the literature, what happened was the insertion of all the questions in a hierarchical evaluation structure.

The AHP multicriteria elements questionnaire can collect the necessary information to feed the model, and thus generate the expected results. It has multiple choice structured questions for each indicator, where the answer alternatives are related to the assessment levels and the constructed scale.

According to Si, Marjanovic-Halburd, Nasiri and Bell (2016), the AHP method has three steps: structuring the hierarchy between criteria and alternatives, producing pair-wise comparison matrix and calculating weight values of criteria and scores of alternative performance.

The substitution rate calculations allowed to create a ranking of importance among indicators. Hence, it was possible to evaluate and compare the performance of the participating managers, since the instrument enables the standardized data collection. Once the substitution rates are structured, it is necessary to define the global rate to assess the performance from each alternative (Gomes & Gomes, 2012).

$$V(\beta) = \sum_{i=1}^{n} WiVi(\beta) \quad (1)$$

Where V(β) represents the global performance from alternative β, Wi refers to the substitution rate form each criteria and Vi (β) the performance in relation the criteria i.

4. Results and discussion

The analysis of the data generated by the AHP method was followed by the evaluation of the existing entrepreneurial behavior in the different stages of the business life cycle. Through the indices of the hierarchical structure, the most prevalent KPIs in each CSF were verified, so that it was possible to identify the characteristics of entrepreneurial behavior that presented the highest indices, as well as the most relevant FPVs.

The identification of these factors made it possible to evaluate, within each stage of the business life cycle, the most prevalent behaviors and characteristics among the dimensions of Realization, Plan, and Power. This identification was defined from the percentages of each behavior in the sum total of the characteristics.

This paper demonstrates in detail the results of one stage of the cycle due to the high amount of data, all stages were reviewed to give an overall score at the end. Table 7showsthe results obtained during the Createstage for

the Realization dimension, composed of five CSF, which corresponds to the eight technology-based companies that are developing the Create stage within the business life cycle.

KPI	Results KPI	Results CSF	Influence
1.1.1 I am committed to accomplishing the things that must be done.	30.00%	4.648477	20%
1.1.3 I like challenges and new opportunities.	30.00%		
1.1.2 I do the things that must be done without others having to ask me.	18.58%		
1.1.5 I challenge myself to do new and different things from the past	12.71%		
1.1.4 I prefer to perform tasks that I master perfectly and feel safe.	1.68%		
-	92.97%	-	-

Table 7. CSF 1.1 Opportunity Search and Initiative –Createstage

The first column of Table 7 describes entrepreneurial behavior in descending order of KPI results. The second column shows the percentage of CSF that when added to the other behaviors gives the percentage of the characteristic of entrepreneurial behavior. The third column reveals the relative result of the CSF, represented by an index formed by the responses of the eight managers of the Create stage. The maximum total of this index is five (according to Likert scale), and that it was estimated in line with the weight of the characteristic in relation to the sum of the hierarchical structure developed for the measurement. The fourth column in the calculation is define the proportionality of CSF index to the FPV, obtaining the final result, which is the percentage of entrepreneurial behavior. McClelland (1987) defines that all Characteristics have the same weight in the entrepreneurial behavior of managers. Thus, since the Realization Dimension encompasses five Characteristics, each CSFs represents 20% of importance in the FVP Realization.

The paper can identify from the analyzes of all CSFs, which is the most predominant among the stages of the business life cycle, as shown in Table 8, these data were possible in all studied stages. In Table 8, the presentation of CSF 1.1 results for the other stages of the organization business life cycle. This compilation was performed with all CSFs.

CSF 1.1 Opportunity Search and Initiative									
Lauch		**Stabilize**		**Extend**		**Mature**		**Evolve**	
Results									
KPI	CSF	KPI	CSF	KPI	CSF	KPI	CSF	KPI	CSF
23.49		28.40		29.33		27.27		18.48	
5.11		20.55		29.33		27.27		18.48	
28.59	4.3882	20.85	4.3060	21.05	4.6702	27.27	4.8181	37.35	4.4750
3.01		2.75		2.67		7.27		3.10	
17.57		13.57		11.03		7.27		12.09	
Total 87.76%		**Total 86.12%**		**Total 93.40%**		**Total 96.36%**		**Total 89.50%**	

Table 8. CSF Results 1.1 Opportunity Search and Initiative - Other stages

Analyzing the CSF 1.1 called "Search for opportunity and initiative" it is clear that the performance of this element remained in the range of 80% and 90% in all stages of the business life cycle with a similarity in the responses about the behaviors of everyone who participated of this search. In the Create stage, the percentage was also in this range, computing the intensity from high to full in relation to the CSFs.

Figure 3 denotes the compilation of the results from the managers' perception of the based-technology companies from the create stage for the five CSF of the Realization Dimension.

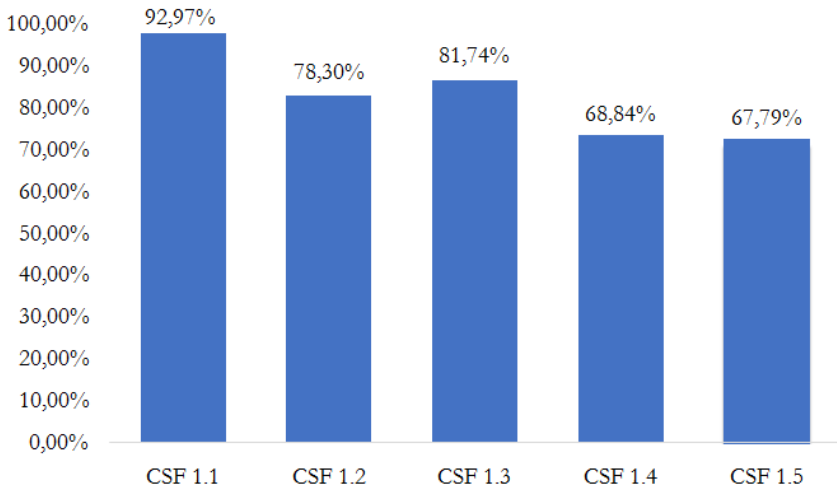

Figure 3. CSFs Results of the Realization Dimension – Createstage

Since the Likert scale (1 to 5) was presented, the calculations of the AHP method transformed these values into an overall percentage of Characteristics (CSFs). In particular, CSF 1.1: The Search for Opportunities and Initiative was considered the highest intensity CSF, presenting full intensity. The interviewed managers consider that proactivity in the search for new solutions and opportunities is essential for the development of their companies. Two CSF were algo highlighted in relation to the intensity of entrepreneurial behaviors, CSF 1.2: Persistence and CSF 1.3: Commitment, presenting high intensity. The commitment characteristic exhibited an index of 81.74%, reflecting that the managers from the creation stage are faithful to the promises they make and present efficiency in the business activities. Staniewski and Awruk's (2018) point out that it is important to develop reliable, accurate, and quality procedures to ensure an enterprise's success with the proper definitions and indicators. Persistence also stood out as a characteristic of entrepreneurial behavior in the create stage, especially in times when the company is not achieving the expected results.

According to the CSF 1.4: Quality and Efficiency Requirements, as well as CSF 1.5: Taking Calculated Risks were rated as moderate in intensity. The percentage of this factor was lower because some behaviors do not fully indicate the risk calculation, and as state by McClelland (1972), people who have strong desires for accomplishment devote more time to challenging tasks that involve risks.

According to the calculations of the AHP method, it was possible to estimate the overall average of the three Dimensions of entrepreneurial behavior (FPVs). The Dimensions of entrepreneurial behavior (FPVs) encompass characteristics identified by McClelland (1987). The analyses pertaining to Table 9 determine how entrepreneurial behavior is presented in the business life cycle stages.

Stage	Realization (FPV)	Plan (FPV)	Power (FPV)
Create	77.92%	85.36%	74.36%
Launch	78.86%	80.72%	79.00%
Stabilize	77.15%	83.08%	74.75%
Extend	79.02%	82.08%	91.90%
Mature	89.19%	94.93%	91.06%
Evolve	79.86%	86.96%	82.28%

Table 9. Overall average of all FPVs

Plan was the Dimension that obtained the most predominant FPV in five researched business life cycle stages. This Dimension involves goal setting, information seeking, and systematic planning, and monitoring, which is essential for any moment of the enterprise. This result shows that Plan is the dimension of entrepreneurial behavior that accompanies the entire process of the business life cycle stages. Even if the manager is starting his activities in the company, or even if he is consolidating his business, Plan remains an essential behavior.

The Plan Dimension in companies facing the Mature stage of business obtained the highest score of the entire research (94.93%). At this stage, the company is in consolidation, and managers already have more market experience. Fisk (2009) points out that one of the priorities of companies in the Mature stage is to manage the variety of products and develop plans to explore the main assets of the business. Even though the company has already achieved good results by reaching the Stabilize and Extend stages, Plan still persists as the most influential dimension of entrepreneurial behavior. Thus, the managers of companies in the Mature stage must have behaviors that explore their strategic and planning vision.

The only stage of the business life cycle that Plan did not obtain greater prominence was the Extend stage. According to Fisk (2009), this stage includes the expansion of the company based on innovations, being a stage in which the company must demonstrate aggressiveness in the market. Exactly at this stage, the interviewed managers demonstrated behaviors more related to Power Dimension, demonstrating a relationship with Fisk's (2009) concepts. The Power Dimension includes behaviors such as persuasion and networking, which are essential factors in expanding a business (Fisk, 2009).

While the Realization Dimension did not excel at any of the stages, the behaviors of the five characteristics belonging to it, showed importance in the managers' view. The Mature stage scored 89.19% on the Realization Dimension, standing out in relation to the other stages. Fisk (2009) states that at this stage, the purpose is to focus resources on the most important market, products and customers. Managers working in technology-based companies facing this stage of business need to exhibit behaviors that admit risk-taking and demonstrate commitment, whether to the market, the products, or the consumers. The Realization Dimension encompasses these characteristics and proves its relevance on the Mature stage.

The second highest score in the Realization Dimension was for the Evolve stage. This stage proposed by Fisk (2009) is aligned with the Characteristics of the Realization Dimension. Opportunity Search and Initiative and Take calculated risks address aspects of impetus for a business. Fisk (2009) states that rethinking the business and seeking new opportunities in the market are essential for a company that is evolving. Managers of technology-based companies that are at this stage agree with the characteristics present in the Realization Dimension.

In Relation to Power Dimension, the Extend and Mature stages stood out, with 91.90% and 91.06% scores. At the same time that companies gain experience in the marketplace, managers develop skills in influencing other employees in order to maintain business relationships and achieve company goals. In the same sense, independence and self-confidence grow as managers face different situations. The results show that managers of companies that experience the stages of Extension and Maturity show entrepreneurial behavior referring to the Realization Dimension, demonstrating that these stages require characteristics such as commitment and persistence.

Power Dimension showed an interesting feature in the research results. The last three stages of business life cycle, in which the managers are more experienced, achieved higher scores. The Dimension involves persuasion and network, independence and self-confidence, these being characteristics of managers who have attributes that can acquired over time. The Create, Launch and Stabilize stages involve characteristics and decisions of managers that involve strategic business planning. Thus, Power Dimension achieved lower scores in the first three stages, when compared to the other two Dimensions.

As a general performance, the entrepreneurial behavior diversifies according to the evolution of the market development stages. The Create, Launch and Stabilize stages are composed of planning and strategic decisions for the advancement of companies, corroborating the presence of the Plan Dimension. Even though this dimension stood out from the others, the high score achieved by the Power Dimension in the Extend stage, in which managers demonstrate characteristics that bring other agents closer to the company, can be highlighted. The Realization Dimension reached a higher score in the Mature stage, but even so, it scored lower in the Extend stage than the Plan and Power Dimensions.

To facilitate the analysis of the paper's results, Figure 4 demonstrates the average entrepreneurial behavior score per stage of the business life cycle.

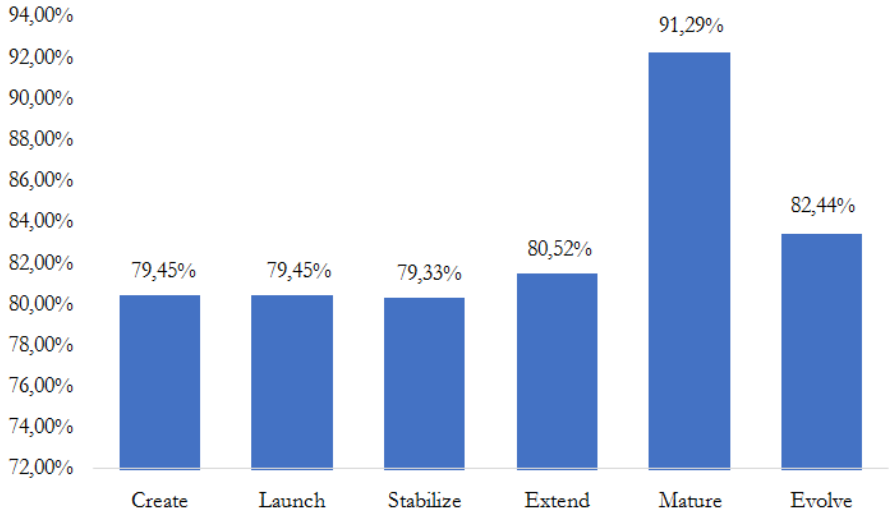

Figure 4. Average entrepreneurial behavior score per stage of the business life cycle

Create (79.45%), Launch (79.45%) and Stabilize (79.33%) had very close scores. Based on the literature consulted, it was realized that the first steps represent a lot of involvement when creating the business, launching the product and seeking expansion. Entrepreneurial behavior collaborates with these aspects, but as companies gain market traction, the results of the research instrument show that managers achieve higher scores that represent an increase in their entrepreneurial behavior, according to McClelland (1987). Managers of technology-based companies demonstrated greater entrepreneurial behavior in the last three phases of the business life cycle.

The results show that even with little difference, managers of technology-based companies in the early stages exhibit lower entrepreneurial behavior. In most cases, managers who have already gone through the stages of evolution of the organizations, present greater experience. Thus, the experience of having gone through negative and challenging situations can benefit the manager with reflections and recognition of the causes of a problem (Shepherd, Patzelt & Wolfe, 2011).

Figure 5 demonstrates that the business life cycle stages involving the creation, launch, and stabilization of companies determine that the manager exhibits entrepreneurial behavior at close levels. It is understood that until business stabilization, managers demonstrate constant entrepreneurial behavior, but thereafter, the challenges and opportunities of the next levels require a higher level of entrepreneurial behavior from managers. The Extend stage requires managers to manifest innovative ideas that may involve entering new segments or markets, demonstrating entrepreneurial characteristics that contribute to the company's expansion.

The managers who work in companies that experience the Mature stage present the highest level of entrepreneurial behavior. At this stage, managers have already acquired knowledge for initial creation to expansion of the business. Managers require entrepreneurial characteristics to exploit the greatest assets of the business, so they need an understanding of which sectors deliver the best long-term results (Fisk, 2009). At this stage, companies are solid in the market, and in addition to the skills that managers have achieved due to the previous stages, the consolidation of the business can provide greater confidence for decision making.

In the Evolve stage, managers present the greatest experience in the business so far. Nevertheless, they show a decrease in entrepreneurial behavior. Although managers have knowledge of their business, this stage marks the evolution of the company or the beginning to its end, which would trigger the Exit stage (Fisk, 2009). At this stage, it is possible that managers are worn out with their business and are heading for business closure.

The analysis of the results of the paper allows us to identify a certain trend in the entrepreneurial behavior of the managers. In the first three stages this behavior is lower and constant. In the fourth stage, the behavior increases and finally in the fifth stage there is a spike in the level of entrepreneurial behavior. Finally, in what

would be the stage in which the company could demonstrate evolution, the managers demonstrate a lower level of entrepreneurial behavior, which may determine a wearing out of managers.

5. Theoretical and managerial implications

This paper measures the intangible capital called entrepreneurial behavior. This aspect involves several variables, and is difficult to identify and measure due to its intangibility. The results can contribute to the development and understanding of other scientific researches, which can understand how to identify if a manager presents the necessary characteristics to develop as an entrepreneur, and how these characteristics are presented in the market.

On the theoretical point of view, the analysis of aspects of managers of technology-based companies presents relevance to the scientific literature. Technological development follows the evolution of the industry, so that researchers investigate ways to collaborate with results related to technology in companies. Managers who perform functions in companies that have technology as their main source of development need to present entrepreneurial behavior for the longevity of their business. This paper makes contributions to the analysis of the characteristics of a sample of these managers, taking into account the stage at which the company is developing in the market.

Since the performance of companies is influenced by the posture, motivation and structure presented by the environment, the aspects analyzed by this paper influence the strategic management of company business. The entrepreneurial behavior of managers of technology-based companies, within stages of the business life cycle, offers relevant analyses for the development of these companies. Both the managers interviewed, and the managers that may examine this paper, have the intention to remain in the market, a factor that is directly influenced by the company's performance, which among several factors, depends on the entrepreneur's behavior. According to Neneh (2019) and Obshonka et al. (2017), an individual's personality traits play a vital role in determining whether or not they will develop the entrepreneurial career intention to pursue the identified opportunities.

The results of this paper demonstrate implications for the self-knowledge of managers who are in charge of businesses. The sample of interviewed managers presented entrepreneurial characteristics, with different dimensions and characteristics, depending on each stage of the business life cycle. With these interviews, it is possible to understand each phase and recognize the beginning of the entrepreneurial activities in the business. As Belchior and Lyons (2021) also found in their research, entrepreneurial intentions happen before the entrepreneurial behavior, so it is possible to find the link between them.

Different than other articles, as Nguyen et al. (2019), where the research got results according to the employee's perspective, and where managers should start caring more about their employees' psychological welfare and attachment to the organization. The contributions of the paper demonstrate that the characteristics of entrepreneurial behavior are influenced by the stage of the life cycle of the business, because each one of them has specific factors that require different behaviors from the manager.

6. Conclusions

The paper achieved the objective of evaluating the entrepreneurial behavior of managers of technology-based companies in specific stages of the business life cycle. The results reflect relevant information to managers about their behavior, identifying more latent characteristics and others that should be developed. These results can help managers to develop their skills as entrepreneurs, with the intention of improving strategic management.

The application of a research instrument that questions managers of technology-based companies about entrepreneurial behavior characteristics aligned to business life cycle stages concepts helped in the solution of the research problem: "How does entrepreneurial behavior diversify across business life cycle stages?". In addition, the use of the AHP method provided the calculations of the managers' answers. Thus, the paper provided analysis of the entrepreneurial behavior of specific managers according to the business life cycle.

The evaluation of the entrepreneurial behavior of the interviewed managers can help them analyze how other managers behave according to the stage that the business is developing. Furthermore, entrepreneurial behavior

represents an intangible aspect that contributes to business performance, consequently managers who understand how behavior influences performance, can become more competitive and permanent in the market.

The results showed that the last three stages of the business life cycle (Extend, Mature and Evolve) presented the highest levels. According to the analyses, an understanding was reached that there is a tendency to develop entrepreneurial behavior characteristics as managers gain experience over time. Even so, companies that develop the first three stages (Create, Launch and Stabilize) present characteristics that contribute to entrepreneurial behavior. Although new businesses present particularities different from those already consolidated, the results demonstrate that managers fit characteristics involving entrepreneurial behavior.

The results generate contributions at the level of development of future scientific research, providing understandings about entrepreneurial behavior according to the stage of business life cycle in technology-based companies. Managers can also benefit by gaining knowledge of how behavior is influenced by timing and how it affects company performance. Therefore, the analyzed information allows reflections concerning managers of technology-based companies, and can be tested in other companies in future research.

6.1. Limitations and future directions

As a limitation, the number of managers responding to the research is identified. The research instrument was sent to 170 managers of technology-based companies, but only 31 responded to the instrument. As the research instrument was applied face to face, all the managers interviewed work in companies in the southern region of Brazil, facilitating the author's approach to the interviewees. The access and locomotion to meet the interviewees involved costs, and therefore, only managers located close to the author were associated with the research.

This paper focused on the analysis of the entrepreneurial behavior of managers according to the characteristics of each stage of the business life cycle. Future research can develop analyses according to each specific stage, addressing the main characteristics of entrepreneurial behavior present in each of these stages. Qualitative analyses of the managers' perceptions can also be developed, in order to investigate how the manager's behavior has influenced the development of the stage in which the company is going through. Furthermore, the results of the study provide questions to be solved in future issues. For example, to identify the causes of the decrease in the level of entrepreneurial behavior of managers who work in companies that experience the Evolve stage.

In addition, as a suggestion for future research, the paper's methodology can serve as a model for expanding these results by increasing the number of managers interviewed. It is recommended that studies be conducted in other technology-based incubators for the purpose of comparison, since the results found in this work, although specific to a set of companies, may be analyzed and inspire new research in other locations that may contribute and fill the gap observed by the lack of publications on the correlated themes

Declaration of Conflicting Interests

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