UFSM

REVISTA DE ADMINISTRAÇÃO DA UFSM
Brazilian Journal of Management
ReA UFSM

ISSN 1983-4659
OPEN ACCESS

Rev. Adm. UFSM, Santa Maria, v. 16, n. 3, e7, 2023 https://doi.org/10.5902/1983465972119
Submitted: 10/26/2022 • Approved: 06/24/2023 • Published: 09/01/2023

Original Article

The influence of entrepreneurs' mental models on organizational absorptive capacity: a multilevel perspective

A influência dos modelos mentais dos empreendedores na capacidade absortiva organizacional: uma perspectiva multinível

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ABSTRACT

Purpose: Entrepreneurs have cognitive styles that directly determine organizational behavior. When building their mental models, the entrepreneur uses both individual and collective capacities, which, in turn, mediate the performance of an organization, configuring themselves in a multilevel perspective. This article aims to analyze the effect of entrepreneurs' mental models on absorptive capacity in incubated companies.

Design/methodology/approach: This article is based on descriptive research with a quantitative approach to the data. A closed questionnaire was applied to 132 incubated companies belonging to the Consortium of Community Universities of Rio Grande do Sul (Consórcio de Universidades Comunitárias do Rio Grande do Sul - Comung) and Santa Catarina Association of Educational Foundations (Associação Catarinense das Fundações Educacionais - Acafe). The statistical treatment used to analyze the relationships investigated in this research comprised descriptive statistical analysis and Modeling by Structural Equations (SEM), with the help of SPSS® version 2.2 and SmartPLS® version 3.2.8 software.

Findings: The results showed a positive relationship between the cognitive variables of the entrepreneurs' mental models in the organizational Absorptive Capacity (ACAP). It is possible to infer that these are significant predictors of the development of organizational ACAP in the companies that make up this sample. This study presents a set of mental models' cognitive variables related to organizational ACAP.

Originality/value: We suggest a qualitative approach that can deepen the observations regarding the relationships investigated in this study. Such an approach would help understand how the relationship between the cognitive variables of the mental models of entrepreneurs in organizational ACAP occurs.

Keywords: Mental models; Organizational absorptive capacity; Multilevel; Entrepreneurs; Incubated companies

RESUMO

Finalidade: Os empreendedores possuem estilos cognitivos que determinam diretamente o comportamento organizacional. Ao construir seus modelos mentais, o empreendedor se vale de capacidades tanto individual quanto coletiva e estas, por sua vez, mediam o desempenho de uma organização, configurando-se numa perspectiva multinível. Este artigo tem como objetivo analisar o efeito dos modelos mentais dos empreendedores na capacidade absortiva em empresas incubadas.
Desenho/metodologia/abordagem: Trata-se de uma pesquisa descritiva com abordagem quantitativa dos dados. Foi aplicado um questionário fechado junto a 132 empresas incubadas pertencentes ao Consórcio de Universidades Comunitárias do Rio Grande do Sul (Comung) e a Associação Catarinense das Fundações Educacionais (Acafe). O tratamento estatístico utilizado para a análise das relações investigadas nesta pesquisa compreendeu análise estatística descritiva e Modelagem por Equações Estruturais (MEE), com o auxílio dos softwares SPSS® versão 2.2 e SmartPLS® versão 3.2.8.
Resultados: Os resultados evidenciaram a relação positiva entre as variáveis cognitivas dos modelos mentais dos empreendedores na Capacidade Absortiva (ACAP) organizacional, sendo possível inferir que estes configuram-se como um importante preditor do desenvolvimento da ACAP organizacional nas empresas que compõe essa amostra.
Originalidade/valor: Como contribuição, este estudo apresenta um conjunto de variáveis cognitivas dos modelos mentais que possuem relação com a ACAP organizacional. Para uma melhor compreensão de como ocorre a relação entre as variáveis cognitivas dos modelos mentais dos empreendedores na ACAP organizacional sugere-se uma abordagem qualitativa, que possa aprofundar as observações a respeito das relações investigadas neste estudo.

Palavras-chave: Modelos mentais; Capacidade absortiva oganizacional; Multinível; Empreendedores; Empresas incubadas

1 INTRODUCTION

The intense changes in the organizational environment transform how organizations seek an advantage over competitors. Making them not limited to the generation of strategies related to traditional factors but also to the development of a region, the generation of jobs, and lace (Behling, Pereira, Mazzoleni, Baccin, & Lenzi, 2015; Guerra, Tondolo, & Camargo, 2016; Meirelles & Camargo, 2014).

For this reason, to analyze and understand organizational changes, the changing nature of the environment must be contemplated (Mintzberg, Ahlstrand, & Lampel, 2010). In addition to cognitive processes and factors related to how individuals think in everyday life, adapt, and react to the environment (Wachelke & Camargo, 2007).

Therefore, the results depend not exclusively on the external environment but also on the vision and capacity of organizational managers (Guerra, Tondolo, & Camargo, 2016).

Thus, the ability to diversify, share and store knowledge determines the organization's abilities for market development and the allocation of strategic resources (Teece, 2007; Winter, 2003). For this, organizations need to learn, renew, reconfigure, and adapt their resources (Barney, 1991; Teece, Pisano, & Schuen, 1997) and skills (Zahra & George, 2002), processes, and routines (Eisenhardt & Martin, 2000; Meirelles & Camargo, 2014), thus configuring their absorptive capacity (Cohen & Levinthal, 1990; Zahra & George, 2002).

For the authors Argote and Ingram (2000), Crossan, Lane, and White (1999), and Spender (1996), the capabilities of a company involve both individual and collective cognitive knowledge. These, in turn, mediate the performance of an organization from a multilevel perspective. The entrepreneur's decisions manifest through the results of behaviors (individual level), learning, and experiences (organizational level) lived at a given moment. This multilevel perspective generates personal knowledge as a product, which, in turn, influences new learning processes in the organization. Thus, strategically, individual management acts as a determining factor of performance in companies (Fischer, Salles-Filho, Zeitoum & Colugnati, 2022). Also, businesses are impacted by characteristics of the owners themselves, such as the fact that they do not dissociate between the personalities of the owners and the business, and are specific to the context (Belkhodja, 2022). While learning (the process) produces new knowledge (the content), this generated knowledge impacts future learning (Daghfous, 2004; Lane & Lubatkin, 1998).

Thus, a multilevel approach would combine micro phenomena embedded in macro contexts. These often emerge from the interaction and dynamics of lower-level elements (Pantoja & Borges-Andrade, 2004). This fact corroborates the study by Rotundo and Giner (2009); when referring to the influence of mental maps or cognitive schemes in decision making. The multidimensionality and richness of absorptive

capacity is an under-explored area in the existing literature (Hussain, Bhatti, Khan, Asslan & Tarba, 2022). They also report the organization as a "body of ideas" and a "practice of thinking," characterizing the multilevel perspective from the effect of the individual level on the organizational level.

This study focuses on the relationship between mental models and absorptive capacity from a multilevel perspective. This study was carried out with entrepreneurs being the subjects of this study the entrepreneurs who have their companies incubated next to innovation environments propitiated by universities belonging to to the Consortium of Community Universities of Rio Grande do Sul (*Consórcio de Universidades Comunitárias do Rio Grande do Sul* - COMUNG) and the Santa Catarina Association of Educational Foundations of Santa Catarina (*Associação Catarinense das Fundações Educacionais de Santa Catarina* - ACAFE). In the context of business incubators, it is important to highlight that these have been strong drivers of entrepreneurship and aim to offer support for the development of innovative ideas (Almeida, Pinto & Henriques, 2021). In addition, incubators help to create a nurturing and nurturing environment, allowing incubates to obtain the resources, services and assistance they need. Emphasizing the role of the incubator, which is orchestration and its categorization, understanding the effects of offering networks and relationships for incubated companies (Antunes, Castro, & Mineiro, 2021).

What is known is that the entrepreneur's characteristics directly influence the organization's diagnosis, choices, and strategic direction (Bressan & Toledo, 2013). With the same thought, Zhao and Parry (2012) defend research aimed at understanding how mental models have important implications for entrepreneurs' decisions. This previous research is in line with Volberda, Foss and Lyles (2010) statement that there is a lack of research on the antecedents of CA. In this research, the mental models explain how they impact absorptive capacity. Understanding how absorptive capacity processes develop from the influence of their antecedents can contribute to comprehending the process of absorptive capacity (Cepeda-Carrion, Cegarra-Navarro, & Jimenez-Jimenez,

2012). In addition, as incubated companies, they need the support of incubators, support, since they are start-ups and are not in contact with important partners. We also need to know how to exploit and transform external knowledge into internal benefits (Miranda, Nodari, Severo & Engelman, 2022).

Rezaei-Zadeh and Darwish (2016) suggest that researchers investigate the influence of antecedents on the dimensions of absorptive capacity. Notably, the relationship between these two themes constitutes an essential analysis perspective for the incubated company's segment. They play a significant role in generating new ventures and technologies, contributing to local and regional development. In addition to this introduction, this study includes the theoretical foundation with the themes of absorptive capacity and mental models, followed by the method and discussion of the results, and finally, the final considerations.

2 THEORETICAL FOUNDATION

2.1 Absorptive capacity

The theory of dynamic absorptive capacity, absorption capacity, or even absorptive capacity (ACAP) (Garzón-Castrillón, 2016) is seen as a stream of Dynamic Capacities (DC) theory. It has received focus in recent decades by scholars in Brazil and abroad (Apriliyantia & Alon, 2017; Guerra, Tondolo, & Camargo, 2016; Ferreira & Ferreira, 2017; Zonatto, 2018).

ACAP is related to Penrose's (1959) theory of the firm. In the literature, the ACAP theme begins to be approached in greater depth by Cohen and Levinthal (1990). The authors refer to the ability to recognize external information, assimilate the implications of this knowledge in the firm, and apply that knowledge to develop innovative performance or generate innovations. In addition, the authors demonstrate the importance of a Research and Development (R&D) department, using the absorptive capacity to appropriate information and knowledge.

The approach proposed by Lane and Lubatikin (1998) is that ACAP is a process that involves three capacities that affect the ability to evaluate, assimilate and commercialize. In this sense, these authors accept that ACAP is formed by the abilities of identification, assimilation, and application of knowledge.

Zahra and George (2002) adopt a more procedural perspective on ACAP. They argue that effective internal knowledge sharing, and integration are critical to this capability. In this aspect, ACAP would be a multidimensional construct formed by a set of organizational routines and processes through which companies produce a dynamic organizational capacity. ACAP is the combination of four capabilities that influence the organization to create and develop the knowledge needed to build other organizational capabilities, which are the basis for a competitive advantage.

These capabilities are, at the same time, different and complementary in influencing organizational results. Thus, Zahra and George (2002) propose a set of organizational routines and processes with two distinct dimensions: potential absorptive capacity (PACAP), which includes acquisition and assimilation capacities; and realized absorptive capacity (RACAP), which includes transformation and application capabilities, which the authors connect to the concept of dynamic capabilities, where the organization's essential resources originate from competitive advantages.

The approach proposed by Lane, Koka, and Pathak (2006) reaffirms the multidimensional aspect of ACAP. However, the authors return to the three capacities of the seminal model by Cohen and Levinthal (1989). They separate the sequential learning processes as far as each process requires different organizational capabilities. Going further, Lane, Koka, and Pathak (2006, p. 856), when combining the original ideas of Cohen and Levinthal (1989, p. 128), suggest the following more detailed definition of absorptive capacity:

> Absorptive capacity is the company's ability to use externally realized knowledge through three sequential processes: (1) recognize and understand as potentially valuable new knowledge that may come from outside the company, through exploratory learning; (2) assimilate

> valuable new knowledge through transformative learning; and (3) using assimilated knowledge to create new knowledge and commercial outlets through exploration learning.

Lowik, Kraaijenbrink and Groen (2016) view ACAP as usually considered a multilevel capability. Its multilevel nature concerns the ACAP of each individual and the mechanisms of social integration at the organizational level. Furthermore, for these authors, the ACAP of a company is not simply the sum of the ACAP of its employees. Therefore, it is helpful to consider which aspects of the ACAP are distinctly organizational.

We adopted the concept of ACAP by Cohen and Levinthal (1990) to guide this study. It refers to the firm's collective ability to recognize the value of new external knowledge, assimilate it and apply it. The adoption of this concept is justified given its adherence to the research objective. In addition, the study converges with the multilevel absorptive capacity perspective proposed by Lowik, Kraaijenbrink and Groen (2016). Ferasso and Grenier (2021) state that capabilities act at the internal level of the company and between companies that are associated for the co-development of innovative projects.

The study of Hussain et al. (2022, p. 2735) identify:

> The links among antecedents, multi-dimensions of absorptive capacity and competitive advantage. Antecedents include prior related knowledge and a firm's combinative and information technology capabilities. Multi-dimensions are PAC (acquisition and assimilation) and RAC (transformation and exploitation of knowledge) that are the main constructs in the framework. Competitive advantage is the outcome variable. The purpose of such amalgamation is to provide a holistic view for managers and ractitioners to successfully develop, maintain and enhance a firm's.

The cognitive structures of individuals are considered important antecedents of absorptive capacity (Cohen & Levinthal, 1990; Lane, Koka, & Pathak, 2006; Todorova & Durisin, 2007). Individual cognition refers to how individuals tend to process information and make decisions (Fiske & Taylor, 2013).

2.2 Mental models

Organizations are open social systems that process information from the external environment, which are used for decision-making (Csaszar & Levinthal, 2016; McCarthy, 2003; Daskou, Yannopoulos & Koutoulas, 2012). Including formal and informal collection systems and data. This information about the external world is then filtered and processed for decision-making (McCarthy, 2003). According to DeToni and Milan (2008) and Daskou, Yannopoulos, and Koutoulas (2012), managers create belief systems or mental models, simplified representations of the information environment.

Mental models are cognitive elements built on an object, and the individual evaluates the image of the object as an impression and a set of attitudes and perceptions about the object (Dichter, 1985; Martineau, 1958). This mental level of perception leaves an intellectual residue, providing a reason for pragmatic, functional, and logical evaluations.

Mental representations derived from mental models are fundamental in strategy because they allow managers to consider alternative strategies offline (Gavetti & Levinthal, 2000). That is, mental representations allow managers to consider the merits of alternative strategies without the need to invest and execute the various options (Csaszar & Levinthal, 2016).

For the authors, Badke-Schaub, Neumann, Lauche and Mohammed (2007), mental models reflect the ability to categorize what we know and organize knowledge. It starts from the idea that mental models are built by internal patterns of how the world works or simplifications. Lucas and Mai (2022) propose that, like any mental model, the influence a given mental model has on a worker depends on whether the worker holds that mental model in the first place and whether that mental model is activated.

Considering Karakaya and Yannopoulos' (2010) mental models' approach, managers receive, process, and disseminate information about their external environment. However, they often need to sift through enormous amounts of information to develop

strategies and respond to environmental challenges. Complementing the idea, Zhao and Parry (2012) state that the network of meanings shapes mental models, which reflect on managers' experiences, as well as inferences from the observed or communicated experiences of others. The way in which these experiences are perceived and interpreted depends, in part, on managerial beliefs and norms, as well as the firm's strategies.

Lucas and Mai (2022) propose that these mental models are impactful because they prime action tendencies (preparation versus production) that differentially influence behavior during creative work.

Apriliyanti and Alon (2017) state that people are driven by the interactions of their behavior, cognition, and external environment. Through a cognitive process, the external environment can determine the organization's behavior (Bandura, 2001). According to Cognitive Theory, the organization relies on the absorptive capacity of its members (Cohen & Levinthal, 1990) The members are influenced by their cognitive structures (Volberda, Foss, & Lyles, 2010). Moreover, these cognitive structures lead individuals to identify, choose, process knowledge, and determine their behavior and decision-making (Bandura, 2001).

In the understanding of Wood and McKelvie (2015), mental models can be understood as simplified images of the environment that support beliefs and judgments.

Martignoni, Menon and Siggelkow (2016) affirmed that mental models have two components: (i) the connection of representations that capture beliefs about mental model elements and (ii) performance (representations that capture the mapping from actions to performance results).

Given this, Godkin's (2008) position regarding mental models mentioned that these are structures from which individual interpretations of the environment derive, including organizational routines that determine perceptions of environmental reality. These individuals carry their mental models and share them with organizations, emphasizing the relationship between cognitive and organizational absorptive capacity (Lane, Koka, & Pathak, 2006).

In summary, it is argued that in the mental model's approach, managers receive, process, and disseminate information in their environment (Day, 1994). Based on a bibliographic review associating mental models and absorptive capacity, the study that came closest to the purpose of this research was that of DeToni, Mioranza, Milan and Larentis (2014). The authors adopt the network perspective of mental models as exogenous variables associated with organizational performance.

Knowledge acquisition (tacit or explicit) derives from one of the primary practices recommended by managers for decision-making. Siachou, Daskou, & Yannopoulos (2011) estimated that mental models play an essential role in the three capacities of absorptive capacity. Therefore, this study intends to understand the effect of incubated entrepreneurs' mental models considering this set of variables identified in the literature on ACAP from a multilevel perspective. Based on the above, the following research hypothesis is presented:

H1: Entrepreneurs' mental models positively and significantly influence organizational absorptive capacity.

Therefore, Table 1 presents a synthesis of the cognitive variables of the mental models pointed out by the literature review and their respective hypotheses.

Table 1 – Cognitive variables of Mental Models and their relationships with Absorptive Capacity

Continue...

Variables	Description	Authors	Hypotheses
Knowledge	*Expertise* to explore new information. Establishing associations between prior knowledge and new knowledge. Existence of a high degree of education, technical training, and practical experience. Technical knowledge of the product/service and the production process.	Baron (2006); Bazzo (2011); Chauvet (2014); Cohen and Levinthal (1990); Flatten, Engelen, Zahra and Brettel (2011); LeBoterf (2003); Lowiik, Kraaijenbrink and Groen (2016); Nonaka and Takeuchi (2008); Karakaya and Yannopoulos (2010); Siachou, Daskou, and Yannopoulos (2011); Wood and McKelvie (2015); Zahra and George (2002).	H2 - The entrepreneur's knowledge exerts a positive and significant influence on the organizational absorptive capacity.

Table 1 – Cognitive variables of Mental Models and their relationships with Absorptive Capacity

Continue...

Variables	Description	Authors	Hypotheses
Creativity	Ability to: generate new ideas, knowledge about the product/service; adoption of new ways of thinking; redefining new ways of doing things; association of hitherto unknown domains; and external knowledge transfer.	Bessant and Tidd (2009); DeToni e Milan (2008); Filli and Rentschler (2010); Lane, Koka, and Pathak (2006); Martin and Wilson, (2016); Patterson and Ambrosini (2015); Seo, Chae and Lee (2015).	H3 - The creative capacity of the entrepreneur has a positive and significant influence on the organizational absorptive capacity.
Relationship	Existence of process of interactive exchange of information between individuals of the same or different organizations. Existence of values of orientation and attention towards customers and employees. Existence of trust, commitment, teamwork, loyalty and results orientation.	Apriliyantia and Alon (2017); Biggemann and Buttle (2012); Caloghirou, Kastelli and Tsakanikas (2004); Lane and Lubatkin (1998); Lowik, Kraaijenbrink and Groen (2016); Bosch, Volberda and Boer (1999); Gummesson (2002).	H4 - The entrepreneur's capacity to relate positively and significant influences the organizational absorptive capacity.
Strategy	Existence of a pattern of guidance for action. Ability to manage and allocate resources. Ability to: model new forms of action or path for the company; to perceive, interpret and use information for decision making. Clarity regarding the general direction of the business. Systemic and intuitive thinking.	Bressan and Toledo (2013); DeToni et al. (2014); Ensing (2008); Gallén (2006); Gary, Wood and Pillinger (2012); Guiette and Vandenbempt (2013); Mintzberg and Quinn (2001); Porter (2004); Winter (2003); Wu (2010).	H5 - The use of strategies by entrepreneurs exerts a positive and significant cativa influence on the organizational absorptive capacity.

Table 1 – Cognitive variables of Mental Models and their relationships with Absorptive Capacity

Conclusion

Variables	Description	Authors	Hypotheses
Experience	Conditions to perceive events and identify new opportunities. Ability to measure the implications of changes and assess the underlying potential. Managerial and technical skills (know-how) to introduce new products/ services/businesses.	Baron, (2006); Cohen and Levinthal (1990); Dimov (2011); Zhao and Parry (2012); Hill and Levenhagen (1995); Hsieh and Kelley (2016); Jansen, Bosch and Volberda (2005); Mitchell, Mitchell and Smith (2008); Pryor, Webb, Ireland and Ketchen (2015); Wood, McKelvie and Haynie (2014).	H6 - The entrepreneur's experience exerts a positive and significant influence on the organizational absorptive capacity.
Risk Management	Ability to: take risks moderately, without taking risks irrationally or unreasonably; to commit resources in a calculated way; to identify and minimize potential risks; and to select relevant information from the environment and evaluate it.	Bessant and Tidd (2009); Foss, Klein, Kor and Mahoney (2008); Fillis and Rentschler (2010); Hsieh and Kelley (2016); LeBoterf (2003); Shepherd, Williams and Patzelt (2015); Yang and Zhang (2015); Zhao and Parry (2012).	H7 - The risk management capacity of the entrepreneur exerts a positive and significant influence on the organizational absorptive capacity.

Source: Elaborated by the authors based on research data (2019)

3 METHODOLOGICAL PROCEDURES

3.1 Population and sample

This study adopted characteristics of descriptive research with a quantitative approach to the data. For sampling purposes, all companies incubated in the set of innovation and technology centers of the Community Universities of Rio Grande do Sul (Universidades Comunitárias do Rio Grande do Sul - COMUNG) and the Santa Catarina Association of Educational Foundations (Associação Catarinense das Fundações Educacionais (ACAFE) were considered.

COMUNG is a group of Community Institutions from Rio Grande do Sul which constitutes the Consortium of Gaucho Community Universities. The institutions that form the Consortium represent a network of education, science, and technology, which covers almost all municipalities in the state (COMUNG, n.d.). ACAFE is formed by the Educational Foundations of the State of Santa Catarina. The educational foundations that support Higher Education Institutions came together around the constitution of a body with the task of planning, articulating, and coordinating integrated actions between them (https://acafe.org.br/site/, retrieved in July 15, 2019). Therefore, COMUNG comprises fifteen universities, and ACAFE comprises eleven universities and five university centers.

Thus, the estimated population of companies in incubators and technology parks at COMUNG and ACAFE is 682, among those classified in the pre-incubated, incubated, and graduated phases. From this population, we defined the sample size. For greater accuracy in estimating the minimum sample size, the software G*Power® version 3.1.9.4 was used (Faul, Erdfelder, Lang, & Buchner, 2007). The parameters adopted for a predictor were 80%, with a significance level of 5% (0.05) and a mean effect (f2) of 0.15 (Hair, Risher, Sarstedt, & Ringle, 2019). Thus, using the "a priori" statistical power, the value of 55 responses was obtained; Nevertheless, based on twice that number for greater consistency of the model (Ringle, Silva, & Bido, 2014). Therefore, the obtained sample of 132 responses has statistical power to verify the hypotheses established in this study.

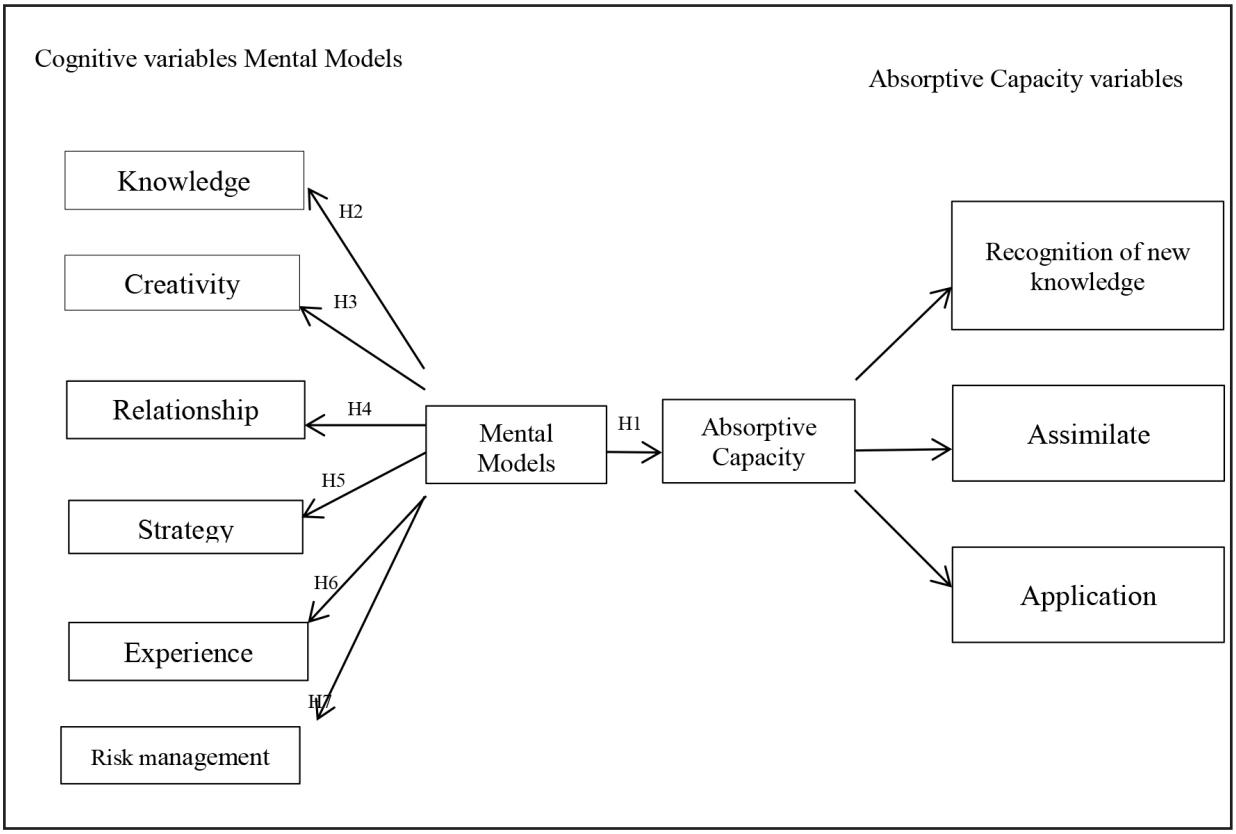
Entrepreneurs who have their companies incubated in the innovation and technology centers of COMUNG and ACAFE were considered research subjects. In this study, we have assumed that the entrepreneur's characteristics impact the company's management. Since a person's behavior and decisions reflect their characteristics, considering the influences of the business environment with its unexpected events (Bressan & Toledo, 2013).

3.2 Measurement of variables and research construction

The instrument for data collection was a closed questionnaire consisting of 51 questions with a Likert-type scale of seven points, with 1 for totally disagree and 7 for totally agree. It was structured with the help of the Google Forms® tool and sent to the e-mail list of incubated companies. The link was sent to the coordinators of the innovation and technology centers at Comung and the Acafe System and forwarded to the entrepreneurs.

As an independent variable, we have the set of six cognitive variables of the mental models: knowledge, creativity, relationship, strategy, experience, and risk management. For measurement purposes, the set of cognitive variables was elaborated from the literature, considering the possible positive influence on organizational absorptive capacity. Figure 1 presents the conceptual model and research hypotheses.

Figure 1 – Conceptual theoretical model and research hypotheses



Source: Prepared by the author based on research data (2017)

We considered the three capacities (recognition, assimilation, and application) to measure the dependent variable ACAP, according to the approach proposed by Cohen and Levinthal (1989, 1990) and Lane, Koka, and Pathak (2006). We used the following references: Cadiz, Sawyer and Griffith (2009), Cappellari (2017), and Enkel, Heil, Hengstler and Wirth (2017) to prepare the data collection instrument.

The instrument underwent validation by two experts to investigate possible ambiguous or difficult-to-understand items, allowing the elimination or inclusion of new items and ensuring the effective structuring of the questions (Devellis, 2016). The experts recommended significant adjustments concerning the questions' verbal agreement since the company is considered the social body of the entrepreneur, that is, as an immediate reflection of the leader's personality (Bazzo, 2011).

3.3 Data analysis procedures

The theoretical relationships investigated in the research were analyzed through Structural Equation Modeling (SEM) (Ringle, Silva, & Bido, 2014) to answer the established hypotheses. For analysis of the measurement model[1] with the SEM technique, the SmartPLS® software version 3.2.8 was used. The use of Smart-PLS in SEM is based on a set of non-parametric evaluation criteria, employing procedures such as *bootstrapping and blindfolding* for the evaluation of the measurement model of the measures of the constructs (convergent and discriminant validity and internal and composite reliability) and of the structural model[2] (size and significance of path coefficients [path], predictive validity of the model [R^2], and effect sizes [F^2]) (Hair, Hult, Ringle, & Sarstedt, 2013).

The first hypothesis to be evaluated deals with the influence of mental models on organizational absorptive capacity. The other hypotheses suggest the influence of cognitive variables: knowledge, creativity, relationship, strategy, experience, and risk management on organizational absorptive capacity.

1 Measurement model (also referred to as external model - outer model), which report the relationships between constructs and indicator variables (Hair et al., 2014).
2 Structural model (also called inner model), which highlights the relationships (paths) between the constructs (Hair et al., 2014).

Thus, two reflective models were estimated to meet this research's hypotheses because of the impossibility of establishing hypotheses in which the indicators are related. Although the present hypotheses relationships between latent variables (VL), they must be understood as indicators when used to measure the second-order LV (Garver & Mentzer, 1999). Thus, the first model includes second-order latent variables and intends to respond to hypothesis H1. The second model includes first-order latent variables (VL) and seeks to respond to hypotheses H2, H3, H4, H5, H6, and H7. Next, we present the analysis and discussion of the research findings.

4 ANALYSIS OF RESULTS

4.1 Sample characterization

A total of 132 companies belonging to the innovation centers of COMUNG and the ACAFE System took part in the study. We found that most of the participants were in the situation of incubated companies, making up 50% (65) of the sample of this study. At this stage, the company supports the enterprise's development by promoting favorable conditions for its growth, followed by graduated companies with 25% (34).

After being strengthened for a certain period, companies entering the market may or may not maintain the link with the incubator. Pre-incubated companies are represented by 25% (32), a stage in which companies are encouraged to develop their business potential, benefiting from sponsorship to start the enterprise effectively.

As a segment of activity, the largest representativeness (45 companies) of the sample studied was Information Technology (IT), with the development of management software, hardware, and digital solutions. The industry sector also presented representation and health, communication, and services, among others mentioned.

4.2 Evaluation of the measurement model – 1st estimated model (H1)

The estimated model (H1) was evaluated for its convergent validity (Average Variance Extracted - AVE), reliability, and discriminant validity (Fornell-Lacker criterion and cross-loadings), recommended by Hair et al. (2013) for reflective models.

Table 2 – Correlation matrix, discriminant validity (Fornell-Larcker criterion), AVE e CR – 1st estimated model

VL 1st order	1	2	3	4	5	6	7	8	9
1. APL	**0.814**								
2. ASS	0.622	**0.790**							
3. CONH	0.417	0.566	**0.735**						
4. CRIAT	0.595	0.679	0.479	**0.720**					
5. ESTRAT	0.339	0.435	0.314	0.563	**0.737**				
6. EXPER	0.454	0.635	0.555	0.705	0.458	**0.802**			
7. GESTRISC	0.568	0.743	0.603	0.678	0.530	0.709	**0.786**		
8. REC	0.518	0.682	0.399	0.624	0.389	0.473	0.595	**N/A**	
9. REL	0.379	0.325	0.506	0.353	0.323	0.280	0.282	0.201	**0.768**
CR	0.907	0.892	0.822	0.841	0.825	0.843	0.865	1	0.877
AVE	0.663	0.624	0.541	0.519	0.544	0.643	0.618	1	0.590
VL 2nd order	1	2							
1. ACAP	**0.847**								
2. MODEL	0.776	**0.718**							
CR	0,884	0,86							
AVE	0,719	0,52							

Source: Elaborated by the authors based on the research data (2019)

Notes. N/A = not applicable
Correlations equal to or greater than |0.126| are significant at 5%, and correlations equal to or greater than |0.166| are significant at 1%.
The square root of the AVE is distributed along the main diagonal, in bold.
The Fornell-Larcker criterion is not applicable to constructs measured with a single indicator (SARSTEDT; RINGLE, 2010).

This validation process observed the factor loading coefficients for each first and second-order LV indicator. As parameters for the first estimated model, factor

loadings >0.6 were maintained, according to Hair et al. (2013). For optimization and objectification purposes, Table 2 presents the correlation matrix. On its diagonal, the values refer to the discriminant validity (Fornell-Larcker criterion) and the AVE and CR values of the order of the first and second-order variables.

The AVE values of the APL, ASS, CONH, CRIAT, ESTRAT, EXPER GESTRISC, REC, and REL indicators reached values >0.50. For the CR of the first order, LV values >0.70 were obtained, with the variable with the highest value being APL, with 0.907. Also, the analyzed data presented statistical normality for the second order VL, ACAP, and MODEL. The reliability indicators were higher than 0.50 for AVE and >0.70 for CR.

In the first analysis for the discriminant validity, cross-loadings were considered. It is possible to verify that the indicators of the first and second-order LVs have higher values relative to the corresponding ones, which ensures their discriminant validity. For the analyzed constructs in which the criteria were met, we inferred that the assertions are effectively observable indicators proposed in this research.

In addition to this analysis, Hair *et al.* (2009; 2013) emphasize using a second criterion, the Fornell-Larker, where the values on the main diagonal must be higher than the values in the respective rows and columns (correlations), evidencing the presence of discriminant validity.

Thus, the correlations between the VL, in which it is possible to verify that they are smaller than the square root of the AVE (indicators have a stronger relationship with its VL than with the other VL), confirming the discriminant validity (Table 2). After conducting the measurement step of the first reflective model, we proceed to the analysis of the structural model and the realization of the H1 hypothesis test.

4.3 Evaluation of the structural model – 1st estimated model (H1)

The analysis of the structural model seeks to verify the statistical validity and confirm the adequacy of the measurement model, attesting to the significance of the

relationships between the study constructs and the confirmation of the hypothesis. Table 3 shows the results of the path, t-value, p-value F^2 and R^2 tests.

The level of significance, the t-value of the VL, is more significant than 1.96, demonstrating that the model is adequate and with a significance level of 5%. For structural relationships of H1, the f^2 of 1.515 was >0.35. The reference value of 0.02 is considered minor, the value of 0.15 is considered medium, and the value of 0.35 is considered significant (Hair et al., 2013). Next, we present the tests for the second estimated model.

Table 3 – Structural Model Results – 1st Estimated Model

Hypothesis	Structural Relations	f^2	Structural Coefficient	Standard Error	t-value	p- value	R^2
H1	Model -> ACAP	1.515	0.776	0.032	24.177	0.000	0.602

Source: Elaborated by the authors based on research data (2019)

Notes. P-values estimated by bootstrapping with 5000 repetitions

4.4 Evaluation of the measurement model – 2nd Estimated Model (H2, H3, H4, H5, H6 e H7)

Tests were performed for CVA for this >0.50 and CR >0.70, as Hair et al. (2009, 2013) recommended. We eliminated indicators with factor loadings >0.6 (Hair et al., 2013). Continuing, Table 4 presents the correlation matrix of the second estimated model, where, on the diagonal, are the values referring to the discriminant validity (Fornell-Larcker), as well as the values of AVE and CR.

As seen for the first order LV, all indicators reached values >0.50 for AVE and >0.70 for CR. The existence of discriminant validity (cross-loadings) in the second model, considering the Fornell-Larcker criterion, where the values of the square root of the AVE are higher than the values of the existing correlation between the cognitive mental models' variables and ACAP, we infer the discriminant validity. Next, we present the analysis of the structural model, as well as the tests of hypotheses H2, H3, H4, H5, H6, and H7.

Table 4 – Correlation matrix, discriminant validity (Fornell-Larcker criterion), AVE and CR - 2nd estimated model

VL 1st order	1	2	3	4	5	6	7
ACAP	**0.751**						
CONH	0.557	**0.818**					
GESTRISC	0.742	0.498	**0.788**				
CRIAT	0.687	0.548	0.672	**0.726**			
ESTRAT	0.477	0.308	0.550	0.578	**0.723**		
EXPER	0.585	0.317	0.709	0.704	0.456	**0.807**	
REL	0.357	0.296	0.246	0.349	0.299	0.233	**0.737**
CR	0.912	0.858	0.867	0.845	0.810	0.848	0.875
AVE	0.565	0.669	0.621	0.527	0.523	0.651	0.542

Source: Elaborated by the authors based on research data (2019)

Notes. Correlations equal to or greater than |0.126| are significant at 5%, and correlations equal to or greater than |0.166| are significant at 1%.
The square root of the AVE is distributed along the main diagonal, in bold.

As seen for the first order LV, all indicators reached values >0.50 for AVE and >0.70 for CR. The existence of discriminant validity (cross-loadings) in the second model, considering the Fornell-Larcker criterion, where the values of the square root of the AVE are higher than the values of the existing correlation between the cognitive mental models' variables and ACAP, we infer the discriminant validity. Next, we present the analysis of the structural model, as well as the tests of hypotheses H2, H3, H4, H5, H6, and H7.

4.5 Evaluation of the structural model – 2nd estimated model (H2, H3, H4, H5, H6 e H7)

The results of the second structural model are represented in Table 5, where it is possible to verify the VL's effect in the ACAP construct.

Regarding the evaluation of the effect size (f^2), the results revealed that the relationships of VL CONH, CRIAT, and GESTRISC with ACAP are of medium and large effect, considering that Hair et al. (2013) indicate a value of 0.15 as a medium

effect and a value of 0.35 as a significant effect. Therefore, the results suggest that the cognitive variables of the incubated entrepreneurs' mental models significantly predict organizational ACAP. Furthermore, we infer that the hypotheses H2, H3, and H7 proved adequate for the model, as they presented a t-value greater than 1.96, with a significance of 5%. After concluding this analysis stage of the two estimated models, we discuss the results.

Table 5 – Structural model results – second estimated model

Hypotheses	Structural Relations	Structural Coefficient	f^2	Standard Error	t-value	p-value
H2	Knowledge -> ACAP	0.153	0.041	0.074	**2.064**	**0.039**
H3	Creativity -> ACAP	0.250	0.058	0.101	**2.475**	**0.013**
H4	Relationship -> ACAP	0.109	0.028	0.057	1.889	0.057
H5	Strategiess -> ACAP	-0.009	0.000	0.084	0.109	0.912
H6	Experience -> ACAP	0.003	0.000	0.109	0.028	0.978
H7	Risk Management -> ACAP	0.474	0.234	0.112	**4.223**	**0.000**

Source: Elaborated by the authors based on research data (2019)

Notes. P-values estimated by bootstrapping with 5000 repetitions.

5 DISCUSSION OF RESULTS

Table 6 shows the seven hypotheses tested in this study, four of which were supported, namely, H1, H2, H3, and H7. H1 is about the influence of mental models on organizational ACAP, and hypotheses H2, H3, and H7 assess the influence of knowledge, creativity, and risk management variables on organizational ACAP. Among those that were not supported is the influence of the entrepreneur's relationship, strategy, and experience in developing organizational ACAP.

As can be seen, the first hypothesis (H1), which indicated the effect of mental models on organizational ACAP, found empirical support. Through institutional/ business mechanisms, such as technological research and the interaction between

community and university, incubated companies become better prepared to transform knowledge into innovative products or services. This interaction can contribute to an increase in the competitive capacity of the new company through its innovative activities. Chen and Edgington (2005) and Belkhodja (2022) validate the supported H1 that individuals have varied aptitudes to reconfigure patterns and modify mental models to build a new understanding of knowledge acquired from external sources.

Table 6 – Validation of the researched hypotheses

Hypothesis	Structural Relations	f^2	Structural Coefficient	Standard Error	t-value	p-value	Results
H1	Model -> ACAP	1.515	0.776	0.032	**24.177*** **	**0.000**	Supported
H2	Knowledge -> ACAP	0.153	0.041	0.074	**2.064*** **	**0.039**	**Supported**
H3	Creativity -> ACAP	0.250	0.058	0.101	**2.475*** **	**0.013**	**Supported**
H4	Relationship -> ACAP	0.109	0.028	0.057	1.889	0.057	Not supported
H5	Strategy -> ACAP	0.009	0.000	0.084	0.109	0.912	Not Supported
H6	Experience -> ACAP	0.003	0.000	0.109	0.028	0.978	Not Supported
H7	Risk Management -> ACAP	0.474	0.234	0.112	**4.223*** **	**0.000**	**Supported**

Source: Elaborated by the authors based on research data (2019)

*** = significance level 1% (=>2,58)
** = significance level 5% (=>1,96)

There is substantial evidence that mental models influence decision-making since managers search for knowledge and combine strategic choices with understanding the business environment (Gary & Wood, 2011). In this context, Zhao and Parry (2012) state that knowledge is necessary to deal with the multidimensional challenges of complex organizational realities. Strategic leaders have a key role to play in preparing

their organizations for episodic disruptions. These include developing their adaptive capabilities (Adobor, Darbi, & Damoah, 2021). Knowledge also allows managers to use mental models to respond adequately in work environments, evidencing the relationship supported by the empirical part for the second hypothesis (H2). It is possible to infer that knowledge positively influences ACAP.

Based on this evidence, we emphasize universities' role in the interaction process between the community and the incubated companies. The latter constitutes an intermediary agent in this relationship to disseminate organizational and technological knowledge, promote entrepreneurial activities, and means for elaborating projects and commercialization, deriving from research and teaching.

The third hypothesis (H3) supported in this study deals with the influence of the variable cognitive creativity on organizational ACAP. Business incubators stand out as converging environments for innovation and entrepreneurship, strengthened by university-business-government relationships for local development. Therefore, creativity in these environments is a complex, multifaceted phenomenon that encompasses the construction of knowledge from several approaches. The involvement with the nature of creative thinking, the distinctive characteristics of a creative person, the development of creativity over time, and the environments most strongly related to creative activities are examples of approaches.

Confirming this hypothesis corroborates the findings of Nyilasy, Canniford and Kreshel (2013), who researched the mental models of professionals in advertising agencies. The results indicated that mental models of creativity are multifaceted and dynamically linked. Furthermore, Zhao, Jiang, Peng, and Hong (2020) state that organizational absorptive capacity depends on the interaction between organizational members when using knowledge, that is, individual creativity. They point out that improving individual creativity can also promote increased efficiency in using knowledge.

On the other hand, it was impossible to support the relationship established in the fourth hypothesis of this study (H4), which advocated the effect of the cognitive

variable relationship on organizational ACAP. For Lane and Lubatkin (1998), the ability to develop new relationships is based on the relationship with partners who have and share knowledge, not just the exchange of experiences in the market and operation. This indicator may be related to the presence of entrepreneurs within the physical space of the incubator so that it is possible to exchange experiences and create relationship ties.

Vieira, Briones-Peñalver and Cegarra-Navarro (2015) state that the impact of relational capital on absorptive capacity may depend on moderating factors such as external connectivity and technological networks. They reinforce by arguing that relational capital may depend on the company's ability to culturally adapt to changes in the organizational environment through a continuous learning process to impact absorptive capacity. Given the environment proposed by the incubators, we assume that the companies incubated there are similar in their knowledge bases and organizational structures since technological specificity is a prerequisite for incubation.

Likewise, the fifth hypothesis (H5) did not obtain empirical support in this study, whose relationship indicated the effect of the cognitive variable strategy on organizational ACAP. Although the incubator supports the incubated entrepreneurs' decision-making, many entrepreneurs still make their decisions in an emergent way. When the practice of strategic planning is neglected, the strategy has to be prepared urgently.

Hill and Levenhager (1995) consider that entrepreneurs must be able to deal with dynamic and sometimes uncertain environments. It would require them to develop a mental model of how to act in their environments and communicate their interests and goals. However, sometimes what happens is an interpretation of the environment, by the entrepreneur, in a limited way. The sixth hypothesis (H6) refers to the relationship of the influence of the experience variable on organizational ACAP, which is the third hypothesis whose established relationships did not find empirical support.

The construction of mental models is a dynamic process between the cognitive process and its network of established social relationships, which may vary over time

and according to acquired experiences (LeBoterf, 2003; Lucas & Nordgren, 2022). Corroborating the author above, Kim (1993) states that individuals' experiences lead to the development of mental models that reflect how individuals value and understand new knowledge, a link to the acquisition dimension Following (Senge, 1990), we also suggest that mental models influence how individuals see the world and affect their understanding of new knowledge.

Thus, individuals' memories play a role in the development of mental models. Memory allows individuals to retain knowledge and make judgments based on it (Kim, 1993; Lucas & Mai, 2022). In other words, past experiences and knowledge impact the intuition of innovative ideas and the search for new external knowledge. The non-support of the H5 can be linked to the experience impacts more on the acquisition dimension than on the absorptive capacity.

Organizational ACAP is based on the accumulation of experience and must be articulated and codified in knowledge (Engelman & Fracasso, 2013). We believe this finding may be related to the decisions that direct the behavior of the employee entrepreneur. The entrepreneur uses biases and previous assumptions that worked at a given moment. Abrantes, Passos, Cunha and Santos (2022) when repeating the decisions made at that moment, they are not assertive. the team effects mental model similarity, reflexivity in action, and transitional reflexivity in improvised teamsvadaptation performance and improvised team adaptation learning

The seventh and last hypothesis (H7) of this study verified the influence of the risk management variable on organizational ACAP, and the results supported its acceptance. Risk management is related to the organization's internal and external changes; therefore, entrepreneurs must identify and manage them to minimize their potential (Behling, 2019). When there is high market uncertainty, companies with high absorptive capacity can quickly perceive external changes. If they understand these changes correctly, companies will be able to find hidden business opportunities, quickly seize market opportunities and enter the market before their competitors. Thus, they

can monopolize a dominant position and reduce external risks and disadvantages caused by environmental dynamism Engelen, Kube, Schmidt and Flatten (2014).

The high absorptive capacity allows companies to redistribute existing resources and external access information quickly. It also understands the information and leverages it effectively to adapt to the unfamiliar environment (Teece et al., 1997; Zahra, Sapienza, & Davidsson, 2006). The information processing for risk recognition in new ventures occurs in two stages: selecting relevant information from the environment and evaluating this information (Yang & Zhang, 2015). Hence, contributing to organizational ACAP.

6 FINAL CONSIDERATIONS

This research aimed to analyze the effect of entrepreneurs' mental models on absorptive capacity in incubated companies. The research adopted a quantitative approach through structural equation modeling. The application of the questionnaire obtained 132 responses from incubated companies belonging to the Consortium of Community Universities of Rio Grande do Sul (COMUNG) and the Santa Catarina Association of Educational Foundations (ACAFE). From the results found, it was possible to evidence a positive effect between the cognitive variables: knowledge, creativity, and risk management in the organizational ACAP in the companies surveyed, being possible to infer how the mental models of the entrepreneurs in this sample are constituted and configured as a significant predictor of organizational ACAP development. And it would be opportune for other researchers to take into account the maturity stages of companies, as well as the segment in which they operate, gender.

The findings of this study reinforced results found in previous studies, especially about cognitive variables: knowledge, creativity, and risk management, revealing a positive effect on their relationships. Therefore, the practical application of knowledge in organizational practices is the ACAP practiced by entrepreneurs, who are directly involved in this process of knowledge absorption. Creativity refers to the ability to

generate latest ideas and creating novel solutions with creativity. It is during the creative process that entrepreneurs use mental models.

Furthermore, risk management, linked to the ability to select relevant information from the environment and evaluate it, is seen as an individual's tendency to assume or avoid risk, strongly influenced by mental models. In this study, the cognitive variables relationship, strategy, and experience did not affect organizational ACAP, which disagreed with the literature findings. The non-confirmation of such relationships may be related to the sample's specificity. They are young companies that, while internally developing their values and practices and forming a culture, entrepreneurs modify and are modified when interacting in this environment.

From this perspective, this study's main contribution is presenting a set of mental models' cognitive variables related to organizational ACAP, as pointed out by the literature. Furthermore, understanding how entrepreneurs' mental models influence organizational ACAP can help to understand under which situations an incubated venture is more likely to be successful or not in the same way, it can be essential and valuable when the growth of enterprises makes their structuring or restructuring imperative and mandatory. Also, in this task, personal characteristics and mental models can significantly influence the diagnosis and solution of management problems since their decisions will impact the enterprise's success and future.

As this is applied research with entrepreneurs of incubated companies, the study did not differentiate between the incubation phases of the companies, which is a limitation of the study. This practice, in turn, can contribute to different findings, as early-stage entrepreneurs can employ a cognitive structure to value opportunities. In addition, a more in-depth characterization of the type of enterprise, size, and activity segment can help understand the cognitive variables employed by entrepreneurs in dynamic sectors.

Although the analysis option of this study has been a quantitative approach, some of the relationships established did not find empirical support. In this way,

understanding how the relationship between the cognitive variables of the mental models of entrepreneurs occurs in organizational ACAP from a qualitative approach, may allow for in-depth observations regarding the relationships investigated in this study. Further studies are encouraged so that other cognitive variables that influence the development of ACAP can be investigated from a multilevel perspective in different segments.

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1. Definition of research problem	√			
2. Development of hypotheses or research questions (empirical studies)	√	√	√	
3. Development of theoretical propositions (theoretical work)	√	√		√
4. Theoretical foundation / Literature review	√		√	√
5. Definition of methodological procedures	√		√	√
6. Data collection	√		√	
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8. Analysis and interpretation of data	√		√	
9. Critical revision of the manuscript	√	√		√
10. Manuscript writing	√		√	

Conflict of Interest

The authors have stated that there is no conflict of interest.

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Edited by

Jordana Marques Kneipp