Innovativeness in Brazilian startups: the effect of the absorptive capacity and environmental dynamism

Carlos Eduardo Carvalho*

Universidade do Oeste de Santa Catarina – Unoesc,
Av. Nereu Ramos, 3777D – Seminário, Chapecó,
Santa Catarina, 89813-000, Brazil
Email: carlos.carvalho@unoesc.edu.br
*Corresponding author

Carlos Ricardo Rossetto

Universidade do Vale do Itajaí – Univali,
Rua João Coan, 400 – Universitarios,
Biguaçu – Santa Catarina, 88161-064, Brazil
Email: rossetto@univali.br

Andrezza Aparecida Saraiva Piekas

Universidade do Oeste de Santa Catarina – Unoesc,
Av. Nereu Ramos, 3777D – Seminário, Chapecó,
Santa Catarina, 89813-000, Brazil
Email: andrezzapiekas@gmail.com

Abstract: Considering the importance of the innovativeness for the success of the startups, we examined the relationship between absorptive capacity (ACAP), innovativeness and environmental dynamism, with a sample of 104 Brazilian startups surveyed at incubators. The structural equation modelling found several results. (1) Dynamic external environments positively influence the innovativeness of startups. (2) Dynamic environments influence firms to absorb external knowledge. (3) ACAP influence innovativeness, so greater the ACAP, greater the firm's innovativeness. (4) ACAP mediates the relationship between dynamic environments and innovativeness. The findings contribute to innovation approaches by analysing the impact of environmental dynamics, and especially by demonstrate the mediate role of the ACAP. In addition to theoretical advancement, we offer practical contributions to managers interested in intensifying their innovative practices.

Keywords: absorptive capacity; ACAP; innovativeness; environmental dynamism; innovation practices; startups; incubators; technology incubators; mediation effect; technology-based entrepreneurship; technology-based new firms; Brazil.

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Biographical notes: Carlos Eduardo Carvalho is a Doctor in Administration and Tourism from Universidade do Vale do Itajaí – Univali in 2011. He is a Full Professor at the Graduate School of Management at Unoesc. He has experience in administration, focusing on strategy, competitiveness, quantitative methods, organisational environment, entrepreneurship and innovation.

Carlos Ricardo Rossetto is a researcher with CNPq Productivity Scholarship, completed his PhD in Production Engineering from the Federal University of Santa Catarina in 1998. He is currently a Visiting Professor at the National University of San Aguntin (UNSA) and Full Professor at the University of Vale do Itajaí. He is a Professor of the Postgraduate Program in Business Administration. His research focus is on studies of environment, strategic behaviour, resources, capabilities and performance.

Andrezza Aparecida Saraiva Piekas is a Doctoral student in Business Administration from the Universidade do Oeste de Santa Catarina – UNOESC. He has PROSUC/CAPES Program Scholarship, modality I, exclusive dedication (2018–2021). He is a participant of the strategy and competitiveness research group. He develops research with emphasis in the area of strategic administration and competitiveness.

1 Introduction

The emphasis on innovation has been seen as essential to the success of the startups, new technology-based firms seeking high growth (Arantes et al., 2019), then understanding contingent factors that influence innovation is crucial in the context of these firms. Thus, understanding the relationship between the dynamism of the environment, the firm's ability to absorb knowledge and its innovation practices is relevant. In order for entrepreneurial activity to flow properly, startups need to offer innovations to the market, this requires the adoption of new knowledge, new skills and an ability to renew and reconfigure existing resources (Bergmann et al., 2004).

Absorptive capacity (ACAP) increases the speed, frequency, and magnitude of innovation, the organisational innovation increases (Lane et al., 2006; Chanal and Le Gall, 2014). Similarly, organisational innovation supports innovation in terms of product and process development, opening up new markets, and a new strategic direction (Wang and Ahmed, 2004; Chanal and Mothe, 2005; Chanal, 2012). To sustain innovation in a dynamic environment, the firm must have the capacity to renew its knowledge base (Jantunen, 2005).

Based on the theoretical perspectives of the ACAP (Zahra and George, 2002), environmental innovation and dynamism (Lumpkin and Dess, 2001), and considering innovativeness as a firm's tendency to engage and support new ideas, novelties, experimentation, and creative processes that can result in new products, services, or processes (Lumpkin and Dess, 1996), this work aims to analyse the relationship between ACAP, innovativeness and environmental dynamism, empirically tests the articulation among these constructs in a sample of more than 100 Brazilian startups. We performed quantitative research, the data collection was done from a survey applied in startups linked to the Brazilian incubators. We obtained a sample of 104 questionnaires duly answered by entrepreneurs from firms linked to 40 Brazilian technology incubators and

parks. We analyse the data from structural equation modelling. We highlight that in this research the latent construct of the environmental dynamism was evaluated as an antecedent of both the innovation and the ACAP, which was tested as an antecedent of the innovation and as a mediator of the relationship between dynamism and innovation.

Startups are companies that seek high growth through innovative, replicable and scalable business models (Blank and Dorf, 2012; Weiblen and Chesbrough, 2015). Thus, innovativeness is essential for these businesses. In Brazil, the process of emergence of high growth startups is relatively delayed in relation especially to the US, Europe, and even to other emerging countries such as China and India. According to CB Insights Report (2019), although it has gained momentum in recent years, only around 1% of startups with a market value above one billion dollars are in Brazil.

This study provides evidence that environmental dynamism is a precursor of both, the ability of technology-based firms to absorb knowledge and their innovative practices. Our findings indicate that dynamic environments lead companies to adopt more knowledge that is external and both conditions, dynamic environments and ability to absorb knowledge, lead the company to be more innovative.

The contributions of this study are two-fold. Theoretically, we advance the theory by analysing the impact that environmental dynamism exerts on the relationship between ACAP and innovation. First, dynamic environments exert a direct and significant influence on ACAP and innovativeness of the firms. Second, ACAP mediate the relationship between dynamic environments and innovativeness. ACAP embodied part of effects of the dynamic environments and accentuates it in innovativeness of the startups. As a practical contribution, this research proves and presents how startups in competitive markets build ACAP and improve their innovativeness.

2 Theoretical development and research hypotheses

2.1 Innovativeness

The innovativeness is the desire and the ability to adopt, imitate or implement new technologies, processes, and idea incorporating them into new products and services (Tajeddini et al., 2006). It is a feature that is part of the firm's culture and reflects its willingness to reach new opportunities, thus generating the capacity to innovate and then leads to effective innovations (Subramanian and Nilakanta, 1996).

Organisational innovativeness implies a proactive feature of the company, which follows certain routines and processes in order to explore new opportunities, rather than simply improving its current resources (Menguc and Auh, 2006). The authors' further state that for a company to be innovative, it needs to adopt a new mind-set that needs to be shared and disseminated throughout the organisation in order to be effective.

Shoham et al. (2012) have identified innovativeness as being a multidimensional construct. The authors found five dimensions, creativity, risk assumption, future orientation, openness to change and proactivity. In terms of creativity, the authors used a measurement scale to identify the generation and implementation of new ideas. Regarding risk-taking, it refers to the willingness of managers to commit resources to decision-making, such as competitive strategies, choice of new products and markets, and the development of new ideas. When it comes to future orientation, it is important for companies to help them adapt and innovate in rapidly changing markets. The concept of

openness to change used in this study was defined by Hult et al. (2004), who assert that this issue comes from the company culture and reflects the employees' willingness to adopt innovations. Finally, proactivity refers to activities related to increased opportunities. Proactive companies take advantage of opportunities, anticipate and act on future needs, this concept is the same used and already defined by Lumpkin and Dess (1996).

Among the studies that sought to measure innovativeness, we highlight that of Deshpandé et al. (1993) in which the authors used a 5-point Likert scale with five variables to measure organisational innovation. The items on the authors' scale were focused on identifying the timing of entry into markets and the company's technological forefront. This same scale was reapplied by the studies of Ferraresi (2010) and Tajeddini (2010). Lumpkin and Dess (1996) view innovativeness as one of the dimensions of entrepreneurial orientation as a firm's tendency to engage and support new ideas, novelties, experimentation, and creative processes that can result in new products, services, or processes. In this work, innovativeness was operationalised as the effort to launch new products and processes, a pioneer in the adoption of technologies and processes and preferential adoption of innovative and differentiated solutions.

2.2 Environmental dynamism

In general, the conceptual proposals related to environmental dynamism are based on the rhythm of changes observed in the elements of the environment. Since Thompson (1967), it is understood that environmental dynamism, seen as the unpredictable changes of the elements of the task environment, impacts the organisation. In addition, Lukas et al. (2001) understand that dynamism refers to changes in the competitive environment while Harrington and Kendall (2005) consider dynamism as the level of volatility in the competitive environment. This understanding is corroborated by Mu and Di Benedetto (2011) who understands a dynamic environment such as that delineated by rapid technological and market changes that generate uncertainty and unpredictability. Luo et al. (2001) understand dynamism as the mean of variability and unpredictability. In a similar way, recent works such as Li and Liu (2014) understand environmental dynamism as the rate of change and innovation in the industry as well as the uncertainty and unpredictability of consumer action.

The work of Harrington and Kendall (2007) considers dynamism as being one of the elements that form uncertainty, along with complexity. This relationship of dynamism to uncertainty is reinforced in the work of Lumpkin and Dess (2001), which considered dynamism as the rate of unforeseen changes in a firm's environment, and is related to the uncertainty about the ability of managers to predict future events and their impact on the firm. This latter definition is in accordance with the understanding of Lukas et al. (2001) that dynamism refers to changes in the competitive environment.

In the work of Luo et al. (2001) dynamism was seen as the average of variability and unpredictability, and in that of Harrington and Kendall (2007) as the level of volatility in the competitive environment, this volatility having diverse origins as actions of the competitors, innovations, and new entrants among others. Nadkarni and Barr (2008) use the term speed of industry, but conceptualise it in the same way that dynamism has been found in the literature, reflecting the frequency, speed of dispersion, and unpredictability of the changes.

In this study, we adopted the approach proposed by Lumpkin and Dess (2001) under which dynamism is seen as the rate of unforeseen changes in a firm's environment and is related to the uncertainty that destroys the ability of managers to predict future events and their impact organisation. The role of environmental dimensions on aspects of management has been studied by several authors. The environmental dynamism tends to influence the leadership to adopt a transformational mode and this, in turn, leads the organisation to develop innovative activities (Jansen et al., 2009).

The work of Santos-Vijande and Álvarez-González (2007) found results that more dynamic markets increase the effect of quality-oriented management systems on the firm's innovation. The results of Miles et al. (2015) show that environmental dynamism influences the strategies chosen by small companies and their strategic posture. Also, Roberts (2015) tested the hypothesis that dynamic environments would intensify the relationship between information integration and the firm's ACAP. Thus, we arrive at the following hypotheses:

H1 Environmental dynamism impacts innovativeness, the greater the dynamism of the environment, the greater the innovativeness of the startup.

H2 Environmental dynamism impacts ACAP, the greater the dynamism of the environment, the greater the ACAP of the startup.

2.3 Absorptive capacity

Recognised as a dynamic capability (Zahra and George, 2002; Wang and Ahmed, 2007), the ACAP is an interdisciplinary construct that is among the most investigated topics in the area of strategic management. The theme is characterised by a wide range of theoretical perspectives and a wealth of empirical evidence (Cohen and Levinthal, 1990; Zahra and George, 2002; Lane et al., 2006; Flatten et al., 2011). The ability to integrate ACAP with other theories promotes their diffusion (Apriliyanti and Alon, 2017).

ACAP is a mechanism by which externally acquired knowledge is recognised as valuable, assimilated and exploited (Cohen and Levinthal, 1990) by the firm with a view to improving its strategic positioning. The concept introduced by Cohen and Levinthal (1990) received contributions from Zahra and George (2002) that inserted a new dimension to the construct, which came to be considered as a set of routines and organisational processes by which firms acquire, assimilate, transform and explore knowledge.

Cohen and Levinthal (1990) proposed that recognition of the value of external knowledge is the first component of ACAP. Before acquiring knowledge, the firm needs to recognise the value that the new knowledge represents. Zahra and George (2002) emphasise that the effort to acquire knowledge is mediated by three attributes, intensity, speed, and direction. Intensity and speed can determine the quality of a company's acquisition capabilities, the greater the effort, the faster the enterprise will build the required capabilities, but there are speed constraints as learning cycles cannot be reduced. The direction, in turn, can influence the ways that the company follows to obtain external knowledge. Considering that organisational memory is connected to experience (Zahra and George, 2002), there is a tendency for firms to seek new knowledge based on past experience, so ACAP is a "path dependence" capability.

The assimilation of knowledge refers to the processes and routines that allow the firm to analyse, process, interpret and understand the information obtained externally. This

capability may not be developed for a number of reasons, such as the fact that the new information is outside the search zone, involves a heuristic understanding that differs from those used by the firm or is closely related to a particular unfamiliar context (Zahra and George, 2002). The knowledge transformation proposed by Zahra and George (2002) denotes the company's ability to develop and refine the routines that facilitate the combination of existing knowledge with newly acquired and assimilated knowledge. This transformation changes the character of knowledge and helps to "open the black box" of the firm, organisational transformation, and strategic change.

The exploitation of knowledge, that is, its application, reflects the firm's ability to refine, extend and leverage existing competencies or create new competencies incorporating the knowledge acquired and transformed into its operations. The exploitation of knowledge requires the sharing of knowledge among the members of the firm as a way to promote mutual understanding and understanding of the new. However, structural, cognitive, behavioural, and political barriers can stifle this process of knowledge sharing. It is for the organisation, therefore, to create formal and informal mechanisms to facilitate the distribution of knowledge within the organisation and between organisations (Camisón and Fóres, 2010; Todorova and Durisin, 2007).

Despite the abstract, intangible and difficult to measure (Szulanski, 1996) essence, interest in the subject is growing. ACAP has been explored in conjunction with other theories (Apriliyanti and Alon, 2017) and operationalised by numerous studies such as Jimenez-Barrionuevo et al. (2011) and Ferreras-Méndez et al. (2016). In general, the studies seek to clarify the conditions under which ACAP can influence organisational results. We acknowledge, however, that even though it originated in the context of firms, its research has also been operationalised in more complex contexts such as countries and regions (Mason et al., 2009), creating new gaps to be investigated.

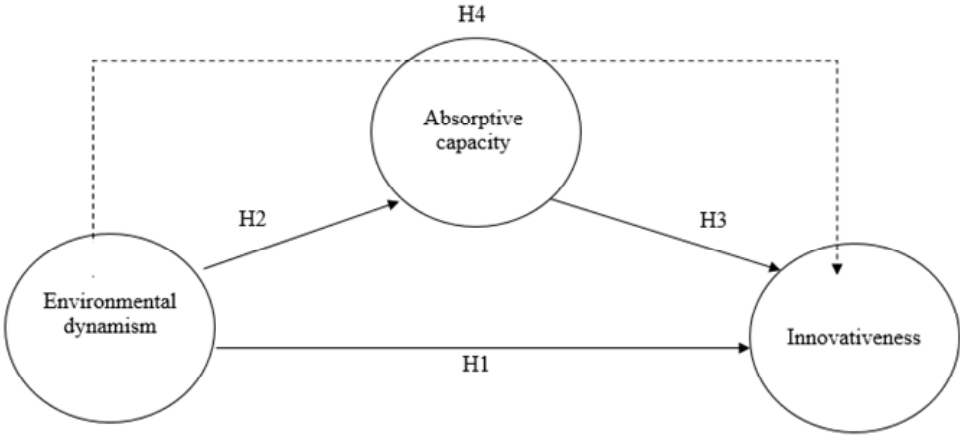
The influence of specific determinants of ACAP was studied by several empirical investigators (Vinding, 2006), yet most of them did not measure ACAP's direct influence on innovation. Rarely, studies have highlighted the importance of ACAP as a variable that influences new products (Smith et al., 2005). As knowledge can be developed internally or acquired from outside sources, innovation must also explore components of ACAP (Zahra and George, 2002). As new knowledge derives from internal and external sources, it is important to study the impact of both sources to facilitate orientation towards innovation (Sofka and Grimpe, 2010). Talke et al. (2010) and van den Bosch et al. (2011) argue that research should be developed to answer how and in what way ACAP impacts on innovation. From this, H3 suggests that:

H3 ACAP impacts on innovativeness, the larger the ACAP the greater the innovativeness of the startup.

Given that the importance of resources comes from their effective configurations and results from the rapid response to changes in the external environment (Su et al., 2013b), it is noted that changes in context have effects on the relationship between ACAP and product innovation orientation. Zhou (2006) highlights the important role the environment has, and emphasises that it can affect the relationship between ACAP and innovativeness. Eisenhardt and Martin (2000) argue that in high-speed markets, dynamic capacities are experimental, fragile processes and unpredictable results. In this way, they consider that environmental dynamism moderates the relationship between ACAP and innovativeness, that is, in environments the relationship between ACAP and innovativeness is more intense (Li and Liu, 2014).

H4 ACAP mediates the relationship between environmental dynamism and innovativeness.

Figure 1 Conceptual model of research



3 Method

To test our research model we performed a survey. The development of the questionnaire was an interactive process that began with a careful review of the literature. An initial draft of the questionnaire was discussed with fellow researchers, to ensure that the questions were correctly understood and easily answered by respondents, adjustments were necessary.

Our initial contact was made with the National Association of Entities Promoting Innovative Enterprises (ANPROTEC). From this contact, we had access to the e-mail of the manager of each of the 86 Brazilian technology incubators and parks. In the possession of these contacts, we sent e-mail to present our research and to request support of the incubators and technological parks so that the questionnaire was destined to the startups. The sample obtained had 104 questionnaires answered by managers of firms linked to 40 incubators and Brazilian technology parks.

The construction of the data collection instrument was based on the theoretical review. The research instrument was constructed on a Likert scale of seven points. In the first part of the questionnaire, we carried out the survey of profile information of the respondent firms, seven questions. In the next stage, the interviewees were asked to indicate issues related to environmental dynamism. This construct was measured from a scale developed by Carvalho and Rossetto (2014), which measures changes in components, economics, competitors, customers, suppliers, technology, regulation and sociocultural, based on seven questions.

The third part of the questionnaire listed issues addressed to ACAP. The ACAP scale included six items that measured the recognition of value, acquisition, internalisation, assimilation, recombination and the use of external knowledge. This instrument was validated by specialists who acted as judges in the evaluation of the relevance of the scale items. Finally, in the fourth part of the questionnaire, respondents were asked to identify

issues related to the company's propensity to innovate. For the innovativeness, the adapted scale was adopted from Lumpkin and Dess (2001). We measure this construct by the firm's emphasis on new products and processes, the search for pioneering products, processes and the use of technologies, and the search for different and innovative solutions.

For data analysis, we used structural equation modelling, performed after the descriptive analysis. The method is suitable for the purpose of this research because it allowed us to examine the relationships between the variables and validate the theoretical frameworks elaborated to explain these relationships. Considering the relatively small size of the sample, we use the partial least squares technique using the SmartPLS software. The tests and indicators used to evaluate the validity and reliability of the modelling of structural equations were composite reliability, Cronbach's alpha, the mean variance extracted (AVE) plus the evaluation of the estimated loads.

Finally, we tested the hypotheses proposed using a 95% confidence interval with a significance of 5%. We highlight that in this research the latent construct of the environmental dynamism was evaluated as an antecedent of both the innovation and the ACAP, which was tested as a antecedent of the innovation and as a mediator of the relationship between dynamism and innovation. We used the routine of calculating the paths to measure the relations between the constructs, as well as the calculation of the coefficient of determination R^2 to identify the effects received by the endogenous constructs of the model. In addition, we perform the bootstrapping routine to calculate the T-test value of each calculated path. To test mediation effect, we follow the routine proposed by Hair et al. (2014) using the indicator of variance accounted for (VAF), above 0.20 as partial mediation, and above 0.80 to fully mediation.

4 Presentation and discussion of results

The sample was characterised by startups in which an average of 4.3 people work. These startups have been incubating on average for 12 months, and as for the developmental stage, the majority are between the implantation stage, with 38.5% and growth, with 21.2%. The collected sample involved incubated companies of origin of all the Brazilian regions, but with a great concentration in the South region, with the States of Santa Catarina and Rio Grande do Sul accounting for 39% and 23% of the sample respectively. There were 34 cities represented, and the city that contributed the most startups was Porto Alegre, with 12% of the sample. The main sectors of activity of the sample companies are IT/communication, management technology, mechanics/mechatronics, biotechnology, electronics, and social technology, which together represent 76% of the sample.

The descriptive values of the measures of dynamism can be observed in Table 1. In the perception of the companies of the sample, the component of the competitive environment in which these are inserted that has presented more dynamism is the technology, followed by the changes in the economic conjuncture.

Table 2 shows the descriptive measures of ACAP indicators. On a scale of 1 to 7, we can identify that firms perceive their ACAP relatively high, with measures ranging from 5.70 to 5.90.

Table 1 Descriptive values of dynamism

Item	*Mean*	*Standard deviation*	*Curtosis*	*Asymmetry*
Dyn economy	5.14	1.616	–0.453	–0.619
Dyn customers	4.69	1.488	–0.43	–0.301
Dyn competitors	4.12	1.56	–0.591	0.039
Dyn suppliers	4.08	1.349	–0.488	–0.094
Dyn adjustment	4.11	1.822	–1.188	–0.042
Dyn technology	5.34	1.641	–0.636	–0.652
Dyn social	4.93	1.639	–0.589	–0.552

Source: Prepared by the authors.

Table 2 Descriptive values of ACAP

Item	*Mean*	*Standard deviation*	*Curtosis*	*Asymmetry*
ACAP identification	5.70	1.069	–0.688	0.675
ACAP acquisition	5.87	1.124	–1.403	2.853
ACAP internalisation	5.70	1.222	–1.133	1.618
ACAP assimilation	5.79	1.180	–0.917	0.315
ACAP recombination	5.87	1.308	–1.473	2.035
ACAP application	5.90	1.153	–1.125	1.325

Source: Prepared by the authors.

Finally, Table 3 presents the descriptive measures of the innovativeness indicators. There is a relative perception of high innovativeness by the companies, and the measures averaged between 5.67 and 5.91, and the highest measure was that relative to the company's emphasis on seeking different solutions to the problems they face.

Table 3 Descriptive values of innovation

Item	*Mean*	*Standard deviation*	*Curtosis*	*Asymmetry*
Innov new products	5.74	1.372	–1.103	0.749
Innov new processes	5.82	1.205	–0.998	0.514
Innov first prod/proc	5.67	1.410	–1.028	0.35
Innov pioneering tec/proc/prod	5.83	1.325	–1.155	0.713
Innov different solutions	5.91	1.150	–1.117	0.791
Innov innovative solutions	5.83	1.397	–1.298	1.176

Source: Prepared by the authors

After descriptive analysis, we constructed the modelling of structural equations using the partial least squares technique in the software SmartPLS 2.0. The original model presented only one validation problem for the dynamism construct, this construct obtained the AVE of 0.47 and the indicator DynReg having had a load below 0.500 in the construct. This indicator was withdrawn and a new analysis was performed.

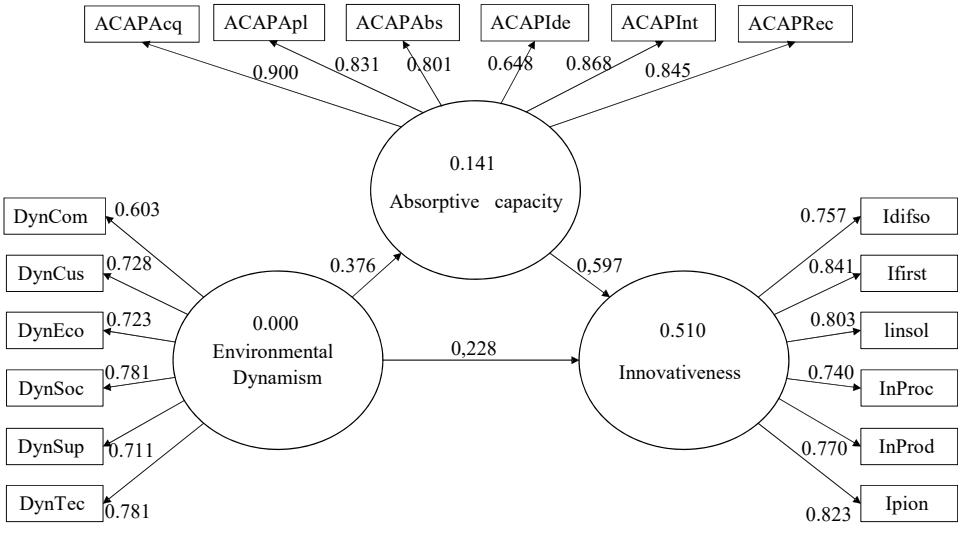
Table 4 The results of the measurement validation tests

Item	*AVE*	*Composite reliability*	*Cronbach alpha*
ACAP	0.672	0.924	0.900
Dynamism	0.525	0.868	0.827
Innovativeness	0.624	0.908	0.879

Source: Prepared by the authors

Figure 2 presents the tested model and its respective loads. We identified that the value of the R^2 coefficient of the innovativeness construct was 0.510, showing that 51% of the variance of this construct was explained by the variance of the other two constructs. By performing the t-test, through the bootstrapping routine with 1,000 subsamples, we identified that all measures of the measurement model had a value greater than 1.96, which all characterise them as significant with a value of $p < 0.05$. In relation to the values of the test t for the measures of the structural model, we identified that the relation between dynamism and innovation presented significance (t-test = 2.993, $p < 0.01$). The relationship between dynamism and ACAP was also significant (t-test = 4,185, $p < 0.001$) as well as the relationship between ACAP and innovation (t-test = 8.711, $p < 0.001$). Thus, both the measurement model, characterised by the measurements of the indicators, and the structural model, characterised by the relationships between the constructs, were validated.

Figure 2 Structural model tested, containing the path loads



Source: Prepared by the authors.

The mediation test predicted in Hypothesis 4 was carried out by first calculating the effect of dynamism on innovativeness, the value of this path is calculated as 0.466, with a determination coefficient R^2 of 0.217, and its t-test value was 7.135, meaning that the effect of dynamism on innovativeness exists, is positive and significant. The second step was carried out with the inclusion of the ACAP construct as a mediator of the relation. In this case, the value of R^2 increased to 0.510, thus increasing the power of explanation of

the model. The dynamism construct continues to have a significant effect on the construct innovation, that is, although the ACAP construct receives the effect of the construct dynamism and works as a mechanism for increasing the innovativeness, however, its insertion in the model did not take for itself the whole effect of the dynamism. According to Hair et al. (2009) for full mediation, the mediator construct should take to itself the significant effects of the exogenous construct, which was not the case in this study. So, in this case, ACAP partially mediates the relationship between dynamism and innovation.

Table 5 presents the hypothesis of the study and its validation.

Table 5 Validation of tested hypotheses

Hypotheses	*Status*
H1: ACAP positively impacts on innovation innovativeness	Supported
H2: Environmental dynamism impacts ACAP	Supported
H3: Environmental dynamism impacts innovativeness	Supported
H4: ACAP mediates the relationship between dynamism and innovativeness	Partially supported

Source: Prepared by the authors.

The proposed H1 hypothesis where the environmental dynamism affects the innovativeness was also supported. The idea that dynamic environments lead firms to innovativeness is empirically supported by several works, such as the study by Baron and Tang (2011) that confirmed the influence of environmental dynamism on the innovativeness of North American firms. By testing this relationship in European companies, Kohlbacher et al. (2013) accepted identical results.

This evidence is consistent with that found by Jiao et al. (2011). The authors studied technology companies in China and found that an increase in dynamism has an effect on firms' innovation rate, for the authors, this is especially due to the need for firms to generate new products and processes to survive in dynamically competitive environments. Similarly, Zulu-Chisanga et al. (2016) studying companies in the UK found that turbulent environments force firms to engage in new product development to meet new consumer demands.

Also studying Chinese companies, Li and Liu (2014) identified that the greater the degree of change in the environment of a particular industry, the more relevant is the adoption of innovation strategies. The study by Cingöz and Akdoğan (2013) identifies the relationship between environmental dynamism and innovation performance. This set of research shows that both firms located in developed and emerging countries, as well as firms in technology-intensive sectors and firms in other segments, being exposed to a higher level of environmental dynamism, tend to be more innovative.

In the sequence, the hypothesis H2 was tested where the environmental dynamism impacts ACAP. This hypothesis was supported.

This finding is in line with the literature on environmental uncertainty, complexity, and dynamism that advocates that organisational survival in more dynamic environments will force firms to be more able to absorb knowledge (Li and Liu, 2014; Roberts, 2015). Dynamic environments require firms to develop their potential ACAP to minimise their risk of obsolescence (De Noni et al., 2013).

Vasudeva and Anand (2011) identified an effect of technology discontinuities on ACAP in energy cell technology development companies. The work demonstrates that in

knowledge-intensive sectors, technological discontinuities are important influencers of ACAP. The results of these authors are consistent with what was found in this paper, especially considering that the sample is composed of technology-based companies hosted in incubators, accelerators and technology parks. The proposed H3 hypothesis where ACAP has a positive impact on innovativeness was supported. Acquiring inter-organisational knowledge has become an increasingly important strategy for firms to improve their innovation levels (Xie et al., 2018). This finding is corroborated by other studies that found a positive effect by testing the effect of ACAP on innovation in different economic contexts. Absorption capacity increases the speed, frequency, and magnitude of organisational innovation (Chanal and Le Gall, 2014).

Kohlbacher et al. (2013) tested this effect in developed economies by studying companies from Central Europe. The authors concluded that ACAP impacts both process innovation and product innovation. An equivalent result was found in a study applied in an emerging economy by Dávila et al. (2018) investigated a sample of 111 firms in southern Brazil, their results confirmed the relevance of ACAP for innovation.

The H4 hypothesis was supported, it was found that ACAP partially mediates the relationship between environmental dynamism and innovation.

The mediating role of ACAP in the relationship between environmental dynamism and innovativeness has been little tested. Among the works that test this relationship, Jantunen (2005) confirms that to sustain innovation in dynamic environments, firms need to be able to renew their knowledge base. Dynamism generates highly volatile and turbulent environments, corroding existing capabilities, influencing managers to take action to transform organisational knowledge (Nadkarni and Barr, 2008).

Other works evaluate other intervening effects between dynamism and ACAP. The work of Guo and Wang (2014) tested and confirmed a moderating effect of ACAP on the relationship between environmental turbulence and the breadth of the external search for knowledge in small and medium-sized manufacturing enterprises in China. Su et al. (2013a) tested and confirmed the moderating effect of technological turbulence on the relationship between ACAP and innovativeness.

The works that test moderation assume that the moderating variable is not influenced by the independent variable, but there are elements to believe that in more dynamic environments firms tend to develop their ability to recognise, acquire and apply external knowledge to their business (Li and Liu, 2014), and that these skills influence firms' innovativeness (Zahra and George, 2002).

This paper demonstrates the ACAP as a partial mediator of the relationship between environmental dynamism and innovativeness. This means that part of the effects of dynamism on innovativeness is embodied in the ACAP that enhances it. Thus, firms wishing to enhance the potential for innovativeness arising from living in a dynamic environment should strive to develop their ACAP.

5 Final considerations

Our findings indicate that environmental dynamism is a precursor both to the ability of technology-based firms to absorb knowledge and their innovative practices. Therefore, dynamic external environments exert a positive influence on ACAP and on the innovation practiced by startups, what confirms our Hypotheses 1 and 2. Likewise, test confirmed the Hypothesis 3, since ACAP has proved itself as a precedent for innovation.

Therefore, dynamic environments lead companies to adopt more external knowledge and both conditions, dynamic environments and capacity to absorb knowledge, lead the company to be more innovative.

Studies that explain the innovation or innovative practices of firms by the knowledge absorption component are vast; however, this work contributes to demonstrating environmental conditions in which this cause and effect relationship is intensified. In the context of startups, which are already inserted in dynamic environments, it is possible to see that those environments in which the dynamism is even more intense influence both the absorption of knowledge and the innovative posture of firms.

The contributions of this study are two-fold. First, considering that the work identifies elements that influence innovation is still at an early stage, confirming that dynamic environments exert a direct and significant influence on firms' innovation can be seen as a theoretical contribution. When choosing to study these relationships in startups we attend to a lack of studies on the ACAP in this type of firm.

The research demonstrates that exposure to more volatile and turbulent environments generates opportunities for the adoption of innovative posture and that being open and intensifying actions of search and internalisation of external knowledge favours the translation of these external opportunities into innovations. This is characterised as a practical contribution by demonstrating that startups in competitive markets tend to improve their knowledge absorption processes and consequently their innovativeness.

Second, mediating the relationship between dynamism and innovation, the ability to absorb knowledge shows that companies can use it as a mechanism through which they take advantage of the environmental dynamics. That is, when companies perceive their dynamic environment, especially economic and technological changes tend to adopt strategies that allow them to turn these changes into opportunities. Especially in startups, which are naturally willing to grow rapidly, the absorption of knowledge must be embedded in this strategic process of transforming environmental change into opportunities for the firm.

This research has some limitations that can be seen as opportunities for future studies. Our relatively small sample has prevented us from testing the contingent effects of the performance sectors, as well as the maturation stage of the startups in the relationships studied. Thus, future researches address this limitation by obtaining larger samples. As a guide for future studies, we consider that studying specific sectors or carrying out comparative studies between sectors can be an opportunity to advance in the literature.

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