Organizational learning capacity of startups in Northeast Brazil

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Abstract

Purpose – This empirical and exploratory study analyzed the role of interaction with the innovation environment and of the organizational learning capacity (OLC) development stage in startups in Northeast Brazil based on the perception of managers of these companies.

Design/methodology/approach – This was a quantitative study. Questionnaires were sent electronically to the managers of startups in the nine states of Northeast Brazil. A total of 54 managers participated, composing a non-probabilistic sample. The data collected were analyzed by multiple linear regressions.

Findings – The results obtained seek to evidence whether the interaction of startups in Northeast Brazil with the startup ecosystem and the development stage in which these companies are found are associated with OLC. The results confirmed the hypothesis that higher startup development stages are positively associated with higher levels of OLC in the sample. A negative association was identified between the manufacturing startup type and the OLC level, and the level of interaction with the innovation environment was still infrequent.

Research limitations/implications – This study contributes to the literature on the determinants of organizational learning and to startup managers who wish to more effectively promote this learning. Implications of the findings are discussed.

Practical implications – This study contributes to the literature on the determinants of organizational learning and to startup managers who wish to more effectively promote this learning. Implications of the findings are discussed.

Originality/value – Studies on Brazilian startups are still relatively scarce, especially studies that focus on learning capacity. No other studies addressing the hypotheses tested here were found.

Keywords Innovation ecosystems, Mechanisms for generating innovative ventures, Organizational learning, Interaction, Company size

Paper type Research paper

1. Introduction

A new movement for the creation of innovative ventures emerged at the beginning of this millennium: startups. Startups experienced significant growth between 1990 and 2000, driven by the strong expansion of the Internet, which stimulated the creation of the so-called dot-com companies (Felizola, 2016). There is no consensus on the concept of a startup, but a proposed definition widely used among entrepreneurs is "a temporary organization designed to search for a repeatable and scalable business model" (Blank, 2013, p. 5).

Over the years, motivated by the performance of companies such as Facebook, Google and Uber, many individuals with an entrepreneurial mindset started to bet on this business model

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because they envisioned the potential for profitability and the apparent little initial complexity of its structure. However, in addition to positive expectations, what exists is a high rate of failure of these businesses (Arruda, 2014), and, consequently, entrepreneurs need to learn how to manage the few resources they have to ensure the sustainability of their company (Tumelero, dos Santos, & Kuniyoshi, 2016).

Associated with the entrepreneur's action, the institutional apparatus (such as components linked to the public sector, universities and financial agents) is considered fundamental for achieving good results in actions toward economic development through innovation (Santos & Santana, 2012). Lundvall (2007) explains that it is the dynamism of the interactions between the structure composed by this apparatus and the companies that benefit from this structure that provides the learning necessary for a given location to become more innovative (Lundvall, 2016).

This interaction is expected to help companies develop the capacity to learn and relearn, and this learning process favors the construction of new knowledge (Johnson & Lundvall, 2005), for which the systemic, dynamic and specific nature of the context in which innovation should be developed must be considered (Lastres & Cassiolato, 2017). In the specific scenario of startups, experts argue that entrepreneurs must be even faster in this learning process (Blank, 2011) and must be capable of generating a higher level of learning because it is considered that the main objective of startups is to "learn to develop sustainable businesses" (Ries, 2012, p. 12). In this context, specific public policies were developed in Brazil to provide conditions for the development of startups. These policies were enacted by making available structures for prototyping, consulting with management and fundraising experts, interaction and networking and, sometimes, financial resources to invest in technologies and qualified human capital. Such practices take place within spaces defined as innovation habitats or startup ecosystems (Audy & Piqué, 2016; Conselho Nacional de Cientifico e Tecnológico [CNPq], 2018; Inovativa Brasil, 2018).

At the regional level, efforts by municipal and state governments were identified, through agencies such as the Brazilian Support Service for Micro and Small Businesses (Serviço Brasileiro de Apoio às Micro e Pequenas Empresas – SEBRAE) and the Bahia Startups Association (Associação Baiana de Startups), to stimulate local development through the construction of a startup ecosystem capable of increasing the competitiveness of these companies. Examples of these programs are the InovAtiva Brasil Program, the Brasil Startup program and the Edital de Inovação para a Indústria (Notice of Innovation for Industry) (CNPq, 2018; Serviço nacinal de aprendizagem industrial, 2017; Inovativa Brasil, 2017).

Participation in such programs is aimed at facilitating the transformation of creative projects into economically viable products or services and is stimulated by institutions composing the innovation environments existing in Brazil, with the goal of increasing the competitiveness of companies located in their states of origin (CNPq, 2018).

There are observed disparities in the regional distribution of the companies that received the aforementioned program benefits in the years evaluated. In a preliminary analysis of the programs through collection of secondary data published on their websites, it was identified that of the nearly 800 startups that were selected to access the benefits between 2012 and 2017, less than 2% were from the North region, 5.8% were from the Central-West region, 17% were from the Northeast region, 21% were from the South region and approximately 48% were from the Southeast region of Brazil. It was not possible to evaluate whether these results were associated with a lack of initiative to participate in the programs, lack of knowledge about the public notice, difficulties meeting the selection criteria or complex selection policies.

Given this regional scenario, it becomes interesting to determine whether there is, at the regional level, an association between (1) the level of interaction with the startup ecosystem and (2) the startup's stage of development with the organizational learning capacity (OLC). According to Lundvall (2007), OLC is necessary for a company to innovate.

Given the above considerations, the following research question was defined: Is the interaction of startups in Northeast Brazil with the startup ecosystem and their development stage associated with OLC? The real problem to be solved by this study is, therefore, to determine whether specific variables affect the learning capacity of startups. This is an important research problem, especially due to the relationship between OLC and innovation performance and organizational performance.

Several studies have established that innovation is related to organizational learning and that innovation can be a trigger for better operational results (Calantone, Cavusgil, & Zhao, 2002; Alegre & Chiva, 2008; Jiménez-Jiménez & Sanz-Valle, 2011; Alegre, Lapiedra, & Chiva, 2006). The objective of the present study was therefore to investigate how the interaction of startups in Northeast Brazil with the startup ecosystem and how their developmental stage is associated with the OLC level based on the perception of their managers. This study aims to contribute to the literature that addresses the factors that determine OLC by proposing and verifying, with empirical data, an original conceptual model. This model is presented in the methodology section. This study also aims to contribute to managerial practice in the context of startups because managers of such companies could focus on developing or improving their performance in variables that are significant for a higher OLC, which contributes, as explained, to their innovation and operational performance.

2. Theoretical framework

This section presents the theoretical perspectives guiding the study. In addition, considerations about the main constructs used and how they relate to each other are explored in subsections that lead to the definition of the hypotheses to be tested.

2.1 Choice of theoretical lenses

This study is based on the neo-Schumpeterian approach that understands the company within an evolutionary perspective in which it is considered an organism in constant transformation and for which innovation is obtained through the identification of an opportunity by an entrepreneur able to transform it into profits (Burlamaqui and Proença, 2009). Still grounded on this view, the study is influenced by the approaches of learning economics and innovation systems, in which innovation is interpreted as a process that depends on learning promoted through the interaction between companies and the structure with which they relate (Freeman & Soete, 2008; Lundvall, 2007, 2016).

Based on the choices presented, it was decided to analyze the interaction with the startup ecosystem from inside out, that is, from the core of the system to its structure, because, as Johnson and Lundvall (2005) explain, despite the difficulties in accessing information from companies, especially in developing countries, it is very important to analyze this information because these are learning organizations that affect the environment through the synthesis and reconfiguration of new knowledge (Galunic & Rodan, 1998). For this reason, it was defined that the study in question will be conducted from the perspective of the startups, through managers, whether they are a partner or not, because it is understood that such individuals are the subject capable of offering information closest to the reality experienced by the studied companies.

In this study, we chose to work with the OLC concept, which, according to Alegre and Chiva (2008, p. 315), comprises the "bundle of tangible and intangible resources or skills the firm uses to achieve new forms of competitive advantage."

2.2 Startup development stages

There is no consensus on how to classify the development stages or life cycle stages startups can undergo. According to Silva, Medall, Bertolin, Stroher and Moura (2016), the typical

criterion used is very subjective. Such classifications depend on the interpretation given by development agents to innovation entrepreneurship.

Casado (2012) presented a classification for the development of technology-based companies that, at times, is used for startups, which has five stages (initiation, development, growth, maturity and aging). When analyzing startups situated in incubators, Silva, Medall, Bertolin, Stroher and Moura (2016) developed a tool called the Startup Maturity Model (SMM). Based on an analysis of the company's skills, the SMM fits it into one of the five levels defined by the authors: problem and solution, business model, maturity, independence and competitiveness (Silva, Medall, Bertolin, Stroher, & Moura 2016). Oleksandr, Ganna, & Tetiana (2018) argue that understanding the development dynamics of startups can identify the main risks of investing in the business. For the authors, there are six stages a startup undergoes: seed, startup, early stage, early growth, expansion, mezzanine and exit.

Nikiforova (2018) presented a startup life cycle analysis model in which eight phases are distributed into four stages: concept, testing, working out and launch.

In Brazil, two institutions have classifications that are widely used by actors in the innovation environment. SEBRAE (2018) classifies, through its SEBRAE Like a Boss project, four startup development stages: ideation, operation, traction and star; these are preceded by the curiosity phase. Associaçao Brasileira de Startups (2018) divides the stages in ideation, operation, scaleup and traction.

According to the international institution Startup Commons, the main startup development phases are committing, validating, scaling and establishing, preceded by the ideation and conception phases (Startup Commons, 2018).

Despite the various classifications for the development stages or life cycles of startups, there is a significant conversion in most of the concepts of the various nomenclatures. They point to the understanding of stages related to formation, validation and growth (Startup Commons, 2018).

For this study, we adopted the Startup Commons' classification because it contains the convergence elements of the other interpretations presented here. Figure 1 shows the convergence of the startup development phases or life cycle, with a brief explanation of what these phases represent.

Ries (2012) explains that learning is a process that can occur in all stages of the company and becomes more evident in the growth stage, that is, when the company can scale its product. However, there are no records of tests that validate this relationship, and it is not possible to determine which variable affects the other, that is, if OLC level affects a startup's level of development or if the latter is what increases a startup's OLC; however, the considerations made so far ground the definition of the first study hypothesis:

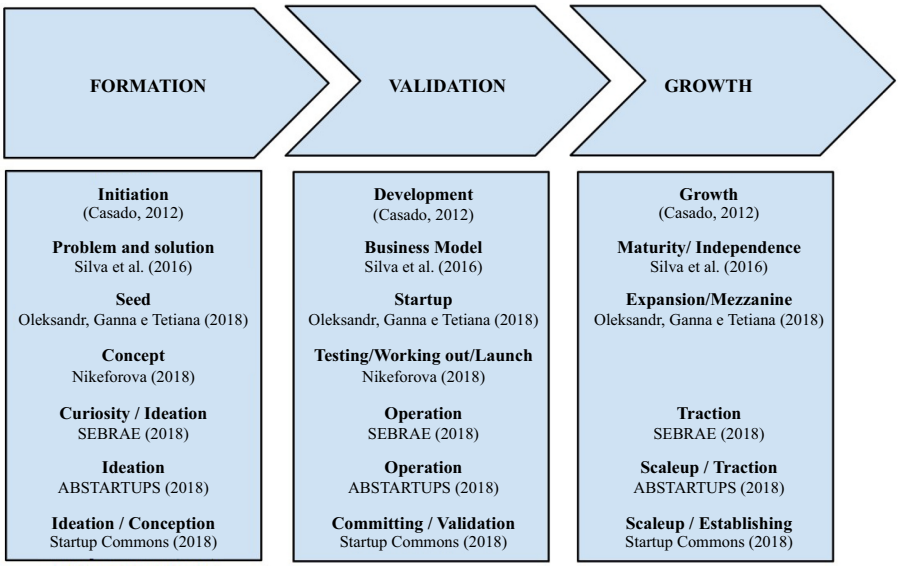
H1. Higher startup development stages are positively associated with higher OLC levels in these companies.

2.3 Startups and innovation ecosystems

The term innovation ecosystem originates from the concept of business ecosystem, and Adner (2006) was its main diffuser. Gomes, Facin, Salerno, & Ikenami (2018) point to a variety of interpretations of its meaning (Gomes, Facin, Salerno, & Ikenami, 2018). Adner (2017, p. 40) defines ecosystems as "the aligning structure of the multilateral set of partners that need to interact so that a proposition of focal value materializes."

Converging the various analyzed interpretations on the innovation ecosystem, Gomes, Facin, Salerno, & Ikenami (2018) propose the following characterization:

> An innovation ecosystem is set for the co-creation or the joint creation of value. It is composed of interconnected and interdependent networked actors, which include focal firm, customers, suppliers,



Source(s): Prepared by the authors, adapted from Associaçao Brasileira de Startups (2018); Casado (2012); Nikiforova (2018); SEBRAE (2018); Silva *et al.* (2016); Startup Commons (2018); Oleksandr *et al*. (2018)

Figure 1.
Startup development phases: convergence of meaning

> complementary innovators and other agents as regulators. This definition implies that members face cooperation and competition in the innovation ecosystem and that an innovation ecosystem has a lifecycle, which follows a co-evolution process (Gomes, Facin, Salerno, & Ikenami, 2018, p. 16).

This is the interpretation adopted by those responsible for developing public policies to encourage innovation entrepreneurship and by other agents acting in this environment (Audy & Piqué, 2016; Valkokari, 2015). In Brazil, this interpretation was translated into Decree n. 9,283/2018, subheading a of item II:

> Innovation ecosystems - spaces that add infrastructure and institutional and cultural arrangements that attract entrepreneurs and financial resources, constitute places that enhance the development of societal knowledge and include, among others, science and technology parks, smart cities, innovation districts and technology hubs (BRASIL, "Decreto 9.283, de 7 de fevereiro de 2018", 2018).

Physical spaces are fundamental for interaction and exchange of experiences, in addition to the acquisition of formal knowledge. According to Takeuchi and Nonaka (2009), people's involvement and commitment, which can be developed in groups, favor the creation of knowledge necessary to innovate. A local structure would facilitate this process (Campos, Cario, & Nicolau, 2003).

Despite the convergence regarding the interpretation that the innovation ecosystem aims to create value for society through solutions that serve end customers, companies or even the government, there are divergences as to how this environment is built and managed, and in regard to its life cycle. While Adner (2006) suggests that this environment is created from "collaborative arrangements through which firms combine their individual offerings into a coherent, customer-facing solution" (Adner, 2006, p. 2), Valkokari (2015) proposes that it must be analyzed not only as a platform but also as "structures of and relationships between interacting actors" (Valkokari, 2015, p. 18).

It is also possible to translate this structure as communities. Associaçao Brasileira de Startups (2017) understands that the ecosystem is composed of individuals and companies, both private and public, that collaborate for the creation and development of startups. In 2018 alone, the institution identified 30 ecosystems spread across Brazil that include more than 10,000 startups, and determined that the number of ecosystems can exceed 60 (Associaçao Brasileira de Startups, 2019).

Certain current public policies seek to offer conditions to increase the competitiveness of startups, offering structures for prototyping, consulting with experts in management and fundraising, interaction, networking and, sometimes, resources to invest in technologies and qualified human resources (Audy & Piqué, 2016; CNPq, 2018; Innovative Brazil, 2018). According to Schot and Steinmueller (2018), such policies are created based on an interpretative analysis that considers experiences from the past, the current context and the possibilities envisioned for the future. They are about offering the necessary support to enhance the creation of knowledge and the investment of venture capital in promising business models through the emergence of new institutional arrangements (Aranha, 2016).

The new arrangements that offer complements to public initiatives to achieve good results via actions in favor of economic development, through innovation, can be defined as mechanisms for generating innovative enterprises (Aranha, 2016; Brasil, 2018).

Decree n. 9,283/2018, subheading b of item II in article 2 defines mechanisms for generating innovative ventures as follows:

> b) Mechanisms for generating ventures - mechanisms that promote innovative ventures and support the development of nascent technology-based companies, which involve innovative businesses, based on technological differentials, and seek to solve social or environmental problems or challenges, offer support to transform ideas into successful ventures, and include, among others, business incubators, business accelerators, open co-working spaces and open prototyping laboratories for products and processes (BRASIL, "Decreto 9.283 de 7 de fevereiro de 2018", 2018).

The valorization of the environment as something capable of providing the necessary interaction for learning, through the relationships among its agents, is defended by many authors (Adner & Kapoor, 2016; Audy, 2017; Etzkowitz & Leydesdorff, 2000; Freeman, 1995; Lundvall, 2007).

Based on a reflection on the above elements, the second study hypothesis is defined:

H2. A startup's level of interaction with the startup ecosystem is positively associated with its OLC.

2.4 Learning in startups: OLC

Some authors conceive innovation as a process that develops through learning and by building new knowledge capable of solving challenges as they present themselves (Johnson & Lundvall, 2005; Alegre & Chiva, 2008). Some authors also claim that innovative organizations not only act responsively but also modify the problems and environment in which they are inserted Takeuchi & Nonaka, 2009).

In this sense, Alegre & Chiva (2008) argue that certain skills and resources at the organizational level are capable of favoring the learning process to positively influence the company. This set of skills and resources is designated by the authors as OLC.

The facilitating factors that comprise OLC are divided into five dimensions, defining skills and resources internal and external to the company: experimentation, propensity to risk, interaction with the external environment, dialog and participatory decision-making (Alegre & Chiva, 2008; Camps, Alegre, & Torres, 2011; Gonçalves & Silva, 2016).

(1) Experimentation - Companies provide support for the development of new ideas, and creativity and curiosity are welcome (Camps, Alegre, & Torres, 2011). It is also

necessary that individuals are encouraged to learn continuously (Chiva, Alegre, & Lapiedra, 2007).

(2) Risk propensity - The tolerance to error and the recognition of this as a source of learning when stimulated are understood as favorable to learning in an organization (Camps, Alegre, & Torres, 2011).

(3) Interaction with the external environment – This dimension reflects the relationship with elements external to the organization that make up the environment in which the company operates (Camps, Alegre, & Torres, 2011; Chiva, Alegre, & Lapiedra, 2007).

(4) Dialog - For Camps, Alegre, & Torres (2011), through the constant communication that occurs in everyday experiences, it is possible to build learning. Teamwork and existing diversity are understood as necessary factors for the learning process (Chiva, 2017).

(5) Participatory decision-making - For Chiva, Alegre, & Lapiedra (2007), empowering company employees to make decisions is a way to give more access to information and increase their self-esteem.

Chiva, Alegre, & Lapiedra (2007) developed an instrument to measure OLC in organizations. Since its validation with workers from the factory floor of ceramics manufactures in Spain (Chiva, Alegre, & Lapiedra, 2007), the scale has been used in other contexts, with significant results. This scale can be interpreted with a focus on learning facilitators, making a multilevel analysis: individual, group and organizational (Correia-Lima, Loiola, & Leopoldino, 2017).

Camps, Alegre, & Torres (2011) tested the scale considering different cultural and social contexts when analyzing Spanish and Costa Rican companies. They evaluated different sectors (manufacturing and service companies) and educational levels of the respondents and were able to demonstrate its ability to offer coherent answers.

In Brazil, the scale was used by Gonçalves & Silva (2016) to analyze which dimensions are identified in the textile industry in Santa Catarina. Gomes & Wojahn (2017) also investigated the relationship between OLC, innovation performance and organizational performance in small companies in the textile industry and identified in their results the relationship between OLC and innovation. Klein, Wojahn, Gomes, & Machado (2016) also tested and identified the relationship between OLC and innovation performance in the same industry in the Brazilian context. Studies aiming to analyze OLC in startups were not identified.

As explained above, OLC is understood as a facilitator of learning (Goh & Richards, 1997), capable of providing the resources and skills necessary for a company to be able to capture, transform and apply new knowledge when developing new products and services (Hsu & Fang, 2009). In the context of startup companies, it is expected for this capacity to be developed quickly and for these companies to advance over the development stages and, for this, to use the benefits of being inserted in an innovation environment.

3. Methodological procedures

This section presents the methodological procedures adopted, the information about the sample, the research techniques, the collection instruments and the analysis techniques adopted. Regarding the approach, this is a quantitative study because it constitutes a systematic investigation of phenomena observed through statistical techniques (Given, 2008). Regarding the typology, this study can be classified as empirical and exploratory because it refers to a problem that has not yet been studied thoroughly and allows conclusions to be drawn only with extreme caution (Shields, 2013).

The questionnaire used was divided into two parts. The objective of the first part was to identify the profile of startups with an emphasis on their a) development stage and b) level of interaction with elements that constitute the innovation environment of their state. The stage was diagnosed in each company, with a categorical classification that listed the characteristics of each stage, taken from the literature (Startup Commons, 2018). The respondents chose the stage that best fit their startup among the three possible stages.

Regarding the questions that assess the interaction with the startup ecosystem, as shown in the literature review, the elements that constitute the so-called innovation ecosystem are more complex structures and are not always found in all Brazilian states. For this reason, in the questionnaire used in this study, the questions were defined in such a way that it was possible to better approximate the local reality of each respondent. There were individual questions for the level of each type of interaction (with technology parks, in the formation of smart cities, with innovation districts, with technology hubs, with business incubators, with business accelerators and with co-working spaces). These questions were always presented on a Likert scale from 1 to 5, in which option 1 corresponded to "never" and option 5 was equivalent to "very frequently." Likert scales are psychometric scales in which the possible responses are arranged into a range or graded series (Burns & Burns, 2008). For example, regarding intelligent cities, question 5 asked: *"how much is your startup a part of the transformation of your city into a "smart city?"* Then, a brief explanation was given on how this participation would take place. The "Level of interaction" variable was then defined as the mean of the seven questions presented. To help validate this construct, the Cronbach's alpha internal consistency index (Hair, Black, Babin, & Anderson, 2010, p. 123) was calculated using SPSS version 21; a very satisfactory alpha value of 0.805 was obtained.

To measure the size of the startups, "number of employees" was used as a proxy, that is, as a variable that represents the unobserved size variable (Upton & Cook, 2002). It was considered that revenue would not be the best unit of measurement because these companies, in general, have little time operating and low revenue. According to the Brazil Digital Report, 46% of Brazilian startups had less than two years of operation in 2016, 69% had less than R$ 50,000 of revenue in the same year and more than half had no revenue in the same period (Mckinsey & Company, 2019). Therefore, revenue does not reflect size, and thus using such a measure could lead to distortions. Given this, the number of employees was adopted as a measure of size, as suggested by Zadeh and Eskandari (2012).

Closed questions were elaborated based on the literature and sent as a pretest to two PhD professors who conduct research in the field of innovation (from Bahia and Pernambuco), one startup manager and one co-working space manager, both from Sergipe, and to a member of the startup association of Rio Grande do Norte. All submitted their suggested improvements, which were incorporated.

In the second part, to measure the level of OLC, the questionnaire adapted to Brazil by Gonçalves & Silva (2016) of the scale elaborated by Chiva, Alegre, & Lapiedra (2007) and Camps, Alegre, & Torres (2011) was used. This scale is a recognized tool, psychometrically sound and previously validated. However, to confirm the internal consistency of the construct in this sample, Cronbach's alpha was calculated using SPSS, obtaining a very favorable value of 0.705 for "risk propensity," 0.846 for "experimentation," 0.867 for "dialog" and 0.903 for "participatory decision-making."

OLC is composed of five determinant factors, assessed by means of closed-ended questions, measured on a seven-point Likert scale, with 1 for "strongly disagree" and 7 for "strongly agree." The mean of the five factors is usually calculated to obtain the "global" OLC level, as determined by Gonçalves & Silva (2016). However, in the present study, there are variables related to the environment external to the company in the dependent and independent variables, a factor that confounds regression analysis. To circumvent this

problem, the dimension "interaction with the external environment" was disregarded in the OLC variable, and the mean of the remaining four dimensions was calculated.

3.1 Sampling

The Abstartups database was chosen as the sampling framework for this study, and 758 registered startups in Northeast Brazil were defined as the study population. The sampling technique adopted is non-probabilistic and convenience sampling. This technique was considered adequate because, according to Milone (2006), non-probabilistic sampling focuses on the intentionality and desirability of the researcher, as there is no randomness in its selection Lakatos & Marconi, 1996).

Responses were obtained from 54 managers representing 49 startups located in Alagoas, Bahia, Ceará, Maranhão, Paraíba, Pernambuco, Piauí, Rio Grande do Norte and Sergipe. It was not possible to calculate the response rate because the questionnaires were sent to the startup managers through several channels (Facebook, Instagram, LinkedIn, WhatsApp and e-mail), and despite the exact number of initial recipients being recorded (131 contacts), these individuals were asked to share the questionnaires with the other managers in their company.

3.2 Analysis techniques

Analysis of the primary data was performed using descriptive statistics, that is, statistical data that summarize aspects of a collection of information (Mann, 1995), and multiple linear regression, which allowed hypothesis testing (Hair, Black, Babin, & Anderson, 2010, p. 151). Harrell (2015) indicates the possibility of performing linear regressions with a ratio of 10 respondents per variable, which is consistent with the number of respondents in this study. For Green (1991), the minimum number required for multiple regression is approximately 50 respondents. In the present study, the number was slightly higher, with 54 questionnaires answered, which minimizes the risk of obtaining low statistical power in the analysis, that is, a lower probability of a type II error, that is, of rejecting the null hypothesis when it should have been accepted (Hair, Black, Babin, & Anderson, 2010, p. 3).

3.3 Analysis model

To meet the study objectives, the two study hypotheses presented were tested. The conceptual analysis model is shown in Figure 2. In the regressions, the R^2 and adjusted R^2 of each independent variable were calculated, and the explanatory power of the regression model was discussed (Henseler, Ringle, & Sinkovics, 2009; Chalmer, 1996

Table 1 provides descriptions of the variables used.

4. Data analysis

In this section, the results obtained from the analysis of the data collected in the study are presented.

Initially, we present descriptive statistics of the dependent variable "organizational learning capacity (OLC)," of the independent variables "development stages (VS and GS)" and "interaction with the innovation environment (STARTUPECO)," and of the control variables "startup type (MANUFS)" and "startup size (SIZE)." The central tendency measure used was the arithmetic mean, and as a measure of dispersion, the standard deviation was analyzed, as shown in Table 2.

OLC, measured by the OLC variable, had a mean of 5.8175 and a standard deviation of 0.8993 on a scale from 1 to 7, with 1 for "strongly disagree" and 7 for "strongly agree," which indicates that the managers of the sample startups agree that OLC facilitators are present in the companies they represent. The frequency of interaction with the innovation environment,

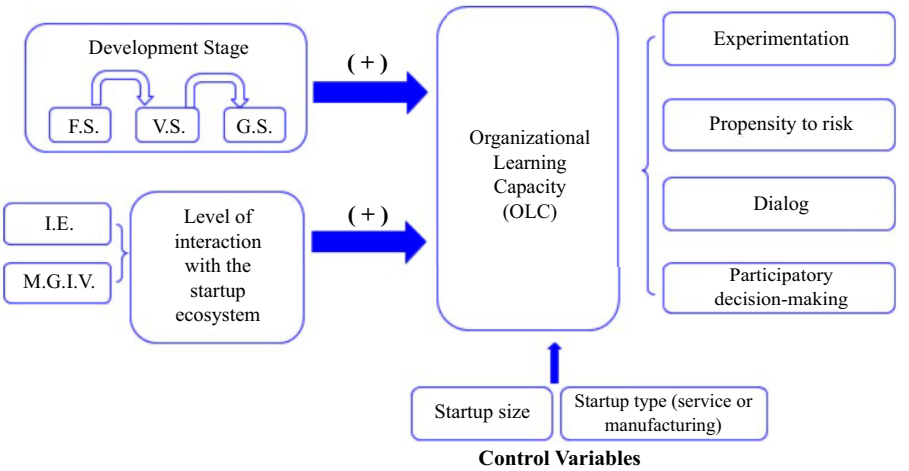


Figure 2.
Analysis model

Note(s): FS - Formation stage; VS - Validation stage; GS - Growth stage; IE - Innovation ecosystem; MGIV - Mechanisms for generating innovative ventures
Source(s): Prepared by the authors

Variable	Description			
Dependent	Organizational learning capacity	OLC	Interval (1 to 7)	The perception of the manager as to the OLC of the startup measured from the set of 18 statements, as proposed in the scale by Gonçalves & Silva (2016) based on Alegre & Chiva (2008)
Independent	Interaction with the startup ecosystem	STARTUPECO	Interval (1 to 5)	The intensity of the interaction between startup managers and the innovation environment was measured based on seven requirements elaborated based on decree n. 9,283/2018
Independent	Development stage	Validation (VS) Growth (GS)	Binary Binary	There are three categories for the startup development stage, according to the manager's perception: formation (FS), validation (VS) and growth (GS). For this reason, two dummy categories were created (validation and growth)
Control	Startup size	SIZE	Discrete	Number of company members, including managers (partners or not)
Control	Startup type	MANUFS	Binary	We chose to use "being a manufacturing startup" as a dummy variable

Table 1.
Description of the variables used in the study

Source(s): Prepared by the authors (2019)

represented by the variable STARTUPECO, was measured using a scale from 1 to 5, in which 1 represents "never" and 5 "very frequently." A mean of 2.5132 was obtained, which expresses the low frequency of interaction of the startups with innovation ecosystems and

with mechanisms for generating innovative ventures that make up this variable. STARTUPECO had a standard deviation of 1.0035, relatively higher than the mean, indicating a greater heterogeneity of responses.

The results obtained with the regression analysis sought to show whether the interaction of startups in the Northeast region with the startup ecosystem and the startup development stage is associated with OLC. When evaluating the relationship between these variables, the coefficient of determination $R^2 = 0.326$ and adjusted $R^2 = 0.256$ were obtained. Henseler, Ringle, & Sinkovics (2009) explain that in social sciences such as marketing, for example, in which one works with variables related to people and management systems, R^2 values above 0.25 are acceptable.

Using ANOVA, a value of 4.653 was obtained in the F test, which confirmed the significance of the regression model, with a significance level of alpha = 0.002. The variance inflation factor (VIF) was used as a measure for the assessment of multicollinearity, and as can be observed in Table 3, values below 5 were obtained, which indicates that there were no collinearity or multicollinearity problems (Hair, Black, Babin, & Anderson, 2010, p. 21).

The coefficients analyzed present information indicating that the variables validation stage, growth stage and manufacturing startups are statistically significant for the model, as shown in Table 3. Despite the low adjusted coefficient of determination, this finding does not necessarily represent a limitation (Chalmer, 1986). It was not the intention of this study to predict behaviors but rather to explain and relate predictors, as well as to verify which selected variables positively or negatively impact the dimensions analyzed.

Therefore, as a result of the hypothesis tests, Hypothesis H1 was confirmed, which states that higher startup development stages are positively associated with the OLC level, both for the validation stage and for the growth stage, as predicted by Ries (2012). This suggests that startups that can accelerate their development and begin developing and testing a minimum viable product, raise funds and grow in the market with scalability have advantages in their organizational learning. In addition, the results also suggest that organizational learning

Variable (n = 54)	Mean	Standard deviation
OLC	5.8175	0.8993
SIZE	8.6296	16.5567
VS	0.3148	0.4688
GS	0.4259	0.4991
STARTUPECO	2.5132	1.0035
MANUFS	0.1111	0.3172

Source(s): Prepared by the authors (2019)

Table 2. Descriptive statistics of the study variables

Variable (n = 54)	Standardized coefficient (beta)	(T-test)	Significance (alpha)	VIF (multicollinearity)
Constant		15.086	0.000	
Size	0.118	0.853	0.398	1.357
VS**	0.453	2.939	0.005	1.695
GS**	0.478	3.054	0.004	1.746
STARTUPECO	0.018	0.141	0.888	1.103
MANUFS**	−0.294	−2.257	0.029	1.210

Note(s): **Significant for $\alpha < 0.05$, Adjusted $R^2 = 0.256$; $F = 4.653$
Source(s): Prepared by the authors (2019)

Table 3. Estimated regression model

management strategies should be adapted to a startup's stage of development so that companies in early stages should pay more attention to the processes of experimentation, their propensity for risk, dialog and participatory decision-making (Gonçalves & Silva, 2016).

Hypothesis H2 states that the level of interaction of a company with the startup ecosystem is positively associated with its OLC, as advocated by several authors (Adner & Kapoor, 2016; Audy, 2017; Etzkowitz & Leydesdorff, 2000; Freeman, 1995; Lundvall, 2007). This hypothesis was not confirmed in the group of Northeast startups in the analyzed sample. This result may be potentially due to the sample being limited to a region of the country or even to poverty in the local Northeast ecosystem.

By empirically proposing and verifying a conceptual model, the results of this study contribute to the literature that examines factors that determine organizational learning, especially in startups. Regarding the contribution to managerial practice, the main contribution lies in the confirmation that more advanced stages of development are associated with a higher OLC. In this sense, there is evidence that managers of startups should try to accelerate their transition from the formation stage to the validation stage and from this second stage to the growth stage. As was shown in the introduction, higher OLC levels are associated with greater operational and innovation performance (Calantone, Cavusgil, & Zhao, 2002; Alegre & Chiva, 2008; Jiménez-Jiménez & Sanz-Valle, 2011; Alegre, Lapiedra, & Chiva, 2006). Although it is outside the scope of this study to determine which practices accelerate the life cycle of startups and given that this process does not depend solely on managerial decisions, there are certainly specific business policies that could potentially contribute to advancing the life cycle of such companies.

5. Final considerations

Based on the identification of the problem related to the development context of the startups and the identification of strong disparities in relation to companies in the South and Southeast regions, the proposed study sought to broaden the theoretical knowledge on startups in Northeast Brazil. It focused on the proposed research problem, which was to elucidate whether specific variables have effects on the learning capacity of startups. OLC is defended in the literature as necessary for the development of innovative enterprises and as a positive influence on operational performance.

The hypothesis test performed showed that at least with regard to responding companies, there was a positive relationship between development stages and higher levels of OLC; however, it was not possible to establish a causal relationship between the two variables, and it is not possible to state whether it is the evolution of the company in regard to its development stage that influences the increase in OLC or vice versa. This is one of the limitations of this study.

The hypothesis that there is a relationship between the interaction with the startup ecosystem and the OLC level of startups was not confirmed. Notably, this is not a conclusive study because of the limitations related, in particular, to the sample size and the fact that it is a regional sample. Thus, it is suggested that further studies be conducted to explore the relationship between startups, learning and environment.

Despite the limitations, the findings presented here indicate a path for future studies that wish to explore the high mortality rate of startups in the formation phase or the gap between this phase and the phases in which the company can already obtain some financial return for its innovative effort (validation phase), as well as when it is able to conquer new markets (growth or scaling phase).

This study is not generalizable to all Brazilian startups due to the characteristics of its non-probabilistic sample. However, the findings of this study contribute to the theoretical

field of innovation and competitiveness and to management practice in this type of company, especially considering the emerging nature of studies on startups.

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