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# Dualism between Creativity and Controls aimed at Innovation: The moderating effect of Simons' Levers of control in the context of Startups

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## Abstract

**Objetivo:** To verify the moderating effect of levers of control on creativity and innovation among startups.
**Method:** A survey was used to collect data, which were treated using descriptive statistics, structural equation modeling, and linear regressions. The sample comprised companies at the gaining traction, operation, or scaling-up stages registered on the database of the Brazilian Startup Association (ABStartups); 153 responses were obtained.
**Results:** Direct relationships were found, corroborating previous studies' results. Additionally, moderation tests highlighted other forms of interaction between the different types of management control (positive and negative) and creativity and innovation. The findings regarding moderating roles represent advancement to previous studies. The results showed that although beliefs and diagnostic controls act as opposing forces, they presented similar (negative) moderating effects in the duality between positive and negative controls. The hypothesis tests' results, which were the opposite of what was expected, provide insights into different forms of interaction between the levers; i.e., not only the use of controls but also the intensity in which they are used may affect these relationships.
**Contributions:** The results help startup managers understand that when controls are balanced and applied together, they do not inhibit creativity or innovation; instead, they can be used to enhance them, a finding not previously reported in the literature.
**Keywords:** Control Levers; Creativity; Innovation.

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## 1. Introduction

In recent years, creativity in the organizational environment has been the object of study in management control (Aguiar & Suave, 2020). Creativity is an essential element for innovation to occur (Pfister & Lukka, 2019; Bisbe & Malagueño, 2015; Taylor, King & Smith, 2019) and plays a vital role in companies' competitive advantage (Rocha, 2018). Therefore, encouraging the creativity of individuals in the organizational environment is vital for companies' innovative performance. However, encouraging creativity in excess may divert the individuals' attention from organizational objectives, implying the need to use controls to shape or direct actions to align the creative process in the search for innovation (Del -Corte-Lora, Vallet-Bellmunt & Molina-Morales, 2015; Calic, Mosakowski, Bontis & Helie, 2022).

The literature reports a dilemma because creativity requires a flexible and free environment to flourish; however, for organizations to implement their strategies, they need to implement controls to direct actions to achieve organizational objectives (Biswas & Akroyd, 2022). In other words, creative production requires managerial controls to direct actions and develop ideas consistent with the established purposes. However, such controls may inhibit creativity by restricting employees' actions (Adler & Chen, 2011; Grabner & Speckbacher, 2016).

From this perspective, Simons' (1995) Levers of Control framework brings the possibility of finding a balance and aligning the creative process and employees' actions with organizational strategies and objectives by using a set of different types of controls. Controls can inspire the search for new opportunities by ensuring vertical communication and information sharing (belief and interactive control systems) and also ensuring that the organization and its employees do not deviate from the path aimed to achieve the established objectives (boundary and diagnostic control systems) (Müller-Stewens, Widener, Moller & Steinmann, 2020). Thus, different (coercive or enabling) control systems may coexist and act interdependently through dynamic tension, promoting creativity and innovation (Barros & Ferreira, 2019; Müller-Stewens et al., 2020).

Studies on the relationship between creativity and control via the Levers of Control framework (Simons, 1995) reached a consensus that there is a direct and positive relationship between belief and interactive controls and creativity, which is in line with studies addressing the ability of these controls in promoting creativity. Nevertheless, the literature presents mixed results regarding the direct effects of diagnostic and boundary controls (Speklé, Elten & Widener, 2017; Kaveski & Beuren, 2020; Oliveira & Beuren, 2021).

Based on previous studies, we suggest that diagnostic control and boundary systems reinforce the use of interactive and belief systems, working together to promote creativity and innovation. The joint use of control systems balances the stimuli generated by belief and interactive controls and the restrictions imposed by diagnostic control systems and boundary systems. This study assumes that the effects of control levers on innovation occur through interactions between control systems and not necessarily through a direct relationship. According to Crespo et al. (2019), Oliveira and Beuren (2020), and Oliveira and Beuren (2021), startups may present the characteristics necessary to investigate relationships between creativity, innovation, and controls. In this sense, this study seeks to answer the following question: How does the interaction between control levers affect creativity and innovation among startups? Hence, the objective of this study was to investigate the moderating effect of control levers on creativity and innovation among Brazilian startups.

Additionally, startups were chosen because they are located in a highly innovative environment. In this context, these organizations' interest in adopting control systems is recent and controversial, as there are doubts as to whether bureaucracy and rigid controls compromise the innovative and entrepreneurial spirit of this type of organization (Crespo et al., 2019; Davila, Fosters, & Jia, 2014).

Crespo et al. (2019) also highlight that contrary to popular belief, management control systems improve the entrepreneurial attitude and performance of startups; however, despite the relevance of this topic and previous studies, results are inconsistent, and many startups choose not to adopt these systems. As the life cycle of startups advances, their needs become more complex and require better planning – i.e., it is a fertile space for management control; therefore, the importance of studying controls, especially those linked to creativity, in this type of company.

Note that Simons' (1995) control levers framework emerged from analyzing large corporations with well-defined control systems. However, the studies investigating the relationship between creativity and control based on levers of controls adopted samples composed of startups (Oliveira & Beuren, 2020; Oliveira & Beuren, 2021), indicating that such controls may be present in these companies' management processes.

Theoretically, this study adds empirical evidence to that obtained by previous studies, which indicated a direct relationship between creativity and levers of control (Speklé, Elten & Widener, 2017; Kaveski & Beuren, 2020; Oliveira & Beuren, 2021), but did not present conclusions regarding the moderating effect of these controls, considering interactions between the variables based on the theoretical assumptions discussed in the literature. As for implications for practice, the findings show that managers can apply management controls to promote extrinsic motivation and encourage employees to work aligned with organizational objectives, to be creative, and to provide the market with innovative solutions, practices, and implementations.

As expected, the results of this study show that the boundary system negatively moderated the relationship between the interactive system and creativity and the relationship between creativity and innovation. However, the results also show that the diagnostic system positively moderated the relationship between creativity and innovation, and contrary to what was expected, the belief system negatively moderated the relationship between creativity and innovation. The results concerning the moderating effects of control levers on the relationship between creativity and innovation suggest that despite acting as opposing forces in the duality between positive and negative controls, belief and diagnostic controls presented similar (negative) moderating effects. Nonetheless, even if they do not favor the effect of creativity on innovation, they prove to be essential for innovation when there is a low level of creativity, acting as compensation.

The findings concerning moderating roles advance regarding previous studies, and the opposite signs found here provide insights into different forms of interaction between the levers when considering not only their existence and use but also the intensity (high/low) of use. These findings indicate the ability of controls to restrict employees' actions, counterbalancing the impacts of efforts in the search for value creation provided by the belief system. This result highlights the importance of adopting tools to guide employees in the process, avoiding unnecessary risks, and focusing on points of interest for implementing innovation.

The findings regarding belief and boundary controls contribute to the literature by incorporating evidence regarding the interdependence and complementarity of controls, showing the importance of seeking more information about these relationships, considering that, among the control levers, these are the least frequently investigated (Tessier & Otley, 2012).

## 2. Theoretical Framework and Study Hypotheses

### 2.1 Levers of Control and Creativity

Creativity consists of the individuals' ability to generate new and valuable ideas (Anderson, Potočnik & Zhou, 2014). It can be encouraged in the organizational environment based on the individuals' intrinsic motivation or by promoting extrinsic motivation such as establishing deadlines, giving incentives, and appreciation (Amabile & Pillemer, 2012). Creativity within an organizational environment is influenced by various factors, including strategies, structures, policies, values, and team dynamics (Amabile & Pratt, 2016).

Hence, management control systems may encourage or restrict creativity and innovation (Simons, 1995; Bedford, 2015). Control systems comprise mechanisms for formulating and implementing strategies (Ferreira & Otley, 2009) designed to influence an organization's members (Anthony & Govindarajan, 2011) and guide organizations in developing and maintaining viable behavior patterns (Otley, 1999). Therefore, controls result in specific behaviors, enabling companies to manage controls according to what they expect from their employees (Turner, Monti & Annosi, 2020).

However, the literature reports a dilemma in the relationship between creativity and control, consisting of autonomy and flexibility *vs.* direction and boundary (Grabner & Speckbacher, 2016). Organizations must balance creative stimuli provided to employees in the search for innovation by applying controls that align their interests with those of the organization while allowing their autonomy to promote creativity (Turner, Monti & Annosi, 2020). Studies addressing this relationship suggest that the formal and informal use of accounting information provides a balance between firmness (controls) and flexibility (creativity and autonomy) in the development of new products (innovation) (Feeney & Pierce, 2018), and a structure that allows the promotion of creativity, balancing both the exploration of ideas (exploration concepts) and the improvement of products (exploitation concepts) (Revilla & Rodríguez-Prado, 2018).

The control levers model is an alternative to the control dilemma problem, as it was designed to reconcile creativity, innovation, and control. Simons' (1995) framework suggests the existence of positive controls (belief and interactive systems associated with learning, motivation, reward, and creativity) that oppose negative controls (represented by boundary and diagnostic systems, which focus on the idea of control, punishment, prescription, and coercion). Thus, the four levers hold the idea of complementarity, i.e., simultaneously using the four control types is conducive to promoting productive tensions and encouraging creativity and innovation (Mundy, 2010; Heinicke, Guenther & Widener, 2016).

The four levers of Simons' model (1995) are interdependent. For example, reinforcing diagnostic controls is desirable when there is a greater focus on interactive controls to ensure stability and focus on objectives. On the other hand, too much emphasis on diagnostic controls may restrict efforts to discover new knowledge; hence, interactive controls are required. Likewise, a greater focus on belief controls may unnecessarily divert management's attention, so boundary controls will be needed to focus on emerging activities. An emphasis on boundary controls restricts experimentation, so employees need to be encouraged through belief controls. This relationship of opposing forces pushes one lever towards the other so that there is a need for constant balance (Bedford, 2015).

Some studies highlight this interdependent relationship between the control levers, indicating the role of diagnostic controls in the relationship between interactive controls and organizational learning (Widener, 2007) through the effects of diagnostic and interactive controls on performance (Bedford, 2015). Additionally, studies show significantly associated combinations between belief systems and boundary systems, beliefs and interactive systems, boundary and interactive systems, and interactive and diagnostic systems (Heinicke, Guenther & Widener, 2016).

Such evidence denotes the existence of interactions between the control levers, suggesting that, as one type of control influences the dynamics of the other, it may also influence their relationships. Additionally, there is a consensus in the literature regarding the existence of a direct and positive relationship between belief and interactive controls with creativity, and also conflicting results regarding the effects of boundary and diagnostic controls (Speklé, Elten & Widener, 2017; Kaveski & Beuren, 2020; Oliveira & Beuren, 2021). Given that boundary and diagnostic systems constitute opposing forces to belief and interactive systems, we propose that boundary controls and diagnoses moderate the effects of belief and interactive controls, negatively influencing creativity. Thus, the following hypothesis is presented:

**H1:** Negative control systems (diagnostic and boundary) negatively moderate the relationship between positive systems (interactive and beliefs) and creativity.

## 2.2 Control of Levers, Creativity, and Innovation

Creativity and innovation are distinct but interconnected concepts (Chenhall & Moers, 2015; Hong, Hou, Zhu & Marinova, 2018), so their relationship is based on the assumption that it is only possible to innovate through the generation of ideas, flexibility, freedom, experimentation, and intrinsic motivation – characteristics that influence the creative process (Amabile, 1996). In this sense, while creativity composes the creation phase, innovation is considered the implementation phase; i.e., innovation is a product of creativity (Taylor, King & Smith, 2019). Thus, creativity and innovation are increasingly essential for organizations' performance, success, and long-term survival (Anderson, Potočnik & Zhou, 2014; Bollinger, 2019).

Studies have already associated creativity and innovation, and a direct and positive relationship was found between incremental and radical innovation (Hong, Hou, Zhu & Marinova, 2018) with organizations' innovative performance (Stojcic, Hashi & Orlic, 2018) and exploration (e.g., research, experimentation, creation, and innovation) and exploitation actions (e.g., refinement and adaptation) (Ferreira, Coelho & Moutinho, 2020), in addition to the mediating role of creativity between knowledge and innovation (Del-Corte- Lora, Molina-Morales & Vallet-Bellmunt, 2016). Despite the evident association between creativity and innovation (Davila, Foster & Oyon, 2009), we should keep in mind that for innovation to occur, there must be a combination between creation and productivity, besides various other factors influencing both elements in the organizational environment dynamics (Dodge, Dwyer, Witzeman, Neylon & Taylor, 2017). Creation efforts hold a high degree of uncertainty and experimentation, requiring activities and guidance to be coordinated for resources to be effectively used and managed, preventing efforts from going in vain (Müller-Stewens et al., 2020).

In this sense, Stojcic, Hashi, and Orlic (2018) investigated the role of employee creativity in innovative behavior and productive efficiency in companies. Their results show that the employees' creative skills and a large number of ideas did not influence the development of products that meet customer needs, so companies with fewer creative people were more effective in this regard. This result is possibly explained by the inability of managers to effectively explore the employees' creative potential in the innovation implementation phase. Such a complex relationship requires skillful leadership to maximize its benefits (Anderson, Potočnik & Zhou, 2014), suggesting that controls are a means to explore creativity and achieve innovation.

The literature approaches innovation as a process divided into two stages: 1) creation, when creative skills are most required, and 2) idea implementation, when for innovation to be effective, compliance with processes, rules, and standardization is required (Stojcic, Hashi & Orlic, 2018; Taylor, King & Smith, 2019). Thus, there seems to be a tendency for formal controls to be more intensively applied in the latter for creativity to be converted into innovation (Taylor, King & Smith, 2019).

Studies have specifically analyzed the relationship between the control of levers framework and innovation. For example, Oliveira and Beuren (2020) show that interactive and diagnostic systems positively influence innovative performance. Henri (2006), Bedford (2015), and Frezatti, Bido, Cruz, and Machado (2017) concluded that interactive systems positively influence the intensity of innovation. However, even though control systems are directly associated with innovation, they are expected to influence the relationship between creativity and innovation.

Thus, knowing that belief and interactive systems provide stimuli, while diagnostic and boundary systems provide predictability and standardization (Simons, 1995), we believe these controls influence the relationship between creativity and innovation with opposite signs. Thus, the following hypotheses are proposed:

**H2a:** Negative control systems (diagnostic and boundary) negatively moderate the relationship between creativity and innovation.

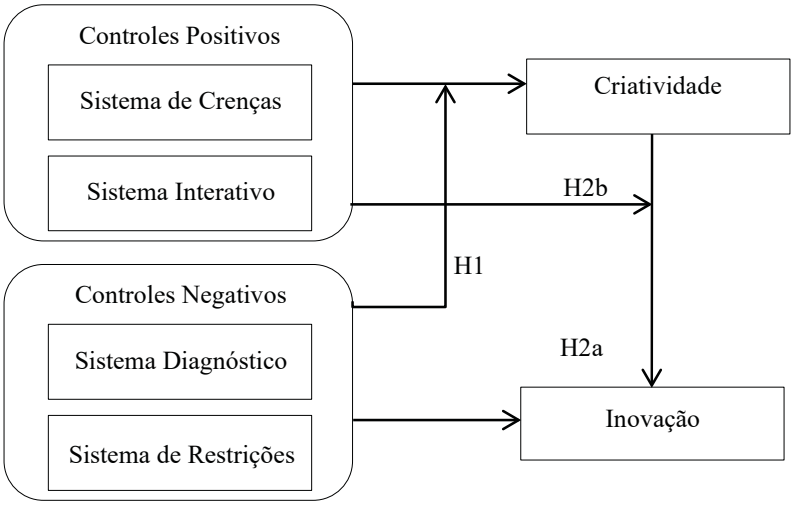
**H2b:** Positive control systems (interactive and belief) positively moderate the relationship between creativity and innovation.

## 3. Methodological Design

A survey was conducted with Brazilian startups registered in the Brazilian Startup Association (ABStartups) database to meet this study's objective and test our theoretical model (Figure 1). This study is restricted to investigating the population of startups registered until 2021 at the life cycle traction, operation, or scaling-up stages, totaling 4,322 registered companies.

Startups go through five phases in their life cycle (Picken, 2017; ABStartups, 2019): ideation, when the business idea's feasibility and validation are verified; operation, which is when operations are initiated; traction, the phase in which there is an organized and disciplined structuring, increasing the need for additional resources; scaling-up, when expansion requires significant investments, aiming to reach a competitive scale; and successful exit, the phase in which the founders reap the accumulated value through sale or merger, for example.

The questionnaire included a question to identify the companies' life cycle stages, and startups at the ideation stage were excluded, as these companies do not yet have an organizational structure that allows for measuring the study variables. Companies whose means of contact were deactivated or out of date, which reported discontinuity of activities, or were registered more than once in the database were also excluded from the sample. The final population comprised 2,441 startups.




Translate: Positive Controls; Belief Systems; Interactive Systems; Negative Controls; Diagnostic Systems; Boundary System; Creativity; Innovation
Source: developed by the authors.

**Figure 1.** Theoretical model

Data were collected between September 2021 and February 2022. Contact was established via the companies' or their managers' (e.g., CEOs, CFOs, or founders) email, Facebook, or LinkedIn. First, a cover letter was sent with an invitation explaining the study's objective. After acceptance, a link was provided to access the questionnaire. Follow-up occurred via telephone or WhatsApp accounts linked to the companies' social networks. At the end of this process, responses were received from 153 startups (6.27% response rate), which constituted the sample. The sample size meets the requirement of at least five respondents for each variable in the estimation model (Marôco, 2010). It exceeds the minimum number of 103 companies, calculated according to Cohen's (1992) recommendations. The probability of type I error was 5%, type II error was 20%, median effect size=0.15, and the construct with the most significant number of predictors = 7.

A structured questionnaire, available online via Google Forms, was used to collect data. Its statements were rated on a 7-point Likert scale, and questions were added to characterize the startups and respondents. Validated instruments reported in the literature were used to measure the theoretical model's variables. The adaptation of international instruments includes the translation of the original instrument (English) into Portuguese and its back-translation to check for potential divergences in the meaning of items or inconsistencies. The terms commonly used in the startup environment were consulted in Brazilian articles. Table 1 presents the variables, measurement items, and references.

Table 1

**Measurement Scales**

| Constructs | Items | FL |
|---|---|---|
| **Belief systems** (Widener, 2007; Bisbe & Malagueño, 2015; Bedford, 2015) | We communicate our values through our mission. | 0.600 |
| | We seek to motivate, inspire, and guide our collaborators through formal declarations of our mission and values in procedure manuals, frameworks, sites, e-mails, LinkedIn, and remaining corporate social networks. | .630 |
| | Our collaborators are aware of the company's values. | 0.865 |
| | CEOs and/or the company's leaders seek to communicate the company's values to collaborators frequently. | 0.804 |
| **Interactive System** (Cruz et al., 2015; Frezatti et al., 2017; Marcelino, 2019) | Information from the control system (budget, costs, sales, competitors/market, customers) is continually interpreted and discussed in meetings between CEOs, team leaders, and employees. | 0.713 |
| | Information from the control system (budget, costs, sales, competitors/market, customers) is used to encourage new ideas and action plans, helping with strategic uncertainties. | 0.873 |
| | Information from the control system (budget, costs, sales, competitors/market, customers) allows for directing the leaders' attention to factors that may threaten or invalidate the current strategy. | 0.690 |
| | Team leaders at all levels devote continuous and regular attention to analyzing and discussing information linked to uncertainties. | * |
| | Intensive interaction between team leaders and employees in the control process. | 0.563 |
| **Diagnostic System** (Henri, 2006; Bedford, 2015) | We seek to identify critical company performance variables (areas or factors in which good performance is necessary to achieve critical performance objectives). | 0.686 |
| | We set goals (budget goals, cost reduction, revenue/profitability goals) and monitor progress toward critical performance objectives. | 0.715 |
| | We gather information that helps correct deviations from critical performance objectives. | 0.831 |
| | We monitor results and compare them to critical performance objectives. | 0.882 |
| **Restriction System** (Widener, 2007; Bedford, 2015; Bisbe & Malagueño, 2015) | Our employees are informed about the risks to be avoided. | 0.503 |
| | The company's code of conduct communicates inappropriate behavior to employees. | 0.964 |
| | The company's code of conduct establishes appropriate behavior for employees. | 0.884 |
| | Employees are directed towards areas of research and experimentation in the search for opportunities. | * |
| **Creativity** (Moulang, 2015); Bisbe & Malagueño, 2015; Speklé et al., 2017) | Employees frequently engage in intelligent and creative problem-solving. | 0.868 |
| | Employees regularly think of new perspectives on recurring problems. | 0.872 |
| | Employees are continually encouraged to think of creative ways to solve problems. | 0.769 |
| | Employees often improvise in problem-solving methods when there is no explicit/ objective answer. | 0.513 |
| | Employees regularly generate ideas about new product/service concepts. | 0.686 |
| | Employees frequently look for innovations and potential improvements. | 0.780 |
| **Innovation** (Schultz et al., 2013; Cruz et al., 2015; Bedford et al., 2019) | Over the last three years, the startup has introduced frequent incremental changes (modifications/improvements) to products/services. | * |
| | Over the last three years, the startup has frequently introduced new products/services to the market. | * |
| | Our products/services add greater value to customers than our main competitors. | 0.653 |
| | Our products/services bring changes to the functioning of the market. | 0.870 |
| | Our products/services bring changes in the nature of competition. | 0.822 |
| | Our new products/services are based on the latest technology. | 0.529 |
| | We are pioneers in launching new products/services with high frequency. | 0.629 |

Notes. FL=Factor load. *Item excluded due to low factor loading.

Source: developed by the authors.

The procedures suggested by Podsakoff, MacKenzie, and Podsakoff (2012) were adopted to decrease the occurrence of common method biases. First, two professionals experienced with startups reviewed the back-translated items, checking the terms, validating content, and eliminating ambiguities. Next, the participants were instructed to complete the questionnaire according to their perceptions of their companies' context, i.e., there were no right or wrong answers. Additionally, they were ensured that their identities would remain confidential. Third, the questionnaire was structured to ensure a proximal and psychological distance between the constructs. Hence, the scales on the control system, creativity, and innovation were inserted into the questionnaire in different blocks, followed by a statement that positioned the respondent in the context we wanted to assess. Fourth, the scales' anchoring properties were changed so that the statements were perceived as distinct. The control system scales were anchored on items ranging from 1 – low intensity to 7 – high intensity; the creativity scale, from 1 – very low to 7 – very high; and the innovation scale, from 1 – totally disagree and 7 – totally agree. Finally, Harman's single-factor test was performed after data collection. The exploratory factor analysis technique based on an eigenvalue greater than 1 suggested a seven-factor structure. The one-factor solution obtained an explained variance index of only 27.9%, which is low, considering most of the data.

The analysis of normality of data was verified based on asymmetry (*sk*) and kurtosis (*ku*) measures. The highest values found were *sk*=2.05 and *ku*=2.83, lower than the parameters required to assume data normality (*sk*<3; *ku*<7) (Marôco, 2010). Next, confirmatory factor analysis (CFA) was performed to validate the scales (see factor loadings in Table 1). One item from the boundary system scale, one from the interactive system scale, and two from the innovation scale were excluded due to low factor loadings ($\lambda < 0.50$). The scales' convergent validity was analyzed using the Average Extracted Variance (AVE) based on the factor loadings. All measures were higher than 0.5 (Fornell & Larcker, 1981). For convergent validity, the square root of the AVE was compared to the correlation coefficients between the constructs (Fornell & Larcker, 1981). No correlation coefficient was higher, indicating that the items in each scale have greater explanatory power than the other constructs. Composite reliability indices were calculated to assess the reliability and were above the expected (CR>0.7) (Hair, Black, Barbin, Anderson & Tatham, 2009).

Table 2 presents the scales' descriptive measures and the adjustment measures of the factor model, which met the parameters recommended in the literature, confirming the structural model's goodness of fit (Marôco, 2010).

Table 2
**Validity and reliability descriptive measures**

| | | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| 1 | Belief systems | - | | | | | |
| 2 | Interactive systems | 0,444 | - | | | | |
| 3 | Boundary systems | 0,450 | 0,282 | - | | | |
| 4 | Diagnostic systems | 0,415 | 0,713 | 0,491 | - | | |
| 5 | Creativity | 0,263 | 0,400 | 0,041 | 0,332 | - | |
| 6 | Innovation | 0,713 | 0,263 | 0,165 | 0,270 | 0,209 | - |
| | AVE | 0,538 | 0,516 | 0,655 | 0,613 | 0,574 | 0,507 |
| | AVE root | 0,733 | 0,718 | 0,809 | 0,783 | 0,758 | 0,712 |
| | CR | 0,820 | 0,806 | 0,842 | 0,862 | 0,887 | 0,833 |

Notes. Confirmatory Factor Analysis by the Maximum Likelihood Method (MLM). Model adjustment indices: $\chi^2 = 448.108$; $\chi^2/df = 1.589$, $p < 0.01$; CFI = 0.921; TLI = 0.909; RMSEA = 0.062; $p > 0.05$.

Source: developed by the authors.

The scores obtained in the constructs were estimated and subjected to multiple linear regression to test the hypotheses. This procedure was adopted because the moderation test with latent variables adds complexity to the model (Marôco, 2010). The goodness of fit of the regression models was verified through analysis of residuals, number of outliers, and the absence of multicollinearity, verified with variance inflation factors (VIF). The variables were first standardized to decrease multicollinearity to create the interactive terms for the moderation tests, and then the product of the variables was determined (Aiken & West, 1991).

## 4. Results Analysis and Presentation

Table 3 presents the respondents' and companies' main information. Most respondents occupied the position of CEO (45.8%) from 3 to 5 years (51.6%). A total of 88.6% of the respondents have been in this position since the companies were founded, which is relevant, as the rate at which control systems are adopted in startups is related to how long CEOs remain in office (Davila & Foster, 2007). Additionally, 94.1% of the participants presented academic qualifications, i.e., a bachelor's degree (39.9%) or postgraduate studies (54.2%), showing their relative preparation to manage a startup (Couto, 2019).

Table 3
**Sample's description**

| Respondents (n = 153) | Frequency % | *Startups (n = 153)* | Frequency % |
|---|---|---|---|
| Position | | Time since foundation | |
| CEO | 45,8% | Up to 2 years | 12,4% |
| Founder/Cofounder | 8,5% | 3 to 5 years | 52,9% |
| CMO | 10,5% | 6 to 10 years | 25,5% |
| COO | 9,2% | More than 10 years | 9,2% |
| CTO | 6,5% | No. of employees | |
| Executive director | 11,1% | Up to 5 | 30,7% |
| Commercial director | 5,2% | 6 to 10 | 25,5% |
| Outros | 3,3% | 11 to 20 | 17,0% |
| Experience in the position | | More than 20 | 26,8% |
| 1 - 2 years | 28,1% | Life cycle stage | |
| 3 - 5 years | 51,6% | Traction | 52,3% |
| 6 - 10 years | 15,7% | Operation | 22,9% |
| More than 10 years | 4,6% | Scaling up | 24,8% |
| Education | | Region | |
| High School | 5,9% | South | 24,8% |
| Bachelor's degree | 39,9% | Southeast | 57,5% |
| Postgraduate studies | 54,2% | Midwest | 4,6% |
| | | North | 4,6% |
| | | Northeast | 8,5% |

Source: developed by the authors.

As for the startups' characteristics, information was aligned with data from ABStartups on the Brazilian ecosystem in 2018, and Costa (2018), i.e., most (52.9%) were founded between 3 and 5 years ago, before the COVID-19 pandemic. Most companies have up to 5 employees (30.7%) and seek to scale up the business (traction phase = 52.3%), as noted by Couto (2019). Additionally, more than 80% of the companies are located in the South and Southeast of Brazil, possibly explained by these regions' economic concentration and the fact that Brazil's main innovation ecosystems are located in these regions (ABStartups, 2018).

## 4.1 Moderating Effects of Control of Levers on Creativity

Hypothesis H1 suggests that negative systems (boundary and diagnostic) negatively mediate the relationship between positive systems (interactive and beliefs) and creativity. Two regression models were developed to test this hypothesis, with creativity as the dependent variable. The first model tested the moderating effect of the boundary and diagnostic systems (negative systems) on the relationship between the interactive system (positive system) and creativity. The second model tested the moderating effect of the boundary and the diagnostic systems (negative systems) on the relationship between the belief system (positive system) and creativity. We chose to develop two models to test the hypothesis because the simultaneous presence of interactive and belief systems in a single model resulted in multicollinearity (VIF>10) (Hair et al., 2009), which could cause problems with the estimation and interpretation of variables.

Thus, the boundary (BOS), diagnostic (DS), belief (BES), and interactive (IS) systems were included as independent variables in the regression models, in addition to double interactions for moderation tests (BOS *vs.* DS; BOS *vs.* IS; DS *vs.* IS; BOS *vs.* BES; DS *vs.* BES), and the control variables time since the foundation, number of employees, and the traction and operation stages. The results are presented in Table 4.

Table 4
**Regression coefficients on creativity**

| Constructs | Beta (β) | SE | *t* | Beta (β) | SE | *t* |
|---|---|---|---|---|---|---|
| (Intercept) | 5,654 | 0,223 | 25,379** | 5,693 | 0,221 | 25,743** |
| Control Variables | | | | | | |
| Time since foundation | -0,004 | 0,018 | -0,201 | -0,004 | 0,018 | -0,207 |
| No. of employees | -0,006 | 0,002 | -2,416* | -0,007 | 0,002 | -2,664** |
| Traction (1=yes/0=no) | 0,176 | 0,181 | 0,972 | 0,186 | 0,182 | 1,017 |
| Operation (1=yes/0=no) | 0,402 | 0,231 | 1,739† | 0,420 | 0,232 | 1,807† |
| Direct effects | | | | | | |
| Boundary system (BOS) | -0,139 | 0,090 | -1,543 | -0,329 | 0,088 | -3,748** |
| Diagnostic System (DS) | 0,203 | 0,133 | 1,519 | 0,466 | 0,096 | 4,874** |
| Belief system (BES) | | | | 0,270 | 0,088 | 3,068** |
| Interactive system (IS) | 0,377 | 0,117 | 3,217** | | | |
| Double moderation | | | | | | |
| BOS x DS | 0,265 | 0,109 | 2,432* | 0,143 | 0,088 | 1,625 |
| BOS x IS (H1) | -0,277 | 0,123 | -2,252* | | | |
| DS x IS (H1) | 0,028 | 0,085 | 0,327 | | | |
| BOS x BES (H1) | | | | 0,091 | 0,077 | 1,195 |
| DS x BES (H1) | | | | -0,170 | 0,080 | -2,128* |
| | | | | | | |
| R2 adjusted | 0,277 | | | 0,266 | | |
| F (model) | 6,831** | | | 6,504** | | |
| VIF (higher) | 5,316 | | | 2,978 | | |

Notes. VIF = Variance Inflation Factor. Beta (β) = Regression coefficient. SE = Standard Error.

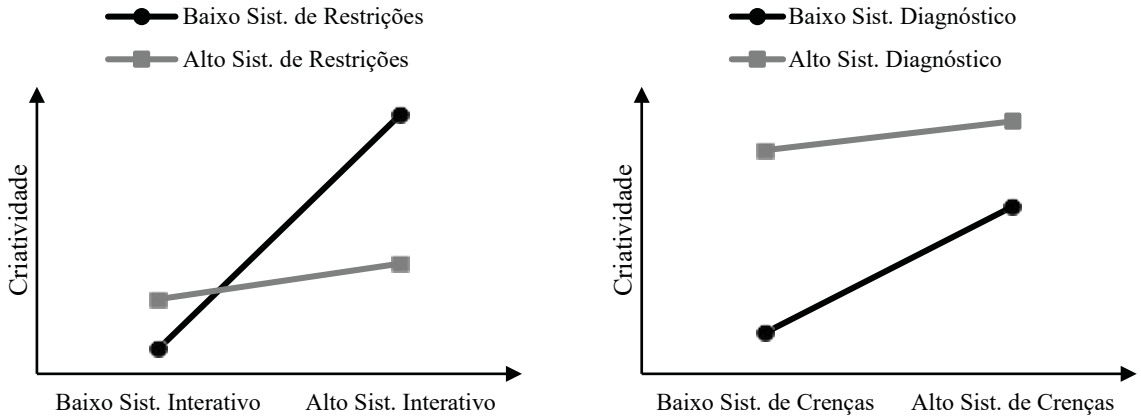
**p < 0.01; *p < 0.05; †p < 0.10.

Source: developed by the authors.

The results of the first and second regression models indicate a direct and positive effect of interactive (β=0.377; p<0.01) and belief systems (β=0.270; p<0.01), respectively, on creativity. Hence, the greater the use of controls to promote vertical communication and organizational interaction or inspire employees to commit to the company's values and mission, the greater the creativity. These results corroborate the findings of Speklé, Elten, and Widener (2017), Kaveski and Beuren (2020), and Oliveira and Beuren (2021).

However, these effects were moderated by negative control systems, partially supporting hypothesis H1. The result of the first model revealed that the relationship between the interactive system and creativity was negatively moderated by the boundary system (β=-0.277; p<0.05), while the second model revealed that the diagnostic system negatively moderated the effect of the belief system on creativity (β=-0.170; p<0.05). Speklé, Elten, and Widener (2017), Kaveski and Beuren (2020), and Oliveira and Beuren (2021) have already shown the insignificance of the direct relationship between negative systems and creativity. Therefore, these findings advance on previous studies, as they detail how the boundary and diagnostic systems are associated with the relationship between interactive and belief systems and creativity, i.e., it is not a direct relationship; instead, it plays a moderating role.

Figure 2 graphically highlights these moderating effects. The relationship between the (positive) interactive (left side) and belief systems (right side) is consistently positive. However, in the condition in which the levels of negative systems are low (solid black line), the slope is greater, indicating that the effect of positive systems on creativity is stronger.




Translate: Creativity; Low levels of Boundary Systems; High levels of Boundary Systems; Low levels of Diagnostic Systems; High levels of Diagnostic Systems; Low levels of Interactive Systems; High levels of Interactive Systems; Low levels of Belief Systems; High levels of Belief Systems

Source: developed by the authors.

**Figure 2.** Moderating effect of the negative systems on creativity

Startups restrict creative work to ensure assertiveness and efficiency (Taylor et al., 2019). Therefore, the level of creation is higher as startups present low levels of Boundary systems and high levels of interactive systems (right side of Figure 2).

When establishing business conduct and strategic restrictions, managers rely on the individual creativity of subordinates to search for opportunities since it is unfeasible for them to specify in detail how this search should be conducted (Simons, 1995). In other words, boundary controls provide conditions for this search; thus, its relationship with creativity occurs as stimuli are provided to make it happen through interactive controls, for instance. Thus, by negatively moderating this relationship, the theory defended by Simons (1995) is reinforced since the author argues that boundary systems comprise opposing forces that impose restrictions on the stimuli proposed by belief and interactive systems, corroborating previous studies such as Widener (2007), Bedford (2015) and Heinicke, Guenther, and Widener (2016) on the notion of interdependent levers.

In short, the results in which creativity is the dependent variable partially support hypothesis H1, as they were not significant for the moderating effect of the diagnostic system on the relationship between interactive systems and creativity (β = 0.028; p = N.S.) or for the moderating effect of the boundary system on the relationship between belief system and creativity (β = 0.091; p = N.S.). Interestingly, non-significant effects occurred in interactions involving control systems that usually describe tensions and the dual role between positive and negative controls (interactive *vs.* diagnostic and beliefs *vs.* boundary) (Tessier & Otley, 2012). Kaveski and Beuren (2020) argue that the non-significance of the relationships between diagnostic and interactive controls may be justified if the companies addressed here balance the use of these controls, which would explain the lack of interdependence between them in this relationship. As shown in Table 2, the degree of correlation between the diagnostic and interactive systems is high in this study's sample (r=0.713), which may represent the lack of interdependence. These results reveal that the dual role of controls goes beyond the dichotomies of diagnostic *vs.* interactive and beliefs *vs.* boundary.

## 4.2 Moderating effect of control of levers on the creativity-innovation relationship

Hypotheses H2a-b deal with the moderating effect of control levers on the relationship between creativity and innovation. Two new regression models were tested, with innovation as the dependent variable. The first model tested the moderating effect of negative control systems (diagnostic and boundary), as predicted in hypothesis H2a. The second model tested the moderating effects of positive controls (interactive and belief) according to hypothesis H2b. Again, the covariates time since foundation, number of employees, and traction and operation stages were included in the models. The results are presented in Table 5.

Table 5

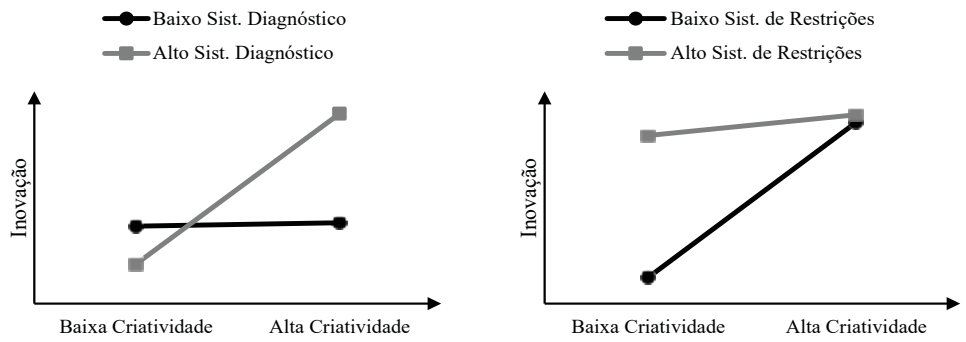
**Regression coefficients on innovation**

| Construct | Beta (β) | SE | *t* | Beta (β) | SE | *t* |
|---|---|---|---|---|---|---|
| (Intercept) | 3,966 | 0,142 | 27,870** | 3,954 | 0,139 | 28,382** |
| Control Variables | | | | | | |
| Time since foundation | -0,035 | 0,012 | -2,912** | -0,037 | 0,012 | -3,163** |
| No. of Employees | 0,000 | 0,002 | 0,046 | 0,000 | 0,002 | 0,239 |
| Traction (1=yes/0=no) | -0,291 | 0,123 | -2,371** | -0,257 | 0,121 | -2,124* |
| Operation (1=yes/0=no) | -0,422 | 0,154 | -2,738** | -0,356 | 0,149 | -2,388* |
| Direct effects | | | | | | |
| Creativity | 0,145 | 0,054 | 2,667** | 0,054 | 0,054 | 0,988 |
| Boundary system (BOS) | 0,123 | 0,060 | 2,063* | | | |
| Diagnostic system (DS) | 0,067 | 0,064 | 1,046 | | | |
| Belief system (BES) | | | | 0,172 | 0,054 | 3,196** |
| Interactive system (IS) | | | | 0,083 | 0,059 | 1,419 |
| Double moderation | | | | | | |
| Creativity vs. BOS (H2a) | -0,111 | 0,054 | -2,049* | | | |
| Creativity vs. DS (H2a) | 0,138 | 0,054 | 2,558* | | | |
| Creativity vs. BES (H2b) | | | | -0,117 | 0,050 | -2,348* |
| Creativity vs. IS (H2b) | | | | 0,143 | 0,056 | 2,537* |
| | | | | | | |
| R2 adjusted | 0,177 | | | 0,204 | | |
| F (model) | 4,644** | | | 5,327** | | |
| VIF (higher) | 1,999 | | | 2,148 | | |

Notes. VIF = Variance Inflation Factor. Beta (β) = Regression coefficient. SE = Standard error.**p<0.01; *p<0.05.

Source: developed by the authors.

As expected, creativity appears directly and positively associated with innovation (β=0.145; p<0.01) in the first model, similar to what Oliveira and Beuren (2021) found. The moderation results showed that the diagnostic system positively moderated the relationship between creativity and innovation (β=0.138; p<0.05). The results do not support H2a, as they oppose the adverse effects expected in this hypothesis. As shown in Figure 3 (left side), the positive effect of creativity on innovation is favored in the intense use of the diagnostic system. Conversely, the boundary system negatively moderated the relationship between creativity and innovation (β=-0.111; p<0.05), i.e., the effect of creativity on innovation is positive when the boundary system is less intensively adopted (see Figure 3. right side), partially supporting H2a. in which the restrictive system negatively moderates the relationship between creativity and innovation.




Translate: Innovation; Low levels of Diagnostic Systems; High levels of Diagnostic Systems; Low Creativity High Creativity; Low levels of Boundary Systems; High levels of Boundary Systems; Low Creativity High Creativity

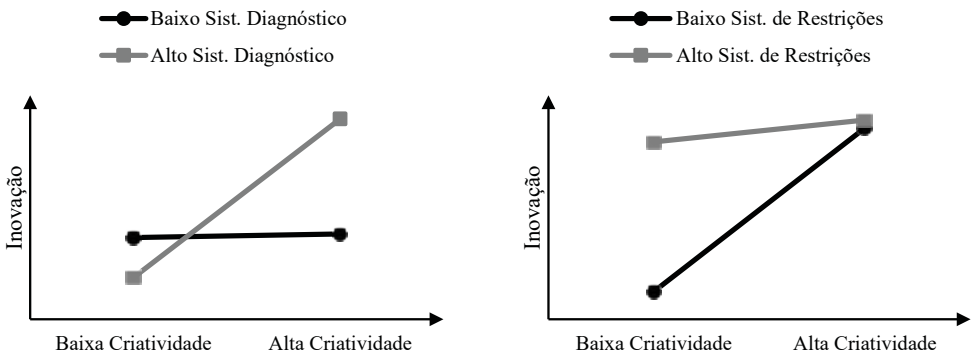
Source: developed by the authors.

**Figure 3.** Moderating effect of negative controls on the creativity-innovation relationship

Considering that the literature shows that formal controls are needed for creativity to be converted into innovation (Bisbe & Malagueño, 2015), diagnostic controls are necessary for this to happen. In the innovation process, employees must be aware of the level of progress toward results and the behaviors expected from them to implement strategies, ensuring that there will be no significant deviations from the innovation planning.

In the second regression model, unlike the previous one, creativity did not significantly affect innovation (β=0.054; p<N.S.) when controlled by the interactive and belief systems. In turn, the belief system positively and significantly affected innovation (β=0.172; p<0.01).

Regarding moderated effects, the result for the moderation of interactive control was significant and positive (β=0.143; p<0.05), supporting H2b. However, the results showed that the belief system negatively moderates the relationship between creativity and innovation (β=-0.117; p<0.05). Note that the expected relationship for H2b was positive (the belief system positively moderates the relationship between creativity and innovation). Therefore, H2b is partially supported by the belief system. Figure 4 shows that the effect of creativity on innovation is positive in the presence of intense use of the interactive system (left side) or less intense use of the belief system (right side).




Translate: Innovation; Low levels of Interactive Systems; High levels of Interactive Systems; Low Creativity High Creativity; Low levels of Belief Systems; High levels of Belief Systems; Low Creativity High Creativity; Low Creativity High Creativity

Source: developed by the authors.

**Figure 4.** Moderating effects of positive controls on the creativity-innovation relationship

Finally, regarding the moderating effects of control levers on the creativity-innovation relationship, even though belief and boundary controls act as opposing forces, they present similar moderating effects in the duality between positive and negative controls; both negatively moderated the relationship between creativity and innovation. However, even if they do not favor the effect of creativity on innovation, they prove necessary for innovation when there are low levels of creativity, acting as compensation. The belief system instills in individuals a feeling of belonging and involvement in their organizations' purposes, values, and mission, highlighting the importance of innovation as an essential element for the survival of startups (Moroni, Arruda, & Araújo, 2015) at the same time that the boundary system is capable of delimiting the actions of employees, counterbalancing the impacts of greater efforts in the search for value creation provided by the belief system.

Likewise, although interactive and diagnostic controls represent opposing forces in the duality of controls, they showed similar moderating effects. Both enhanced the effect of creativity on innovation. The diagnostic system can direct employees' attention to variables critical for successful innovations, ensuring optimized creative efforts. In turn, the interactive system can reduce the uncertainties inherent to the innovative process, involving managers in the subordinates' decision-making and debating ideas, establishing an innovation agenda (Simons, 1994).

Finally, Table 6 summarizes the results of the hypothesis tests. In practice, these results reinforce the notion that the duality between positive and negative controls should not be confused with the concept of quality control (Tessier & Otley, 2012). Positive and negative controls are not necessarily bad for the flourishing of creativity or innovation in the context of startups. They are desirable for designing a control intended to improve innovation performance, ensure efficiency in creative efforts, and search for opportunities within acceptable limits.

Table 6
**Summary of the hypotheses tests**

| | Findings | Decision |
|---|---|---|
| H1 | The boundary system negatively moderates the relationship between the interactive system and creativity. | Supported |
| H1 | The diagnostic system does not play a moderating role in the relationship between the interactive system and creativity. | Unsupported |
| H1 | The boundary system does not play a moderating role in the relationship between the belief system and creativity. | Unsupported |
| H1 | The diagnostic system negatively moderates the relationship between the belief system and creativity. | Supported |
| H2a | The diagnostic system positively moderates the relationship between creativity and innovation. | Unsupported |
| H2a | The boundary system negatively moderated the relationship between the interactive system and creativity. | Supported |
| H2b | The belief system negatively moderates the relationship between creativity and innovation. | Unsupported |
| H2b | The interactive system positively moderates the relationship between creativity and innovation. | Supported |

Source: developed by the authors.

In general, the findings concerning direct relationships corroborate previous studies' results, while moderation tests highlighted other forms of interaction between different types of management controls (positive and negative), creativity, and innovation, representing an advance in the literature. The results of the H2a and H2b tests, contrary to the expected, provide insights into different forms of interaction between the levers when considering not only their existence/use but the intensity (high/low) in which they are used, which may also affect these relationships.

## 5. Conclusion and Recommendations

This study aimed to identify the moderating effect of control levers on creativity and innovation among Brazilian startups. Regarding creativity, boundary, and diagnostic systems were found to negatively moderate the relationship between interactive and belief systems and creativity. Therefore, systems considered negative acts as typical elements of compliance (Tessier & Otley, 2012), as they inform individuals at startups about restrictions to creative work and direct creative effort towards exploring desirable opportunities. Startups are characterized by a high degree of innovation; hence, creativity is expected to be strongly encouraged by organizational beliefs and values and by interaction with managers (Kaveski & Beuren, 2020). Therefore, this study's contribution includes evidence that negative systems are essential to regulate creative efforts encouraged by positive controls.

As for startup innovation, the results showed that boundary and belief systems negatively moderated the relationship between creativity and innovation. However, these are important when a startup's level of creativity is low. These results show that belief and boundary systems may compensate for a low level of creativity. On the other hand, interactive and diagnostic systems play a positive moderating role, strengthening the effect of creativity on innovation. Therefore, these results contribute to the literature by showing that the dualities between beliefs *vs*. boundary and interactive *vs*. diagnostic systems may serve the same purposes, not acting as opposing but synergistic forces.

The findings regarding positive and negative controls contribute to the literature by providing evidence regarding controls' interdependent and complementarity nature, showing the importance of seeking more information about their relationships. For example, the different types of control were present at the different stages of the innovation process (idea creation and implementation), indicating that they are complementary and balance each other in a broader context.

From a general perspective, the results found here can help startup managers understand that when controls are balanced and applied together, they do not inhibit creativity and innovation, as previously suggested in the literature, but rather, they can be used to achieve creativity and innovation.

Thus, managers can use controls to promote extrinsic motivation and encourage employees to act according to the organization's objectives, being creative and providing innovative solutions, practices, and implementations in the market. Such actions occur based on a structure that promotes interaction and information sharing and includes employees in the decision-making and creative process while establishing limits, clarifying risks, defining goals, and establishing means to assess performance.

This study's limitations concern its sample. Even though there were sufficient responses to perform the statistical method and follow the criteria recommended by Hair, Hult, Ringle, and Sarstedt (2014), the return percentage was only 6.27% of the population. Another limitation is that the results cannot be generalized, as they are restricted to the companies in the sample.

A suggestion is to expand this study to other sectors, addressing periods of greater economic stability, considering that data in this study were collected during the COVID-19 pandemic. Additionally, longitudinal studies are interesting to verify the behavior of these relationships over time, considering the startups' characteristics – such as the speed with which these companies are often created and become viable businesses; the indicators reported in the literature show that the use of controls increase and change as these companies grow (Davila, Foster & Jia, 2010; Heinicke, Guenther & Widener, 2016). Furthermore, given the results concerning moderating roles with signs different from the expected, another suggestion is to analyze these relationships in the context of contingency theory or the configuration approach, including some rational goal performance variables (Cardinal, Kreutzer & Miller, 2017) to assess such interactions.

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