INFLUENCE OF INTERATIVE AND DIAGNOSTIC OF MANAGEMENT CONTROL SYSTEMS ON PROCESS INNOVATION AND STARTUPS PERFORMANCE

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ABSTRACT

This study analyzes the influence of interactive use and diagnostic of management control systems (MCS) on process innovation and organizational performance in startups. In a complementary way, it analyzes the mediating effect of process innovation on the relationship between the interactive use and diagnostic of MCS and organizational performance. A survey was conducted with Brazilian start-up managers registered in the LinkedIn network, in which a sample of 122 valid responses was obtained. To test the hypotheses the technique of modeling structural equations was applied. The results indicated that the use of MCS diagnostic influences process innovation and organizational performance. The interactive use of MCS also influences organizational performance, but there is no evidence that it influences process innovation. Process innovation had a partial mediating effect on the relationship between diagnostic use of MCS and organizational performance, which was not observed for interactive use. These findings contribute to the flow of research that seeks to explain the effects of MCS on process innovation and organizational performance.

Keywords: Interactive use. Diagnostic use. Management control systems. Process innovation. Organizational performance.

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INFLUÊNCIA DO USO INTERATIVO E DIAGNÓSTICO DE SISTEMAS DE CONTROLE GERENCIAL NA INOVAÇÃO DE PROCESSOS E NO DESEMPENHO DE STARTUPS

RESUMO

Este estudo analisa a influência do uso interativo e diagnóstico de sistemas de controle gerencial (SCG) na inovação de processos e no desempenho organizacional em startups. De forma complementar analisa o efeito mediador da inovação de processos na relação do uso interativo e diagnóstico de SCG com o desempenho organizacional. Uma survey foi realizada com gestores de startups brasileiras cadastrados na rede LinkedIn, em que se obteve uma amostra de 122 respostas válidas. Para testar as hipóteses aplicou-se a técnica de modelagem de equações estruturais. Os resultados indicaram que o uso diagnóstico de SCG influencia na inovação de processos e no desempenho organizacional. O uso interativo de SCG também influencia no desempenho organizacional, mas não há evidências de que influencia na inovação de processos. A inovação de processos exerceu efeito mediador parcial na relação entre uso diagnóstico de SCG e desempenho organizacional, o que não foi observado para o uso interativo. Esses achados contribuem com o fluxo de pesquisa que busca explicar os efeitos dos SCG na inovação de processos e no desempenho organizacional.

Palavras-Chave: *Uso interativo. Uso diagnóstico. Sistemas de controle gerencial. Inovação de processos. Desempenho organizacional.*

1 INTRODUCTION

The recognition of organizations as to the relevance of developing and exploiting their innovative capabilities is decisive in performance and obtaining competitive advantages, regardless of the way in which they are composed (Helfat & Peteraf, 2003), especially in environments that experience constant changes (Subramaniam & Youndt, 2005). On that line, the assumptions of the resource-based perspective consider organizational innovation a useful element in competitive environments, since it can establish advantages (Raymond & St-Pierre, 2010). This panorama has been instigating researchers to investigate the effects of innovation on performance (Wang & Wang, 2012).

Innovation is defined as the commercial introduction of a new product or the invention of something new through the combination of something that already existed in the scientific or technological field (Schumpeter, 1934). Innovation can take place in different ways, with product and process innovations being the most common types examined by research (Gunday, Ulusoy, Kilic & Alpkan, 2011). The main reason for their occurrence in organizations is the fact that they are easily identified and present less complexity for their implementation (Azar & Drogendijk, 2014). In addition, product innovations offer strategic advantages in the market, which does not take the merits out of process innovations, since both are relevant sources of competitive and strategic advantages (Prajogo, 2016).

Innovation can be driven by organizations or, at the other extreme, hampered using management control systems (MCS). Therefore, these play an important role in competitive and highly dynamic environments (Hofmann, Wald & Gleich, 2012). Thus, it is relevant to understand not only the design of these systems, but also their use. This research analyzes the use of MCS in line with the lever model proposed by Simons (1995), focusing specifically on interactive use and diagnostic.

The interactive use of MCS enables greater exchange of information, which promotes incentives for individuals to feel challenged and encouraged to participate and discover creative and innovative solutions (Speklé, Van Elten & Widener, 2017). While diagnostic use presents more structured communication channels, it restricts and concentrates attention on strategic areas and opportunities (Simons, 1995; Henri, 2006; Speklé et al., 2017). Both can operate in a balanced and simultaneous manner (Simons, 1995; Henri, 2006), being complementary and interdependent (Widener, 2007).

The reflections from the elements described suggest gaps in research regarding the connections of the constructs presented, especially in companies that have at its core an innovative character, such as *startups* (Ries, 2012; Perin, 2016; Blank & Dorf, 2020). In view of the above, this study aims to analyze the influence of interactive use and diagnostic of MCS on process innovation and organizational performance in *startups*. In a complementary way, it analyzes the mediating effect of process innovation in the relationship between interactive use and diagnostic of MCS with organizational performance. From this perspective, a *survey* was conducted with the *managers of Brazilian startups registered* in the *LinkedIn network,* which circumscribes the results to the perception of these respondents.

Startups are organizations that operate in different segments and proliferate in environments of uncertainty, holding an important role when it has high competitiveness in the market (Blank & Dorf, 2020). They are created by entrepreneurs who are willing to take risks in the developing of innovative and creative ideas, in addition to boosting the economy (Moroni, Arruda & Araujo, 2015). It is a mistake to expect this type of organization to remain focused only on product innovations, as they also focus on innovations related to the adoption of new processes for management (Moroni et al., 2015).

In this scenario, interest in understanding the sources of organizational performance has become increasing in the accounting and managerial fields, with a view to promoting contributions, both theoretical and empirical (Richard, Devinney, Yip & Johnson, 2009). This research seeks to *provide new insights* by investigating different sets of relationships, which can provide additional explanations and instigate research possibilities, besides arousing interest in the theme in the context of organizational practice.

The empirical results of this research contribute to the literature that addresses the relationship between the use of MCS and innovation (e.g.: Henri, 2006; Lopez-Valeiras, Gonzalez-Sanchez & Gomez-Conde, 2016; Lopes, Beuren & Martins, 2018), use of MCS and performance (ex: Adler & Chen, 2011; Lopes, Beuren & Gomes, 2019), innovation and performance (e.g. Yoshikuni, Favaretto, Albertin & Meirelles, 2018). With a closer approach to the present research are studies that investigated the influence of interactive use of MCS on innovation and performance (e.g.: Bisbe & Otlhey, 2004; Nisiyama, Oyadomari, Yen-Tsang & Aguiar, 2016).

In the field of management practice, the study seeks to contribute to organizations by emphasizing the importance of the use of MCS that can support the promotion of innovation and, consequently, provide competitive conditions and boost performance. Innovation in the workplace is presumed to be decisive for organizational performance as well as for long-term success and survival (Anderson, Potočnik & Zhou, 2014). In addition, MCS influence the process of implementing organizational strategies (Otley, 1999), which makes them relevant in the search for competitive advantages by organizations (Jacomossi & Silva, 2016).

The article was structured in five sections, the introduction being the first. The second section presents a review of the literature and the rationale of the research hypotheses, which comprise the relationships between the use of MCS, process innovation and organizational performance. The third section discusses the methodological procedures adopted in research. The fourth section is intended for the description and analysis of the results of the study. In the fifth section, the final considerations of the research are presented, with the main findings, contributions, limitations and propositions for future research.

2 LITERATURE REVIEW AND HYPOTHESES

2.1 Interactive Use and Diagnostic of MCS and Process Innovation

MCS can play an important role in the innovative management process, and its design and use are considered crucial in promoting innovation (Davila, Epstein & Shelton, 2006). We highlight the structure of the control levers proposed by Simons (1995), which considers the need to examine jointly the belief systems, border systems, interactive control systems and diagnostic control systems.

The structure of the control levers plays different roles in the innovation process (Davila, Foster & Oyon, 2009). The control levers generate dynamic tensions between innovation and the achievement of predictable goals (Simons, 1995), besides facilitating the development of organizational capabilities, as a technological one (Henri, 2006). Managers use the four levers to balance the requirement between control and need for innovation and learning (Mundy, 2010), and for managing multiple types of innovation (Bedford, 2015).

Interactive use of control systems tends to increase effectiveness in teams of organizations where innovation is paramount (Chong & Mahama, 2014). In addition, it allows members of the organization to be able to look at alternative ways of solving problems with a view to promoting process innovation, due to the environment that involves greater capacity building, debate and greater information flow (Ylinen & Gullkvist, 2014). In this line, the interactive use of MCS is a determining factor in the development of process innovation (Lopez-Valeiras et al., 2016). Thus, it is proposed that:

H_{1a}: The interactive use of MCS directly and positively influences process innovation.

The literature points out that the diagnostic use of control systems tends to negatively influence organizational capacities, among which are entrepreneurship, market orientation, organizational learning and innovation (Henri, 2006). However, it should be considered that diagnostic use can also trigger processes that provide the motivation of managers in achieving the objectives. Diagnostic use provides an environment that contributes to innovation activities, since it induces the monitoring of critical performance variables and assists in the process of monitoring and coordinating strategies (Simons, 1995). In this line, it is assumed that:

H_{1b}: The diagnostic use of MCS directly and positively influences process innovation.

2.2 Interactive Use and MCS Diagnostic and Organizational Performance

Simons (1995) proposed a theoretical model of MCS with four control levers. However, several studies have focused on two specific levers, on the interactive use of control systems and on the diagnostic use of control systems, relating them to different variables, such as organizational performance (Degenhart & Beuren, 2019). The interactive use and diagnostic of MCS has been an important theoretical lens to analyze the support of strategies that improve organizational performance (Abernethy & Brownell, 1999; Henri, 2006).

Organizational capacities reflect on performance, both in the prevalence of interactive use of control systems, and in situations in which the diagnostic use of control systems prevails (Henri, 2006). In general terms, MCS can contribute to the increase of financial and non-financial indicators in the strategic context of the organization (Merchant & Van der Stede, 2007).

The interactive use of MCS stimulates the exchange of information between managers and their subordinates (Su, Baird & Schoch, 2015). Fluid communication in the interactive environment facilitates *feedback of* the information generated, which provides directions in identifying initiatives to maximize results (Widener, 2007), as well as promotes innovation and stimulates creativity (Su et al., 2015). Several studies have observed a positive relationship between the interactive use of MCS and performance, considering different environmental contexts (Sakka, Barki & Côté, 2013). Thus, it is proposed that:

H_{2a}: The interactive use of MCS directly and positively influences organizational performance.

The diagnostic use of MCS, in turn, is based on monitoring performance and achieving the desired goals (Sakka et al., 2013). Research indicates that the diagnostic use of MCS has a positive impact on organizational performance (Adler & Chen, 2011; Hofmann et al., 2012). It is argued that the diagnostic use of control systems aims to control critical performance variables (Hofmann et al., 2012). In view of the above, it is assumed that:

H_{2b}: The diagnostic use of MCS directly and positively influences organizational performance.

2.3 Process Innovation and Organizational Performance

Innovation is considered a determinant of competitiveness because it contributes to better organizational performance (Damanpour & Aravind, 2012). In this line, if the organization is interested in sustaining competitive advantages, it needs to be in a constant process of change, with the development of new business models or even modifications in its products and processes (Huang, Lai & Lo, 2012).

Process innovation, the focus of this research, provides conditions for organizations to achieve greater savings in scale, reduce costs, and increase the flexibility capacity and quality of the products and services offered (Klomp & Van Leeuwen, 2001). Such improvements help in the search for competitive advantages, improvement of economic results and greater chances of survival in the market (Nieto & Santamaría, 2010; Verhees, Meulenberg & Pennings, 2010), important elements for the organization's performance.

Innovation is considered an important growth strategy and functions as a source of competitive advantage generation (Damanpour, Walker & Avellaneda, 2009). Innovation can improve the efficiency and potential of the organization, as well as offer conditions to increase the quality of what is offered, which enables the creation of new intangible assets (Parasuraman, 2010; Wang & Wang, 2012).

Kafouros, Buckley, Sharp and Wang (2008) investigated internationalized companies, and found that innovation has a strong effect on the organization's performance. The relationship between innovation and performance has been observed in different studies, which found that innovation or innovative capacity has a positive effect on the organization's results, whether considering aspects of innovative, market, financial or production performance (Damanpour & Evan, 1984; Santos & Peffers, 1995; Baer & Frese, 2003; Gunday et al., 2011; Ali, Kan & Sarstedt, 2016). Thus, it is assumed that:

H_3: Process innovation directly and positively influences organizational performance.

2.4 Mediating Effect of Process Innovation on Interactive Use and MCS Diagnostic with Organizational Performance

The literature supports considering the direct relationship between MCS use and organizational performance (Adler & Chen, 2011; Hofmann et al., 2012; Sakka et al., 2013), as well as between process innovation and organizational performance (Gunday et al., 2011; Ali et al., 2016). The pressure for organizations to be innovative reinforces the potential of control to help motivate innovative efforts (Chenhall & Moers, 2015). Greater innovative capability allows customer needs to be better met, which promotes conditions for superior performance (Sadikoglu & Zehir, 2010).

Performance improvements can be achieved by aligning or restructuring the innovation process with the proper use of MCS (Wijethilake, Munir & Appuhami, 2018). However, the authors argue that only developing innovation strategies may not be sufficient to promote performance improvements, there is a need to consider internal and external contextual factors. It is considered that the research of Wijethilake et al. (2018) considered environmental innovations and enabling and coercive control systems.

Process innovation, the target of this research, considers the need to maintain and improve performance, including, for example, changes in reporting systems, management accounting and controls adopted by the organization (Sisaye & Bimberg, 2010). The interactive use of MCS favors conditions that lead to collaboration, exchange of information and evaluation of alternatives that, at a time, allow good integration of innovations in the company, directing initiatives that can maximize results (Widener, 2007; Lopez-Valeiras et al., 2016). Thus, it is assumed that:

H_{4a}: Process innovation affects the relationship between interactive MCS use and organizational performance.

The diagnostic use of MCS provides conditions for the organization to be able to restrict excessive innovations, which makes it possible to realize emerging opportunities (Chenhall & Morris, 1995). In this sense, the diagnostic use of MCS can create the necessary space and flexibility for the experience of adjustments in daily activities, with direction in relation to the intended results, which can lead to better organizational performance (Adler & Chen, 2011). In view of the above, it is presented that:

H_{4b}: Process innovation affects the relationship between the diagnostic use of MCS and organizational performance.

Figure 1 presents the theoretical model of the research, highlighting the constructs and hypotheses formulated.

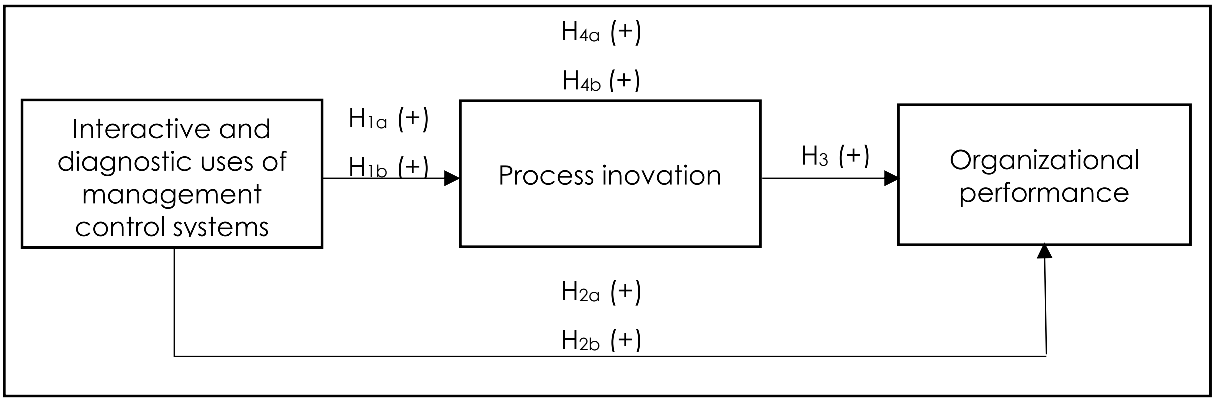

Figure 1. Theoretical model of research
Source: Own elaboration.

According to Figure 1, it is conjecture that the interactive use and diagnostic of MCS influences process innovation and organizational performance. Theoretical arguments predict that the use of MCS influences process innovation (H_{1a}; H_{1b}), as well as organizational performance (H_{2a}; H_{2b}), and that process innovation influences organizational performance (H_3). It should also be seen that process innovation acts as a mediating variable in the relationship between the use of MCS and organizational performance (H_{4a}; H_{4b}).

3 RESEARCH METHODOLOGY

3.1 Population and Sample

A *survey* was conducted with the managers *of Brazilian startups* listed in StartupBase, in which 12,848 registered companies were identified*, working* in segments such as education, finance, health and well-being, internet and agribusiness. After identifying *the startups* in operation, invitations were sent to managers registered in *the LinkedIn network*, having as parameters the terms "founder", "founding partner", "CEO", "CFO", "leader", "manager" or "director". Invitations were sent to these managers from November 2019 to January 2020.

A group of 1,130 invitations were sent to the *managers* of the selected startups, linked to 516 companies. Of the invitations sent, 782 were accepted, and for these managers a message was forwarded with a brief description of the research objective and the link of the questionnaire by the *QuestionPro platform*. A total of 226 responses were obtained, of which 104 were incomplete, resulting in 122 valid questionnaires.

3.2 Measurement of Constructs and Data Analysis Procedures

The theoretical model of the research consists of the constructs process innovation, organizational performance and interactive use and diagnostic of MCS. Thus, the research instrument (Appendix A) consists of three blocks, with a total of 20 assertive in five-point Likert scale. The first block, process innovation, has five statements of the research instrument developed by Gunday et al. (2011). The second block, organizational performance, with four assertions, was based on darroch's (2005) research. The third block, use of MCS, has seven statements for interactive use and four for diagnostic use, according to Henri research (2006).

Before testing the proposed relationships, factor analysis of the research instrument was performed using the SPSS software, in order to identify the relationships and common factors of the construct (Fávero & Belfiore, 2017). The statements showed reliability and adequacy of samples considered satisfactory, without the need for removal of assertions (Fávero & Belfiore, 2017). Process innovation (a=0.836) and organizational performance (a=0.837) are grouped. In the construct interactive use and diagnostic of MCS, both the interactive use and the diagnostic use each formed one main component, with alphas of 0.905 and 0.903, respectively. Therefore, the model presents reliability, since Cronbach's alphas presented values higher than 0.70 (Hair Jr, Hult, Ringle & Sarstedt, 2016).

The Single Harman factor test was applied to verify the question of variance of the common method or single factor (Podsakoff, MacKenzie & Podsakoff, 2003). In exploratory factor analysis, the percentages of the main components met the compliance assumptions considered by Podsakoff et al. (2003), with values greater than 50%. Process innovation presented variance of 60.42%, organizational performance 67.41%, interactive use 64.23% and diagnostic use 77.58%. Furthermore, the results did not indicate significant differences (at the significance level of 5%) among the respondents.

In the analysis of the proportion of variances considered common among the variables adopted by *the Kaiser-Meyer-Olkin* (KMO) statistics, for the variable process innovation the value was 0.765, organizational performance 0.656, interactive use 0.887 and diagnostic use 0.840, which meets the limits recommended by Fávero and Belfiore (2017). Bartlett's scouting test was also performed on the overall adequacy of factor analysis.

Then, to test the hypotheses of the research, the Structural Equations Modeling (SEM) was applied, estimated from the Partial Least Squares (PLS), with the aid of the SmartPLS software. The choice for this technique stems from the fact that it is multivariate statistics, which examines interrelationships similarly to multiple regression equations (Hair Jr. et al., 2016).

4 DESCRIPTION AND ANALYSIS OF RESULTS

4.1 Measurement Model

The PLS-SEM analysis was initiated by verifying the measurement model. The values generated for the validity of the measurement model are shown in Table 1.

Table 1
Validity of the measurement model

	AVE	CR	Alfa	1	2	3	4
1. Process innovation	0.602	0.883	0.835	**0.776**			
2. Organizational performance	0.673	0.891	0.838	0.431	**0.820**		
3. Interactive use	0.642	0.926	0.907	0.295	0.508	**0.801**	
4. Diagnostic use	0.775	0.932	0.903	0.338	0.553	0.584	**0.880**

Note: Diagonal elements represent the square roots of the extracted mean variance (AVE). The elements outside the diagonal represent the correlations between the latent variables.
AVE= Average Variance Extracted (>0.50); CR= Confiabilidade composta (>0.70); Alfa de *Chronbach* (>0.70).
Source: Search data.

The convergent validity criteria were met in accordance with the one proposed by Fornell and Larcker (1981), who consider it necessary to have a veal value greater than 0.5 (Hair Jr. et al., 2016). The discriminating validity also met the one recommended by Fornell and Larcker (1981), because the square roots of the values of the AVE were superior to the correlations between the constructs (Hair Jr. et al., 2016).

Reliability and internal consistency were also analyzed to verify whether there is reliability in the responses (Ringle, Silva & Bido, 2014). The model presents reliability and internal consistency, since the loads of composite reliability and Cronbach's alphas were higher than 0.70 for all constructs (Hair Jr. et al., 2016). In the analysis of Cronbach's alphas, the interactive use obtained a load of 0.907, followed by the diagnostic use variable, which presented a load of 0.903.

4.2 Structural Model

In SmartPLS, the path coefficients of the proposed model were estimated. Bootstrapping was used to verify whether the measurement model and the significance of the relationships between latent variables are adequate, considering 5,000 subsamples, using the Bias-Corrected and Accelerated (BCa)

Bootstrap confidence interval and bicaudal test at the significance level of 0.05 (Hair Jr et al., 2016). By bootstrapping, values were obtained for the structural coefficients, t-value and p-value of each tested relationship, effect size (F^2) and coefficient of determination (R^2). Blindfolding was used for reuse of samples, which works with model estimates to predict the omitted part (Hair Jr et al., 2016), i.e., predictive relevance (Q^2). Table 2 shows the results of the tests performed considering the hypotheses of the research.

Table 2
Results of the structural model

	Hypotheses	Coefic. structural	Standard deviation	Value t	Value f2	VIF	P-value	Decision
H_{1a}	Interactive use → Process innovation	0.148	0.116	1.282	0.017	1.517	0.200	Does Not Accept
H_{1b}	Diagnostic use → Process innovation	0.251	0.117	2.152	0.048	1.517	0.031	Accepts
H_{2a}	Interactive use → Organizational performance	0.244	0.081	2.994	0.065	1.542	0.003	Accepts
H_{2b}	Diagnostic use → Organizational performance	0.326	0.089	3.661	0.114	1.589	0.000	Accepts
H_3	Process innovation → Organizational performance	0.249	0.090	2.760	0.092	1.147	0.006	Accepts

Note: Evaluation of the structural model: R_2: Process innovation= 0.128; Organizational performance= 0.412.
Predictive relevance (Q^2): Process innovation= 0.066; Organizational performance= 0.249.
Source: Search data.

It is observed that, apart from H_{1a}, the other hypotheses formulated were accepted. H_1 provided a direct and positive relationship between the interactive use and diagnostic of MCS with process innovation. Based on the literature presented, we opted for the segregation of the hypothesis, and H_{1a} was intended for the relationship between interactive use and process innovation and H_{1b} for the relationship between diagnostic use and process innovation, for which a direct and positive relationship was expected. The evidence presented led not to accept H_{1a}, since it did not present statistical significance. This contradicts the results of research et al by Chong and Mahama (2014) and Lopez-Valeiras et al. (2016). On the other hand, statistical evidence allowed the accept of H_{1b} with a structural coefficient of 0.251 ($p<0.05$). This result is consistent with the one exposed by Simons (1995) and Henri (2006).

It is speculated that the non-acceptance of H_{1a} swells from the interpretation of flexibility and learning by respondents as being natural in the innovative environment of startups. It is also conjectured that the relationship between the interactive use of MCS and innovation may vary depending on the level of innovation (Bisbe & Otley, 2004). These authors observed that in highly innovative organizations the interactive use of MCS does not seem to stimulate creativity and innovation, whereas in organizations with low innovation the evidence indicates that there are incentives for the generation of creativity and innovation (Bisbe & Otley, 2004).

In the same vein, we opted for the segregation of the H_2 hypothesis, and H_{2a} provided a direct and positive relationship between the interactive use of CGS and organizational performance and H_{2b} direct and positive relationship between the diagnostic use of MCS and organizational performance. Both were accepted, with H_{2a} presenting a positive structural coefficient of 0.244 ($p<0.01$) and H_{2b} a positive structural coefficient of 0.326 ($p<0.01$). This finding corroborates the results of research et al. (2015), who observed a positive association between interactive use and diagnostic of MCS and organizational performance.

Still considering the direct and positive relationships, H_3 was established, which provided direct and positive influence of process innovation on organizational performance. Statistical evidence led to acceptance of the hypothesis, since the structural coefficient of 0.249 ($p<0.01$) was obtained. This finding is consistent with research such as Naranjo-Valencia, Jiménez-Jiménez and Sanz-Valle (2016), which found a positive relationship between process innovation and organizational performance. Moreover, the results show that process innovation promotes conditions that lead to competitive advantages and, consequently, to increased economic results, in addition to improvements that drive the growth and survival of the organization (Verhees et al., 2010).

To analyze the size of the effect, the criteria proposed by Cohen (1988) were used. The greatest effects were found in the relationships between diagnostic use and organizational performance (0.114) and process innovation and organizational performance (0.092). Variance Inflation Factors analysis shows adequacy of the model and absence of multilinearity (Hair Jr et al., 2016).

The analysis of the coefficient of determination was used to indicate the quality of the adjusted model. In the social and behavioral sciences, an R^2 of 2% characterizes a small effect, 13% mean effect and 26% large effect (Ringle et al., 2014). The variable process innovation has an average effect and organizational performance has a large effect. When analyzing the Predictive Relevance or Validity, which verifies the accuracy of the model and adequacy of the constructs for the general adjustment of the model, the need for values greater than zero is considered (Ringle et al., 2014). In this study, the relevance or predictive validity was achieved, with emphasis on the organizational performance variable, which presented Q^2 of 0.249.

In the fourth hypothesis, the use of MCS was also segregate. H_{4a} provided for interaction of interactive MCS use and organizational performance, mediated by process innovation, and H_{4b} provided interaction of diagnostic MCS use and organizational performance, mediated by process innovation.

Table 3
Effects of mediation

Hypothesis H_{4a}	Effect Model without mediation	Interactive use	
		Indirect effect	**Mediation**
Interactive use→Process innovation→Organizational performance	0.284***	0.037	No mediation
Hypothesis H_{4b}	**Effect Model without mediation**	**Diagnostic use**	
		Indirect effect	**Mediation**
Diagnostic use→Process innovation→Organizational performance	0.387***	0.063*	Partial mediation

Note: *p<0.10; **p<0.05; p<0.01.
Source: Search data.

To verify mediation the recommendations of Baron and Kenny (1986) were followed. No mediation of process innovation was observed in the relationship between interactive use and organizational performance, since the first assumption was not met, in which the independent variable affects the dependent variable directly (interactive use → organizational performance, p>0,10). In H_{4b}, partial mediation was found, evidencing that process innovation is not a necessary condition for diagnostic use to influence organizational performance, but process innovation promotes the influence of diagnostic use on organizational performance.

In general, the results found reinforce what is described in the literature and that observed in previous studies, particularly regarding the importance of MCS with a view to innovation, which translates into improvement in performance. The identification of the effects of MCS, especially interactive use, ultimately draws the attention of high-ranking managers to the patterns of use of formal control systems (Bisbe & Otley, 2004). In addition, in view of the benefits of innovation in the search for results, we highlight the need to promote an environment that supports the generation of new ideas (Prajogo & Ahmed, 2006).

5 FINAL CONSIDERATIONS

This study analyzed the influence of interactive use and diagnostic of MCS on process innovation and organizational performance in startups and the mediating effect of process innovation in the relationship between interactive use and MCS diagnostic with organizational performance. The results of hypothesis tests showed convergence of the relationships established in this research with those found in previous studies (Sakka et al., 2013; Lopez-Valeiras et al., 2016), except for the relationship between the interactive use of MCS and process innovation, which did not present a statistically significant relationship.

The results presented contribute to the literature by revealing influences among the variables analyzed and in the field of the companies investigated, serving as a source for the development of research that addresses the theme in the context of startups or companies with similar structure. Process innovation is relevant for organizations in general, which extols the importance of understanding the influence of this variable on organizational performance (Verhees et al., 2010; Anderson et al., 2014). Interactive use and diagnostic use of MCS are variables that also require attention, since they can cause effects on organizational performance (Joshi, Kathuria & Porth, 2003).

The research also contributes to the practice of organizational management, particularly startups, given the relevance of understanding the interactions of the variables analyzed and how they can influence the performance of these companies. It is important to highlight the role of interactive use and diagnostic use of MCS for organizations, in order to establish flexible practices that favor creativity and innovation and, at the same time, standardized routines aimed at efficient operations, since both forms of use of MCS are indispensable in the organizational context (Speklé et al., 2017).

The importance of investigating startups is emphasized, since they adopt organizational models focused on innovation (Ries, 2012). Startups differ from other business configurations mainly because they are focused on the development of innovative ideas, with low maintenance costs, which allows the generation of favorable results more quickly and consistent (Perin, 2016). Theoretical and empirical evidence indicates that MCS are relevant in innovative businesses, as they help in the management of activities that lead to innovation (Ferreira, Moulang & Hendro, 2010; Adler & Chen, 2011).

Among the limitations of this research, we highlight the possibility of occurrence of the bias of the common method, since the same respondents reported the dependent and independent variables, even if the tests did not identify problems. Thus, it is recommended to carry out studies that take different methodologies. As the choice of variables for each construct implied disregarding assertions used in related studies, it is recommended that future studies observe aspects related to the individual characteristics of managers, which may influence the use of MCS and the innovation process, in addition to aspects of the organizational context and other variables that may affect organizational performance. Future research may also consider mediating or moderating effects of other variables that may affect organizational performance.

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APPENDIX A - RESEARCH INSTRUMENT

1 TYPES OF PROCESS INNOVATION (Gunday et al., 2011)
Please indicate the extent to which the types of process innovation have been implemented in your organization in the past five years, on a scale of 1 (not implemented) to 5 (original process innovations have been implemented).

1. Determining and eliminating non-value adding activities in delivery related processes.
2. Decreasing variable cost and/or increasing delivery speed in delivery related logistics processes.
3. Increasing output quality in manufacturing processes, techniques, machinery and software.
4. Decreasing variable cost components in manufacturing processes, techniques, machinery and software.
5. Determining and eliminating non-value adding activities in production processes.

2 ORGANIZATIONAL PERFORMANCE (Darroch, 2005)
Please indicate your degree of agreement with the following statements regarding the performance of your organization, on a scale of 1 (strongly disagree) to 5 (strongly agree). 1.
1. In general, our organization is performing better than it did 12 months ago.
2. In general, our organization is performing better than it did five years ago.
3. Over the past 12 months, our organization has met its performance objectives.
4. Over the past five years, our organization has met its performance objectives.

3 INTERACTIVE AND DIAGNOSTIC USES OF MANAGEMENT CONTROL SYSTEMS (Henri, 2006)
Rate the extent to which your management team makes diagnostic and interactive use of control in your organization, on a scale of 1 (none) to 5 (to a great extent).
Diagnostic use
1. Track progress towards goals.
2. Monitors results.
3. Compare outcomes to expectations.
4. Review key measures.
Interactive use
1. Enable discussion in meetings of superiors,sub-ordinates and peers.
2. Enable continual challenge and debateunderlying data, assumptions and action plans.
3. Provide a common view of the organization.
4. Tie the organization together.
5. Enable the organization to focus on common issues.
6. Enable the organization to focus on critical success factors.
7. Develop a common vocabulary in the organization.