Diagnostic and interactive uses of the management control system as enhancers of strategic responses in times of pandemic

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Resumo

The COVID-19 pandemic has led to enormous changes, and organizations have adopted different options in terms of strategic responses to their businesses, with consequences for their own sustainability. Some of these responses strictly affect the short term, while others affect the medium and long terms, and initially, the most important thing was to continue activities. Some responses could have resulted from the existence or absence of management control mechanisms for diagnostic and interactive use. This study aims to comprehend organizational actions, antecedents, and outcomes beyond COVID-19 pandemic. It identifies strategic responses, assesses their correlation with organizational control mechanisms, and outlines response profiles. Constructs such as control systems and governance supported firm's strategic responses. We developed a survey with 144 Brazilian firms and applied structural equation modeling analysis to test our hypotheses. The contributions of this research are multiple: (i) it offers a comprehensive perception of observed strategic responses, which is useful to practitioners; (ii) it elucidates the nexus between decision-making and the utilization of diagnostic and interactive control systems as precursors to strategic responses. Notably, the findings underscore that organizations that adopt and use management control mechanisms tend to exhibit greater resilience and proactivity in their strategic responses to crises.

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Abstract

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Keywords: Strategic decisions, Strategic responses, Management control, Strategy, Covid-19 pandemic, Diagnostic and interactive use.

1. Introduction

The extent of the pandemic was surprising for anyone or entity. Initially, it was thought to be something that would end in weeks or a few months, but in different ways, it had developments and new waves, and the initial reaction may not be adequate in the sequence of activities. Some more vulnerable sectors were affected more sharply and were reminded of experiences from other similar moments (Guo, Yang, Huang, & Guo, 2020). Many actions were developed through different strategies, and a time interval is needed to properly perceive them in order to assess their relevance and effectiveness in terms of sustainability.

Considering that organizations live and compete in an increasingly socially and technologically interconnected world, challenges occasionally appear in the form of uncertainties and minimal compensations that may seem insignificant but can create the so-called "butterfly effect" in a wide interconnected network of companies (Annarelli & Nonino, 2014). Therefore, it is always more difficult for an organization to be an independent entity and withstand or try to resist shocks, impacts, and disasters while maintaining a competitive position (Annarelli & Nonino, 2014). Organizations have been and will be charged, even when they do not offer responses (Greenwood, Oliver, Suddaby, & Sahlin-Andersson, 2008). There will always be crises, and the knowledge gained in past situations is useful to avoid or improve future performance.

In some ways, crises represent a real opportunity for companies to unleash the full potential of their dynamic capabilities (Linnenluecke, 2017; Martinelli et al. 2018; Yang and Hsieh 2013). In any situation, we find organizations that benefited and others that incurred very relevant losses. In the context of a crisis, dynamic capabilities can be divided into three dimensions, which are (Guo et al., 2020): i. the ability to sense a crisis, ii. the ability to seize new opportunities in a crisis (Ballesteros et al., 2017; Teece, 2007), and iii. the ability to reconfigure resources to cope with a crisis. These elements motivate the team to develop research and incorporate learnings about positive and negative elements.

Companies with dynamic capabilities have the potential to sense or understand the crisis in a timely manner (Ballesteros et al., 2017; Lampel et al., 2009; Teece, 2007). Some companies may have perceived the outbreak's spread and predicted that it would have a significant impact on their business. By evaluating how the ordinary operations of a given context would be influenced by the potential crisis, such as the interruption of production and distribution activities, market failures, and lack of staff, companies can

better perceive the crisis (Guo et al., 2020). Without sensing and understanding a crisis, it would not be possible to develop comprehensive and interconnected strategic responses that are necessary to respond to and face it (Müller, 1985).

Once the crisis is understood, companies are more likely to identify and capture new opportunities in a crisis (Ballesteros et al., 2017; Danneels, 2002; Easterby-Smith et al., 2009). The pandemic of the reach of COVID-19 broke social patterns and, on the one hand, generated significant economic losses, also provided new business opportunities (Guo et al., 2020).

Organizational inertia can keep companies from observing changes in the external environment and adapting to them (Newey & Zahra, 2009). In this sense, companies without the ability to reconfigure their resources may fail to implement response strategies to short or long-term crises. For strategic adjustments to be developed effectively and structurally, mechanisms that allow the operationalization of strategic responses and the model of the management control system, thinking about diagnostic use and interactive use, are proposed to do this.

Regarding management control practices and mechanisms, Hopper (2020) encourages investigation into how companies, in general, responded to the pandemic and to what extent they were effective. He suggests that organizations are being asked to readjust their strategies and focus more on decentralized and flexible practices. He considers that "*diagnostic use systems that provide financial analyses can deal with short-term problems, but interactive systems are necessary to develop emerging strategies*" (Hopper, 2020, p. 535).

Based on these discussions, we address the following research question in this paper: **Would there be an association between the existence of a set of mechanisms of the control system with diagnostic and interactive use and the practiced strategic responses?**

The relevance of the theme stems from the need to understand the set of decisions made by organizations and their results, evaluating their past adequacy and reference for the future in terms of short, medium, and long terms. We focus on the use of management control mechanisms as antecedents of different strategic responses during the COVID-19 pandemic, such as retrenchment, perseverance, innovation, and exit strategies (Wenzel et al., 2021).

The gaps identified in this research area are: (1) previous studies were developed ring the occurrence of the pandemic, without it being possible to understand the impact

of the financial performance of organizations and the possible simultaneous strategic responses implemented; (2) analysis diagnostic and interactive use of the control system associated with different strategic responses. Based on these gaps, this paper is expected to provide the following contributions. First, to identify strategic responses that were adopted by firms to overcome the threats posed by the COVID-19 pandemic (e.g., Hopper, 2020). Second, we contribute to the management accounting literature during the crisis since we provide evidence about the association between the diagnostic and interactive control systems used as antecedents and the firm´s strategic responses. Our results support a positive indirect association between controls and, perseverance and innovative strategic responses through the formalization of the strategies during the pandemic.

2. Literature Review, Constructs, and Hypotheses

The literature review is divided into four subsections that discuss the main constructs of this study as well as the development of the hypotheses: (1) Management control system – diagnostic use and interactive use; (2) Set of planning and control artifacts, (3) Types of strategic responses, and; (4) Conceptual model of this research.

2.1. Management Control System – Diagnostic Use and Interactive Use

The operationalization of management control can be perceived from various models, among which Simons' (1995) that introduces the perspective of the Levers of Control. He indicates four different dimensions of a management control system: belief and value systems, boundary systems, diagnostic control systems, and interactive control systems. This set of mechanisms exists to provide strategic direction for organizations and requires adequate configurations of control artifacts. Without the specification of management control artifacts, it is not possible to translate the actions demanded by management, nor to define responsibilities over time.

The management control of organizations enables decision-making at various levels. Through an organizational structure, information systems, artifacts, and planning and control processes, management control guides organizations based on strategies that should be consistent with a normal world that previously existed. After all, crises have always existed, and management control should provide alerts to draw attention to them (Bundy et al., 2016). We have recently gone through severe crises, such as the economic recession of 2008 (Becker et al, 2016) where planning mechanisms were questioned and

their roles changed. Previous research has shown that, in crises, how the organization uses management control mechanisms is even more important (Becker et al., 2016).

The structure is necessary so that the use of mechanisms is treated in a specified manner and allows an understanding of its evolution. The logic of linking planning and control stems from the approach of Merchant and Van der Stede (2007), who considers that one of the functions of management control involves informing employees of what they should do to maximize their contributions to meet organizational objectives. The existence of the planning and control system provides benefits to the organization, such as anticipatory decisions, coordination of activities, oversight responsibilities, motivation to achieve goals, and conditions for performance evaluation. Planning is embedded in the logic of result control by deciding the directions in advance. Achieved results stimulate and encourage executors to develop their talents and improve performance (Merchant & Van der Stede, 2007). As a set, the various aspects contribute to executives increasing their ability to achieve results: a. knowledge of expected results, which provides both the direction of what is expected from a person and the opportunity for commitment by understanding whether the goal is achievable or not, b. the ability to influence results, by knowing the expected performance profile and being able to develop strategies and tactics for it and c. the ability to effectively control the results, since they know the goals and plan how to achieve them.

In turn, the establishment of performance targets can have different conceptual constructions that favor different perspectives, such as: a. relationship with historic or negotiated targets, b. fixed or variable targets, c. internal or external reference points (Merchant & Van der Stede, p.331), allowing performance evaluation to occur and recognition to become technically feasible (Merchant & Van der Stede, 2007). Well-defined outcomes provide executives with an understanding of what is expected of them and encourage them to produce the expected results (Merchant & Van der Stede, 2007), with the planning and control process being an appropriate mechanism to define performance dimensions, performance measurement, targets, and recognition and incentives (Merchant & Van der Stede, 29).

Beyond formal and bureaucratic issues, the planning and control process increases internal commitment as goals become clear and formalized. The fact that they are discussed and analyzed should provide benchmarks against overly optimistic or pessimistic forecasts, which should avoid surprises for top management. By avoiding

extremes, the goal is to have feasible challenges. It is quite likely that this set will reduce "organizational games" (Merchant & Van der Stede, 2007).

2.2. Set of Planning and Control Artifacts

It is expected that, in addition to having various artifacts, organizations can use them in several ways, from which we point out the diagnostic and/or interactive uses. The use depends not only on the artifact's availability but also on the organization's maturity level to apply it, considering also the management model and the actual need for information. Although the identified artifacts (Merchant & Van der Stede, 2007; Frezatti, 2015) are separate, each presents a different emphasis impacting hierarchies and even the complementarity of use.

Planning cycles include strategic planning, capital budgeting, the balanced scorecard, the budget, and budgetary control as relevant artifacts and are cited by various authors (Merchant & Van der Stede, 2007; Frezatti, 2015). They encompass definitions and specifications that reflect the development stage and meet the demands of the organization. The planning cycle is expected to start with a long-term strategic review where decisions affecting both the external and internal environment of the organization are formalized. The capital budget contains long-term investment projects and is usually developed concurrently with strategic planning. The budget, in turn, operationalizes strategic planning decisions over the covered horizon. It demands relatively greater involvement of various management levels of the firm.

In organizations where the balanced scorecard has been adopted as a tool, it provides a link between strategy and the operationalization of the organization by organizing the relationship between the two artifacts and providing the use of indicators that align decisions (Kaplan & Norton, 1992). Management control mechanisms are expected to support responses in times of crisis (Smart & Vertinsky, 1977), acting as a bridge to reduce the gap between the necessary information and available information for the decision-making process (Galbraith, 1973). At the manager's request, the management control mechanisms provide information for possible course adjustments after changes (Smart & Vertinsky, 1977; Ezzamel & Bourn, 1990).

As a complement to the process, in terms of budgetary control, we see the opportunity to provide feedback on the system, indicating relevant budgetary variations and the search for alternatives to redirect actions and pursue the qualitative targets defined

in the strategic planning and related in the budget. A significant portion of the interactive use of the control system stems from this stage of the planning and control process.

Finally, due to the various models and demands, the concept of forecast becomes part of the planning and control process, both to review the budget and to initiate the planning process for the next period. It emerges as an instrument to refine and update the planning and control process to reduce distortions from turbulent environments (Bhimani, Sivabalan, & Soonawalla, 2017). The term forecast appears in various ways and with different understandings. In some cases, the forecast is mentioned as a substitute for the budget (Sivabalan et al., 2009, p.850) for some functions, as there is an argument that it provides accurate information. It can be perceived, for example, that the forecast provides support for the operational plan but is not used for performance evaluation (Sivabalan et al., 2009).

In this research, the term forecast will be used within the following approaches. Firstly, forecast as a budget review, called by Hansen (2011) a base forecast, is used to update the information contained in the annual budget (Sivabalan et al., 2009) for the remaining period it covers. In an organization with the real month of January calculated it's possible to structure the forecast from February to December, for example. The potential for recovery or maintenance of results is discussed, and adjustments are included in the artifacts. It can be done at the frequency that the entity considers appropriate, being monthly, quarterly, etc. It can be developed without the involvement of executives in updating the data; therefore, the questioning in terms of commitment to meeting targets becomes frequent (Merchant and Van der Stede, 2007). The great utility of this type of forecast is to provide a more likely view of the expected outcome. Secondly, rolling forecast is a mechanism that sets the planning horizon in the organization (Hansen, 2011). It can contain information for 12, 18, 24, or 36 months; in short, it is the horizon that provides the generation of useful information. The projections are added to the elapsed periods. A company that has the real month of January calculated includes in its mechanism the projection of January of the next year, for example. Regarding the utility of the artifact, it can be the starting point for the budget of the next year and/or can contribute to analyses of investment and structure of capital decisions, for example.

In addition, the interactive use of the performance measurement system as a formal control was positively associated with the performance outcome of revenue growth for NFPs in the aged care sector in Australia (Jiao et al, 2023). The combination of mechanisms provides the formalization of the defined strategies. Consequently, the

interactive use of the mechanisms contributes to the structured and formalized strategies. It is expected that the interactive use of the management control system mechanisms in times of crisis will increase due to the need to increase organizational learning and to provide quick and appropriate reactions as responses and facilitate the quality of coordination (Asel et al., 2011). On the other hand, during crises, managers' autonomy is often restricted (Asel et al., 2011).

Based on these arguments, we propose the following hypotheses:

H1(+): The greater the presence of artifacts that provide diagnostic use, the greater the presence of formalized strategies.

H2(+): The greater the presence of elements that imply interactive use, the greater the presence of formalized strategies.

2.3. Types of Strategic Responses

We follow the strategic responses typology suggested by Wenzel et al. (2021), who consolidated various contributions and presented the segmentation of strategic responses to the crisis. They separated various alternatives, namely entrenchment, perseverance, innovation, and exit strategic responses.

Entrenchment = RE 1

The entrenchment strategies involve a defensive logic of resisting by reducing costs, assets, overhead, and products (Pearce & Robbins, 1993). It is an approach emphasizing cash generation, strong budget control, and increased monitoring of employees. It can be understood as a strategy that prepares the horizon for the future, basing actions on current elements. It can, as a continuity in the long term, erode the organization's potential and limit its potential. It is seen as a short-term strategy, hardly sustainable in the long term, applicable to stabilize a declining trend and allow long-term recovery (Pearce & Robbins, 1994; Robbins & Pearce, 1992). It refines the focus on existing activities by decreasing complexity and increasing transparency (Benner & Zenger, 2016; Gartenberg, 2014). There are arguments that this option provides continuous underperformance compared to other strategies (Barker & Duhaime, 1997; Barker & Mone, 1994).

A likely motivation for choosing this response would be the evidence of negative financial results (Figueiredo et al., 2019), and the great challenge of this response is linked to the care in balancing the cuts to minimize the losses from negative impacts that cause

loss of synergy for the long term in the relationship with the various stakeholders (Asel et al., 2011). As a consequence, we indicate the following hypothesis:

H3(+): The greater the presence of formalized and implemented strategies, the higher the presence of entrenchment strategic responses.

Perseverance = RE 2

This is a response to maintaining the organization's strategies in the face of a crisis. It aims to maintain the status quo and mitigate the adverse impacts of the crisis (Wenzel et al., 2021; Stieglitz et al., 2016). Various authors indicate that it can be a surprisingly effective response compared to competitors who changed their strategies (Pacheco-de-Almeida, 2010; Stieglitz et al., 2016). One possible explanation for the performance is that frequent changes in strategies undermine performance opportunities. Additionally, there may occur a situation in the value chain where external institutions offer support actions (Chakrabarti, 2015). One possible alternative is using reserves, if any, to maintain strategies. On the other hand, avoiding changes in previously discussed and approved strategies is part of this response. It is noteworthy that internationalized companies, which may be punished in the short term by maintaining their strategies, can benefit in the long term, Chakrabarti (2015) and De Carolis et al. (2009) indicated that not all resources and capabilities are essential in terms of perseverance in the crisis but rather those related to the core of the organization. Lim et al. (2009) indicated that for maintenance, managers had to adapt their way of thinking about strategic aspects of the organization. It is perceived as a medium-term response.

Van Gelderen (2012) suggests that perseverance is closely tied to goal pursuit and revision, drawing from control theory and appraisal theory. This supports the rationale that greater interactive use correlates with increased strategic perseverance responses. In essence, the ability to set and adapt goals within management control systems directly influences perseverance strategies. As a consequence, we propose:

H4(+): The greater the presence of formalized and implemented strategies, the greater the presence of perseverance strategic responses.

Innovation = RE 3

Although there is the devastating impact of the pandemic (Wenzel et al., 2021), opportunities for innovation arise as responses and imply new strategies. The argument is that in crisis scenarios, there is a relaxation of restrictions which allows understanding,

proposing, and deciding things that would be difficult in other environments (Roy et al, 2018) or moments arise in the environment. The strategic response of innovation constitutes a way to identify emerging strategies and operationalize them. The research by Reymen et al (2015) brought examples of strategic responses seeking new alternatives in hitherto unexplored environments, including demand for new assets (Helfat, 1997) and even acquisitions (Wan & Yiu, 2009). Baker and Nelson, (2005) counter that there is no management team that produces innovation out of nothing, and cash liquidity has a significant impact on the option of continuity (Kim & Bettis, 2014).

Lopez-Valeiraz et al. (2015) suggest that the interactive use of management control system effectively drives process and organizational innovations implying that managers should actively incorporate it into their innovation strategy. This entails fostering an environment conducive to change and leveraging the benefits of these innovations to achieve financial objectives. Moreover, Bisbe and Otley (2004) indicate the significant role of formal MCS in fostering innovation and long-term performance. The authors specifically highlight the importance of how formal MCS is utilized, distinguishing between various functional effects of interactive usage and demonstrating its clear impact on both innovation and performance.

This aligns with the reasoning that the greater the presence of elements implying interactive use, the greater the presence of innovative strategic responses. The examples provided above illustrate how interactive utilization of MCS drives process and organizational innovations and how the effective utilization of formal MCS can significantly impact innovation and long-term performance. By fostering an environment conducive to change and actively leveraging the benefits of interactive utilization of MCS, organizations can enhance their ability to identify emerging strategies and operationalize them effectively, ultimately driving innovation and achieving financial objectives. Hence, we propose the following hypothesis:

H5(+): The greater the presence of formalized and implemented strategies, the greater the presence of innovation strategic responses.

Exit = RE4

This is about discontinuing the organization's activities. It may be an alternative when other options prove to be unviable (Wenzel et al., 2021; Argyres, Bigelow, & Nickerson, 2015). Multinationals may tend to use this type of response more frequently

(Dai, Eden, and Bemish, 2017). It can be total or partial abandonment within the entity's environment.

Souza and Tan (2015) concluded that strategic misfit and poor international performance have a detrimental effect on the firm's stance in the foreign market. Conversely, a tight strategic fit with the headquarters enables a foreign affiliate to build a good relationship with management at headquarters and, therefore, gain more commitment. Besides, developing effective control systems requires time, and foreign subsidiaries consistently present challenging staffing and supervision issues, which decreases the likelihood of exit (Boddewyn, 1979). Therefore, when considering discontinuing the organization's activities as a viable option, it is important to recognize that this decision may be influenced by a range of factors. These include strategic misfit, unsatisfactory international performance, and operational challenges faced by foreign subsidiaries. While close connection with headquarters may mitigate some of these hurdles, the lack of elements implying interactive use may increase the likelihood of exit strategic responses. As a consequence, we suggest:

H6(+): The greater the presence of formalized and implemented strategies, the higher the presence of exit strategic responses.

Strategic responses H3 and H4 indicate greater proactivity and chance of success, which really affect the long-term prospects of companies, even though the short-term pressure to protect cash flow and cut costs (Asel et al., 2011) is present. The existence of management control mechanisms, whether for diagnostic use, interactive use, or both, can be a stimulating factor for more active strategies (H3 and H4) to the detriment of others.

2.4. Conceptual Model of the Research

We present the Conceptual model of this paper in Figure 1, which is based on seven constructs and six hypotheses. Size and family control were included as control variables, as these variations in the sample could influence both the use of controls and strategic responses.

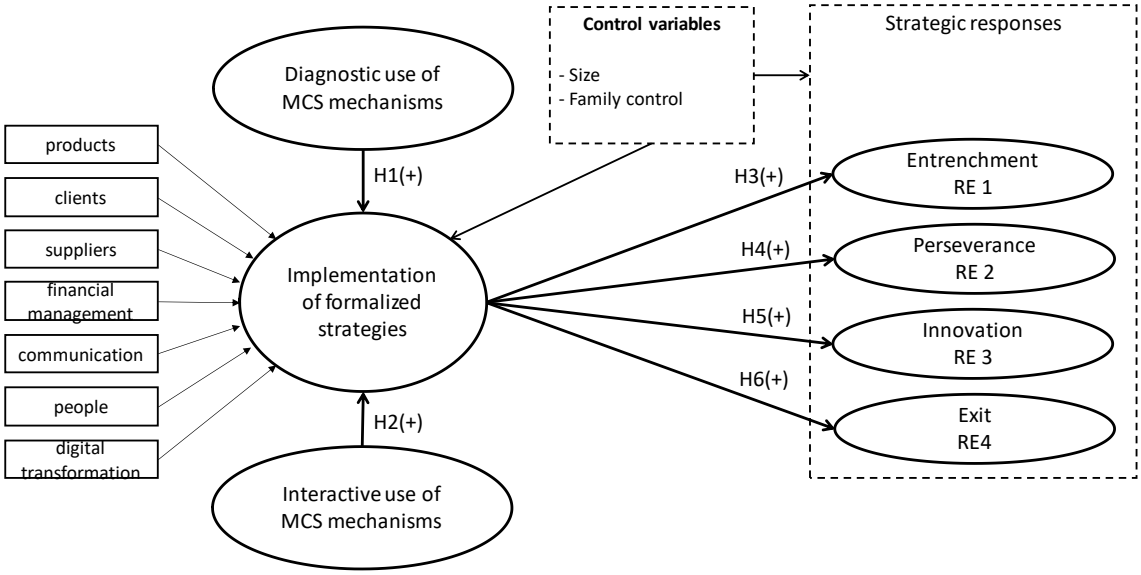

Figure 1. Conceptual model of the research

3. Methodology

3.1. Population and Sample

The research population consists of Brazilian companies, characterized by size, in terms of the number of employees by the European standard (European Commission, 2020): (1) up to 49 employees (small size); (2) 50 to 249 (medium size); (3) 250 to 1000 (large size A); (4) more than 1000 (large size B). Although the European definition limits identifying large firms as those that have more than 250 employees, we capture higher levels to improve the quality of the sample.

Regarding ownership control, we approached managers from firms classified as (1) multinational firms operating in the country, (2) family-owned companies with shares on the stock market, and (3) family-owned companies without shares on the stock market. We also considered information regarding industry (industrial, commercial, and services), by size and by ownership control. The sample was defined by convenience, and for analyses, we considered a sample of 144 firms. It is important to mention that this project received the approval of the research ethics committee, and among the requirements, it was established a Informed Consent Form (ICF), as an attachment to the questionnaire.

3.2. Instruments

All research items were measured using a 5-point Likert scale. We elaborated the items for each strategic formalization and response (entrenchment, perseverance, innovation, and exit) based on prior literature (e.g., Wenzel et al., 2021; Guo et al., 2020). We also supported the instruments for diagnostic and interactive use based on prior studies. The details of each instrument are presented in Appendix 1 to 6.

3.3. Data analysis

For data analysis, specifically the testing of research hypotheses, the Structural Equation Modeling (SEM) technique was used through the Partial Least Squares method (PLS-SEM). We used the SmartPLS® software version 4. The SEM has advantages related to the estimation of complex models and mediation models with fewer observations (the case of this research), in addition to not imposing data distribution assumptions. It is also worth noting that this technique has been used in several studies in management accounting and strategy research areas. Based on the power analysis, carried out using the GPower 3.1.9.2 software, the sample is adequate to detect a small relative effect (f^2 greater than 0.08) as statistically significant, considering a power statistical value of 0.8 (type II error of 20%) and significance level of 5% (type I error) and four predictors (Nitzl, 2016).

4. Results

This study follows a quantitative approach based on a survey. In Table 1, we present the descriptive statistics of the sample. Regarding the sample characteristics, we observe a homogenous distribution in terms of firm size (employees), ranging from small firms (between 10 and 49 employees – 24.7%), medium firms (between 50 and 249 employees (19.2%) and a more prevalence of large firms (more than 250 employees – 44.5%). In terms of revenue, we find a similar interpretation since large firms are considered those with an annual revenue higher than 300 million reais (37% of the sample). In terms of family control, we have in our sample 43.2% firms controlled by family and 45.2% in which family owns less than 50 of the shares or are considered nonfamily firms (e.g., public listed firms, governmental firms, etc.). In terms of age our sample 28.1% consists of young firms, 43.2% of medium age firms (between 10 and 49 years) and 17.2% of mature firms, few of them that have been funded more than a century ago. Our respondents are also informative. Based on our sample, 24.7% respondents are

the CEO or the main owner of the firm, 52.1% respond directly to the CEO, 6.8% respondent to the TMT and 4.8% respond to the mid-level team.

Table 1

Descriptive Statistics

Panel A. Size (Number of Employees)	**n**	**%**	**Panel C. Family control**	**n**	**%**
Between 10 and 49 employees	36	24.7%	100% of the shares	48	32.9%
Between 50 and 249 employees	28	19.2%	Between 50% but less than 100% of the shares	15	10.3%
Between 250 and 999 employees	27	18.5%	Lower than 50% of the shares	9	6.2%
Between 1000 and 4999 employees	28	19.2%	Nonfamily firm	57	39.0%
More than 5000 employees	10	6.8%	Missing	17	11.6%
Missing	17	11.6%			
			Panel D. Foundation (age)		
Panel B. Size (Revenue)			Less than 10 years	41	28.1%
Less than 50 million BRL	51	34.9%	Between 11 and 49 years	63	43.2%
Between 50 and 100 million BRL	8	5.5%	Between 50 and 99 years	22	15.1%
Between 100 and 300 million BRL	16	11.0%	More than 100 years	3	2.1%
Between 300 and 500 million BRL	14	9.6%	Missing	17	11.6%
Between 500 and 1000 million BRL	10	6.8%			
Between 1000 and 5000 million BRL	19	13.0%	**Panel E. Tier**		
More than 5000 million BRL	11	7.5%	CEO or main owner	36	24.7%
Missing	17	11.6%	Tier 1	76	52.1%
			Tier 2	10	6.8%
			Tier 3	7	4.8%
			Missing	17	11.6%

4.1 Measurement Model Assessment

The measurement of the constructs was evaluated in two stages: (i) first, the measurement model of the seven dimensions of the Diagnostic Use construct as first-order latent variables was conducted, and they showed convergent validity, discriminant validity, and adequate reliability (Hair Jr. et al, 2022), (ii) subsequently, the complete model was evaluated, including Diagnostic Use as a second-order latent variable (the average scores of its dimensions were used as its indicators), with the results presented in Tables 1 and 2. In the first stage, all the items used were kept to estimate the artifacts latent variables, which scores were used in the second stage to measure the construct of Diagnostic Use. In the second stage we excluded one item for the Interactive Use (InteraU_1).

In Table 2, it can be seen that all items have higher factor loadings on their constructs than the loadings on other constructs (crossloadings), leading to the conclusion that there is discriminant validity at the indicator level (Hair Jr. et al 2022).

Table 2

Cross loadings – complete model

	DiagUse	InteraUse	FormalStrategy	Strat_Entrench	Strat_Maint	Strat_Inov	Strat_Aband
LV scores - BSC	**0.686**	0.417	0.383	0.073	0.318	0.409	0.088
LV scores - Bforecast	**0.812**	0.465	0.360	0.098	0.289	0.257	0.159
LV scores - BudgetCon	**0.828**	0.568	0.490	0.021	0.374	0.360	0.068
LV scores - Budget	**0.839**	0.499	0.471	0.138	0.428	0.422	0.033
LV scores - Capex	**0.838**	0.468	0.434	0.116	0.344	0.316	0.038
LV scores - Rforecast	**0.730**	0.384	0.402	0.035	0.210	0.277	0.058
LV scores - SP	**0.850**	0.682	0.624	0.065	0.386	0.383	0.031
InteraU_2	0.531	**0.755**	0.418	0.032	0.327	0.321	0.065
InteraU_3	0.540	**0.879**	0.661	0.121	0.353	0.385	0.055
InteraU_4	0.540	**0.912**	0.649	0.202	0.333	0.421	0.122
InteraU_5	0.557	**0.902**	0.645	0.127	0.406	0.450	0.042
InteraU_6	0.618	**0.891**	0.654	0.128	0.356	0.335	0.061
FormalStrategy1	0.450	0.593	**0.811**	0.096	0.344	0.369	-0.028
FormalStrategy2	0.442	0.608	**0.845**	0.175	0.425	0.450	0.072
FormalStrategy3	0.378	0.504	**0.686**	0.279	0.387	0.319	0.016
FormalStrategy4	0.475	0.408	**0.673**	0.072	0.271	0.338	0.057
FormalStrategy5	0.478	0.582	**0.860**	0.164	0.407	0.513	0.116
FormalStrategy6	0.544	0.619	**0.843**	0.021	0.385	0.507	0.057
FormalStrategy7	0.453	0.574	**0.797**	0.023	0.335	0.533	0.087
Strat_Entrench1	0.050	0.143	0.106	**0.798**	0.221	0.160	0.164
Strat_Entrench2	-0.065	-0.030	0.023	**0.591**	0.128	0.142	0.227
Strat_Entrench3	0.027	0.008	0.079	**0.623**	0.125	0.152	0.202
Strat_Entrench4	0.138	0.174	0.156	**0.896**	0.196	0.113	0.197
Strat_Maint1	0.245	0.236	0.224	0.176	**0.783**	0.251	0.032
Strat_Maint2	0.330	0.299	0.393	0.218	**0.852**	0.364	0.057
Strat_Maint3	0.315	0.252	0.284	0.291	**0.797**	0.314	0.079
Strat_Maint4	0.287	0.223	0.300	0.212	**0.770**	0.376	0.013
Strat_Maint5	0.293	0.353	0.374	0.242	**0.838**	0.423	0.099
Strat_Maint6	0.466	0.409	0.487	0.064	**0.830**	0.378	0.005
Strat_Maint7	0.372	0.416	0.418	0.170	**0.749**	0.457	0.172
Strat_Inov1	0.266	0.298	0.373	0.150	0.347	**0.825**	0.041
Strat_Inov2	0.335	0.345	0.469	0.185	0.349	**0.876**	0.074
Strat_Inov3	0.372	0.434	0.437	0.174	0.386	**0.770**	0.052
Strat_Inov4	0.429	0.424	0.486	0.186	0.457	**0.801**	-0.027
Strat_Inov5	0.390	0.375	0.543	0.122	0.412	**0.886**	-0.006
Strat_Inov6	0.417	0.371	0.484	0.045	0.412	**0.835**	-0.101
Strat_Inov7	0.292	0.293	0.383	0.158	0.332	**0.805**	-0.037
Strat_Aband1	0.042	0.070	0.068	0.249	0.054	-0.007	**0.967**
Strat_Aband2	0.018	0.044	0.036	0.233	0.061	-0.020	**0.946**
Strat_Aband3	0.023	0.032	0.024	0.220	0.071	-0.037	**0.948**
Strat_Aband4	0.093	0.078	0.076	0.233	0.078	0.006	**0.975**
Strat_Aband5	0.117	0.111	0.089	0.238	0.119	0.010	**0.970**
Strat_Aband6	0.088	0.071	0.075	0.218	0.081	0.001	**0.971**
Strat_Aband7	0.043	0.057	0.012	0.228	0.040	-0.020	**0.906**

In Tables 3, we present the results of the measurement model evaluation at the construct level. They confirm that convergent validity, discriminant validity, and reliability (above 0.7). In terms of convergent validity our results meet the threshold defined by Hair Jr. et al. (2017) in terms of Cronbach's alpha (higher than 0.7) and Average variance extracted (AVE) (higher than 0.5). Concerning discriminant validity, we observe that the square root of the AVE (diagonal) is higher than the correlations between the latent variables and that the HTMT values above the diagonal (in grey) are lower than 0.85.

Table 3

Fornell-Larcker and HTMT Matrix

	1	2	3	4	5	6	7
1. DiagUse	**0.800**	0.686	0.630	0.121	0.445	0.468	0.081
2. InteraUse	0.638	**0.870**	0.763	0.179	0.426	0.474	0.078
3. FormalStrategy	0.581	0.707	**0.791**	0.168	0.486	0.594	0.075
4. Strat_Entrench	0.096	0.147	0.147	**0.738**	0.280	0.229	0.306
5. Strat_Maint	0.427	0.407	0.464	0.233	**0.803**	0.493	0.088
6. Strat_Inov	0.437	0.441	0.554	0.174	0.468	**0.829**	0.062
7. Strat_Aband	0.078	0.079	0.071	0.241	0.084	-0.002	**0.955**
Cronbach's alpha	0.906	0.919	0.899	0.750	0.910	0.924	0.985
Composite reliability (rho_c)	0.925	0.939	0.921	0.823	0.927	0.939	0.986
Average variance extracted (AVE)	0.640	0.756	0.626	0.545	0.646	0.688	0.912

Note: Diagonal values are the square root of the AVE (as they are greater than 0.5, there is convergent validity). The values below the diagonal are correlations between the constructs (as they are smaller than the values on the diagonal, there is discriminant validity). The values above the diagonal are the disattenuated correlations (HTMT matrix), as they are less than 0.85, there is discriminant validity (Hair Jr. et al, 2022, p.122).

4.2 Structural Model Assessment

The structural model was tested in two stages: (i) the control variables (size and family control) were linked to the endogenous variables (formalized and implemented strategies and the four strategic responses, retrenchment, maintenance, innovation, and abandonment). The results with the control variables are presented in Table 4, and in Table 5, we present the results for the indirect effects. The hypothesis tests were conducted through the analysis of the structural coefficients and effect sizes.

Our results show that the diagnostic use (measured indirectly by the artifacts) and the interactive use are positively related to the formalization of strategies, which respectively supports H1 (β=0.250, p-value=0.001, f^2=0.074) and H2 (β=0.519, p-

value=0.000, f^2=0.318). Hence, we observe a small effect size for the relationship between diagnostic use and a strong effect between interactive use and the level of formalization of strategies.

With respect to the second group of hypotheses, referring to the relationship between the level of formalization of strategies and the adoption of different strategies during the Covid-19 pandemic, we observe support for two of the four hypotheses. We find support for the positive relationship between the level of formalization of strategies and the maintenance and innovation of strategic responses, thus supporting hypotheses H4 (β=0.482, p-value=0.000, f^2=0.290) and H5 (β=0.565, p-value=0.000, f^2=0.455). In that way, we find both large effects of the level of formalization of strategic responses related to the level of firm persistence and the firm capability to innovate in response to the pandemic crisis. We do not find support for whether the level of formalization of strategies inhibits the entrenchment response and abandonment strategy such as hypothesized. This might explain that organizations facing extreme situations that challenge their continuity are expected to drive entrenchment and abandonment responses without relying on management accounting mechanisms and formalized strategies.

Table 4

Direct effects

		Model 1			Model 2			
	H	**β**	**P-values**	**f2**	**β**	**P-values**	**f2**	**R2**
DiagUse -> FormalStrategy	**H1(+)**	**0.218**	**0.004**	**0.060**	**0.250**	**0.001**	**0.074**	0.524
InteraUse -> FormalStrategy	**H2(+)**	**0.568**	**0.000**	**0.406**	**0.519**	**0.000**	**0.318**	
Size_Emp -> FormalStrategy					-0.192	0.455	0.008	
Family_Control -> FormalStrategy					-0.172	0.197	0.013	
FormalStrategy -> Strat_Entrench	**H3(+)**	0.147	0.154	0.022	0.112	0.312	0.013	0.037
Size_Emp -> Strat_Entrench					-0.055	0.898	0.000	
Family_Control -> Strat_Entrench					-0.292	0.174	0.019	
FormalStrategy -> Strat_Maint	**H4(+)**	**0.464**	**0.000**	**0.274**	**0.482**	**0.000**	**0.290**	0.226
Size_Emp -> Strat_Maint					0.193	0.490	0.005	
Family_Control -> Strat_Maint					0.196	0.207	0.011	
FormalStrategy -> Strat_Inov	**H5(+)**	**0.554**	**0.000**	**0.443**	**0.565**	**0.000**	**0.455**	0.321
Size_Emp -> Strat_Inov					0.367	0.305	0.021	
Family_Control -> Strat_Inov					0.003	0.982	0.000	
FormalStrategy -> Strat_Aband	**H6(+)**	0.071	0.518	0.005	0.029	0.736	0.001	0.053
Size_Emp -> Strat_Aband					-0.658	0.309	0.048	
Family_Control -> Strat_Aband					-0.136	0.418	0.004	

Table 5 presents the indirect effects between the use of MCS and strategic responses, mediated by the level of formalization of strategies. These results show that the use of MCS (both diagnostically and interactively) is indirectly associated with an increase in perseverance and innovation strategies.

Table 5

Indirect effects

	β	|T statistics|	P-values
DiagUse -> FormalStrategy -> Strat_Entrench	0.032	1.106	0.269
InteraUse -> FormalStrategy -> Strat_Entrench	0.084	1.394	0.163
DiagUse -> FormalStrategy -> Strat_Maint	**0.101**	**2.475**	**0.013**
InteraUse -> FormalStrategy -> Strat_Maint	**0.264**	**4.207**	**0.000**
DiagUse -> FormalStrategy -> Strat_Inov	**0.121**	**2.704**	**0.007**
InteraUse -> FormalStrategy -> Strat_Inov	**0.315**	**4.858**	**0.000**
DiagUse -> FormalStrategy -> Strat_Aband	0.015	0.576	0.564
InteraUse -> FormalStrategy -> Strat_Aband	0.040	0.649	0.516

5. Discussion and Conclusions

After the COVID-19 crisis, it is important to get, understand, and keep the know-how developed in the heart of the crisis. Learning is important, and this research captured some elements.

The research started with the perspective that diagnostic and interactive uses of management systems are the conditions that have formalized strategies in organizations (Merchant & Van der Stede, 2007). Considering this, the linkage of diagnostic system usage that provides the mechanisms, like strategic planning, budgeting, forecast, BSC, and capital budget, provide conditions for interactive use (Simons, 1995; Kaplan & Norton, 1992). As a consequence, the formalized strategies for products, clients, suppliers, people, financial management, communication, and digital transformation are defined and treated by the hypothesis H1 and H2:

The H1+, “The greater the presence of artifacts that provide diagnostic use, the greater the presence of formalized strategies” **was validated**. It corroborates with prior literature that did not treat the strategies responses as exploratory research.

The H2+, “The greater the presence of elements that imply interactive use, the greater the presence of formalized strategies”, was validated. Similar to H1, it corroborates with prior literature that did not treat the strategies responses as exploratory research.

Once the formalized strategies are available, the different responses could be offered based on the management control structure:

The H3-, "The greater the presence of **formalized and implemented strategies**, the higher the presence of entrenchment strategic responses", **was not validated**. It was expected that the formalized strategies would provide good conditions for actions (Guo et al., 2020), reconfiguring resources to cope with the crises. Literature considered that some companies have no ability to reconfigure their resources to implement actions in the short or long term in a crisis environment (Newey & Zahara, 2009).

The H4+, "The greater the presence of **formalized and implemented strategies**, the greater the presence of perseverance strategic responses", was validated. Guo et al. (2020) considered that the formalized and implemented strategies allow the organization to reconfigure resources to cope with the crises. By understanding the crises in a timely manner (Ballesteros et al., 2017), it is possible to predict the impact on the business and evaluate the ordinary operations needed to adjust or keep the trend. Without this understanding, it is difficult to develop or keep a comprehensive and interconnected response to crises (Muller, 1985).

The H5+, "The greater the presence of **formalized and implemented strategies**, the greater the presence of innovation strategic responses", was validated. Guo et al. (2020) considered that the formalized and implemented strategies allow the organization to reconfigure resources to cope with the crises (Merchant & Van der Stede, 2007).

The H6+, "The greater the presence of **formalized and implemented strategies**, the higher the presence of exit strategic responses" was not validated. Similar to hypothesis 3, it was expected that the mechanisms, direct or indirect, could provide a driver for actions (Guo et al., 2020). Although hypothesis H6+ has not been directly validated, it is suggested that the inadequate presence of elements promoting interactive use may render the decision to discontinue the company's activities more probable in certain contexts. Thus, the ability to adapt strategies interactively and effectively may be crucial in avoiding the need for market exit and promoting the sustainability of the company's global operations.

Both diagnostic and interactive use of management control mechanisms impact strategies, which supports the perspective that the kit of mechanisms is important for supporting strategies. When considering the strategies, it is key for the ones that define perseverance and innovation strategies. Also, when considering size as the control variable, the association of the strategies of innovation and abandonment was found.

Finally, it tells us about the support that management control mechanisms provide for proactive strategies.

Appendix 1. Strategic responses - entrenchment

Scale: Likert with 5 points

The challenges of businesses during the pandemic have been faced with:

	I totally disagree	I partially disagree	Neither agree nor disagree	Partially agree	Completely agree
Cost reduction and expenses reduction e despesas (*)					
Assets reduction (*)					
Product and services reduction (*)					
Overhead reduction (*)					
References for the construct:	(*) Wenzel et al. (2021), (**) Asel et al. (2011)				

Appendix 2. Strategic responses - perseverance

Scale: Likert with 5 points

The pandemic has been tackled by maintaining (perseverance) strategies, adjusting elements of the new scenario related to:

	I totally disagree	I partially disagree	Neither agree nor disagree	Partially agree	Completely agree
Products and services (*)					
Clients (*)					
Suppliers (*)					
Financial management (*)					
Communication (*)					
People (into organization) (*)					
Digital transformation (**)					
References for the construct:	(*) Wenzel et al. (2021), (**) Guo et al. (2020)				

Appendix 3. Strategic responses - innovation

Scale: Likert with 5 points

The pandemic has been tackled by innovative strategies, adjusting elements of the new scenario related to

	I totally disagree	I partially disagree	Neither agree nor disagree	Partially agree	Completely agree
Products and services (*)					
Clients (*)					
Suppliers (*)					
Financial management (*)					
Communication (*)					
People (into organization) (*)					
Digital transformation (**)					
References for the constructo:	(*) Wenzel et al. (2021), (**) (Guo et al., 2020)				

Appendix 4. Strategic responses - exit

Scale: Likert with 5 points

The pandemic has been tackled by exit strategies, adjusting elements of the new scenario related to

	I totally disagree	I partially disagree	Neither agree nor disagree	Partially agree	Completely agree
Products and services (*)					
Clients (*)					
Suppliers (*)					
Financial management (*)					

Communication (*)					
People (into organization) (*)					
Digital transformation (**)					
References for the construct:	(*) Wenzel et al. (2021), (**) Guo et al (2020)				

Appendix 5. Artifacts Structure of the Diagnostic Use Control System
Scale: 5-Likert scale

Construct	Assertive	Reference for the construct
Strategic Planning	1. Identity items (mission, vision, beliefs, and values) explores identity elements such as mission, vision, beliefs, and values.	(Merchant & Van der Stede, 2007; Ferreira & Otley, 2009; Frezatti et al., 2011)
	2. Approved and formalized business strategies: approves and formalizes strategies for the business.	(Merchant & Van der Stede, 2007; Ferreira & Otley, 2009; Frezatti et al., 2011)
	3. Operational plans for strategy implementation: develops operational plans to implement the strategies.	(Merchant & Van der Stede, 2007; Ferreira & Otley, 2009; Frezatti et al., 2011)
	4. Long-term financial statements (income statement, balance sheet, and cash flow): considers/evaluates long-term financial statements in the development of strategic planning.	(Merchant & Van der Stede, 2007; Ferreira & Otley, 2009; Frezatti et al., 2011)
	5. Strategic planning exists and is reviewed: regularly reviews the strategic planning.	(Merchant & Van der Stede, 2007; Ferreira & Otley, 2009; Frezatti et al., 2011)
Budget	1. Assumptions for budgeting (inflation, interest, salary variations, and input variations): considers assumptions such as inflation, interest rates, salary variations, and input variations for budgeting.	(Hansen & Van der Stede, 2004; Frezatti et al., 2011;). (Haka & Krishnan, 2005; Frow et al., 2010; Henttu-Aho, 2018)
	2. Operational plans (marketing, operations, hr, and investments).	(Hansen & Van der Stede, 2004; Frezatti et al., 2011;). (Haka & Krishnan, 2005; Frow et al., 2010; Henttu-Aho, 2018)
	3. Operational plans for strategy implementation: develops operational plans to implement the strategies.	(Hansen & Van der Stede, 2004; Frezatti et al., 2011;). (Haka & Krishnan, 2005; Frow et

		al., 2010; Henttu-Aho, 2018)
	4. Financial plan: projection of financial statements: income statement, balance sheet, and cash flow.	(Hansen & Van der Stede, 2004; Frezatti et al., 2011;). (Haka & Krishnan, 2005; Frow et al., 2010; Henttu-Aho, 2018)
	5. The budget is aligned with strategic planning.	(Hansen & Van der Stede, 2004; Frezatti et al., 2011;). (Haka & Krishnan, 2005; Frow et al., 2010; Henttu-Aho, 2018)
Capital Budget	1. Contains all relevant long-term investment projects;	(Frezatti et al., 2011; Frezatti et al., 2013)
	2. Covers periods longer than one year;	(Frezatti et al, 2011; Frezatti et al., 2013)
	3. Major projects are supported by analyses such as net present value (NPV), payback, and internal rate of return (IRR);	(Frezatti et al., 2011; Frezatti et al., 2013)
	4. There is monitoring of the financial execution of projects.	(Frezatti et al., 2011; Frezatti et al., 2013)
Base forecast – year	1. Reprojects the income statement for the remaining months of the year.	Hansen (2011) (Sivabalan et al, 2009 (Bhimani, Sivabalan, & Soonawalla, 2017; Henttu-Aho, 2018; Brüggen et al., 2020). (Merchant e Van der Stede, 2007) (Lukka & Granlund, 2003) (Berg & Karlsson, 2014), 2014) Henttu-Aho (2018) e Bhimani et al. (2017)
	2. Reprojects economic and financial assumptions during the year.	Hansen (2011) (Sivabalan et al, 2009 (Bhimani, Sivabalan, & Soonawalla, 2017; Henttu-Aho, 2018; Brüggen et al., 2020). (Merchant e Van der Stede, 2007) (Lukka & Granlund, 2003) (Berg & Karlsson, 2014) Henttu-Aho (2018) e Bhimani et al. (2017)
	3. Monitoring of actual results compared to the base forecast	Hansen (2011) (Sivabalan et al, 2009 (Bhimani, Sivabalan, &

		Soonawalla, 2017; Henttu-Aho, 2018; Brüggen et al., 2020). (Merchant e Van der Stede, 2007) (Lukka & Granlund, 2003) (Berg & Karlsson, 2014), 2014) Henttu-Aho (2018) e Bhimani et al. (2017
Rolling forecast	1. Reprojects financial statements adding the months already passed in the year so that there are always 12 or 24 months projected.	(Bhimani et al., 2017) (Hansen, 2011) (Su, Baird, & Schoch, 2017) (Jordan & Messner, 2020) (Hansen & Stede, 2004)
	2. The rolling forecast is considered when establishing the budget for the next year.	(Bhimani et al., 2017) (Hansen, 2011) (Su et al., 2017) (Jordan & Messner, 2020) (Hansen & Stede, 2004)
	3. Performs monitoring of actual results and includes comparison with the forecast.	(Bhimani et al., 2017) (Hansen, 2011) (Su et al., 2017) (Jordan & Messner, 2020) (Hansen & Stede, 2004)
Budget Control	1. The budget is monitored monthly.	(Merchant & Van der Stede, 2007) (Scapens, 2006) (Sponem & Lambert, 2016).
	2. Identified variations are analyzed and explained.	(Abernethy & Brownell, 1999)
	3. Variations affect the performance evaluation of executives.	(Merchant & Van der Stede, 2007) (Scapens, 2006) (Sponem & Lambert, 2016).
	4. The planning and control mechanism is seen as useful even if the accuracy (variation of numbers) is not as desired.	(Abernethy & Brownell, 1999)

Appendix 6. Interactive Control System

Scale: 5-Likert scale

Construct	Assertive
Interactive Control System	Information on opportunities and challenges, including innovations, are important elements for the highest level of managers.
	There is frequent interaction between operational management and senior managers.
	The information is regularly used in scheduled face-to-face meetings between operational and senior managers.
	Operational and senior managers use the information to discuss opportunities and changes occurring within the organization.
	The information provides an important and recurring action agenda in discussions between operational and senior managers.
	The information is often used as a means to develop action plans.
Reference for the construct	Su, Baird & Schoch, 2015

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