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Strategic Information Systems Enabling Strategy-as-Practice and Corporate Performance: Empirical Evidence from PLS-PM, FIMIX-PLS and fsQCA

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Abstract

Many studies have been investigating how IS (information systems) can help build a corporate performance, but there are less research investigating how IS contributing to performance by mediating business strategy in uncertain environments. To address this question, the present study seeks to empirically explore the relationship between strategic information systems and corporate performance by mediating business strategy. Partial Least Squares-Path Modeling (PLS-PM) confirmed SIS's strong influence on strategy, and full strategy mediation on the relationship between SIS and performance. SIS showed greater performance contribution in high heterogeneity environments than in lower ones, and small and medium-sized firms have 50% more contribution of the effects of strategy on performance than large firms. The post-hoc-analysis study did not identify the presence of heterogeneity segmentation not observed by Finite Mixture (FIMIX-PLS). Through fuzzy set qualitative comparative analysis (fsQCA), non-linear causality was verified in the strategy in certain solutions by the variables of large firms, with intensive use of SIS and high environmental heterogeneity. Moreover, the study demonstrated that SIS's strategic alignment has strong effects and explanation power on performance and may suggest that it is an indissociable resource for the strategy-as-practice effectiveness. Hence, the study contributed to understanding how SIS create value to strategy-as-practice approach under environmental turbulence to impact corporate performance.

Keywords: strategic information systems, strategy-as-practice, business strategy, IS strategy, FIMIX-PLS and fsQCA approach

1. Introduction

Over the years environmental turbulence has challenged organizations to develop business strategies that impact on corporate performance (Whittington, Yakis-Douglas, Ahn, & Cailluet, 2017). Since 1990s, increasing environmental turbulence has generated radical implications for strategy management practices (Wolf & Floyd, 2017; Yoshikuni & Albertin, 2018a). Hence, the strategy evolves to the strategy-as-practice approach, which through IT/IS enables organizations to address the challenges of environmental uncertainty (Jarzabkowski & Kaplan, 2015; Whittington et al., 2017).

The contemporary strategies approaches are essential means for organizations to compete, obtain better corporate performance (CP) in highly complex and dynamic environments (Babafemi, 2015; Hill, Jones, & Schilling, 2014; Miller & Friesen, 1983; Mintzberg, Ahlstrand, & Lampel, 2009; Porter, 1986; Skokan, Pawliczek, & Piszczur, 2013; Whittington et al., 2017), and in the latter have intensified the research of IS strategy contribution (D. Q. Chen, Mocker, Preston, & Teubner, 2010; Leidner, Lo, & Preston, 2011) incorporated into the routines of BS (Arvidsson, Holmström, & Lyytinen, 2014; Newkirk & Lederer, 2006; Yoshikuni & Albertin, 2018b), enabling it as strategy-as-practice (Marabelli & Galliers, 2017; Peppard, Galliers, & Thorogood, 2014; Whittington, 2014; Yoshikuni & Albertin, 2018a) on the effects of turbulence and environmental uncertainty (Y. Chen et al., 2014; Merali, Papadopoulos, & Nadkarni, 2012; Mikalef & Pateli, 2017; Newkirk & Lederer, 2009; Teo & King, 1997).

This study was carried out with firms located in Brazil, an interesting context to investigate relevant issues of the theoretical and practical contribution of IS strategy in an uncertain environment aggravated by the turbulence of economic crisis. Brazil's GDP was negative in 2015 and 2016 (IBGE, 2016, 2017), and presents different levels of turbulence and environmental uncertainty than countries with a stable economy (Yayla & Hu, 2012). Thus, the study sought to fill open gaps in the IS strategy literature and n Practice theory, contributed with new insights into the relationship between SIS and BS and performance, enabling strategy-as-practice in organizations and examining the implications of environmental uncertainty of dynamism, heterogeneity and hostility separately and for high and low levels. Post hoc analysis results contributed to identify heterogeneity not observed in the proposed model, the nonlinear causality of latent variables in SIS and BS relationship, as well as to the understanding SIS's contribution incorporated into the BS process (Kohli & Grover, 2008), confirming the positioning of IS strategizing (Marabelli & Galliers, 2017; Peppard et al., 2014; Whittington, 2014; Yoshikuni & Albertin, 2018a). Hence, a theoretical approach incorporating previous knowledge was employed, and therefore, contributing to the cumulative research flow in the IS field.

2. Theory Development

Strategic Information Systems

Academic studies on the use of IS to support business strategies have increased over the years (Arvidsson et al., 2014; Yolande E. Chan, Denford, & Jin, 2016; Marabelli & Galliers, 2017; Newkirk & Lederer, 2006; Teo & King, 1997), contributing to productivity, innovation, competitive advantage and organization growth and performance (Y.E. Chan, Sabherwal, & Thatcher, 2006; Y. Chen et al., 2014; Yoshikuni & Albertin, 2018a). IS strategy empowers the organization to capture, store, transfer and display information to support strategic decision-making (Yolande E. Chan et al., 2016; D. Q. Chen et al., 2010), to address the challenges of environmental turbulence, understand the various external actors and utilize the intelligence of markets and society for innovation in complex and dynamic environments (Merali et al., 2012).

Given the importance of IS strategy approaches (process and content, desired impact and alignment, D. Y. Chen et al, 2010), and the impracticability of examining all in an empirical study, it was decided to focus on SIS to support the process and BS content in the context of environmental uncertainty, adopting the IS strategizing definition (Marabelli & Galliers, 2017; Peppard et al., 2014; Whittington, 2014; Yoshikuni & Albertin, 2018b) in the stages of strategic planning process, strategic awareness, environmental analysis, development and BS execution and monitoring (D. Q. Chen et al., 2010; Newkirk & Lederer, 2006; Singh, Watson, & Watson, 2002). SIS was approached as a set of IS/IT (information technology) applications that involve current processes and practices of the strategy (D. Q. Chen et al., 2010; Merali et al., 2012), contributing to a holistic, interactive, decentralized, knowledge and learning dynamic vision of practitioners of the strategy-as-practice (Marabelli & Galliers, 2017; Peppard et al., 2014; Whittington, 2014; Yoshikuni & Albertin, 2018a).

Business strategy

Several approaches are used in strategy theory to conceptualize the firm's strategy (Mintzberg et al., 2009). "Strategic planning" received considerable emphasis and research conducted in the past decades (1960s, 70s, 80s and 90s) investigated strategic planning in stable and predictable environments, which driven by the increase of environmental turbulence has changed in the present (Grant, 2003).

The main dimensions to measure a strategic planning construct correspond to strategic objectives disseminations (Hill et al., 2014; Kaplan & Norton, 2008; Yoshikuni & Albertin, 2014) at different organization levels (Bromiley & Rau, 2014; Dameron, L ê & Lebaron, 2015; Heyden, Fourn, Koene, Werkman, & Ansari, 2017), scanning the external environment (Hill et al., 2014; Kaplan & Norton, 2008; Porter, 1986), identifying positive and negative factors (Davenport, Harris, & Morison, 2010; Jarzabkowski & Kaplan, 2015; Yoshikuni & Albertin, 2018a), selecting and formulating strategies and plans (Babafemi, 2015; Dameron et al., 2015; Grant, 2003; Heyden et al., 2017) in a continuous cycle of simulation and evaluation of strategic projects (Kaplan & Norton, 2008; Yoshikuni & Albertin, 2018a), executing the strategy (Grant, 2003; Mintzberg et al., 2009) and translated by employees (Dameron et al., 2015; Grant, 2003; Kaplan & Norton, 2008; Yoshikuni & Albertin, 2018a), and controlling and following-up the strategy (Dameron et al., 2015; Grant, 2003; Whittington, 2014) to measure achievements versus those planned (Babafemi, 2015; Heyden et al., 2017; Kaplan & Norton, 1992).

Recent studies have investigated strategic planning evolution, with the strategy-as-practice approach, which occurs through the intense participation of employees, generating flexibility, agility and understanding of the dynamic and complex process of executing the BS (Bromiley & Rau, 2014; Chin, Thatcher, Wright, & Steel, 2013; Dameron et al., 2015; Marabelli & Galliers, 2017; Peppard et al., 2014; Whittington, 2014), characterized by the dynamic and complex realization of everyday strategic practices (Kaplan & Norton, 2008; Yoshikuni &

Albertin, 2018a), fusing prescriptive strategy practices with new ways of gaining and maintaining differential competitive advantage (Marabelli & Galliers, 2017; Mintzberg et al., 2009).

Corporate Performance

CP measurement was broadened to assess the multiple dimensions of organizational effectiveness (Mithas, Ramasubbu, & Sambamurthy, 2011; Mostaghel, Oghazi, Beheshi, & Hultman, 2015; Yoshikuni & Albertin, 2018a). Several researchers have considered the Balanced Scorecard (BSC) (Kaplan & Norton, 1992, 2008) as an effective and comprehensive tool for CP based on financial success that measures organizational growth and productivity. It converts the firm's tangible and intangible assets in increased shareholder value (Atkinson, Kaplan, Matsumura, & Young, 2011; Park, Lee, & Chae, 2017b; Yoshikuni & Albertin, 2018b), in the client performance measured by the value creation and market delivery (Bento, Bento, & White, 2013; Mostaghel et al., 2015; Yoshikuni & Albertin, 2017), in the business process performance measured by the efficiency and effectiveness of value chain activities that transform assets into benefits for customers and shareholders (Kaplan & Norton, 1992; Park, Lee, & Chae, 2017a; Sen, Bingol, & Vayway, 2017), and in the organizational perspective of learning and growth by alignment of the intangible assets that are consumed to create organizational value (Albertin & Albertin, 2012; Bento et al., 2013; Kaplan & Norton, 2008; Mithas et al., 2011; Yoshikuni & Albertin, 2017).

Environmental uncertainty

Environmental uncertainty has been extensively investigated in BS theories (Grant, 2003; Lumpkin & Dess, 2001; Mintzberg et al., 2009; Schilke, 2014; Whittington et al., 2017; Yoshikuni & Albertin, 2018b) as contextual factor influencing the use of IS applications as a mechanism that enables the firm to face the complexity, dynamism, uncertainty and unpredictability of social, political and economic systems (Merali et al., 2012; Newkirk & Lederer, 2006; Ray, Wu, & Konana, 2009; Yayla & Hu, 2012), also characterized by dynamism, heterogeneity and hostility (Miller & Friesen, 1983).

Heterogeneity is identified by the complexity and diversity of external environmental factors that influence the organization's market and production processes ((Mao, Liu, & Zhang, 2014; Miller & Friesen, 1983). Market turbulences are measured by changes in evaluation, behavior and preferences of the new and current customers (Y. Chen et al., 2014; Wilden & Gudergan, 2015; Yayla & Hu, 2012). Dynamism is measured by market volatility (Newkirk & Lederer, 2006; Schilke, 2014), i.e., by the high changing rates of the external environment that generate difficulties to predict future situations and events (Y. Chen et al., 2014; Lumpkin & Dess, 2001; Merali et al., 2012; Ray et al., 2009). Hostility is measured by resources scarcity and the intensity by which the actors in a particular market compete for these (Y. Chen et al., 2014; Lumpkin & Dess, 2001; Mao et al., 2014). Turbulence index corresponds to the degree of competition in a particular market (Newkirk & Lederer, 2006; Wilden & Gudergan, 2015).

3. Research Model and Hypotheses

The research conceptual model below illustrates our hypotheses and assumes that the impact of SIS on corporate performance is mediated by business strategy (Figure 1). Therefore, a strong SIS is hypothesized to promote business strategy, enabling greater flexibility of strategy process and a repertory of options for strategy content, which is fundamental condition for gain corporate performance. Once IT/IS empirical studies debate about the external conditions that favor the realization of the IT business value from business strategy and corporate performance (Mikalef & Pateli, 2017; Yoshikuni & Albertin, 2018a), these study also investigated the moderation of uncertainty environment in the relationship of conceptual model.

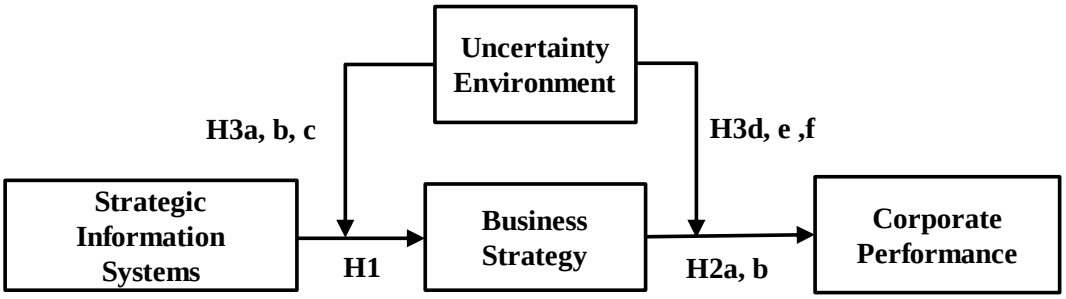

Figure 1. Conceptual model of the influence of business strategy mediation on the relationship between SIS and CP moderated by the environmental uncertainty

Strategic Information Systems and Business Strategy

Communication, integration and cooperation, without local boundaries, enables awareness of strategic guidelines through SIS (D. Q. Chen et al., 2010; A.H. Segars & Grover, 1999; A.H. Segars, Grover, & Teng, 1998), generating effective understanding of these, objectives and priorities for all organizational levels (Karpovsky & Galliers, 2015). SIS promote flexibility and agility, i.e., such as adaptability, agility, resilience, robustness, versatility, and absorption (Pavlou & El Sawy, 2010). to map positive and negative external factors (Dameron et al., 2015; Newkirk & Lederer, 2006; Xue, Ray, & Sambamurthy, 2012; Yoshikuni & Albertin, 2018a) through the application of business intelligence and big data that collect and analyze a large volume of data and information (D. Q. Chen et al., 2010; George, Haas, & Pentland, 2014; Marabelli & Galliers, 2017), reducing the environment analysis cycle, integrating data and market information (Grant, 2003), reducing decision making time (Rouhani, Ashrafi, Ravasan, & Afshari, 2016; Shollo & Galliers, 2016), and formulating strategic actions to capture opportunities and mitigate threats (Kaplan & Norton, 2008; Sabherwal & Chan, 2001; Xue et al., 2012). The organization enables analytical capacity by SIS to structure a large volume of data and information and to translate it into strategic knowledge (Davenport et al., 2010; Rouhani et al., 2016; Yoshikuni & Albertin, 2018a, 2017), formulate and implement BS action plans (Kearns & Sabherwal, 2006) of innovation and productivity (Johnson & Lederer, 2013; Leidner et al., 2011; Marabelli & Galliers, 2017; Merali et al., 2012; Shollo & Galliers, 2016). Monitoring and controlling strategic planning objectives and goals are enabled by SIS by collecting, integrating, consolidating data and information to be discussed in face-to-face meetings of employees, superiors, subordinates and peers, disseminating and strengthening the firm's accountability (Davenport et al., 2010; Yoshikuni & Albertin, 2018a).

In this regard, SIS empowered the organization to successfully execute strategic planning (D. Q. Chen et al., 2010; Newkirk & Lederer, 2006; Albert H. Segars & Grover, 1998; Singh et al., 2002; Yoshikuni & Albertin, 2018a) in a comprehensive holistic system that enables the firm to develop an effective participatory and decentralized work of thinking, analyze, select, implement and monitor the BS supported by the various IS, postulating the following hypothesis:

H1: *The use of SIS enables BS with flexibility and agility.*

Business Strategy and Corporate Performance

Over the last few decades, theoretical and empirical studies have shown that strategic planning improves CP by aligning its operations towards the implementation of common strategic objectives (Anwar & Hasnu, 2016; Kaplan & Norton, 1992, 2008; Song, Zhao, Arend, & Im, 2015; Whittington et al., 2017). Theoretical studies on IS/IT value creation investigated by Melville et al. (2004) and Kohli and Grover (2008) demonstrated that SIS precedes and incorporates BS processes by providing indirect effects to CP. Other empirical studies showed the various benefits delivered in strategy mediation in the relationship between SIS and CP (Yolande E. Chan et al., 2016; Kearns & Sabherwal, 2006; Kim, Shin, Kim, & Lee, 2011; Yoshikuni & Albertin, 2018a, 2017). Thus, the following hypotheses are highlighted:

H2a: *BS positively influences CP.*

H2b: *BS mediates the relationship between SIS and CP.*

Environmental Uncertainty, Strategic Information Systems and Business Strategy

Over the past few years, studies of the indirect effects of environmental uncertainty on SIS have been intensified (Y. Chen et al., 2014; Leidner et al., 2011; Mao et al., 2014; Mikalef & Pateli, 2017; Newkirk & Lederer, 2006; Yoshikuni & Albertin, 2018a). Teo & King (1997) developed one of the first studies on the effects of heterogeneity, dynamism and hostility in the use of IS supporting business strategies. Newkirk and Lederer's (2006) investigations have empirically demonstrated that using SIS in uncertain environments of dynamism, heterogeneity and hostility have contributed organizations to respond to unpredictable challenges and events. Recent studies have shown that SIS enable organization in high uncertain environments to develop organizational capacity to analyze and make agile decisions (Y. Chen et al., 2014; Mao et al., 2014), enabling competitive strategies and influencing performance (Y.E. Chan et al., 2006).

Kearns & Sabherwal (2006) found that IS incorporation in strategic planning enabled the organization to face the intensity of market diversity, and the greater the diversity, the greater the firm's need to obtain information to understand and take decisions. Thus, in a heterogeneous environment, SIS enable the organization's capacity to coordinate, disseminate, collect, analyze, implant and effectively follow the BS, formulating the following hypothesis:

H3a: *The relationship between SIS and BS is moderated by the environmental uncertainty of high and low heterogeneity.*

Rapidly changing environments raise the organization's challenge to develop agile BS to effectively deal with dynamism complexity (Y.E. Chan et al., 2006; Mikalef & Pateli, 2017). Recent studies have shown that SIS enable the organization to quickly and flexibly respond to the demands arising from dynamism uncertainty (Y. Chen et al., 2014; Pavlou & El Sawy, 2010; Yoshikuni & Albertin, 2018a). Merali et al (2012) confirmed the effectiveness of SIS in supporting adaptation or transformation strategies for firms to remain competitive in rapidly changing environments. Chen et al. (2014) identified that SIS contribute to the rapid information availability for innovation and productivity strategy development by mapping new opportunities, capturing market information, and analyzing customer and competitor data. Thus, dynamism uncertainty could positively moderate the relationship between SIS and BS.

H3b: *The relationship between SIS and BS is moderated by the environmental uncertainty of high and low dynamism.*

Resources scarcity and increasing competition for these resources increase the competitive turbulence (Mao et al., 2014; Yoshikuni & Albertin, 2018a). High hostility rates restrict resource use and may negatively impact collaboration, participation, communication, analysis, formulation and strategic decision making (Y. Chen et al., 2014). However, hostility requires greater organization ability to efficiently and effectively use the limited organizational resources, and SIS can contribute to the success of the strategic planning process by enabling the organization to gather, analyze data and information on the availability and location of resources and the best way to obtain and use them (Newkirk & Lederer, 2006). Thus, it can be concluded that:

H3c*: The relationship between SIS and BS is moderated by the environmental uncertainty of high and low hostility.*

Environmental Uncertainty, Business Strategy and Corporate Performance

Turbulence increases organizations' efforts to look forward, to project scenarios and future situations into shorter planning horizons (Whittington et al., 2017). The complexity and dynamism of the digital age challenge organizations to develop flexibility and agility to achieve higher performance through new strategic e-business strategic planning practices (Lipitakis & Phillips, 2015). Turbulence and uncertainty pressured contemporary strategic planning to develop mechanisms to respond to the demands of this environment and achieve organizational effectiveness (Grant, 2003; Whittington, 2014; Yoshikuni & Albertin, 2018a). Thus, it was considered that:

H3d: *The relationship between BS and CP is moderated by the environmental uncertainty of high and low heterogeneity.*

H3e: *The relationship between BS and CP is moderated by the environmental uncertainty of high and low dynamics.*

H3f: *The relationship between BS and CP is moderated by the environmental uncertainty of high and low hostility.*

4. Methodological Approach

The sample was selected from Brazilian firms from the directory provided by the Center for Applied Information Technology (GVcia) of FGV. Target respondents were senior business executives with appropriate knowledge of the firm's strategic business and IT/IS processes. Executives were asked to consult other members of their firm to obtain information about which they were not highly knowledgeable (Mikalef & Pateli, 2017). The survey was sent to 1089 organizations from which 139 (13%) of the questionnaires were answered. The platform was configured to restrict missing data fill errors.

The sample showed to be 10 times bigger than the structural paths number that predict a particular reflexive construct (Hair, Sarstedt, Ringle, & Gudergan, 2018); however, a more rigorous test of the minimum study sample size was performed using the *G*Power v.3.1.9.2* software (Faul, Erdfelder, Lang, & Buchner, 2007), with a median effect size [f^2] of 0.15 and with statistical power of not less than 0.80 (Hair et al., 2018; Ringle, Bido, & Da Silva, 2014), recommending a minimum sample size of 43 cases. Demographic data of respondents on behalf of their respective organizations show that 28% hold presidential, director and superintendent positions, 42% were managers and coordinators and 30% were decision-makers. Table 1 shows the distribution of companies in the sample.

Table 1. Types of participating firms

Sector		Number of employees (Size)	
Agrobusiness	6%	≤ 9	4%
Manufacturing	30%	10 – 49	9%
Services	64%	50 – 99	12%
		100 – 249	9%
		250 – 499	9%
		≥ 500	58%

5. Research Findings

After evaluation of the descriptive statistics of the demographic variables, scale clearance followed through the confirmatory factorial analysis (convergent validity, discriminant validity and reliability).

Measurement model

Dimensions were defined from theoretical reference (see Table 2) and the survey instrument was developed to collect data to validate the main constructs and test the research hypotheses. It maintained for confirmatory factor analysis, the constructs poses reflective indicators and were connected to each other, assuming they are correlated (Hair, Hult, Ringle, & Sarstedt, 2016). The 7-point Likert scale was used, varying from 1 (totally disagree) to 7 (totally agree) to evaluate the constructs. The validated scale, with the items used - the constructs, the scale assertions (variables/indicators) and their factorial loads - can be found in the survey instrument with the first author.

Table 2. Measures and sources of variables used in the analyses

Variables	Measures	Sources
Strategic Information Systems	IS support BS	Yoshikuni & Albertin (2018a)
Business Strategy	Strategic planning process	Grant (2003) and Hill, Jones and Schilling (2014)
Corporate Performance	Financial Customer Business process Learning and growth	Kaplan and Norton (1992,2008)
Enviromental Uncertainty	Hostility Dynamism Heterogeneity	Mikalef & Pateli (2017), Miller & Friesen (1983) and Yayla & Hu (2012)
Control Variables	Size Sector	Melville, Kraemer, & Gurbaxani (2004), Chan et al. (2016, 2006) and Sabherwal & Chan (2001)

The factorial load and the convergent validity of the constructs were performed and the items were above 0.50, confirming an adequate extracted mean variance (Hair, Sarstedt, Matthews, & Ringle, 2016). The discriminant validity was verified by observing the values on the diagonal (square root of the extracted mean variance) and these were higher than the values outside the diagonal (correlations) (Hair, Hult, et al., 2016). Reliability was adequate, with composite reliability values higher than 0.7 (Table 3) (Hair, Hult, et al., 2016).

Table 3. Correlations matrix between constructs

Latent variables	1	2	3	4	5	6	7	8	9
1 - Strategic IS	**0.85**								
2 - Business strategy	0.70	**0.81**							
3 - Financial performance	0.37	0.50	**0.92**						
4 - Customer performance	0.34	0.54	0.54	**0.75**					
5 - Business process performance	0.54	0.64	0.54	0.62	**0.75**				
6 - Learning and growth performance	0.38	0.60	0.41	0.53	0.65	**0.74**			
7 - Heterogeneity	0.20	0.33	0.13	0.23	0.35	0.13	**0.77**		
8 - Dynamism	0.17	0.14	0.12	0.13	0.27	0.19	0.36	**0.76**	
9 - Hostility	- 0.23	- 0.21	- 0.16	- 0.12	- 0.08	- 0.06	0.12	0.25	**0.74**
AVE	0.72	0.65	0.85	0.56	0.56	0.55	0.59	0.58	0.54
Composite reliability	0.93	0.90	0.94	0.79	0.79	0.78	0.80	0.81	0.78
Means	4.56	4.77	4.56	5.27	4.83	4.97	4.67	3.68	3.89
Standard deviation	1.30	1.01	1.61	0.93	1.13	1.11	1.41	1.13	1.41
Variance coefficient	0.28	0.21	0.35	0.18	0.23	0.22	0.30	0.31	0.36

Structural Model

The model implicates a complex operationalization as it involves the evaluation of the moderation effects of environmental uncertainty and control variables, and inclusion of a latent variable to remove the bias from the MLMV (measured latent marker variable). As recommended by Chin, Thatcher, Wright and Steel (2013), four items designed to have the lowest possible logical correlation with other constructs under investigation were included to control the bias of the common method (Table 4). The analysis was based on the cases of Table 5 and the results are commented in the following sections.

Table 4. Indicators used for MLMV analysis

MLMV_1: I always conquer my goals.
MLMV_2: My dream is to have my own business.
MLMV_3: I like the hot weather.
MLMV_4: I always imagine what my life will be like in the future.

Table 5. Standardized regression coefficients of the structural models with MLMV items

Case	Structural model	Path coefficient	Standard error	t value	p value	R^2
1	SIS -> Corporate performance	0.0892	0.098	0.912	0.362	45.3%
	BS -> Corporate performance	0.5399	0.109	4.938	0.000	
	MLMV -> Corporate performance	0.4063	0.136	0.091	1.493	
2	SIS -> Business strategy	0.6327	0.050	12.709	0.000	57.0%
	MLMV -> Business strategy	0.3016	0.054	5.636	0.000	

Legend: Business strategy (BS) and Strategic information systems (SIS).

Note 1. Significance was estimated by bootstrap with N = 139 cases and 1000 replicates in SmartPLS 3.2.6.

The relationships between SIS and CP, and SIS and BS with the inclusion of the MLMV in cases 1 and 2 (Table 5), presented statistical significance (p value <0.001), from which the need to operationalize the model without the inclusion of the MLMV (Table 6) was noticed, and the structural coefficients of the model "without the inclusion of the MLMV" and "with the inclusion of the MLMV" were compared.

Table 6. Standard regression coefficients of the structural models without MLMV items

Case	**Structural model**	**Path coefficient**	**Standard error**	**t value**	**p value**	**R^2**
1	SIS -> Corporate performance	0.062	0.094	0.660	0.509	43.90%
	BS -> Corporate performance	0.532	0.081	6.540	0.000	
2	SIS -> Business strategy	0.698	0.046	15.296	0.000	48.70%

According to Hair et al (2018), to compare the path coefficients differences between the structural models, the use of multigroup analysis (PLS-MGA) is recommended. Table 7 shows the result for the relations of latent variables and did not present statistically significant differences between the path effects (p value > 0.05). The sample did therefore not present bias of the common collection method, and structural model of Table 3 was used for analysis of hypothesis H1 and H2, showing that the R2 values in all relations presented a great effect and provided a measure of structural model quality, as suggested by Ringle et al. (2014).

Table 7. Comparison of the structural coefficients with and without inclusion of the MLMV

Relationship between variables	With MLMV		Without MLMV		With MLMV vs Without MLMV		
	Path Coefficient	Standard error	Path Coefficient	Standard error	|β1 - β2|	t value	p value
SIS -> Corporate performance	0.0892	0.098	0.062	0.094	0.028	0.204	0.839
BS -> Corporate performance	0.5399	0.109	0.532	0.081	0.008	0.057	0.955
SIS -> Business strategy	0.6327	0.050	0.698	0.046	0.065	0.971	0.333

Hypotheses H1 and H2a supported (value p < 0.001) that SIS influence the BS, and the BS influences the CP.

As recommended by Hair, Hulf et al (2016), the indirect effects of BS mediation on the relationship between SIS and CP through VAF (variance accounted for) result was verified, as it was totally mediated by the BS (direct effect = 0.062, total effect = 0.433, indirect effect = 86%, VAF = 14%) with statistical significance (p value < 0.001), thus supporting the H2b hypothesis.

The influence of environmental uncertainty through the variables of heterogeneity, dynamism and hostility, and control variables in the variables dependent on BS and CP (Carlson & Wu, 2012) were also verified. The PLS-MGA method was used to analyze the effect of environmental uncertainty. Subgroups classified as "high" and "low" presence of heterogeneity, dynamism and hostility dimensions (Newkirk & Lederer, 2006; Yayla & Hu, 2012) were created and investigated the predictive power of SIS and BS on the dependent variables, comparing the path effects in the relations between exogenous and endogenous variables, according to Tables 8, 9 and 10.

Table 8. Comparison of structural coefficients of low (41 cases) and high (98 cases) heterogeneity

Relationship between variables	Low heterogeneity (41 cases)		High Heterogeneity (98 cases)		Low vs High		
	Path Coefficient	Standard error	Path Coefficient	Standard error	|β1 - β2|	t value	p value
SIS -> Corporate performance	0.086	0.141	0.064	0.141	0.023	0.093	0.926
BS -> Corporate performance	0.744	0.108	0.539	0.144	0.206	0.885	0.377
SIS -> Business strategy	0.564	0.120	0.754	0.039	0.191	1.969	0.050

The subgroup of low heterogeneity consisted of 41 firms and the high of 98 firms. The relationship between SIS and the BS presented a difference in path coefficients and statistical significance (p value < 0.05) and supported the H3a hypothesis. The H3d hypothesis did not present statistical significance and was not supported when comparing the path effects in the relationship between strategy and CP (p value = 0.377).

Dynamic and hostility variables were moderated in the relationships between SIS and BS, and BS and CP, and no statistical significance was found (p value > 0.05) for these. Hence, hypotheses H3b, H3c, H3e and H3f were not supported (Tables 9 and 10).

Table 9. Comparison of structural coefficients of low and high dynamism cases

Relationship between variables	Low dynamism (84 cases)		High dynamism (55 cases)		Low vs High		
	Path Coefficient	Standard error	Path Coefficient	Standard error	|β1 - β2|	t value	p value
SIS -> Corporate performance	0.078	0.099	0.038	0.239	0.040	0.175	0.861
BS -> Corporate performance	0.614	0.104	0.611	0.217	0.003	0.015	0.988
SIS -> Business strategy	0.648	0.063	0.786	0.057	0.139	1.545	0.124

Table 10. Comparison of structural coefficients of low and high hostility

Relationship between variables	Low hostility (82 cases)		High Hostility (57 cases)		Low vs High		
	Path Coefficient	Standard error	Path Coefficient	Standard error	|β1 - β2|	t value	p value
SIS -> Corporate performance	0.1459	0.123	- 0.039	0.153	0.185	0.959	0.339
BS -> Corporate performance	0.5616	0.123	0.675	0.142	0.114	0.605	0.546
SIS -> Business strategy	0.7257	0.056	0.653	0.059	0.073	0.875	0.383

IT/IS expenses of Brazilian organization keep increasing, and as evidenced by the annual research carried out by the Getulio Vargas Foundation (FGV), the services sector spent 11% and manufacturing 4.5% of their net sales in 2016 in this (Meirelles, 2018). Thus, this investigation sought to study the influences, through control variables of the characteristics of the organization (Melville, Kraemer, & Gurbaxani, 2004), its sector and its size by the number of employees (Y.E. Chan et al., 2006; Yolande E. Chan et al., 2016) in relation to SIS, BS and CP (Sabherwal & Chan, 2001). The influence of the control variables - size and sector - in the relations of the latent model variables was also evaluated and compared with the path coefficients using the PLS-MGA method (Hair, Hult, et al., 2016; Yoshikuni & Albertin, 2017). Subgroups of firms with <499 and >500 employees were created and it was identified that the relationships between SIS and BS, and BS and CP, are moderated by the firm's size, showing a statistically significant difference of respectively 0.391 (50%) for the relation between BS and CP (p value <0.05). However, the direct relationship between SIS and CP for both groups of <499 and >500 employees did not present statistical significance (p value = 0.198, p value = 0.071) (Table 11).

Table 11. Comparison of the structural coefficients of the firm ´s size control variable

Relationship between variables	Less than 499 employees (59 cases)		More than 500 employees (80 cases)		Less than 499 vs More than 500		
	Path Coefficient	Standard error	Path Coefficient	Standard error	|β1 - β2|	t value	p value
SIS -> Corporate performance	-0.1492	0.116	0.242	0.134	0.391	2.126	0.035
BS -> Corporate performance	0.7897	0.103	0.399	0.123	0.391	2.342	0.020
SIS -> Business strategy	0.6874	0.056	0.650	0.071	0.038	0.399	0.690

The moderation sector was analyzed regarding the relation between exogenous and endogenous variables for the sectors with the highest representation in the sample, manufacturing and service (Table 12). No influence of the sector was identified in the relationship between SIS and BS, and BS and CP (value p> 0.05).

Table 12. Comparison of the structural coefficients of the control variable of the industry and service sectors

Relationship between variables	Manufacturing (43 cases)		Service (89 cases)		Manufacturing vs Service		
	Path Coefficient	Standard error	Path Coefficient	Standard error	|β1 - β2|	t value	p value
SIS -> Corporate performance	0.038	0.206	0.076	0.109	0.038	0.182	0.856
BS -> Corporate performance	0.5408	0.200	0.658	0.107	0.117	0.572	0.568
SIS -> Business strategy	0.7386	0.062	0.677	0.061	0.062	0.639	0.523

Post hoc analysis

A post hoc analysis was carried out in order to guide and direct possible conclusions of the study, structuring it to investigate the presence of unobserved heterogeneity, examine combinations of non-linear causal conditions and the influence of IS strategizing by means of IS moderation product and BS.

The presence of unobserved heterogeneity was realized through Finite Mixture modeling (FIMIX-PLS), identifying the existence of significant differences in structural model relationships between data groups that were not observed by the environmental control and uncertainty variables (Becker, Rai, Ringle, & Volckner, 2013; Hair, Sarstedt, et al., 2016). The FIMIX-PLS algorithm was run 10 times for segments 1-5 using the Akaike Information Criterion (AIC), modified AIC with factor 3 (AIC_3), Bayesian Information Criterion (BIC), Consistent AIC (CAIC), Hannan-Quinn Criterion (HQ) and normed Entropy Statistics (EN) to identify the appropriate targeting solution from appropriate segmentation (Matthews, Sarstedt, Hair, & Ringle, 2016; Sarstedt, Becker, Ringle, & Schwaiger, 2011). The information criteria for segment selection (Hair, Hult, et al., 2016; Hair et al., 2018) indicate the two-segment solution as the most appropriate (values coincide for AIC_3 and CAIC together with ACI_3 and BIC, in addition to AIC_4 and BIC, MDL_5 criterion presented the largest choice of a

segment and AIC the choice of <5 segments, with EN criterion value >0.5, Table 13), and the sample size by segment was greater than the minimum size indicated in the structural model of 43 cases (Table 14).

Table 13. Information criteria by segment by FIMIX-PLS

Criterion	Number of solutions				
	1	2	3	4	5
AIC	1,607.342	1,532.897	1,520.447	1,511.244	**1,504.407**
AIC3	1,620.342	**1,559.897**	1,561.447	1,566.244	1,573.407
AIC4	1,633.342	**1,586.897**	1,602.447	1,621.244	1,642.407
BIC	1,645.490	**1,612.128**	1,640.761	1,672.640	1,706.886
CAIC	1,658.490	**1,639.128**	1,681.761	1,727.640	1,775.886
HQ	1,622.845	**1,565.094**	1,569.339	1,576.831	1,586.689
MDL5	**1,902.083**	2,145.051	2,450.014	2,758.225	3,068.801
EN	n/a	**0.647**	0.648	0.705	0.718

Legend: AIC - Akaike's Information Criterion, AIC_3 - Modified AIC with Factor 3, AIC_4 - Modified AIC with Factor 4, BIC - Bayesian Information Criteria, CAIC - Consistent AIC, HQ - Hannan Quinn Criterion, MDL_5 - EN - Entropy Statistic (Normed).

Table 14. Relative size of declining segments per solution

N °of solutions	Solutions size				
	S = 1	S = 2	S = 3	S = 4	S = 5
2	0.541	0.459			
3	0.373	0.342	0.285		
4	0.443	0.250	0.160	0.147	
5	0.316	0.261	0.153	0.144	0.126

Note. The table shows the relative size of the segments in descending order per solution

The simple intersection of FIMIX-PLS segments 1 and 2 was performed with the control and environmental uncertainty variables (Table 15), and the best combination for the environmental uncertainty variables (heterogeneity, dynamism and hostility) and sector (agribusiness, manufacturing and services) was verified for FIMIX-PLS group 1 (numbers in bold in the table). Only the size of the firm by the number of employees for the segmentations of ≤9 and between 50-99 employees proved to be suitable for FIMIX-PLS group 2 (Table 13 - numbers in bold). The groupings by the number of cases of the environmental uncertainty variables and sector by segment obtained the result of 80 cases for the FIMIX-PLS group 2, with 58% of cases, slightly lower than 60% as recommended by Hair et al (2016). However, the grouping for firm size was unsatisfactory with a total of 53% of cases. Since the clusters for environmental and sector uncertainty variables presented a slightly satisfactory overlap for explanatory environmental and sector uncertainty variables, the structural models by segment 1 and 2 of FIMIX-PLS (Hair, Hult, (FIMIX-PLS 1, and FIMIX-PLS) were estimated and differences between these models compared by multi-group analysis (PLS-MGA) (Hair, Hult, et al., 2016) (Table 16) with the indicators of the structural models and the identified differences.

Table 15. Simple crossing of moderation variables and FIMIX-PLS segments

Solutions	Environmental Uncertainty						Sector			Number of employees (Size)					
	Heterogeneity		Hostility		Dynamism		Agrobusiness	Manufacturing	Service	<9	10 to 49	50 to 99	100 to 249	250 to 499	>500
	High	Low	High	Low	High	Low									
1	40	19	19	40	20	39	1	18	39	**4**	4	**10**	5	4	32
2	**58**	**22**	**38**	**42**	**35**	**45**	**6**	**25**	**50**	1	**8**	6	**8**	**9**	**48**

Table 16. Comparison of structural models by segment FIMIX-PLS

Structural Model	Path coefficients			Multigroup analyses (MGA) |β1 - β2|		
	Original sample (OS)	Solution 1 (S1)	Solution 2 (S2)	OS - S1	AO - S2	S1 - S2
SIS -> Corporate Performance	0.062	0.038	0.100	0.024	0.038	0.062
BS -> Corporate Performance	0.532 ***	0.701 ***	0.533 ***	0.169	0.001	0.168
SIS -> Business strategy	0.698 ***	0.709 ***	0.707 ***	0.012	0.009	0.003
AVE	+	+	+	+	+	+
Composite reliability	+	+	+	+	+	+
R^2- Corporate performance	43.90%	53.00%	36.90%			
R^2- Business strategy	48.70%	50.40%	50.00%			

Note. *** p value <0.001; ** p value <0.01; * p value <0.5; Measurement model evaluation criterion fulfilled/not fulfilled in accordance with Hair et al. (2016).

All measures of the model met the common quality standards when comparing the path coefficients between FIMIX-PLS segments 1 and 2 and the original analysis (Hair, Hult, et al., 2016). A difference in the structural coefficients was observed comparing AO-S1 (0.169; 23%) and S1-S2 (0.168; 23%) segments, but was not statistically significant (p value >0.05).

The analysis of non-linear causal combinations was performed through the analytical approach of boolean algebra, fuzzy set qualitative comparative analysis (fsQCA) (Fiss, 2011; Frambach, Fiss, & Ingenbleek, 2016; Ragin, 2008; Woodside, Ko, & Huan, 2012). According to FIMIX-PLS, the fsQCA was used in both solutions, individually analyzing the relationship between SIS and BS, and the causality of the variables of environmental uncertainty and firm's size were verified. The calibration procedure of fsQCA described by Mikalef and Pateli (2017) to transform the constructs measured on the Likert scale of 7 points in diffuse set, denoting total adhesion (diffuse score=0.95), total non-association (diffuse score=0.05) and the crossover point (diffuse score=0.50) was used. Thresholds of full members are set to values of 6, cross points to 4.5 and full score of non-members to 3 (Tho & Trang, 2014). The overall consistency level was 0.928854, above the recommended 0.75 (Ragin, 2008). Overall coverage of the solution was 0.639021, showing that the identified configurations represented 64% adherence to the result in the presence of BS according to Table 17.

Table 17. fsQCA configuration analysis

Causal conditions	Solution 1 Business strategy				Solution 2 Business strategy			
	Dynamism	Heterogeneity	Hostility	Size	Dynamism	Heterogeneity	Hostility	Size
SIS	⊗		●	●			⊗	●
UE and CV	⊗	●	⊗	•	⊗		⊗	⊗
Raw coverage	0.819699	0.849749	0.879800	0.774624	0.927752	0.736812	0.865826	0.561353
Unique coverage	0.819699	0.849749	0.879800	0.774624	0.927752	0.159978	0.103211	0.294151
Consistency	0.872114	0.862712	0.966972	0.928000	0.803376	0.953523	0.807163	0.824739
Overall solution coverage: 0.639021								
Overall solution consistency: 0.928854								

Note. Black circles indicate the presence of a condition, and "□" indicate its absence. Large circles indicate core conditions; small ones, peripheral conditions. Blank spaces indicate "do not care." Used software fsQCA version 3.0 available www.fsQCA.com

In solution 1, SIS proved to be present in the causality of the BS in the absence of hostility and in the peripheral presence of the firm´s size. The absolute presence of heterogeneity in the causality of the BS, as well as the peripheral absence of SIS and dynamism in the causality of the BS were identified. In solution 2, SIS proved necessary the causality of the strategy with the absence of the firm´s size; the other solutions presented peripheral absence of environmental uncertainty variables and causality of the BS.

The strategic alignment measure was created through the moderation between SIS factor scores (Tallon, 2007) and BS, where the product of this measure is equivalent to the strategic alignment of SIS dimension score. According to Sabherwal and Chan (2001) and Tallon (2007), the strategic alignment of SIS was measured as a deviation from the profile that corresponds to the absolute difference of the ideal use (100%, value 1) of SIS and the actual use of SIS collected and standardized. Small deviation points to tight alignment (fit), while large deviation points to misalignment. To reverse this scale, 1 of each absolute deviation was subtracted. In this way, firms with absolute or perfect alignment received the value of one and below one imply some sense of misalignment. Subsequently, the direct effects of the strategic alignment of SIS on CP were analyzed as "product of moderation" and "profile deviation" (Table 18).

Table 18. Standardized regression coefficients of the SIS strategic alignment structural models

Structural model	Method	Path coefficient	Standard error	t value	p value	R^2
SIS alignment -> CP	Product of moderation	0.615	0.053	11.643	0.000	37.8%
	Perfil desviation	0.466	0.067	6.868	0.000	21.2%

Note 1. Significance was estimated by bootstrap with N = 139 cases and 5000 replicates in SmartPLS 3.2.6.

The influence of SIS alignment on CP showed higher direct SIS and BS relations in CP (Table 6), but in the multigroup analysis between the relations did not present statistical significance (p value> 0.05) for both cases (product of moderation and profile deviation).

6. Conclusion, Limitation and Future Study

This study empirically demonstrated that SIS enabled strategy-as-practice (Arvidsson et al., 2014; Marabelli & Galliers, 2017), agreeing with other studies conducted in developed countries and stable economic situation (Y.E. Chan et al., 2006). SIS have had a strong influence in enabling flexibility and agility in developing the steps of the strategic planning process to disseminate strategic guidelines, analyze the overall environment, formulate, execute and monitor BS at shorter intervals in a continuous cycle of strategy-as-practice in complex environments.

This research confirmed the strong influence of BS on CP without contribution differences in this relationship in the various levels and dimensions of environmental uncertainty. However, it was observed that small and medium-sized firms (<499 employees) had an effect of 50% higher contribution in the relation (BS->CP) than large firms (>500 employees), demonstrating the maturity of small and medium-sized enterprises in the use of strategic management practices that until then were only used by large firms (Grant, 2003).

The empirical research of the study confirmed that SIS possess full strategy mediation in relation to CP in complex environments and environmental uncertainty, as evidenced in countries of economic stability (Y.E. Chan et al., 2006; Kim et al., 2011; Tallon, 2007). The study confirmed that in environments of economic turbulence and uncertainty, SIS enabled a broad performance management system that contributes to improve the quality of strategic decisions, coordinates decentralized strategic decision-making and drives the improvement of CP. SIS promote planning time reduction, making strategic decisions more flexible and enabling employees to participate in the strategic planning process.

The study showed that SIS influence the BS in high heterogeneity environments by 33% more than in low heterogeneity environments. Thus, SIS enabled the organization to face the intensity of market diversity and confirmed to be an effective mechanism to enable the organization's capacity to coordinate, disseminate, collect, analyze, implement and follow effectively promote strategy-as-practice.

The study did not demonstrate moderation of dynamism and hostility in the relationships between SIS and BS, and the latter and CP. The strong economy contraction in 2015 and 2016, with a GDP of -3.8% and -3.6% respectively (IBGE, 2016, 2017), may have influenced the validation of the hypotheses, since the economic crisis imposes a restriction of resources for product/service launches, influencing the dynamism of the environment and the competition of the same resources imposed. However, similar results of non-moderation support for the dimensions of environmental uncertainty were found in studies conducted in stable economies (Newkirk & Lederer, 2009, 2006).

The post-analysis study investigated the possibility of heterogeneity not observed by the FIMIX-PLS method (Hair et al., 2018), and identified two group segments that demonstrated that the aggregated analysis of the data level was consistent with the results found in the structural model for the observable variables of environmental control and uncertainty, with no statistically significant differences for the two FIMIX-PLS segments groups.

However, the fsQCA analysis demonstrated the possibility of non-linear causality for the BS in solution 1 and 2 of FIMIX-PLS for the firm´s size variable and the environmental uncertainty of heterogeneity. Moreover, it contributed to the understanding of how the intensive use of SIS in large enterprises can be equally effective in achieving a state of effect in BS, and confirmed PLS-PM of heterogeneity influence in BS.

Following, the post hoc analysis study allowed to identify the effect of the strategic alignment of SIS on CP, and in both methods of moderation and profile deviation presented a strong path effect, with statistical significance and high explanatory power in CP. The result contributes with studies that emphasize that process are not executed without the presence of IS/IT (Kohli & Grover, 2008) and confirmed that SIS incorporated the strategic planning process, and can be considered inseparable for the success of the strategy-as-practice, positioning as IS strategizing, in the context of economic turbulence and environmental uncertainty.

This study contributed to Strategy-as-Practice researchers recognize the significance of material technology in strategy work and there are many potential avenues for mutual exchange and collaboration between IS field and Practice Theory.

It is possible to emphasize that the way of collecting data limited the generalization of the results obtained, since the sample was not probabilistic. The cross-sectional method imposed another limitation in the study to evaluate the relationship between the constructs.

As a future study, it is suggested to pursue analyses of the moderation of the ideal use of SIS strategic alignment in CP weighted by strategy types, such as leadership in cost, differentiation and focus (Porter, 1986), strategic orientation defense, analysis, proactivity and reaction of customer intimacy (Miles, Snow, Meyer, & Coleman, 1978), operational excellence and product leadership (Mintzberg et al., 2009). Longitudinal research on the antecedents and consequences of SIS may generate new results from SIS value creation for strategy-as-practice, as well as its impact on innovation, competitive advantage and organizational performance over time.

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