

## The effects of the performance measurement system debate and cognitive conflict on ambidextrous innovation

*Efeitos do debate do sistema de mensuração de desempenho e do conflito cognitivo na inovação ambidestra*

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### Keywords

Performance measurement system.  
Cognitive conflict.  
Ambidextrous innovation.

### Abstract

This study follows the flow of research that investigated the relationship between the performance measurement system and innovation but differs in considering innovation as a multidimensional construct. This study analyzes the effects of the performance measurement system debate and cognitive conflict on ambidextrous innovation. A survey was conducted with managers of companies listed in Brazil Bolsa Balcão (B3), according to the ranking of research and development values and intangible assets, and 124 valid answers were obtained. To test the hypotheses we used the structural equation modeling technique. The results revealed that the performance measurement system debate positively influences ambidextrous innovation and that cognitive conflict moderates this relationship. It is concluded that discussions between managers about performance measures allow the problem-solving, pursuit of learning, creativity, and innovation, especially when intensified by cognitive conflict.

### Palavras-chave

Sistema de mensuração de desempenho.  
Conflito cognitivo.  
Inovação ambidestra.

### Resumo

*Este estudo segue o fluxo de pesquisas que investigaram a relação entre o sistema de mensuração de desempenho e a inovação, mas difere ao considerar a inovação um construto multidimensional. Este estudo analisa os efeitos do debate do sistema de mensuração de desempenho e do conflito cognitivo na inovação ambidestra. Uma pesquisa de levantamento foi realizada com gestores de empresas listadas na Brasil Bolsa Balcão (B3), conforme o ranking dos valores de pesquisa e desenvolvimento e do ativo intangível, e obteve-se 124 respostas válidas. Para testar as hipóteses utilizou-se a técnica de modelagem de equações estruturais. Os resultados revelaram que o debate do sistema de mensuração de desempenho influencia positivamente na inovação ambidestra e que o conflito cognitivo modera essa relação. Conclui-se que as discussões entre os gestores sobre as medidas de desempenho permitem a resolução de problemas, busca pela aprendizagem, criatividade e inovação, principalmente quando intensificado pelo conflito cognitivo.*

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### Practical implications

This study helps companies create an environment where managers debate performance measures, mainly within agendas to elaborate plans and actions, because this creates learning and increases the capacity to create new ideas, which enable organizations to anticipate what will happen to give them an advantage against their competition.

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## 1 INTRODUCTION

There have been a series of studies which address Management Control Systems (MCS) and innovation, due to their importance in managing innovation in organizations (Bisbe & Otley, 2004; Bedford, 2015). Studies along this line focus mainly on the effects of MCS in product innovation (Davila, 2000; Bisbe & Otley, 2004; Bisbe & Malagueño, 2009), innovation in general (Henri, 2006; Davila, Foster & Oyon, 2009; Chenhall, Kallunki & Silvola, 2011) and recently ambidextrous innovation (Bedford; Bisbe & Sweeney, 2019). Different approaches to them have been taken in the literature (Davila, 2000) with there being, on one hand, studies that point out that MCS make the Research and Development (R&D) process more difficult, and on the other hand, studies that argue that MCS stimulate the creative capacity of individuals and organizational learning, which lead to an increase in innovation (Davila *et al.*, 2009; Bisbe & Malagueño, 2015; Lopez-Valeiras, Gonzalez-Sanchez & Gomez-Conde, 2016).

Davila *et al.* (2009) comment that MCS provide stable structures that facilitate the communications process between individuals in an organization and provide balanced freedom, which favors creativity and the search for innovation. Lopez-Valeiras *et al.* (2016) affirm that studies of MCS have limited their focus to the interactive use of MCS in the investigation of their impact on innovation. These choices are justified by the fact that their interactive use makes a permanent dialogue between managers possible, providing the organization with greater creativity and capacity to innovate (Simons, 1995; Bisbe & Malagueño, 2015). Previous studies have provided evidence that the interactive use of MCS positively influence organizations' capacity for innovation (Henri, 2006; Naranjo-Gil & Hartmann, 2007; Bisbe & Malagueño, 2015; Lopez-Valeiras *et al.*, 2016)

Chenhall (2003) points out that the mission of MCS is to provide financial and non-financial information to improve the decision-making process. This study focuses on Performance Measurement Systems (PMS), which consist of a group of financial and non-financial measures used to evaluate performance (Lamberti & Noci, 2010). PMS are considered to be antecedents to innovation in this study because they represent an important mechanism to achieve innovation (Davila, Epstein & Shelton, 2012). Another reason for this objective is the limited knowledge of the impact of PMS on innovation capacity in organizations (Bedford *et al.*, 2019).

Previous studies have considered the interactive use of MCS in the analysis of the innovation capacity of companies (Lopez-Valeiras *et al.*, 2016), a multidimensional construct which captures the dialogue and debate, strategic uncertainties and intensity of their use by operational managers (Bedford & Spekle, 2018; Bedford *et al.*, 2019). This study is focused on this dialogue and debate, given that the interest of the proposal is centered around communication between managers, with PMS debate being a construct (Bedford *et al.*, 2019). This reflexive construction assumes that debate and the free flow of information between managers help promote innovation (Lopez-Valeiras *et al.*, 2016), which is pertinent to this study's objective.

Unlike previous studies which have considered innovation to be a one-dimensional construct (Bisbe & Otley, 2004; Bisbe & Malagueño, 2009), this study analyzes innovation from two perspectives: incremental and radical. Incremental innovation is defined as small technological changes made in products or services which are capable of meeting the needs of the interested parties (Garcia & Calantone, 2002). Radical innovation is defined as significant changes in products or services, which are capable of demands which are unknown a priori (Jansen, Van Den Bosch & Volberda, 2006). The search for incremental and radical changes in products and/or services at the same time is considered ambidextrous innovation (Sarkees & Hulland, 2009).

In order for PMS to promote ambidextrous innovation it is indispensable for the performance measures to be presented in a balanced manner (Bedford *et al.*, 2019), and to foster debate between managers due to divergences of opinion in terms of the use of performance measures (Bedford *et al.*, 2019). Dreu and West (2001) affirm that disagreement between managers in the decision-making process, aggregates quality in decision making. To Simons (1995), the permanent debate about performance measures (interactive control) tends to strengthen the relationship between decision makers and increases communication between them, which leads to the achievement of organizational objectives.

These divergences of opinion among managers in the decision-making process are considered cognitive conflicts and their occurrence in the work environment is common and beneficial to the decision-making process (Dreu & West, 2001; Dreu, 2006). Thus, individuals with common objectives, even though they have different opinions, seek to manage conflicts so that divergencies are legitimized and generate innovative ideas (Tjosvold, Poon & Yu, 2005; Desivilya, Somech & Lidgoster, 2010). It is presumed that the cognitive conflict among managers intensifies the relationship between PMS debates and ambidextrous innovation.

Bisbe and Otley (2009) warn about the need for more studies of various types of innovation to increase the understanding of the relationship between MCS and innovation. Bedford (2015) points out that it is not clear whether different patterns of control are equally efficient for different types of innovation adopted simultaneously. Bedford *et al.* (2019) suggest the adoption of cognitive conflict as a moderating element in the relationship between PMS and innovation. Thus, we have one of our research questions: What are the effects of PMS debate and cognitive conflict on ambidextrous (incremental and radical) innovation?

The relevance of this study is understanding how organizations use PMS in seeking incremental and radical innovation. Thus, it contributes to the body of literature which relates MCS and innovation (Davila, 2000; Bisbe & Otley, 2004; Bisbe & Malagueño, 2009; Davila *et al.*, 2009), following the flow which conjectures a positive relationship between PMS and innovation and adopts cognitive conflict as a variable which intensifies this relationship. To Bedford (2015), the knowledge of MCS employed in the search for ambidextrous innovation is limited. In this sense, this study advances the understanding of how performance measures are used in organizations with multiple (incremental and radical) innovation objectives, suggesting that PMS used in an interactive manner, through debate among managers, increase ambidextrous innovation

It also adds to the literature by considering that cognitive conflict is present in manager discussion agendas and produces a positive effect, such as the generation of innovative ideas. This evidence reinforces the arguments in favor of the benefits of cognitive conflict pointed out by the literature (Dreu, 2006). For managerial practices it contributes by seeking empirical evidence to sustain the arguments that through PMS debate, organizations encourage a closer environment among managers to resolve problems, improve technologies and outperform the competition.

## 2 THEORETICAL BACKGROUND

### 2.1 Performance measurement systems and ambidextrous innovation

The literature about MCS is vast and has been conceived of in various ways. Anthony (1965) conceived of MCS as a process through which managers ensure that resources are obtained and used in an efficient manner in order to achieve organizational objectives. Flamholtz, Das and Tsui (1985) defined MCS as a group of norms and patterns which influence the behavior of individuals in the organization. Malmi and Brown (2008) understand MCS as a system of values and rules which guide the behavior of the individual to achieve organizational objectives. To Chenhall (2003), MCS are not just related to the providing of formal, financial and quantifiable information, but also providing non-financial information which is useful to the decision-making process.

The financial and non-financial information furnished by MCS is used to assess organizational performance on various levels and support the PMS (Lamberti & Noci, 2010). Ferreira and Otley (2009) recognize the difficulty of establishing a definition for PMS, however, they conceive of them as formal and informal mechanisms, processes and systems used by the organization to transmit the main objectives to help the strategic process and continual management. PMS have proven to be an important mechanism in achieving organizational innovation (Davila *et al.*, 2012). In this sense, Bedford *et al.* (2019) propose PMS debate, which is related to the content of the information and the exchange of information between the managers.

To Bedford *et al.* (2019), PMS debate improves the decision-making process in companies in which their managers have to deal with dual demands for innovation. From this perspective, companies use resources to provide their products and services to their customers in an efficient manner, and also innovate to meet the future needs of the same customers as well as potential customers (Sarkees & Hulland, 2009). When companies put their efforts into R&D projects with these dual demands, they are seeking ambidextrous innovation (Sarkees & Hulland, 2009; Bedford *et al.*, 2019). Even though studies such as Bedford's (2015) have examined the use of MCS in relation to various types of innovation, they have conducted theirs in a different manner. For example, they have investigated radical vs. incremental, product vs. process, and administrative vs. technological innovation (Kim, Kumar & Kumar, 2012).

For PMS to provide ambidextrous innovation, it is crucial that they be balanced, or in other words, made up of various measures (Bedford *et al.*, 2019). Incremental innovation occurs through small changes in product or service design, function, price, quantity and characteristics to meet customer needs (Garcia & Calantone, 2002; Sarkees & Hulland, 2009), while radical innovation implies adopting new technologies capable of creating new customer and market demands (Jansen *et al.*, 2006; Sarkees & Hulland, 2009).

Incremental innovation presents a low level of risk and offers fewer benefits (Koberg, Detienne & Heppard, 2003), while radical innovation involves a high degree of risk and uncertainty. In the face of multiple strategic priorities, Dekker, Groot and Schoute (2012) recommend PMS with a variety of performance measures.

Balanced PMS with various performance measures makes discussions possible between managers during the elaboration of plans and actions which can improve decision making (Bedford *et al.*, 2019). The performance measure debate corresponds to the way PMS are used to facilitate the exchange of information and the increase in efficiency during the managers' decision-making process (Bedford *et al.*, 2019). Previous studies have proved that the interactive use of MCS stimulate innovation by fostering permanent debate and recurring agendas which involve closer work relationships and frequent communication (Simons, 1995). The author further argues that the performance measure debate stimulates new innovative ideas and leads to the creation of new products and services.

The interactive use of PMS increases an organization's capacity to innovate (Simons, 1995; Widener, 2007; Bisbe & Malagueño, 2009; Malagueño & Bisbe, 2010). Studies indicate a positive relationship between the interactive use of MCS and innovation (Henri, 2006; Naranjo-Gil & Hartmann, 2007; Widener, 2007; Bisbe & Malagueño, 2015). Henri (2006) presents evidence that the interactive use of control influences learning and innovation. Naranjo-Gil and Hartmann (2007) point out that the interactive use of MCS influences innovation in services. Widener (2007) shows that interactive control increases organizational learning, which is consistent with innovation. To Bisbe and Malagueño (2015), the interactive use of MCS promotes creativity, which influences innovation. Lopez-Valeiras *et al.* (2016) observe that the interactive use of MCS leverages innovation.

It may be surmised that the interactive use of MCS assumes debate and the free flow of information, enabling managers to procure alternative ways of solving problems in their processes and developing proposals which promote innovation (Lopez-Valeiras *et al.*, 2016). In making dialogue and debate possible, the interactive use of MCS facilitates the evaluation of organizational norms and standards and the efficiency of processes that legitimize organizational innovations (Bisbe & Otley, 2004; Lopez-Valeiras *et al.*, 2016). Bedford *et al.* (2019) supply evidence that the interactive use of PMS increases ambidextrous innovation. Based on the literature, we can make the following hypothesis:

**H<sub>1</sub>**: The PMS debate has a direct and positive effect on ambidextrous innovation.

## **2.2 The moderating effect of cognitive conflict in the relationship between the PMS debate and ambidextrous innovation**

The literature which addresses the impact of MCS on innovation is growing (Simons, 1995; Davila, 2000; Bisbe & Otley, 2004; Davila *et al.*, 2009; Davila *et al.*, 2012; Bedford, 2015), and reveals that MCS plays an important role in innovation management (Bisbe & Otley, 2004). Simons (1995) points to the capacity of MCS to articulate and make innovations possible. In terms of this aspect, Davila *et al.* (2012) warn that managers should choose appropriate performance measures to leverage their company's capacity to innovate.

Chenhall *et al.* (2011) believe that MCS exert an indirect influence on innovation. Other variables can help improve the understanding of this relationship (Bisbe & Otley, 2004; Bedford, 2015). Bedford *et al.* (2019) suggest that cognitive conflict should be tested as a moderating variable in the relationship between MCS and innovation. It seems reasonable to consider cognitive conflict as a moderating variable in the relationship between the PMS debate and innovation, given that its occurrence is inevitable between teams working in an organization (Dreu, 2006).

Cognitive conflict involves the distribution of resources, procedures, judgement and the interpretation of facts (Jehn, 1995). Cognitive conflict is the subject of this study because it is related to the content of information, differences in ideas, opinions and points of view (Clercp, Menguc & Auh, 2009). To Jehn (1997), cognitive conflict strengthens the relationship between team members and enables a greater consciousness regarding differences in opinion. These occurrences increase mutual understanding and communication, which permit divergent views about work procedures to be legitimized and promotes innovation (Tjosvold *et al.*, 2005; Desivilya *et al.*, 2010).

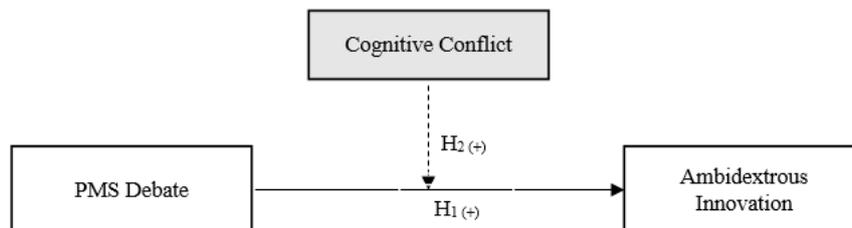
Dreu (2006) points out that cognitive conflict can be beneficial to learning and R&D for new products. West (2002) observes that the decision-making process and the debate among managers leads to more innovative ideas, given that conflict during decision-making debates promote individual creativity and innovation.

Bedford *et al.* (2019) argues that cognitive conflict increases the probability that top-level managers will analyze ideas and opinions in a critical and reflective manner. This thus reinforces the need for debate between individuals and the legitimization of these discussions in problem resolution (Tjosvold *et al.*, 2005), to improve the effectiveness of manager decisions and the decisions of the organization as a whole (Amason & Mooney, 1999).

In organizations which seek multiple (incremental and radical) innovation objectives, it is important that these individuals have different opinions (Jehn, 1995; Simons & Peterson, 2000; Dreu, 2006), and these divergencies require dialogue and debate among managers (Calton & Payne, 2003). Thus, it is expected that performance measure debates lead to an increase in ambidextrous innovation and are intensified by cognitive conflict. Simons (1995) affirms that permanent dialogue, conceived of as interactive use, affects an organization's innovation capacity. Bedford *et al.* (2019) warn that the PMS debate leads to tension between individuals, which may be intensified by cognitive conflict. These tensions enable managers to learn and create opportunities for presenting innovative ideas and realizing the innovative potential of an organization (West, 2002). In this way, we can make the following hypothesis.

**H<sub>2</sub>:** Cognitive conflict moderates the positive relationship between the PMS debate and ambidextrous (incremental and radical) innovation.

Given our theoretical-empirical base and the formulated hypotheses, we present the study's theoretical model in Figure 1.



**Figure 1.** Theoretical model

Along general lines, we predict that the PMS debate has a positive relationship with ambidextrous innovation and that cognitive conflict intensifies this relationship.

### 3 STUDY METHODOLOGY

#### 3.1 Population and sample

The data research was conducted with managers of Brazilian companies listed on Brazil Bolsa Balcão (B3). A ranking was established according to the values of R&D and the intangible assets divulged by companies. This ranking is justified by the fact that this study is focused on company innovation in a dual sense (incremental and radical innovation). The projects which translate a company's capacity for innovation are identified by the R&D items and Intangible Assets listed in their financial reports. This study's population consists of the first 100 companies in the ranking.

We entered into contact with the managers of these companies through the LinkedIn network, with the sending of approximately 5,000 invitations to Chief Executive Officers (CEO), Financial Directors, Controllers, Managers, Supervisors and Coordinators, of which 1,136 accepted joining the social network and participating in the study. We sent the study link to them during the period from February through October 2019 and received 128 responses, with four being incomplete, therefore the final sample consisted of 124 high level and middle level managers.

This number of responses enabled us to perform our planned statistical procedures, given that it satisfies the criteria of effect size (an average of 0.15); level of significance ( $\alpha = 5\%$ ); and the sample power ( $1-\beta = 0.8$ ), attested by G\*Power (Faul, Erdfelder, Buchner & Lang, 2009). Another examined assumption was the non-response bias, which indicates possible sample distortions. The T test and the comparison between the first 12 and the last 12 respondents did not indicate significant differences at the 5% level, which suggests that there is no non-response bias (Af Wählberg & Poom, 2015). We also evaluated the common method bias using Harman's single factor, in which the first factor presented a total explained variance less than 0.5, which confirms the absence of the common method bias.

### 3.2 Measurement of the variables and the analysis procedures

The three study constructs were measured based on statements that have been validated by the studies of Simons and Peterson (2000) and Bedford *et al.* (2019). The perception of the managers in terms of the measure debate for performance measurement within the context of companies that seek ambidextrous innovation was anchored by statements using a five-point Likert scale.

The PMS debate has been measured based on four statements of Bedford *et al.*'s study (2019), which developed this construct considering the interactive use of MCS, which makes it possible to assess the performance measure debate (Henri, 2006; Naranjo-Gil & Hartmann, 2007; Widener, 2007). This construct seeks to capture the use of performance measures by managers in their discussions of their decisions related to investments and action plans relative to the effort involved in incremental and radical innovation. For example, in one of the statements, managers were asked to indicate on a scale from 1 (never) to 5 (always), whether performance measures are frequently discussed in senior manager team meetings.

Cognitive conflict is assumed to interact with the PMS debate due to the fact that it generates tension in the agendas of managers and create innovative ideas which are intensified by the level of managers' cognitive conflict. This construct was developed by Simons and Peterson (2000) and was based on Jehn's study (1995). It consists of four statements that seek to assess manager perceptions about the effect of PMS on the generation of cognitive conflict. For example, in one of the statements managers are asked to indicate on a scale from 1 (none) to 5 (many) how many manager team members disagree with the content of the company's strategic decisions. This variable is the moderator of the proposed model. The moderating variable can alter the force and or direction of the relationship between two variables (Hair Jr, Hult, Ringle & Sarstedt, 2016).

Ambidextrous innovation is used as a multidimensional construct which encompasses aspects of incremental and radical innovation (Bedford *et al.*, 2019). Thus, they were requested to evaluate the capacity of managers to effectively achieve the objectives of incremental innovation (improving existing products/services) and radical innovation (new products which require a change of direction). The ambidextrous innovation construct is composed of eight statements, with the first four being about incremental innovation, and the last four dealing with radical innovation. For incremental innovation, the manager was asked to indicate on a scale from 1 (totally disagree) to 5 (totally agree) whether the company has frequently introduced new incremental products/services over the past three years. For radical innovation, the manager was to indicate in comparison with the company's main competitors, whether the company introduced more radically new products/services over the past three years. These statements were extracted from Bedford *et al.*'s study (2019), which was adapted from Atuahene-Gima (2005) and Lin, McDonough, Lin and Lin (2013).

To test these hypotheses, we used Structural Equation Modeling (SEM) estimated based on Partial Least Squares (PLS). Using the SmartPLS version 3 software, we determined the PLS algorithm, the bootstrapping and blindfolding. The PLS algorithm technique, which evaluates the measurement model, follows the definition of 300 iterations with 7 criteria for stopping. To confirm the reliability of the constructs, indices of Cronbach's Alpha and composite reliability above 0.70 are required (Hair Jr *et al.*, 2016). To confirm this validity, the Average Variance Extracted (AVE) needs to be above 0.50 (Hair Jr *et al.*, 2016) and the Fornell and Larcker criteria must be met. To verify the relationships between the constructs and the structural model's accuracy, we used the bootstrapping and blindfolding techniques (Hair Jr *et al.*, 2016). Since the moderating variable is continuous, we followed the moderation approach for interactive terms (Hair Jr *et al.*, 2016).

## 4 ANALYSIS OF THE RESULTS

### 4.1 Measurement model

The PLS-SEM was realized in two steps. The first explored the measurement model, which analyzes the validity criteria (convergent and discriminating) and reliability (internal and external), in order to attest the measures of the constructs (Hair Jr *et al.*, 2016). Then we tested the structural model. In Table 1 we present the results of the measurement model.

**Table 1.** Measurement model

Constructs	Cronbach's Alpha	Composite Reliability	AVE	R <sup>2</sup>	Discriminant validity		
					CC	AI	PMSD
Cognitive Conflict	0.876	0.923	0.800	-	0.894		
Ambidextrous Innovation	0.914	0.930	0.627	0.12	0.090	0.791	
PMS Debate	0.757	0.841	0.596		-0.154	0.318	0.772

Note: Cronbach's Alpha >0.70; Composite Reliability >0.70; Average Variance Extracted (AVE) >0.50. CC = Cognitive Conflict; AI = Ambidextrous Innovation; PMSD = PMS Debate.

According to Table 1, the values of Cronbach's Alpha are greater than 0.70, thus they attest to the model's reliability and assure that the responses of the managers do not present biases (Hair Jr *et al.*, 2016). Among the constructs, the ambidextrous innovation construct presented the highest Cronbach's Alpha (0.914) followed by cognitive conflict (0.876) and the PMS debate (0.757). Item CG\_4 with a value below 0.4 was excluded from the model. Hair Jr. *et al.* (2016) point out that the exclusion of an item can occur if it leads to an increase in AVE. The convergent validity criteria of the model were met, given that the AVE of the constructs is above the limit of 0.50 (Hair Jr *et al.*, 2016). The discriminant validity can be realized by the cross-loading matrix or by the criteria of Fornell and Larcker, whose criteria demonstrate how distinct the constructs are.

#### 4.2 Structural model

The structural model makes it possible to test the hypotheses and verify whether the relationships between the constructs conform to the statistically valid path diagram (Hair Jr *et al.*, 2016). To accomplish this, we executed the bootstrapping technique, using the 5,000 subsample and interaction parameter, with a bias-corrected and accelerated confidence interval and a significance level of 5% (Hair Jr *et al.*, 2016). Thus, we obtained the size and significance of the path coefficients. Through the blindfolding technique, we also determined the predictive validation of the model indicated by the Pearson coefficient (R<sup>2</sup>) and observed the Predictive Relevance of the Stone-Geisser indicator (Q<sup>2</sup>). In Table 2 we present the relationships between the constructs.

**Table 2.** Path coefficient and structural model evaluation

Relationships between the constructs	$\beta$	T-value	P-value	Hypotheses
PMS Debate → Ambidextrous Innovation	0.289	3.747	0.000 ***	H <sub>1</sub> Support
Cognitive Conflict → Ambidextrous Innovation	0.175	1.637	0.050 **	H <sub>2</sub> Support
PMS Debate X Cognitive Conflict → Ambidextrous Innovation	0.325	5.085	0.000 **	

Note: N = 124. Significance level \*p<0.10; \*\*p<= 0.05; \*\*\*p<0.01. R<sup>2</sup> = Ambidextrous Innovation (0.12); Q<sup>2</sup> = Ambidextrous Innovation (0.12).

The H<sub>1</sub> hypothesis postulates that the PMS debate exercises an influence on ambidextrous innovation (0.289, p<0.01), which supports the non-rejection of H<sub>1</sub>, to a significance level of 1%. We can deduce that the PMS debate leads to an increase in organizational capacity to innovate, which indicates that performance averages need to be aligned with plans in terms of the relative efforts required and the capacity to create new ideas and generate new products or services.

In Hypothesis H<sub>2</sub>, it is assumed that cognitive conflict moderates the relationship between the PMS debate and ambidextrous innovation (incremental and radical). The results demonstrate that cognitive conflict moderates the relationship between the PMS debate and ambidextrous innovation (0.325, p<0.01), which supports the non-rejection of H<sub>2</sub> at a 1% level of significance. This evidence means that the interaction between the PMS debate and cognitive conflict leads to greater ambidextrous innovation, or in other words, discussions between managers lead to cognitive conflict, which favors the creation of new ideas, which in turn drive efforts to increase the innovative capacity of companies.

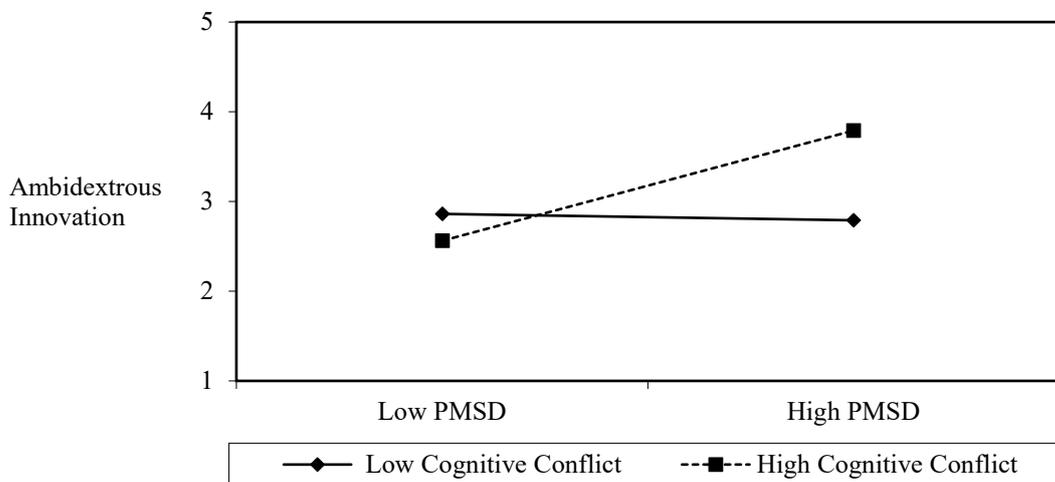
The predictive validity evaluation presents a Pearson determination coefficient (R<sup>2</sup>) of 12% which indicates that the PMS debate and cognitive conflict variables provide a moderate explanation of ambidextrous innovation. The predictive relevance of 12% indicated by Q<sup>2</sup>, attests to the accuracy of the model, which is better the greater it is than zero (Hair Jr *et al.*, 2016).

### 4.3 Discussion of the results

The discussions of the study's main findings seek to analyze the effects of the PMS debate and cognitive conflict in ambidextrous innovation. Among the constitutive dimensions of the interactive use of MCS is the PMS debate, which enables the establishment of communication standards between the Top Management Team (TMT), which leads to greater interaction among its members. Thus, the confirmation of Hypothesis H<sub>1</sub> suggests that in the researched companies, the PMS debate facilitates the communication process between managers and provides balanced freedom, which favors the innovation process (Davila *et al.*, 2009; Bedford *et al.*, 2019). These findings corroborate that MCS stimulate the creative capacity of individual and organizational learning, which promote organizational innovation (Simons, 1995; Davila, 2000; Lopez-Valeiras *et al.*, 2016). It may be inferred due to the frequent debate about performance measures that organizations try to anticipate their competitors and introduce more radically new products and services to the market.

Various opinions among managers contribute to the making of better-quality decisions (Dreu & West, 2001). Thus, it is important that the debate be constant, which may make the relationships between managers closer and increase communication (Simons, 1995). It is also essential that the use of PMS facilitates the decision-making process. In the researched companies, it can be observed that the PMS debate is recurring and has led to an increase in the efforts made in incremental and radical innovation, and has affected sales growth for new products and services. Companies are concerned not just with making changes in their products and services to meet their customer's known demands (Garcia & Calantone, 2002), but also creating technological changes which generate unknown demands which are not being met by the market (Jansen *et al.*, 2006).

In Hypothesis H<sub>2</sub>, which forecasts the moderation of cognitive conflict in relation to the PMS debate and ambidextrous innovation, we first confirmed the direct relationship between cognitive conflict and ambidextrous innovation at a 5% level of significance (0.175,  $p=0.050$ ). These findings are in line with Dreu (2006), who finds that the presence of cognitive conflict incites individuals to examine organizational problems, and that it encourages them to become more involved in creative activities and increase innovation. Then we confirmed the moderating role of cognitive conflict in the relationship between the PMS debate and ambidextrous innovation at a significance level of 1% (0.325,  $p<0.01$ ). Figure 2 illustrates the effect of interaction between the PMS debate and cognitive conflict.



**Figure 2.** Effect of interaction between the PMS debate (PMSD) and cognitive conflict

We can verify in Figure 2 that to the extent to which cognitive conflict is increased, the stronger the PMS debate effect will be on ambidextrous innovation, or in other words, the existence of various opinions among managers during the decision-making process, intensifies the relationship between PMS debate and ambidextrous innovation. In order for the PMS debate to facilitate the exchange of information among managers (Bedford *et al.*, 2019), make the relationships between managers closer (Simons, 1995), and generate greater communication and more assertive decisions in order to achieve incremental and radical innovation (Bedford *et al.*, 2019), it is important that managers develop the capacity to resolve problems and learn and create new ideas in the face of divergent opinions (Dreu, 2006). This makes it possible for these joint forces to align and lead to an increase in the capacity of organizations to generate technological changes in their products and services (Garcia & Calantone, 2002; Jansen *et al.*, 2006).

It may be inferred that the presence of cognitive conflict due to differences of opinion between managers is important to achieving organizational objectives. However, it is necessary for managers during PMS debates to avoid emotional conflicts, given that disagreements lead to personal dissatisfaction and are not considered beneficial for the work environment, managers and the organization as a whole (Dreu, 2006; Desivilya *et al.*, 2010). The results of this study support the understanding that a better comprehension of performance measurement discussions and the existence of disagreements over tasks and strategies related to R&D investment projects improve the decision-making process and organizational performance.

## 5 CONCLUSIONS

This study's results reveal that PMS debates exercise a positive and significant influence on ambidextrous innovation, which indicates that performance measure discussions encourage the involvement of managers in the search for solutions oriented towards the greater visibility of efforts in relation to technological changes in products and services. They also demonstrate that cognitive conflict moderates the relationship between PMS debates and ambidextrous innovation, which suggests that it is important that PMS debates occur in an environment with differences of opinion between managers, because this generates creative ideas, learning and increases incremental and radical innovation.

This study presents the theoretical implications of the relationship between PMS and innovation based on a multidimensional construct of innovation (incremental and radical), therefore it differs from previous studies which have investigated the relationship between MCS and innovation based on a unidimensional construct. Thus, it will contribute to advances in the literature on studies of organizational contexts which seek ambidextrous innovation related to MCS. It also contributes to the literature about conflict, by reinforcing the idea that the presence of cognitive conflict in the work environment promotes results which are beneficial to the organization, because they intensify the relationship between MCS and innovation, since the performance measure debate dimension is focused on the interactive use of PMS. Previous studies have considered cognitive conflict as a mediating variable, while in this study we have found evidence that this variable also functions as a moderator.

This study also presents practical implications for organizations by revealing the positive and significant impact of PMS debate on ambidextrous innovation. These results inspire companies to stimulate the debate environment among managers, mainly in the agendas of elaborating the organization's plans and actions. Differing opinions between managers favor an approximation between them, increasing learning and the capacity to create new ideas in order to solve problems. In this manner, manager agendas tend to feature strategies which provide visibility to technological improvements in products and services. This effort needs to be directed in a dual manner (incremental and radical). Companies need to anticipate the actions of their competitors by seeking improvements related to the design, function, price, quantities and characteristics of their products and services, in terms of radical as well as incremental innovation.

However, the results of this study should be interpreted with parsimony due to the limitations imposed by its delineation. Significant relationships were observed between the proposed constructs based on the path analysis. However, we recommend the adoption of experimental methods to verify the causal relationships between the proposed constructs. Cognitive conflict was considered to be a moderating variable, and as a result, future studies could identify whether affective conflict exerts a negative influence on creativity or in the capacity of an organization to generate technological changes in their products and services. We also recommend that cognitive conflict be considered a quadratic effect variable, since it can present a dual effect, being positive up to a certain point and afterward negative.

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