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Research Article

Performance Measurement System, Organizational Learning, and Creativity

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ABSTRACT

This study aimed to analyze the effects of the diagnostic and interactive use of the performance measurement system (PMS) on organizational learning and improvisational and compositional creativity, considering the moderating effects of competitive intensity. A survey was carried out with education technology startups (EdTechs) of the Brazilian ecosystem, and the data were analyzed with structural equation modeling. The findings suggest a positive association of the use (diagnostic and interactive) of the PMS with organizational learning and of the latter with creativity (improvisational and compositional). Organizational learning mediates the relationship between PMS use and compositional creativity. In addition, the competitive intensity positively moderates the relationship between organizational learning and creativity (improvisational and compositional). The study aggregates new evidence of PMS use relative to organizational learning, extends the discussion on organizational learning to different levels of novelty in creativity (improvisational and compositional), and contributes to a flow of studies exploring the moderating role of competitive intensity. Subsidies for startup managers to conduct their activities in search of organizational learning and employee creativity are also presented.

Keywords: performance measurement system; organizational learning; creativity; competitive intensity.

JEL Code: M10, M13, M41

INTRODUCTION

The competitive intensity of specific markets affects the internal strategies of organizations (Wu et al., 2020), which, besides causing unpredictability, may generate opportunities for improvements in processes, products, and services (Tsai & Hsu, 2014; Tsai & Yang, 2013). This scenario has encapsulated education technology startups (EdTechs) through a dynamic and extremely competitive market (Burch & Miglani, 2018; Ramiel, 2021). Organizational learning and employee creativity are necessary for such organizations to ensure their continuity. Learning implies that the organization matures with past actions and stimulates current and future efficacy (Fyol & Lyles, 1985). In turn, employee creativity consists of the generation of new ideas that are useful and applicable within the organizational context (Amabile, 1988). However, finding new means for startups to foster organizational learning (Gonzaga et al., 2020) and individual creativity is not a simple path (Frare & Beuren, 2021b).

One way for organizations to manage their activities and foster positive behaviors is by using management control systems (MCSs), which are mechanisms employed to promote congruence among organizational and individual goals (Simons, 1990). From this perspective, one of the main MCSs is the performance measurement system (PMS), which consists of performance metrics (Henri, 2006). This MCS may be used diagnostically (feedback and monitoring) or interactively (to promote dialogue and communication) by organization managers (Simons, 1995).

Gaps are observed in the literature regarding the exposed. Firstly, the relationship between MCSs and learning is inconclusive, and new evidence is necessary (Santos et al., 2021). Various studies postulate the positive effect of the interactive use of PMS or another MCS on organizational learning (Henri, 2006; Srimai, Damsaman, & Bangchokdee, 2011; Zhang & Yu, 2020), whereas there is evidence of a negative influence (Henri, 2006) or a positive influence (Oyadomari et al., 2013) on organizational learning of the diagnostic use of the PMS. Moreover, the evidence of the diagnostic and interactive use of MCSs in startups is limited (Eldridge et al., 2014). This scenario instigates more research on the MCS use modalities that may favor or perhaps harm the organizational learning process, given that this is one of the main paths for organizations to adapt in the face of quick and dynamic environmental changes (Kloot, 1997). This is particularly relevant for EdTechs since they are inserted in an emerging market with constant transformations of educational technology products and services (Mattsson & Andersson, 2019).

Secondly, although organizational learning is typically tied to creativity (Huber, 1998), the studies do not distinguish between the levels of novelty of the creativity. Creativity may be improvisational or compositional (Valaei et al., 2017), with improvisational creativity stemming from intuition and spontaneity, resulting in improvisation in the face of unpredictable or challenging contexts (Vera et al., 2016). In turn, compositional creativity permeates lower levels of novelty, resulting in incremental improvements to existing actions or contexts (Fisher & Amabile, 2009). It is important to explore the role of organizational learning at different levels of novelty in creativity, given that organizations, including startups, may need their employees to have propositions of incremental improvements in some contexts while requiring more radical and transformative ideas in others (Valaei et al., 2017).

Thirdly, the literature is limited regarding the effects of the competitive intensity on the organization, i.e., the level of competition that the organizations face in the market (Tsai & Hsu, 2014). Several studies have indicated a moderating effect of the competitive intensity on, for example, the relationships between organizational learning (exploration and exploitation) and performance (Auh & Menguc, 2005), innovativeness and performance (Tsai & Yang, 2013), effectuation approach and development speed and quality of new products (Wu et al., 2020), competitive advantage and performance (Keskin et al., 2021), marketing and innovation (Bachmann et al., 2021), and disruptive business models and performance (Olabode et al., 2022). Despite the indications that competitive intensity intensifies the effect of the search and integration of knowledge on innovative results (Aliasghar et al., 2022; Tsai & Hsu, 2014), the literature is silent on the relationship between organizational learning and creativity. In general terms, the expectation is that EdTechs require more considerable organizational learning for employee creativity to be fostered at higher levels of perceived competitive intensity. This is consistent with the argument that the competitive environment causes organizations to be in constant learning to improve their innovative capacity (Jones & Linderman, 2014).

The gaps exposed instigated the proposition of the purpose of this study, which is to analyze the effects of the diagnostic and interactive use of the PMS on organizational learning and improvisational and compositional creativity, considering the moderating effects of competitive intensity. For such, a survey was conducted in EdTechs of the Brazilian ecosystem, and the data were analyzed through partial least squares structural equation modeling (PLS-SEM).

The study contributions permeate the literature and organizational practice. The study aggregates new evidence for the relationship between the diagnostic and interactive use of the PMS and organizational learning, extends the discussion of learning and creativity upon considering the level of novelty of creativity (improvisational and compositional), and explores the moderation of the competitive intensity in such relationships. All this in the field of startups, particularly EdTechs. In turn, the implications for organizational practice point to ways for managers to stimulate organizational learning and employee creativity from low to highly competitive intensity scenarios in the sector.

THEORETICAL FOUNDATION AND HYPOTHESES

The PMS and organizational learning

The study of MCSs in organizations has been increasingly emphasized in academia, with a considerable number of publications in recent decades (Frare, Barbosa, et al., 2021). MCSs are relevant mechanisms for an organization to create and execute its strategy, besides being used in the search for congruence between organizational targets and expectations (Simons, 1990). One of such MCSs is the PMS, which is based on financial and non-financial, internal or external, and ex-post or ex-ante metrics and short or long temporal dimensions (Henri, 2006). The metrics contained in the PMS are commonly used to quantify actions within organizations (Neely et al., 1995).

The PMS provides support to managers from a broad and holistic view of the main metrics the organization uses, which allows them to make decisions in the face of the levels of reach of the goals and targets outlined (Franco-Santos et al., 2012). The literature indicates that the PMS may be used diagnostically or interactively (Henri, 2006). The diagnostic use consists of monitoring targets and results, comparing results with the expectations, analyzing the main metrics, and providing subsidies for the traditional feedback (Henri, 2006). In turn, the interactive use allows the stimulation, communication, and discussion among peers and hierarchical levels with the purpose of providing a common view of the organization (Simons, 1990; 1995), besides being indicated to promote innovation behaviors (Cruz et al., 2015).

The PMS is typically considered an antecedent of positive behaviors in organizations, given its role in leading to the achievement of organizational goals such as organizational learning. In general, organizational learning pervades the development of knowledge and perspectives of past actions to promote more significant efficacy in future actions (Fiol & Lyles, 1985). Henri (2006) observed that the diagnostic (interactive) use of the PMS negatively (positively) influenced organizational learning. The positive effect of the interactive use of the PMS or similar MCSs was proven in later studies (Srimai et al., 2011; Zhang & Yu, 2020), reinforcing its occurrence. However, the evidence of the effect of the diagnostic use of the PMS on organizational learning is still inconclusive. Moreover, the evidence is limited in the context of startups. For example, Oyadomari et al. (2013) found a positive relationship between organizational learning and both the interactive and diagnostic use of the MCS. Hence, it is presumed that the diagnostic and interactive use of the PMS leads to organizational learning:

H1a: The diagnostic use of the PMS positively influences organizational learning.

H1b: The interactive use of the PMS positively influences organizational learning.

Organizational learning and creativity

Organizational learning is deemed essential for organizations to promote improvements to their methods, processes, and activities (Fiol & Lyles, 1985), besides favoring the creation of competitive advantages (Baker & Sinkula, 1999). Organizational learning fosters positive behaviors within an organization, such as creativity and innovation, for example (Huber, 1998). Fundamentally, creativity is defined as the production of new ideas that are useful and applicable in a given situation or organizational activity and that potentially result in innovation (Amabile, 1988).

The literature suggests that organizational learning promotes creativity (Huber, 1998) but is silent on the distinction between improvisational and compositional creativity. Improvisational creativity originates from intuition and spontaneity, which results in improvisation in the face of challenging or unpredictable situations and contexts (Cunha et al., 2003; Vera et al., 2016). Compositional creativity has a lower degree of creativity and results in incremental improvements to procedures, products, and services (Fisher & Amabile, 2009). The main difference between them is the level of novelty and creativity, given that compositional creativity refers to a lower degree of creativity for extended periods (Valaei et al., 2017).

Under the premise that the context of information and feedback may generate a creative environment for individuals (Huber, 1998), this study proposes that organizational learning has the potential to foster both the creativity of total improvisation (improvisational creativity) and that of minor improvements to the existing means (compositional creativity). Moreover, considering that startup management typically stimulates creativity (Frare & Beuren, 2021b), it is important to understand how certain conditions may be predictive in this context. Hence, the following is presumed:

H2a: Organizational learning positively influences improvisational creativity.

H2b: Organizational learning positively influences compositional creativity.

Moderating effects of competitive intensity

Competitive intensity is considered the level of market competition that organizations face, which may potentialize the perceived opportunities to generate something differentiated and reach competitive advantages (Tsai & Hsu, 2014). The literature indicates that, in sectors of highly competitive contexts, organizations need to find means to absorb information in an agile manner and provide new solutions quickly to be able to maintain themselves and gain space in the market (Tsai & Yang, 2013). As open systems, organizations are impacted by the environment in which they are inserted (Scott & Davis, 2015). In such an environment, the competitive intensity is associated with the fostering of technological development, which is reflected in innovative results (Wiggins & Ruefli, 2005) that are fundamental to ensuring the survival of organizations and their continuity in the market (Zahra & Covin, 1995).

Previous studies have explored the moderating effect of competitive intensity on different organizational behaviors. The moderating effect of competitive intensity was observed between organizational learning (exploration and exploitation) and company performance (Auh & Menguc, 2005), company innovativeness and business performance (Tsai & Yang, 2013), multifunctional collaboration/knowledge integration mechanisms and new product performance (Tsai & Hsu, 2014), and effectuation approach and development speed/quality of new products (Wu et al., 2020). More recent evidence also suggests a moderating effect of competitive intensity between the creation of competitive advantages and export performance (Keskin et al., 2021), business marketing and exploitative and exploratory innovation (Bachmann et al., 2021), disruptive business models and market performance (Olabode et al., 2022), and search for knowledge and process innovation (Aliasghar et al., 2022). Generally, these studies support that competitive intensity strengthens the relationship between the search for knowledge, internal capacities, and learning and results within the scope of creativity and innovation.

The evidence of the moderating effect of competitive intensity on relationships between learning or knowledge and innovative results provides subsidies to propose that competitive intensity moderates the relationship between organizational learning and improvisational and compositional creativity (Aliasghar et al., 2022; Bachmann et al., 2021; Tsai & Hsu, 2014). Given that higher levels of competitive intensity may result in more opportunities for new solutions, processes, products, and services (Tsai & Hsu, 2014), a positive moderation is expected, i.e., the

benefit of organizational learning to promote employee creativity will be more considerable. This is in line with the premise that competitive environments put more pressure on companies and, consequently, the role of organizational learning will be more critical for the organizational knowledge, capacity, and resources to provide an organic, liberal, and innovative environment for the employees (Aliasghar et al., 2022; Auh & Menguc, 2005; Jones & Linderman, 2014; Tsai & Hsu, 2014). Hence, the following is proposed:

H3a: The competitive intensity positively moderates the relationship between organizational learning and improvisational creativity.

H3b: The competitive intensity positively moderates the relationship between organizational learning and compositional creativity.

Coherent with the theoretical foundation, Figure 1 synthesizes the research model and the formulated hypotheses.

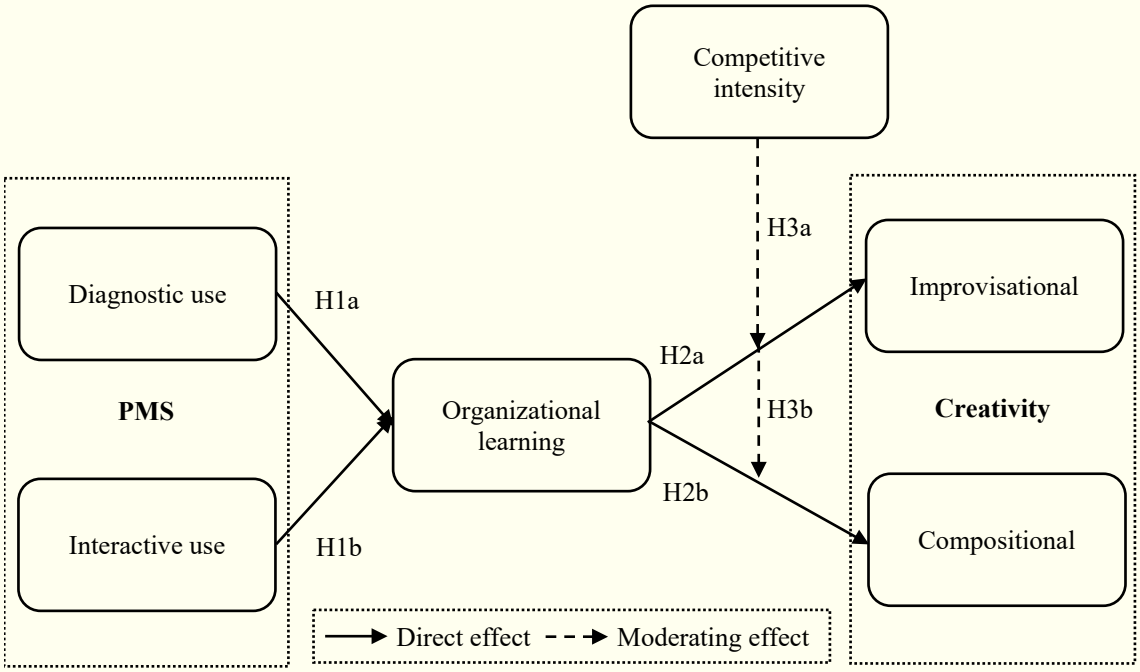

Figure 1. Theoretical research model.

Continuous (dashed) lines represent the relationships proposed with a direct (moderating) effect. Moreover, two control variables were inserted into the model (firm age and firm size).

METHOD

Population and sample

The research population comprises the 822 startups of the educational segment (EdTechs) listed by the Brazilian Association of Startups (Abstartups) operating in the data collection period.

Contact was made and the invitation for the research was sent to one manager of each EdTech through LinkedIn from January to June 2021. A guiding letter and the link to access the questionnaire on the QuestionPro platform were sent to those who accepted the invitation. There were 182 accesses to the questionnaire, 102 of which did not complete the survey (they only visualized the home page or responded to the first items) and, thus, were excluded. Therefore, the study covers a final sample of 80 EdTechs whose managers filled out the questionnaire in full. This sample size is compatible with similar studies with startups (Samagaio et al., 2018), including in the Brazilian reality of research delimiting the sample to startups registered with Abstartups (Costa et al., 2021; Frare & Beuren, 2021b).

These EdTechs had been operating in the market for an average of five years (median = 5). The ages of the EdTechs at the time comprised the following ranges, with numbers (n) and proportions: up to two years (n = 10; 12.5%); three to four years (n = 26; 32.5%); five to six years (n = 20; 25%); seven to eight years (n = 16; 20%); nine to ten years (n = 5; 6.25%); eleven or more years (n = 3; 3.75%). The EdTechs had an average of 115 employees at the time but with a median of 26, which suggests that few had a high number of employees. This may be explained partly by the presence of startups that had had a fast and considerable expansion (Frare & Beuren, 2021a). Regarding the size of the EdTechs, 56 (70%) could be classified at the time as small (up to 49 employees), 18 (22.5%) as medium-sized (50 to 249 employees), and six (7.5%) as large (250 or more employees) (about the classification, see Moreno-Mondéjar et al., 2021; Roza et al., 2011). Lastly, at the time of the survey, the respondents were, on average, 35 years old, had been working at their respective EdTechs for three to four years on average, and most (75.31%) were in senior management.

Measurements

The questionnaire was developed based on previous studies with multiple items on a seven-point Likert-type scale. The research instruments were translated into Brazilian Portuguese and later reverted to assess the quality of the translation. In sequence, a pretest was carried out with researchers of accounting and management control with the purpose of verifying the suitability and comprehensibility of the questionnaire.

The diagnostic and interactive use (four and seven items, respectively) of the PMS was assessed based on Henri (2006) through a scale of use of performance measurements by management (1 = not at all; 7 = to a great extent). The items 'track progress towards goals' and 'monitor results' are examples of items related to diagnostic use, while 'provide a common view of the organization' and 'enable the organization to focus on critical success factors' are examples of items related to interactive use.

Organizational learning was measured with four items from the study by Fiol and Lyles (1985) on an agreement scale (1 = strongly disagree; 7 = strongly agree). Examples of items referring to the perception of organizational learning within the company context are 'belief that the ability to learn is the key to improvement' and 'belief that employee learning is an investment, not an expense'.

The competitive intensity was measured with three items from Wu et al. (2020), based on Jaworski and Kohli (1993). An agreement scale was used (1 = strongly disagree; 7 = strongly agree). Examples of items are 'there are many 'promotion wars' in our industry' and 'whatever one competitor can offer, others can match readily.'

Improvisational creativity and compositional creativity were measured with eight and four items, respectively, based on Valaei et al. (2017). The respondents indicated the degree of agreement with each statement regarding employee creativity in their companies (1 = strongly disagree; 7 = strongly agree). The items 'employees demonstrate originality in their work' and 'employees try new approaches to problems' are examples of items referring to improvisational creativity, whereas 'employees make suggestions on incremental changes to existing processes/products that are useful to the organization in a long period' and 'employees suggest ideas that improve upon existing processes or products and services' are examples of items referring to compositional creativity.

Two organizational control variables were considered: firm age (continuous number in years) and firm size (number of employees). Firm age and size may influence the innovation levels of specific contexts (Hansen, 1992). Firm age and size may affect the extent of the creativity levels in the organization since more mature companies with more employees tend to benefit from more organizational knowledge and resources (Yoon et al., 2016).

Common method bias (CMB) and non-response bias (NRB)

All research variables were captured in the same data collection by the self-perception of the respondents, which suggests that the CMB could be a problem (Podsakoff & Organ, 1986). Hence, Harman's single-factor test was applied to verify whether a single factor explained most of the total variance. Seven factors with eigenvalues higher than 1 were found in an exploratory factorial analysis, totalizing 78.78% of the total variance. The first factor explained 29.82% of the variance, which indicates it was not a problem (Podsakoff & Organ, 1986).

Since the characteristics of the non-respondents are unknown, the last respondents (late respondents) were considered in an analogy to the non-respondents, i.e., as a comparison proxy for the NRB (Feder & Weißenberger, 2021; Mahama, 2006). After a means test between the responses of the first and second halves of respondents, no significant difference was obtained (the lowest *p*-value = 0.150). Therefore, the NRB does not represent harm to this research.

Procedures for the hypothesis testing

The hypotheses were tested through structural equation modeling. The estimation method used was the partial least squares, also known as PLS-SEM. This method presents a series of benefits, from simple analyses to more complex analyses that include multiple independent and dependent variables, moderating effects, and indirect effects (Hair Jr. et al., 2017). Moreover, the technique is suitable regardless of the normality of the data and of small sample sizes (Hair Jr. et al., 2017). PLS-SEM was applied to test the hypotheses (direct effects and moderating effects), check the possible influence of the control variables, and analyze the specific indirect effects complementarily.

ANALYSIS AND DISCUSSION OF THE RESULTS

Statistical analysis

Assessment of the measurement model

The first step seeks to identify the suitability of the measurement model. Initially, three items referring to improvisational creativity were excluded to adjust the model. Hence, the construct remained with five items. After this, the assumptions of factorial loads, reliability, and convergent and discriminant validity were analyzed (Table 1) as per the teachings of Hair Jr. et al. (2017).

The factorial loads (λ) proved appropriate since they presented values over 0.60. Cronbach's alpha (α), Rho_A (ρ_A), and composite reliability (CR) were observed to assess the reliability, with values over 0.70 being suggested. The α of the competitive intensity appeared slightly below the suggested value (0.67), partly due to the sensibility of the scale because of the number of items. Hence, the three criteria in combination (α, ρ_A, and CR) support the reliability. Lastly, the convergent validity is made evident by the average variance extracted (AVE) with values over 0.50. The discriminant validity is presented by two analyzed criteria. The first is the Fornell-Larcker method, which postulates that the square root of the AVE (value in bold between parentheses) should be superior to the correlations among the constructs (values below the diagonal). The second criterion is the heterotrait-monotrait (HTMT) ratio, according to which the correlations (values above the diagonal) should be lower than 0.90 (Hair Jr. et al., 2017).

Table 1

Reliability, correlations, and validity

Panel A — Reliability and convergent validity								
Variable	(λ)		α	ρ_A	CR	AVE		
dPMS	[0.818; 0.880]		0.909	0.965	0.933	0.778		
iPMS	[0.829; 0.905]		0.935	0.944	0.947	0.717		
OL	[0.870; 0.921]		0.917	0.923	0.941	0.801		
IC	[0.629; 0.876]		0.860	0.883	0.900	0.645		
CC	[0.743; 0.916]		0.881	0.889	0.919	0.741		
CI	[0.703; 0.873]		0.670	0.750	0.812	0.593		
Panel B — Correlations and discriminant validity								
Variable	1	2	3	4	5	6	7	8
1.dPMS	**(0.882)**	0.444	0.487	0.157	0.215	0.153	0.073	0.156
2.iPMS	0.437	**(0.847)**	0.477	0.228	0.213	0.258	0.047	0.16
3.OL	0.482	0.451	**(0.895)**	0.211	0.299	0.148	0.045	0.021
4.IC	0.062	0.211	0.185	**(0.803)**	0.803	0.335	0.082	0.076
5.CC	0.188	0.182	0.275	0.721	**(0.861)**	0.487	0.048	0.171

Continues

Table 1 (continued)

Variable	1	2	3	4	5	6	7	8
6.CI	0.053	0.171	0.014	-0.280	-0.379	**(0.770)**	0.164	0.155
7.Firm size	0.037	0.023	-0.026	0.065	-0.025	0.125	-	0.193
8.Firm age	-0.123	-0.107	0.012	-0.059	-0.159	0.124	0.193	-

Note. dPMS = diagnostic use of PMS; iPMS = interactive use of PMS; OL = organizational learning; IC = improvisational creativity; CC = compositional creativity; CI = competitive intensity. In panel B, the values below the diagonal are the correlations between the constructs. The above values are the HTMT values. The values in bold in parentheses are the square root of the AVE.

In general, the measurement model presents suitable assumptions, which allows proceeding with the statistical analysis (Hair Jr. et al., 2017).

Hypothesis testing

The relationships among the variables are presented in Table 2. The beta coefficient (β), the *t*-statistic, and the *p*-value are presented for each relationship. Besides the hypotheses and control variables, the relationships between the moderating variable (competitive intensity) and the dependent variables (improvisational creativity and compositional creativity) were tested. The study also employs the analysis of specific indirect effects as a complementary resource, a common practice in similar studies (e.g., Feder & Weißenberger, 2021). Hence, four specific indirect effects are possible, starting from the PMS (diagnostic and interactive), passing through organizational learning, and reflecting on the creativity (improvisational and compositional).

Table 2

Relationships between variables

Panel A — Direct effects					
H	Relationship	Coefficient (β)	*t*-statistic	*p*-value	f^2
H1a	dPMS → OL	0.352	2.801	0.005***	0.144
H1b	iPMS → OL	0.297	2.723	0.006***	0.103
H2a	OL → IC	0.194	1.805	0.071*	0.045
H2b	OL → CC	0.285	2.590	0.010**	0.112
-	CI → IC	-0.293	3.089	0.002***	0.099
-	CI → CC	-0.375	4.235	0.000***	0.190
H3a	OL*CI → IC	0.158	1.669	0.095*	0.034
H3b	OL*CI → CC	0.188	1.790	0.074*	0.056
-	Firm age → CI	-0.046	0.480	0.631	0.002
-	Firm age → CC	-0.125	1.138	0.255	0.020
-	Firm size → CI	0.125	1.931	0.054*	0.018
-	Firm size → CC	0.065	0.707	0.480	0.005

Continues

Table 2 (continued)

Panel B — Indirect effects			
Relationship	Coefficient (β)	*t*-statistic	*p*-value
dPMS → OL → IC	0.068	1.466	0.143
iPMS → OL → IC	0.058	1.331	0.183
dPMS → OL → CC	0.100	1.818	0.069*
iPMS → OL → CC	0.085	1.887	0.059*
Panel C — Assessment of the structural model			
Construct	Max. VIF	R^2	
OL	1.236	0.304	
IC	1.054	0.156	
CC	1.054	0.279	

Note. dPMS = diagnostic use of PMS; iPMS = interactive use of PMS; OL = organizational learning; IC = improvisational creativity; CC = compositional creativity; CI = competitive intensity. In the direct effects, the values of f^2 are classified into small (0.02), medium (0.15), and large (0.35) effects (Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2. ed.). Lawrence Erlbaum Associates). In the hypotheses with interaction terms (H3a and H3b), the values of f^2 are classified into small (0.005), medium (0.01), and large (0.025) effects (Hair Jr., J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2021). A primer on partial least squares structural equation modeling (PLS-SEM) (3 ed.). Sage). * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

The results support accepting all hypotheses (H1a, H1b, H2a, H2b, H3a, and H3b). The presence of negative effects of the competitive intensity on creativity (improvisational and compositional) is also observed. In addition, the firm size is positively and significantly associated with improvisational creativity. The other control variables did not present significant relationships with the dependent variables. The results also suggest that the use (diagnostic and interactive) of the PMS has positive and direct effects on compositional creativity, mediated by organizational learning. For improvisational creativity, the indirect effects are not statistically significant.

The parameters (multicollinearity and predictive accuracy) considered in the structural model analysis are made evident in Table 2. The maximum variance inflation factor (VIF) of the predicting constructs is lower than 3.00 for each dependent construct, which proves the absence of multicollinearity (Hair Jr. et al., 2017). The coefficient of determination (R^2) of the dependent constructs nears medium (13%) and high (26%) values (Cohen, 1988), which indicates predictive accuracy.

The $PLS_{predict}$ analysis was also employed in this study to assess the predictive power of the model, considering the latent variables (constructs) and manifest variables (items) that are dependent variables at some point in the model. For such, the study followed the recommendations of Shmueli et al. (2019). Firstly, in Panel A, all items of the dependent constructs meet the criterion that the $Q^2_{predict}$ of the PLS-SEM be higher than zero. Secondly, the prediction errors seem to be distributed considerably symmetrically, which suggests using the root mean squared error (RMSE) for comparison between the PLS-SEM model and the linear model (LM). Thirdly, it was verified that all indicators presented lower RMSE values for the PLS-SEM model than for the LM model. Hence, it is inferred that there is high predictive power. Panel B presents the RMSE, the mean absolute error (MAE), and the $Q^2_{predict}$ values of the latent variables, which suggest that the model presents satisfactory predictive power.

Table 3

PLS$_{predict}$

Items	PLS-SEM		LM	PLS-SEM - LM
	RMSE	$Q^2_{predict}$	RMSE	RMSE
OrgLea1	0.779	0.148	0.907	-0.128
OrgLea2	0.945	0.127	1.143	-0.198
OrgLea3	1.045	0.200	1.099	-0.054
OrgLea4	1.234	0.171	1.488	-0.254
ImpCre1	1.538	0.004	1.699	-0.161
ImpCre2	1.625	0.056	1.925	-0.300
ImpCre3	1.455	0.072	1.782	-0.327
ImpCre4	1.423	0.042	1.602	-0.179
ImpCre5	1.327	0.046	1.381	-0.054
ComCre1	1.259	0.050	1.316	-0.057
ComCre2	1.242	0.052	1.257	-0.015
ComCre3	1.262	0.174	1.376	-0.114
ComCre4	1.223	0.153	1.292	-0.069

Constructs	RMSE	MAE	$Q^2_{predict}$
Organizational learning	0.941	0.647	0.241
Improvisational creativity	0.994	0.826	0.069
Compositional creativity	0.956	0.755	0.157

Discussion of results

H1a and H1b predict that the diagnostic and interactive use of the PMS positively influences organizational learning, with both being supported statistically and presenting small to medium effect sizes. This finding contrasts with the positive effect of the interactive use of the PMS or other MCSs on organizational learning (Henri, 2006; Srimai et al., 2011; Zhang & Yu, 2020). Moreover, it aggregates new evidence related to the diagnostic use of the PMS and its relationship with organizational learning since the literature indicates negative effects (Henri, 2006) and positive effects (Oyadomari et al., 2013). Corroborating the Brazilian environment of the sample of Oyadomari et al. (2013), besides the sample being composed exclusively of EdTechs, the present study revealed that both the diagnostic and interactive uses of the PMS foster organizational learning.

The findings point out that, in the diagnostic use, the monitoring, control, and feedback of the performance metrics (Henri, 2006) provide stimuli for the organization to learn from past actions and promote efficacy in the present and future (Fiol & Lyles, 1985). The finding that the interactive use of the MCS fosters organizational learning is not surprising since it is generally viewed as a way to guide managers to promote organizational learning, aiming to encourage individuals in new opportunities, i.e., communication promotes organizational learning (Pletsch et al., 2016). Therefore, the use of MCSs tends to be a facilitator in elaborating management

strategies and one of the main artifacts of the control and planning process (Klein, Beuren, & Dal Vesco, 2019), fostering the organizational learning of startups. Thus, it is corroborated that using the PMS in startups is relevant to generating a creative, innovative, and competitive environment (Costa et al., 2021; Frare & Beuren, 2021b), primarily through interactive and diagnostic use (Eldridge et al., 2014).

H2a and H2b propose, respectively, that organizational learning positively influences improvisational creativity and compositional creativity. Both are supported statistically and reveal small to medium effect sizes, highlighting the overall role of organizational learning in favor of innovative behaviors such as creativity (Huber, 1998). This implies that the improvement of processes, methods, and activities through organizational learning instigates employees to develop new ideas that are useful and applicable in some perspective of the organizational context (Amabile, 1988).

The finding extends the generic perspective of organizational learning in favor of creativity upon evincing that the beneficial effect is valid for improvisational and compositional creativity. This suggests that organizational learning fosters the creativity based on spontaneity in challenging and unpredictable contexts (Vera et al., 2016) in addition to the creativity that generates incremental improvements to the preexisting procedures, products, and services (Fisher & Amabile, 2009). Hence, the organizational learning of the startups reveals itself as an antecedent of the different levels of novelty and creativity in the ideas generated and applied by the employees (Valaei et al., 2017). This finding reveals that learning from past errors is vital for startups to manage to adapt to the changes in the environment so as to promote a favorable climate for employees to present ideas from minor improvements to considerable transformations within the organization (Kloot, 1997; Mattsson & Andersson, 2019).

H3a and H3b postulate, respectively, that competitive intensity positively moderates the relationships between organizational learning and improvisational creativity and compositional creativity. Both hypotheses are supported and present large effects, indicating that the degree of competition in the market perceived by the EdTechs impacts the relationship between the action of organizational learning and employee creativity, potentializing the perceived opportunities and generating competitive advantages (Tsai & Hsu, 2014; Tsai & Yang, 2013). This finding also corroborates previous studies that confirmed the moderating role of competitive intensity among other variables of the organizational context (Aliasghar et al., 2022; Auh & Menguc, 2005; Bachmann et al., 2021; Keskin et al., 2021; Olabode et al., 2022; Tsai & Hsu, 2014; Tsai & Yang, 2013; Wu et al., 2020).

Figure 2 explores the moderating effect of H3a and H3b in greater detail.

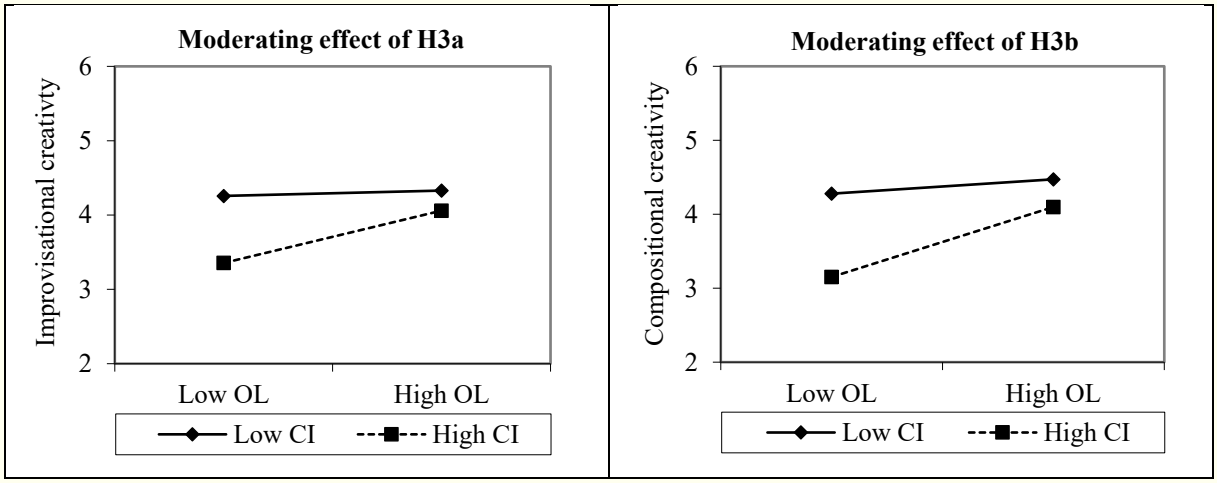

Figure 2. Moderating effects of competitive intensity (CI) on the relationship of organizational learning (OL) with improvisational and compositional creativity.

Organizational learning at low levels of competitive intensity results in creativity (improvisational and compositional) at above-average levels. At high levels of competitive intensity, average levels of creativity (improvisational and compositional) are only achieved with high levels of organizational learning. Therefore, with high competitive intensity, improvisational and compositional creativity rises as organizational learning increases. This finding is in line with that by Tsai and Hsu (2014), who found that higher competitive intensity levels generate more considerable opportunities for organizations to innovate, and the study determined that organizational learning is a way to promote creativity under such circumstances. This indicates that, in scenarios of high competitive intensity, EdTechs need to be more attentive to the advances and transformations of the market so as to learn and improve their routines and behaviors and absorb knowledge (Aliasghar et al., 2022; Auh & Menguc, 2005). This way, subsidies are generated for employees to present creative responses according to the existing adversities and opportunities, which, for EdTechs, plays a crucial role in their survival and continuity in the market (Burch & Miglani, 2018; Ramiel, 2021; Zahra & Covin, 1995).

The results also point to a specific indirect effect of the use (diagnostic and interactive) of the PMS on compositional creativity through organizational learning. This suggests that, in addition to encouraging and communicating (Henri, 2006), using the PMS to monitor and control fosters organizational efficacy through learning from past actions (Fiol & Lyles, 1985), and this reflects on the creativity for incremental improvements to the existing procedures, services, and processes (Valaei et al., 2017). That the interactive use of the MCS is beneficial for creativity is not new (Kaveski & Beuren, 2020), but new evidence of the positive reflexes of the diagnostic use on creativity was added. This finding signals that using the PMS may indirectly reflect on employee creativity, especially the small propositions of improvements and innovations that occur daily. However, using the PMS does not have a significant indirect effect on creativity, which requires more significant improvisation. In part, this finding is backed by the idea that improvisation may depend on other factors external (e.g., leadership) and/or internal (e.g., cognitive, affective, and social aspects) to individuals (Cunha et al., 2003). In short, the result signals to EdTechs that, depending on their priorities and expectations in the demands for innovation, they may take advantage of the use (interactive and/or diagnostic) of the PMS to stimulate organizational learning and the respective employee creativity.

CONCLUSIONS

The empirical results of the study allow some conclusions. Initially, it is noticed that the use (diagnostic and interactive) of the PMS positively influences learning, i.e., using the performance metrics for monitoring and communication promotes more significant efficacy of the present and future actions based on past actions. Moreover, this organizational learning fosters employee creativity at different novelty levels, from the most basic (compositional creativity) to the highest levels of improvisation (improvisational creativity). Moreover, the use (diagnostic and interactive) of the PMS indirectly affects compositional creativity through organizational learning. Finally, the high competitive intensity requires more considerable organizational learning for EdTechs to continue fostering the creativity of their employees. In general, it is concluded that the use of the PMS and organizational learning contribute to the different novelty levels in the creativity of employees of Brazilian EdTechs.

Implications and contributions

Implications for the literature are involved in the study. Firstly, it aggregates new evidence of using the PMS relative to organizational learning. It corroborates previous studies that found a positive relationship between the interactive use of MCSs and learning (Henri, 2006; Srimai et al., 2011; Zhang & Yu, 2020) and, regarding the diagnostic use, it supports the perspective of a positive effect (Oyadomari et al., 2013) in contrast to the negative effect (Henri, 2006). Secondly, beyond the discussion that organizational learning promotes innovation (Huber, 1998), it extends the discussion to different levels of novelty in creativity: improvisational and compositional (Valaei et al., 2017). Thirdly, it contributes to the research flow that explores the moderating role of competitive intensity (Aliasghar et al., 2022; Auh & Menguc, 2005; Bachmann et al., 2021; Keskin et al., 2021; Olabode et al., 2022; Tsai & Hsu, 2014; Tsai & Yang, 2013; Wu et al., 2020), especially in the relationship between organizational learning and creativity (improvisational and compositional). Fourthly, it extends the discussion to a segment of startups with little evidence in the literature: EdTechs (Burch & Miglani, 2018; Mattsson & Andersson, 2019; Ramiel, 2021).

The research also contributes to the managerial practice of organizations, especially startups, with an emphasis on the educational segment (EdTechs). Initially, it points to ways for managers to align the control and learning of the organization with employee creativity. Hence, the use of the PMS, whether within the scope of monitoring and feedback or discussion and involvement, is a way for managers to be able to promote more significant efficacy in the present and future actions based on the knowledge acquired and absorbed from past actions. This reflects on employee creativity, both in more basic (compositional creativity) and higher novelty levels (improvisational creativity). The study also signaled to managers the relevance of considering the competitive intensity of the sector since the higher it is, the greater the need to foster organizational learning to back an environment conducive to creativity.

Limitations and opportunities

The study is not free from limitations. Initially, one must exercise caution in generalizing the

findings since the sample was delimited to the context of Brazilian EdTechs. The PLS-SEM technique was employed to analyze the data, providing a linear approach to the proposed relationships. Future studies may analyze the data non-linearly, qualitatively, or through other resources to enrich the findings about the relationships between the study variables. Regarding the use of the PLS-SEM, future research with larger sample sizes may benefit from advanced approaches such as multi-group analysis (according to observable characteristics, such as startups located within versus startups located outside business ecosystems or startups in search of scalability versus startups already in a scalability phase). In addition, it is acknowledged that, although the test uses proxies to control and analyze the common-method and non-response biases, such biases cannot be entirely eliminated in survey-type research.

Regarding the latent variables employed in the study, the research considered only one type of specific MCS: the PMS. New research may consider other MCS types/approaches/frameworks, such as the perspective of formal versus informal controls or enabling versus coercive controls. Exploring the role of cultural and planning controls is also a valid option for the context of innovation and search for better organizational performance (Frare, Cruz, et al., 2021). Moreover, the study considered only one dimension to measure organizational learning; hence, new research may unfold perspectives such as acquiring knowledge and interpreting information. Finally, creativity was considered regarding its novelty level (improvisational and compositional), which may be explored together with other variables/approaches, such as creativity performance.

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