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Keep Innovating: Absorptive Capacity and the Performance of Brazilian Information Technology Companies

Continue Inovando: Capacidade Absortiva e o Desempenho de Empresas Brasileiras de Tecnologia da Informação

Claudio Testoni Cardozo[1]
https://orcid.org/0000-0002-5672-6084

Oscar Rudy Kronmeyer Filho[1]
https://orcid.org/0000-0002-8964-5483

Guilherme Luis Roehe Vaccaro[1]
https://orcid.org/0000-0001-9992-7380

Universidade do Vale do Rio dos Sinos, Programa de Mestrado em Gestão e Negócios, Porto Alegre, RS, Brasil[1]

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Resumo

A inovação contínua é considerada um grande desafio para as empresas. Ao aprofundar nesse tema, este artigo destaca a capacidade absortiva, que é a capacidade das empresas na exploração do conhecimento externo. Este estudo analisa até que ponto a capacidade absortiva afeta o desempenho organizacional de empresas brasileiras de TI. Um modelo teórico contendo três hipóteses relacionadas à capacidade absortiva potencial, capacidade absortiva realizada e desempenho organizacional é analisado por meio de análise fatorial e modelagem de equações estruturais utilizando um instrumento aplicado em 130 empresas entre os meses de julho agosto de 2017. Os resultados mostram relações significativas entre as dimensões da capacidade absortiva e desempenho organizacional, indicando que uma característica do mercado tecnológico é traduzida pela capacidade de adaptação e demonstrando a influência da capacidade absortiva potencial e realizada no desempenho, como explicado pelas capacidades dinâmicas da firma.

Palavras-chave: capacidade absortiva; gestão do conhecimento; capacidades dinâmicas; tecnologia da informação; performance organizacional.

Abstract

Continuous innovation is considered a major challenge for companies. By deepening this issue, this article highlights the absorptive capacity, which is the ability to explore external knowledge. This study analyzes the extent to which absorptive capacity affects the organizational performance of Brazilian IT companies. A theoretical model containing three hypotheses related to potential absorptive capacity, realized absorptive capacity, and organizational performance is analyzed by using factor analysis and structural equation modeling using an instrument applied to 130 companies between the months of July and August of 2017. The results show significant relations between the dimensions of absorptive capacity and organizational performance, indicating that a characteristic of the technological market is translated by adaptation ability, which demonstrates the influence of potential and realized absorptive capacity in performance as explained by the firm's dynamic capabilities.

Keywords: absorptive capacity; knowledge management; dynamic capabilities; information technology; organizational performance.

JEL Code: N76, O32, L25.

Introduction

Owing to its rapid and unpredictable technological change, the Brazilian information technology (IT) market is undergoing a continuous transformation in order to survive under turbulent conditions (Mikalef & Pateli, 2017). Byun, Sung, and Park (2018) found that the average life of technological innovations is declining, which is rapidly transforming firms' competitive advantage. Furthermore, IT companies seek the obsolescence of their own products before they are surpassed by their competitors. The ability of companies to adapt to external environments undergoing constant change requires the coordination of intangible assets that are difficult to replicate. This capacity is regarded as a dynamic capacity of the firm (Pelaez, Melo, Hofmann, & Aquino, 2008; Pisano, 2017; Teece, 2000). In the context of knowledge-intensive business services (KIBS) such as IT (Muller & Zenker, 2001), companies must therefore understand how to coordinate organizational knowledge (Grant, 1996) and use it to adapt and innovate their products and services.

Absorptive capacity (ACAP) — the ability to recognize, assimilate, and commercially exploit new external knowledge (Cohen & Levinthal, 1990) — is a component of a company's dynamic capabilities (Wang & Ahmed, 2007) that is fundamental to improve organizational innovation (Fosfuri & Tribó, 2008). ACAP significantly influences innovation (Fosfuri & Tribó, 2008; Tsai, 2001) by transferring internal knowledge (Szulanski, 1996; Vega-Jurado, Gutiérrez-Gracia, & Fernández-de-Lucio, 2008) and external knowledge (Lane & Lubatkin, 1998; Vega-Jurado et al., 2008) as well as affects organizational performance (Flatten, Adams, & Brettel, 2015; Flatten, Engelen, Zahra, & Brettel, 2011; Lane, Salk, & Lyles, 2001). Rangus and Slavec (2017) found that decentralizing decision-making strengthens the connections between employees by increasing their levels of trust, cooperation, and interaction, thus extending ACAP and significantly influencing organizational innovation and performance. However, their study investigated companies in developed countries characterized by a high educational level. Consequently, this hinders generalization to most emerging economy countries. Adams, Flatten, Brinkmann, and Brettel (2016) showed the positive influence of ACAP on the performance of small and medium-sized enterprises in developed and emerging countries. They found that while ACAP is not moderated by values or the regional culture, formalizing internal structures significantly influences ACAP, especially in countries at a lower level of development, since the presence of these structures inhibits discriminatory behaviors based on gender, color, and race, thereby fostering the exchange of ideas and cooperation among employees.

However, research on the extent to which ACAP influences the organizational performance of IT companies in Brazil is lacking, as shown in Table 1. Based on the foregoing, this study investigates whether ACAP (including potential and realized ACAP) has a causal relationship with the performance of Brazilian IT companies. To this end, a theoretical model is analyzed and tested, based on a survey of 130 companies linked to the National Federation of Technology Companies (Federação Nacional das Empresas de Informática [FENAINFO]). The data are analyzed by using factor analysis and structural equation modeling (SEM).

Table 1

Studies of ACAP and Organizational Performance

Author(s)	Focus of the study
García-Sánchez, García-Morales and Martín-Rojas (2018)	A sample of 160 European technology companies shows improvement in organizational performance through the positive influence on potential and realized ACAP.
Rangus, Drnovšek, Di Minin, and Spithoven (2017)	The authors examine how ACAP and open innovation interact to impact on innovation performance, based on a large dataset of companies operating in Slovenia. The results show the positive effect of ACAP on innovation performance.
Rangus and Slavec (2017)	Using a sample of 421 manufacturing and services firms, the results suggest that ACAP impacts on a firm's innovation, which in turn affects organizational performance.
Adams et al. (2016)	This study investigates the relationship between ACAP and organizational performance in Austria, Brazil, Germany, India, Singapore, and the United States, using a sample in several industries. It shows a positive relationship between ACAP and organizational performance.
Najafi-Tavani, Najafi-Tavani, Naudé, Oghazi, and Zeynaloo (2018)	Survey data from 258 Iranian companies in high and medium technology manufacturing industries show that the effects of collaborative innovation networks on either product or process innovation capability are significant only in the presence of ACAP.
Wu and Voss (2015)	The influence of ACAP on organizational performance is positive in Chinese companies, using a sample from the manufacturing sector and other diversified industries including textiles, telecommunications, and chemicals.

The remainder of the article presents the theoretical framework supporting the research and describes the methods used for the data collection and analysis. After the results are analyzed and the conclusions are reported.

Theoretical Foundation

Cohen and Levinthal (1990) presented the seminal concept of ACAP as an organization's ability to acknowledge the value of the new technical and scientific knowledge available in the external environment, acquire this knowledge, assimilate it, and apply it commercially. The authors also proposed that ACAP is constituted from previous knowledge existing in the organization. The greater such previous knowledge, the greater is a firm's ability to find potential in new emerging knowledge, acquire it, assimilate it, and explore it. Consequently, this increases an organization's ability to acquire knowledge (Cohen & Levinthal, 1990).

Zahra and George (2002) suggested a reconceptualization of the Cohen and Levinthal (1990) model, splitting ACAP into potential ACAP and realized ACAP. These authors emphasized ACAP as a set of routines, in which external knowledge, after being recognized as relevant by the organization, must be incorporated into existing organizational knowledge so that it may be combined and transformed into products, services, and new technologies that are applicable and commercially viable to be exploited by the organization. These routines are presented as new and old information, which join to produce useful knowledge for a company that becomes central to its search for innovation (Lima, 2013). Zahra and George (2002) suggested that potential ACAP consists of the acquisition and processing dimensions and realized ACAP consists of the transformation and exploration dimensions. Hence, information must be transformed through the refinement of routines and processes to associate existing knowledge to the

new knowledge acquired before it is commercially applied. This model has since been widely employed in ACAP research for KIBS (Camisón & Forés, 2010; Kurtz, Santos, & Steil, 2013).

Potential ACAP and organizational performance

Regarded by Zahra and George (2002) as the ability of an organization to acquire and assimilate new external knowledge, ACAP seeks to understand the communication between an organization and its external environment (Fosfuri & Tribó, 2008). Intuition, reflection, and interpretation are the individual processes involved in these activities (Cepeda-Carrion, Cegarra-Navarro, & Jimenez-Jimenez, 2012). This provides the conditions for an organization to be receptive to externally acquired knowledge.

Acquisition is a firm's ability to identify and acquire external knowledge, namely externally created knowledge that is relevant to the firm's strategy and operation (Cohen & Levinthal, 1990; Zahra & George, 2002). Once identified and acquired, external knowledge complements the firm's knowledge base and influences decision-making.

Assimilation is the analysis, processing, and interpretation of information captured from external sources, which enables an organization to effectively assimilate knowledge. In this activity, assimilation aims to enable an organization to understand external knowledge by utilizing its own processes (Jiménez-Barrionuevo, García-Morales, & Molina, 2011). The previous knowledge of the organization influences how effectively new knowledge is acquired. Under this assumption, discoveries made outside the organization's area of interest area tend to be ignored because of the difficulty of understanding them.

By intensifying efforts to add external knowledge, companies acquire new knowledge more rapidly. However, this speed is limited to learning cycles that cannot be easily shortened. Further, some of the resources needed to develop ACAP cannot be quickly found (Flatten et al., 2011; Jiménez-Barrionuevo et al., 2011; Zahra & George, 2002). Since ACAP accumulates over time, the direction in which knowledge acquisition takes place also influences how a company pursues this activity. Therefore, it may be concluded that the prior knowledge base of the organization, developed by ACAP activities, not only determines its ability to acquire new knowledge, but also influences the paths by which the organization maintains its activity.

Further, Cohen and Levinthal (1990) suggested that suggest that a firm's aspiration level in a technologically progressive environment is not simply determined by past performance or the performance of reference organizations, but also depends on the firm's absorptive capacity. Ahuja and Katila (2001) also corroborated the study by Cohen and Levinthal (1990), demonstrating that technological acquisitions may significantly influence organizational performance. Acquiring external knowledge may foster the creation of new products and services, thus suggesting an extension of technological portfolios and commercial differentiation. Fosfuri and Tribó (2008) identified which companies use external R&D alliances to produce better ACAP. The authors also found that potential ACAP plays a key role in innovation, as high-potential ACAP companies earn a significant proportion of sales from new or substantially improved goods. This relationship is even more intense when internal information flows are more efficient. Hence,

H1: Organizational performance is significantly influenced by potential ACAP.

Realized ACAP and organizational performance

Realized ACAP consists of knowledge transformation and exploration activities. Both these activities occur within the organization (Fosfuri & Tribó, 2008) to guarantee that new knowledge is applied throughout its operations (Zahra & George, 2002). Transformation represents the ability of the organization to combine internal and external knowledge into a new kind of knowledge that can be applied by the organization, by adding, reducing, or reinterpreting externally acquired and assimilated

knowledge. These skills can create knowledge, helping an organization recognize opportunities and altering how it perceives its competitive environment (Camisón & Forés, 2010; Zahra & George, 2002). In addition, knowledge management practices play an important role in transformation activities since their commitment to people's connection enables a structure to be established in the necessary networks (Dávila, 2016).

Exploration helps an organization refine and develop by incorporating newly acquired, assimilated, and transformed knowledge into its operational processes. If incorporation occurs systematically, knowledge exploitation becomes sustainable. The results of expanding this capacity are new assets, services, organizational processes, business models, and even knowledge. Further, knowledge exploitation enables organizations to leverage their current skills, thereby improving and creating new resources. Consequently, the result of knowledge exploitation processes is the creation of new products, services, systems, processes, and business models (Flatten et al., 2011; Zahra & George, 2002). Hence,

H2: Organization performance is significantly influenced by realized ACAP.

Complementarity between potential and realized ACAP

Lane, Koka, and Pathak (2006) stated that the theoretical contribution by Zahra and George (2002) enabled a major breakthrough in ACAP studies, allowing researchers to understand ACAP as a process within the organization. However, the existence of a communication interface with the external environment alone does not guarantee that new knowledge is absorbed and transformed into innovation by firms (Versiani, Cruz, Ferreira, & Guimarães, 2010). Organizations that only aim to acquire and assimilate knowledge continuously renew their knowledge stock and understand complex technical problems, giving them a high level of potential ACAP. Nonetheless, they are unable to apply this new knowledge; thus, without commercially exploiting the new knowledge acquired, the process is not viable when considering the return on investment of these activities (Jansen, Van Den Bosch, & Volberda, 2005; Zahra & George, 2002). On the contrary, organizations that focus on the transformation and exploitation of knowledge (i.e., realized ACAP) may achieve short-term results but may be unable to respond to environmental change effectively (Jansen et al., 2005; Oliveira, 2016).

Lane et al. (2006) identified the existence of a chain of activities requiring efforts from the people involved in this process to ensure that new knowledge is incorporated into the firm's activities. Potential ACAP is converted into realized ACAP by individuals through social integration mechanisms (Zahra & George, 2002), facilitating the exchange of information. This overcomes the barriers to sharing information, improving the efficiency of the assimilation and transformation activities, promoting the mutual understanding of information for further knowledge application, and increasing process efficiency necessary to compete in changing markets (Versiani et al., 2010; Zahra & George, 2002). However, companies do not always ensure that knowledge is shared or integrated effectively. Behavioral, cognitive, structural, and political barriers may compromise knowledge integration and sharing. These opportunities may help the firms sustain superior performance because of first mover advantages, responsiveness to customers or other strategic advantages (Zahra & George, 2002).

While Zahra and George (2002) presented realized ACAP as mediating potential ACAP and a firm's performance, Dávila (2016) found that both potential and realized ACAP constructs have a direct and significant effect on performance. To directly evaluate the influence of potential and realized ACAP on organizational performance as well as the moderating effect of realized ACAP in IT companies in Brazil, H3 is suggested.

H3: Realized ACAP is significantly influenced by potential ACAP.

Methods

Measurement model

The three hypotheses above were formulated to evaluate the relationship between potential ACAP and organizational performance. These relationships were analyzed directly and via the mediating effect of realized ACAP. Figure 1 defines the conceptual framework of this study.

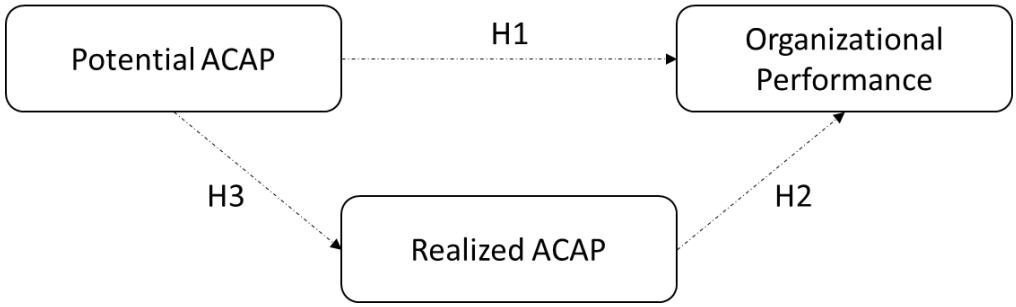

Figure 1. Conceptual Framework of ACAP and Organizational Performance

To evaluate the relations in the theoretical model, the instrument selected to measure ACAP was the one developed by Flatten, Engelen, Zahra, and Brettel (2011) used by relevant studies in various contexts (Adams, Flatten, Brinkmann, & Brettel, 2016; Herath & Mahmood, 2014). This instrument consists of 16 variables measured on a seven-point Likert scale. Importantly, the instrument was validated in the Brazilian context by Engelman, Fracasso, Schmidt, and Muller (2016), enabling us to distinguish potential ACAP from realized ACAP as well as their elements: acquisition, assimilation, transformation, and exploration.

To measure the elements of organizational performance, the instrument devised by Darroch (2005) was selected. This tool has also been validated in the Brazilian context by Dávila (2016). It consists of seven variables measured on a seven-point Likert scale, identifying the following performance measurement dimensions: (a) comparative performance, which assesses profitability, market share, and growth, and (b) internal performance, assessing the performance of an organization from the perspective of achieving its objectives. Finally, one question, represented by V24, was added to the comparative performance section of the final instrument to improve the content validity and reliability during the factor analysis procedures (see Appendix). The final instrument was thus composed of 24 variables, named V1 to V24.

Data collection

The FENAINFO company database was used to collect the data. FENAINFO was founded in 1990 by the data-processing unions of seven states: Rio de Janeiro, Pernambuco, Santa Catarina, Minas Gerais, Paraná, Rio Grande do Sul, and Bahia. Its main objectives are to defend the interests of companies in the sector by creating class entities and strengthening collective interests (FENAINFO, n.d.). The research instrument was distributed to nine class entities associated with the federation, located in the seven Brazilian states, with a range of approximately 1150 companies. The data collection occurred in July and August 2017 and answers from 149 IT companies were gathered. During the data analysis stage, 15 responses were eliminated from companies with fewer than five years of existence. Four responses were eliminated from companies that answered that they did not belong to the IT segment. The final sample thus comprised 130 valid cases.

Because of the use of an electronic form, which was devised to avoid the submission of incomplete answers, no missing data were found. Outlier analysis was carried out by using boxplot graphs (Hair, Black, Babin, Anderson, & Tatham, 2009). The atypical observations found in the 130

responses were analyzed together with the whole dataset. No discrepancies were found to justify the removal of these records.

Data analysis

The skewness and kurtosis of the data were initially analyzed, with skewness values ranging from -1.619 to -0.231. This result suggests weak skewness (Kline, 2015). The kurtosis values were between -0.949 and 2.210, meaning data normality (Kline, 2015). The multicollinearity analysis found a Pearson's correlation coefficient above 0.80 (Hair et al., 2009). The reliability analysis used Cronbach's alpha, obtaining a coefficient of 0.934, above the recommended minimum value of 0.70 (Hair et al., 2009), thus proving adequate for factor analysis.

Exploratory factor analysis (EFA) was used in this study to confirm whether the dimensions and variables presented could be empirically verified. EFA was adopted for three reasons: (a) the ACAP measurement instrument proposed by Engelman et al. (2016) presented problems with discriminant validity; (b) a variable was included in the instrument to strengthen the constructs; and (c) no studies using both ACAP and organizational performance have been conducted.

The principal components were analyzed by using the Varimax orthogonal rotation method, based on eigenvalues above 1. The Kaiser–Meyer–Ohlin test presented a result of 0.898, above the recommended minimum of 0.60 for this index and with a significance level of < 0.001 in the sample. This finding indicated the adequacy of the data for factor analysis (Hair et al., 2009). During the communality analysis of each element, V4 presented a communality factor of 0.426, and V13 presented a communality factor of 0.396, both variables below the minimum value of 0.5 necessary for this analysis (Hair et al., 2009). These results area shown in Table 2.

Table 2

EFA Results

Variable	F1	F2	F3	F4	F5	F6
V1			0.642			
V2			0.723			
V3			0.813			
V5				0.737		
V6				0.620		
V7				0.579		
V8				0.627		
V9					0.836	
V10					0.752	
V11					0.793	
V12					0.776	
V14						0.561
V15						0.846
V16						0.595

Continue

Table 2 (continued)

Variable	F1	F2	F3	F4	F5	F6
V17	0.591					
V18	0.704					
V19	0.654					
V20	0.682					
V21		0.871				
V22		0.811				
V23		0.828				
V24		0.712				

Note. F1 – Internal Performance; F2 – Comparative Performance; F3 – Acquisition; F4 – Assimilation; F5 – Transformation; F6 – Exploration.

The data seemed adequate for the use of confirmatory factor analysis based on SEM. Standardized residual covariance analysis was also performed, and V24, presenting indices above 2.58, was also eliminated from the model (Koufteros, Babbar, & Kaighobadi, 2009).

Moreover, to reduce the potential method and sampling biases, the Harman (1976) single-factor test was performed. The six factors (Acquisition, Assimilation, Transformation, Exploration, Internal Performance and Comparative Performance) concluded a total of 75.00 percent of the total variance, and the first factor was responsible for 39.89 percent of the variance, suggesting that common method bias (CMB) is not likely to confound the interpretation of the results.

The convergent and discriminant validity of the model was analyzed by using Fornell and Larcker (1981) criterion in first- and second-order models. In the first-order construct assessment, the indices seemed adequate since the data from each element presented greater relevance in their own explanation than in the explanation of other constructs: composite reliability (CR) ≥ 0.70, AVE (average variance extracted) ≥ 0.50, and CR > AVE (see Table 3; Hair et al., 2009; Kline, 2015).

Table 3

Convergent and Discriminant Validity

	CR	AVE	**AC**	**AS**	**TR**	**EX**	**CP**	**IP**
First-order factor constructs								
AC	0.750	0.511	**0.715**					
AS	0.844	0.576	0.671	**0.759**				
TR	0.883	0.654	0.499	0.614	**0.809**			
EX	0.920	0.800	0.473	0.686	0.584	**0.894**		
CP	0.886	0.722	0.311	0.426	0.366	0.318	**0.850**	
IP	0.887	0.663	0.476	0.684	0.525	0.585	0.726	**0.814**
Second-order factor constructs			**Potential ACAP**	**Realized ACAP**	**OP**			
Potential ACAP	0.829	0.714	**0.845**					
Realized ACAP	0.747	0.597	0.877	**0.773**				
OP	0.899	0.826	0.633	0.659	**0.909**			

Note. CP – Comparative performance; AS – Assimilation; TR – Transformation; EX – Exploration; AC – Acquisition; IP – Internal performance; OP – Organizational performance.

In the second-order construct assessment, AVE showed that the potential and realized ACAP constructs could be convergent because the data of their own explanations presented a value lower than in the explanation with other constructs. So, a second test was realized, based on the Bagozzi and Phillips (1982) criterion, testing the constructs in pairs and comparing the forced model with the free one. As shown in Table 4, the two models present a significant difference, confirming their discriminant validity.

Table 4

Discriminant Validity of the Second-order Constructs

Correlation	χ^2 constrained model	χ^2 unconstrained model	Difference	Sig.
Potential ACAP ↔ Realized ACAP	97.712	93.251	4.461	0.035

The suitability of the model can be assessed by using $\chi 2$ tests or suitability indices. The cutoff criteria for defining the acceptability of the model are somewhat arbitrary (Hair et al., 2009). The suitability indices normally employed to assess the degree of adequacy for SEM models include GFI (goodness-of-fit index), NFI (normed fit index), CFI (comparative fit index), RMSEA (root mean square error of approximation), SRMR (standardized root mean square residual), and TLI (Tucker–Lewis index). These indices may be affected by the poor specification of the model, small samples, effects caused by the violation of normality premises, and estimation method used. In this study, the following indices were used as a decision criterion: $\chi 2/df < 3$; RMSEA ≤ 0.05; SRMR ≤ 0.10. TLI ~1, CFI ~1, and PClose ≥ 0.05.

The data collected were analyzed by using the IBM SPSS software (version 24) and the IBM AMOS module (version 24). To address common problems with the small sample of data analyzed with IBM AMOS software, the indices $\chi 2/df$, RMSEA, SRMR, TLI, CFI and PClose demonstrate enough adequacy to avoid the common problems of trivial misspecifications (Hox, 1995).

Results

Descriptive statistics for the respondents

The control variables, position and number of employees, represent the current position of the respondent and the number of employees of your company. Table 5 presents the descriptive statistics of theses control variables in the sample used by this study.

Table 5

Descriptive Statistics for the Respondents

	Frequency	Percentage	Cumulative Percentage
Position			
President	14	10.8	10.8
Director	42	32.3	43.1
Manager	38	29.2	72.3
Supervisor	15	11.5	83.8
Other	21	16.2	100.0

Continue

Table 5 (continued)

	Frequency	Percentage	Cumulative Percentage
Number of employees			
Until 9 employees	13	10.0	10.0
Between 10 and 49 employees	60	46.2	56.2
Between 50 and 99 employees	20	15.4	71.5
More than 100 employees	37	28.5	100.0

The results show 73.3 percent of the respondents in high management level positions (Presidents, Directors and Managers), suggesting a good capability of respondents to respond to the instrument appropriately. It is also possible to observe a low rate of respondents in companies until 9 employees, representing only 10 percent of the sample.

EFA results

A preliminary analysis was carried out to evaluate the covariance and correlation of the data and no correlation above 0.80 was found, confirming the absence of multicollinearity. Indeed, all correlations were above 0.30, which were considered to be ideal for the factor analysis (Hair et al., 2009).

The six factors (F1–F6) extracted by EFA were obtained in eight iterations, explaining 72.682% of the variance in the data. The EFA results (Table 2) suggest F1 consists of V17, V18, V19, and V20. Reciprocally, the theoretical reasoning of this study and Appendix suggest that these variables are associated with internal performance. F2 comprises V21, V22, V22, V23, and V24. These variables were analyzed together with the original instruments and their theoretical reasoning, which identified this factor as comparative performance.

F3 was composed of V1, V2, and V3, which corroborated the theoretical reasoning and instrument used in this research. This factor was called acquisition. In the analysis of V5, V6, V7, V8, and V13 that constituted F4, V13 was the only one that belonged to the set of variables originally associated with assimilation. Since most of these variables remained grouped in this factor, it was called assimilation.

F4 grouped V5, V6, V7, and V8. The grouping of these variables corroborated the theory investigated and research instrument used. This factor was called transformation. V14, V15, and V16 were grouped according to the theoretical reasoning and instrument used for the data collection; this factor was called exploration.

SEM results

Figure 2 illustrates the measurement model devised to specify how the latent variables were measured in tandem with the observed variables and describe their measurement properties. This second-order model groups acquisition and assimilation into a single construct reflecting potential ACAP and transformation and exploration into a single construct representing realized ACAP (Zahra & George, 2002); it also groups internal and comparative performance into a single construct termed organizational performance (Darroch, 2005). As previously shown, the adequacy measures of this measurement model are $\chi 2/df = 1.235$, RMSEA = 0.043, SRMR = 0.053, TLI = 0.969, CFI = 0.974, and PClose = 0.734.

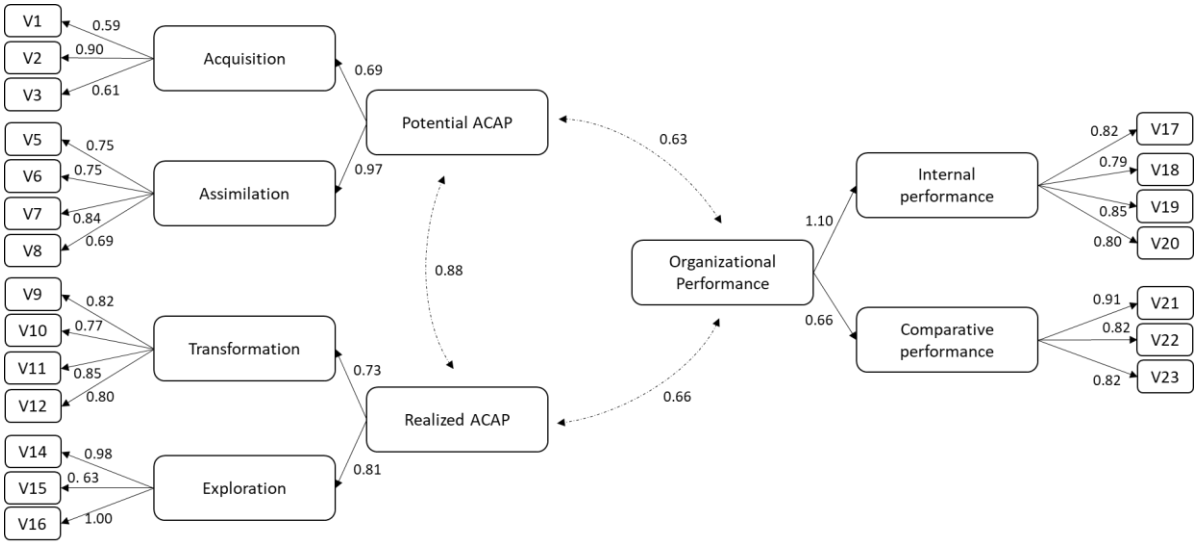

Figure 2. Second-order Measurement Model

Figure 3 shows the final model after the hypothesis testing. This figure illustrates the paths that have sufficient significance ($p \leq 0.05$) for determining a causal relationship in the model, with the respective standardized regression coefficients presented. Figure 3 shows that H2 and H3 are supported by the model, whereas H1 is not.

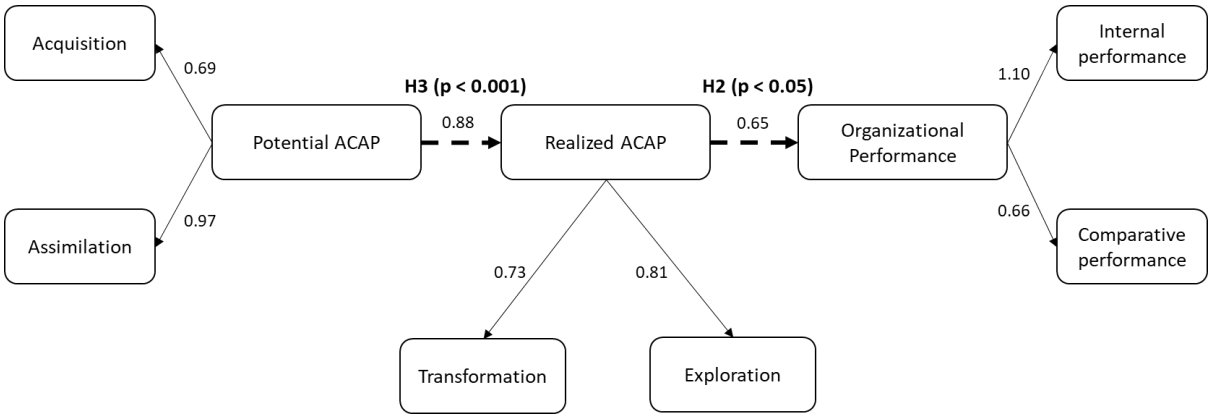

Figure 3. Causal Model

The analysis of the coefficients of determination (R^2) of the endogenous constructs, which demonstrate the explanatory power of the model and its predictive validity, shows that the final model explains 77% of realized ACAP and 45% of organizational performance. This indicates that the model has moderate predictive capacity (Hair et al., 2009).

Influence of potential ACAP on organizational performance (H1)

H1 was not supported by the model analyzed in this research, presenting a significance level of 0.334, above the minimum required of 0.05 (Hair et al., 2009). The lack of support found for this hypothesis contradicts the finding of Fosfuri and Tribó (2008), suggesting that in the Brazilian IT market, represented by the companies associated with FENAINFO, organizational learning ability alone is insufficient to influence firm performance. The ability to acquire and assimilate external knowledge enables a company to value information and expand its organizational knowledge base through technology acquisition, consulting, training, as well as hiring employees with expertise to work on new projects. Nonetheless, as organizations perform these activities, they only increase their implementation

potential, without fostering activities enabling it to apply this ability to new and improved processes. They are thus unable to produce new services or improve management practices.

Influence of realized ACAP on organizational performance (H2)

H2 was supported by the model, with a significance level of 0.04 and a standardized regression coefficient of 0.65, demonstrating weak-to-average intensity for this relationship (Suhr, 2008). The confirmation of this hypothesis shows that the conversion of knowledge previously acquired by the company into new products and services is the foundation of higher performance (Calantone, Cavusgil, & Zhao, 2002; Camisón & Forés, 2010), enabling an organization to achieve its goals and objectives, using new information in a systematic and applicable way, and thus enhancing its competitive advantage (Zahra & George, 2002).

Influence of potential ACAP on realized ACAP (H3)

H3 was supported by the model, obtaining a standardized regression coefficient of 0.88 and a significance level < 0.001, representing high intensity in this relationship (Suhr, 2008). The confirmation of this hypothesis corroborates the findings of Zahra and George (2002), Fosfuri and Tribó (2008), and Oliveira (2016), who showed the complementarity between the dimensions of potential ACAP and those of realized ACAP. The greater the ability of an organization to acquire and assimilate knowledge, the greater is its ability to transform them into new knowledge. Consequently, the new knowledge acquired through new technologies in products and services can be explored. Such conversion from potential ACAP to realized ACAP also depends on social integration mechanisms. These overcome barriers to sharing and access to information, while increasing the assimilation and transformation capacities of these organizations (Zahra & George, 2002).

Conclusion

This study has an interdisciplinary nature since it contributes to various fields such as knowledge management, dynamic capabilities, and ACAP. The development of mechanisms and processes using elements of ACAP brings companies closer to knowledge sources, which may enhance their performance. Our investigation into the influence of ACAP on the performance of IT organizations found that for the companies included in this sample, for each 1.0 standard deviation increase in potential ACAP resulted in an 0.88 standard deviation increase in realized ACAP activities and, also 0.65 standard deviation points increase in organizational performance. However, the analysis highlighted the interdependence of both dimensions of ACAP, suggesting that the intensity of potential ACAP activities, such as human resources training and contracts, must be balanced with company investment in structuring and institutionalizing methods and processes (i.e., realized ACAP). Not only must firms be capable of fully using their knowledge capacity, they must also transfer and disseminate such external information to other relevant people. Their previous knowledge combined with new ones from external sources can promote an increase in the firm's results. Table 6 shows how these dimensions manifest in organizations, what they demand from the companies, and what mechanisms are used in their construction.

Table 6

Manifestation of ACAP Dimensions

Potential ACAP is manifested by	**Realized ACAP is manifested by**
Interaction, trust, respect, friendship, reciprocity, a common language, and complementarity (Jiménez-Barrionuevo et al., 2011).	Communication, meetings, documents, projects, processes, deadlines, and flows (Jiménez-Barrionuevo et al., 2011).
What potential ACAP demands	**What potential ACAP demands**
Changes, flexibility, and creativity (Cepeda-Carrion et al., 2012; Rangus & Slavec, 2017).	Order, control, and stability (Jansen et al., 2005; Vega-Jurado et al., 2008).
How to increase potential ACAP	**How to increase realized ACAP**
R&D investment (Murovec & Prodan, 2009).	R&D investment (Murovec & Prodan, 2009).
Staff participation in decision-making (Jansen et al., 2005)	Freedom to express opinions (Cepeda-Carrion et al., 2012).
A linkage between professionals and the scientific community (Vega-Jurado et al., 2008).	A linkage between professionals and the scientific community (Vega-Jurado et al., 2008).
Positive attitudes towards change (Murovec & Prodan, 2009).	The value of learning and risks taken (Cepeda-Carrion et al., 2012).
Interaction between the organization, its customers, and its suppliers (Ndiege, Herselman, & Flowerday, 2012; Oliveira, 2016).	Internal and external connectivity (Rangus & Slavec, 2017).
Informal relations (Tu, Vonderembse, Ragu-Nathan, & Sharkey, 2006).	Formalizing internal processes (Vega-Jurado et al., 2008).
Knowledge diversity (Grace, 2012).	Internal R&D (Vega-Jurado et al., 2008).
Relevant previous knowledge (Tu et al., 2006).	Collaborative culture (Najafi-Tavani, Najafi-Tavani, Naudé, Oghazi, & Zeynaloo, 2018).

This research improves the measurement of ACAP by presenting an advance in the research of Engelman et al. (2016) with the contribution of second order constructs: potential ACAP and realized ACAP, proposing and testing a structural model. The analysis of this knowledge field may enable maturity models to be developed and used to analyze the dynamic capacities of knowledge-intensive organizations. This assessment may help assess the performance of a company and its ability to adapt to market changes — a characteristic inherent in the IT market — through the maturity of the processes capable of obtaining relevant external knowledge.

This study suffered from some limitations. First, the dearth of similar research made it difficult to make comparisons. Second, data were collected during a turbulent economic and political period, which is likely to have caused interference in the interpretations of the results. Third, only certain Brazilian states were analyzed because of the scope of the FENAINFO data. Indeed, although FENAINFO is the largest federation of the IT segment in Brazil, this sample may still not be representative of all IT companies in the country. Fourth, a cross-sectional approach was adopted in this study to prepare the structural equations and interviews. Future research could be conducted by using longitudinal analysis to compare the results over time.

Given the nature of the work, and the small sample used in this research, it is not possible to generalize by extending the findings across larger populations. A larger sample population across a broader range of organizations would certainly add robustness and depth of understanding of the issues being explored in this work.

In summary, the causal relationships found between the observed constructs are a novel contribution of this work that may be used in future studies of knowledge management, organizational learning, as well as dynamic and absorptive capacities. In the management field, this research also provided a strategic perspective for IT companies.

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Authors
Claudio Testoni Cardozo
Av. Dr. Nilo Peçanha, 1640, 91330-002, Porto Alegre, RS, Brasil
E-mail address: ccardozo29@gmail.com; ctcardozo@edu.unisinos.br

Oscar Rudy Kronmeyer Filho
Av. Dr. Nilo Peçanha, 1640, 91330-002, Porto Alegre, RS, Brasil
E-mail address: kronmeyer@unisinos.br

Guilherme Luis Roehe Vaccaro
Av. Dr. Nilo Peçanha, 1640, 91330-002, Porto Alegre, RS, Brasil
E-mail address: guilhermev@unisinos.br; claris.lucasmachado@gmail.com

Contributions

1st author: Conceived the presented idea. Participates in drafting the article and revising it critically. Developed the theory, verified the analytical methods, interpretation of the results, wrote the manuscript in consultation with 2nd and 3rd authors.

2nd author: Substantial contributions to conception and design. This author participates in drafting the article and revising it critically for important intellectual content. This author gives final approval of the version to be submitted and all posterior revised version.

3rd author: Participates in drafting the article and revising it critically. This author had substantial contributions to conception and design. Performed the computations and final approval of the version to be submitted and all posterior revised version.

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Supplementary Material

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APPENDIX

Sentences Included in the Questionnaire Used To Collect the Data

2nd Order	Dimension	Sentence	Author(s)
Potential ACAP	Acquisition	V1 - The search for relevant information concerning our industry is everyday business in our company.	Flatten et al. (2011)
		V2 - Our management motivates employees to use the information sources within our industry.	
		V3 - Our management expects employees to deal with information beyond our industry.	
		V4 - A periodic meeting with external experts within our industry for the accumulation of relevant information goes without saying in our company.	
	Assimilation	V5 - In our company, ideas and concepts are communicated across departments.	
		V6 - Our management emphasizes cross-departmental support to solve problems.	
		V7 - In our company, there is a quick information flow, e.g., if a business unit obtains important information, it communicates this information promptly to all other business units or departments.	
		V8 - Our management demands periodic cross-departmental meetings to interchange new developments, problems, and achievements.	
Realized ACAP	Transformation	V9 - Our employees have the ability to structure and use the collected knowledge.	
		V10 - Our employees are used to absorbing new knowledge as well as preparing it for further purposes and making it available.	
		V11 - Our employees successfully link existing knowledge with new insights.	
		V12 - Our employees are able to apply new knowledge in their practical work.	
	Exploration	V13 - Our management supports the development of prototypes.	
		V14 - Our company regularly reconsiders technologies and adapts them in accordance with new knowledge.	
		V15 - Our company has the ability to work more effectively by adopting new technologies.	
		V16 - Our company regularly reconsiders technologies and adapts them in accordance with new knowledge.	
Organizational Performance	Internal performance	V17 - In general, our organization is performing better than it did 12 months ago.	Darroch (2005)
		V18 - In general, our organization is performing better than it did five years ago.	

		V19 - Over the past 12 months, our organization has met its performance objectives.	
		V20 - Over the past five years, our organization has met its performance objectives.	
	Comparative performance	V21 - Compared with the industry average, we are growing more rapidly.	
		V22 - Compared with the industry average, we are more profitable.	
		V23 - Compared with the industry average, we have a greater market share.	
		V24 - Compared with the industry average, we have better productivity.	Shin and Konrad (2017)

Note. Instrument adapted from Engelman, R., Fracasso, E. M., Schmidt, S., & Muller, H. F. (2016). Capacidade absortiva: Adaptação e validação de uma escala em empresas sul-brasileiras (p. 239). *Base - Revista de Administração e Contabilidade da UNISINOS, 13*(3), 235-247. http://doi.org/10.4013/base.2016.133.04