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Antecedents of Effectiveness of Outsourced Information Systems

Antecedentes da eficácia dos sistemas de informação terceirizados

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ABSTRACT

This research aimed to analyze the efficiency of management practices that govern IT projects, represented by the decision to adopt project management methodologies and by the internal controls over suppliers and users, reflected in the perceived effectiveness of outsourced information systems. We have employed a quantitative methodology, using structural equation modeling with partial least squares and the sample consisted of 299 information technology professionals. The results show the positive effect of management practices that monitor supplier capacity on the effectiveness of information systems, as well as the processes associated with the control of project deviations.

Keywords: outsourced information systems, procurement, project change.

RESUMO

Esta pesquisa teve como objetivo analisar a eficiência das práticas de gestão que regem os projetos de TI, representada pela decisão de adotar metodologias de gestão de projetos e pelos controles internos sobre fornecedores e usuários, refletida na eficácia percebida

dos sistemas de informação terceirizados. Empregamos uma metodologia quantitativa, utilizando modelagem de equações estruturais com mínimos quadrados parciais, e a amostra foi composta por 299 profissionais de tecnologia da informação. Os resultados mostram o efeito positivo das práticas de gestão que monitoram a capacidade dos fornecedores sobre a eficácia dos sistemas de informação, bem como os processos associados ao controle de desvios de projetos.

Palavras-chave: sistemas de informação terceirizados, aquisição, mudança de projeto.

1 INTRODUCTION

The increased investments in computational resources in organizations lead to the increasing number of Information Technology (IT) projects in organizations worldwide (Gingnell *et al.*, 2014). In 2019, IT investments by Brazilian companies represented approximately 8% of the organizations' total revenues and have evolved with an increasing trend over the last years (Meirelles, 2020). However, the complexity and uncertainties in IT project management have increased, both in relation to investments and the necessary technologies and users (Lee *et al.*, 2019; Ayat *et al.*, 2020).

Because of these difficulties, part of IT investments is allocated to the payment of outsourced suppliers. IT outsourcing enables organizations to streamline business, managers to focus on specific business activities, cost reduction by scalability and agility in obtaining advanced technological resources, and competitive advantages (Sanchez & Cappellozza, 2012; Ahimbisibwe, Daellenbach, & Cavana, 2017).

Despite the popularity of IT outsourcing in organizations (Barthélemy & Quélin, 2006; Fehrenbacher & Wiener, 2019; Lee *et al.*, 2019), studies indicate that customer dissatisfaction with the performance of outsourced information systems and projects is one of the factors that can lead to significant financial losses in companies due to project failures, in addition to termination of commercial agreements between interested parties (Narayanan *et al.*, 2011),

The *ex-ante* risk assessment of problems related to information system outsourcing by the contracting companies may not be effective in preventing unforeseen failures during the project life cycle, and incomplete contracts can lead to opportunistic behaviors of suppliers and imposed retention of clients throughout the term of the

contracts (Ravindran *et al.*, 2015). In addition, projects are subject to failures caused by the lack of skills, experience and capacity of the contracted suppliers, which may result in problems detected only after the start of project execution (Gorla & Bik, 2010; Wang & Wang, 2019).

Methodologies that guide project management practices are tools that can assist managers in the implementation of information systems; however, some studies evaluate that such methodologies cannot be considered as "silver bullets" in solving problems in projects because they present shortcomings in several aspects, such as: network estimates and planning (O'Brien & Fischer, 2000; Zwikael, 2009). In addition, project effectiveness depends on understanding and delivering the requirements established in the planning (Chou & Yang, 2012). User requests that may result in deviations in expected actions, or deliveries, may result in future problems and dissatisfaction of stakeholders (Allen, Mclees *et al.*, 2015).

Studies that address the impact of organizational governance mechanisms associated in the context of information systems projects and their users are relevant themes in the business administration literature (Kirsch, 1997). Thus, the literature on project management outsourcing has a gap in the analysis of the relationships between the company and its outsourced suppliers (Barthélemy & Quélin, 2006; Ravindran *et al.*, 2015; Lee *et al.*, 2019), as well as in the results of management processes of contracting companies and the benefits perceived by users in the use of outsourced information systems (Narayanan *et al.*, 2011). In this context, this research aimed to analyze the efficiency of management practices that govern IT projects, represented by the decision to adopt project management methodologies and by the internal controls over suppliers and users, reflected in the perceived effectiveness of outsourced information systems. The research question is: What are the effects of processes involving project suppliers, user requests and the adoption of project management methodologies on the perceived effectiveness of technological applications?

The article is structured by starting with this introductory chapter, and then Chapter 2 discusses the theoretical framework of project management with IT outsourcing, also presenting the study's hypotheses. Chapter 3 presents the methodological aspects, also detailing information about the measuring instrument, the

sample and some descriptive statistics. Chapter 4 presents the analysis of the results, which are discussed in Chapter 5. The final chapter presents the conclusions, with the study limitations and research suggestions.

2 SUCCESS FACTORS IN PROJECT MANAGEMENT

Project management is composed of processes developed in organizations that result in a unique product or service. The main challenge in project management is to achieve the client's goals and expectations as to the expected delivery of the project, mainly in terms of scope, deadline, costs and quality (Allen *et al.*, 2015).

The adoption of project management processes and methodologies is not a recent behavior in organizations. It is known that the organization and dissemination of practices that assist managers in completing projects occurred in the mid-twentieth century through the development of innovations in American military institutions. One of the first projects to address the organization and planning principles that influenced the development of modern project management practices was the Manhattan Project, which culminated in the development of the atomic bomb in the mid-1940s.

Project management is seen as the best form of planning and conducting tasks oriented to the development of a product, or service, and which would not be carried out optimally by traditional management methods: for example, an execution delegated to several functional departments within an organization (Avots, 1970). One of the principles that guide the conduct of projects is the full attribution of responsibility for project success by an individual or organizational department dedicated to project execution, in this case, the project office (Avots, 1970).

There are several ways to define project success: from the point of view of product or service performance as to reaching the established requirements and achieving stakeholder satisfaction or in a way more frequent in the literature and that evaluates the project deliveries using criteria that involve planned deadline, requirements and budget (Cheng *et al.*, 2007; Narayanan *et al.*, 2011).

It is known that several factors can have a fundamental role in project success, such as: adequate communication between stakeholders during the project life cycle, control of costs inherent to the execution of activities, and the precise delivery of the

planned scope (Gingnell *et al.*, 2014). Client involvement can also have an impact on project results through communication channels and avoiding problems of variations, or deviations, in the expected results of projects (Ramasubbu *et al.*, 2015).

In addition, the skills of managers of teams that work on the project also influence the project success (Zwikael, 2009); according to Cheng *et al.* (2007), the professionals' competence in carrying out tasks contributes to superior outcomes in delivering results. It is known that staff turnover in project teams also tends to negatively affect the continuity of activities and the outcomes (Cheng *et al.*, 2007).

This diversity of factors that can influence project success can be categorized into seven categories: project-related factors; company and work-related factors; customer-related factors; project management factors; design team-related factors; contractor-related factors; and project manager-related factors (Gunduz & Almuajebh, 2020).

Some studies seek to assess whether the outsourcing of activities influences project results. It is known that supplier involvement in task planning influences product and innovation development (Najafi Tavani *et al.*, 2013).

3 INFORMATION TECHNOLOGY OUTSOURCING AND PROJECT MANAGEMENT

IT outsourcing originated in the 1960s with activities that included the supply of hardware, since computers were large, expensive and required controlled environments. Lacity *et al.* (2008) had already predicted that IT outsourcing would continue to grow in companies and recent studies show that this resource continues to be observed as a practice in organizations and the number of agreements corresponds to more than half of the outsourcing contracts in the world (Gorla & Bik, 2010).

The benefits of a successful IT outsourcing strategy may include reducing the costs of the contracted activities, the possibility of the contracting company focusing on its strategic activities, increased flexibility in procuring resources, skills and innovations (Lacity *et al.*, 2008). In addition, they enable the company to find ways to access external resources, specialized knowledge, industry best practices and learning opportunities (Lee *et al.*, 2019).

Project success is also directly associated with success in carrying out tasks in the

scope by the responsible teams and that can be outsourced (Gingnell *et al.*, 2014). Thus, it is understood that the effectiveness of information systems arising from outsourced projects may depend directly on supplier capacity management (O'Brien & Fischer, 2000; Perez & Zwicker, 2005; Gorla & Bik, 2010), since the quality of project deliveries is a result of the efforts and skills of the executors in carrying out the activities (Zwikael, 2009). The supplier capacity is defined as the maximum productivity result of its resources mobilized to the project, such as equipment and staff (O'Brien & Fischer, 2000). Therefore, the following hypothesis is conceived:

H1: Controlling supplier capacity positively influences the effectiveness of outsourced information systems

Procurement management is included as a complementary aspect in project quality (Zwikael, 2009), stakeholder satisfaction and project success (Chou & Yang, 2012). The contracting organization's procurement management processes can be related to the contracted suppliers' capacity management: for example, conducting deals that coordinate the selection and procurement of suppliers to provide the skills adequate to future demands (Lacity *et al.*, 2008; Perez & Zwicker, 2005; Gorla & Bik, 2010) and to increase task productivity during the project life cycle (Allen, Herring *et al.*, 2015). Based on these propositions, the following hypothesis is conceived:

H2: The procurement contracting processes positively influence the supplier capacity control

One of the practices suggested to project managers is the monitoring of suppliers in the procurement processes (PMI, 2013; Allen *et al*., 2015) as a way of reducing any uncertainties associated with the execution of outsourced processes (Mani & Barua, 2015). Implementing governance practices in the relationship with suppliers with the inclusion of monitoring of outsourcing through performance assessments, contracts with incentives and service level agreements that establish penalties for the degradation of deliveries are recurrent practices, after supplier contracting processes, in project offices and organizations that have active procurement departments (Lacity *et al.*, 2008; Power *et al.*, 2006; Allen, Herring *et al.*, 2015; Allen, Mclees *et al.*, 2015). In this sense, the following hypothesis is generated:

H3: Procurement contracting processes positively influence the monitoring of

outsourcing

In the search for better results from projects carried out in organizations, management methodologies have been developed that disseminate fundamentals and practices to managers and that amplify the chances of success in projects (Larsen *et al.*, 2006; Chou & Yang, 2012).

Outsourcing information technology projects can result in problems to the contracting organization, such as: degraded quality of services in the organization, loss of control over the knowledge of the contracted activities (Perez & Zwicker, 2005; Gorla & Bik, 2010), among other annoyances.

Among the several recommended actions, procurement monitoring is recommended to managers with tools for selecting suppliers suitable for the jobs, assessing supplier performance, controlling contracts, among other resources (PMI, 2013). Therefore, the following hypothesis is conceived:

H4: The adoption of project management methodologies positively influences the monitoring of outsourcing

Changes in outsourced projects can also turn into problems that demand attention from managers, for example, changes that involve reducing deadlines established in the project planning can reflect on the actions of suppliers, as well as actions to reduce costs can also impact the quality of deliveries (O'Brien & Fischer, 2000; Barthélemy & Quélin, 2006).

Project changes can originate in requests from users that will use the resources and functionality resulting from the project during the project life cycle. In order to achieve the expectations of project requirements and greater stakeholder satisfaction, the project management literature recommends that managers use change control systems (Avots, 1970; Kirsch, 1997; PMI, 2103). Therefore, the following hypothesis is conceived:

H5: The adoption of project management methodologies positively influences the control of project changes by users

In this study, project deviation control is defined as the mechanisms used by managers to regulate the behavior of suppliers, so they fully perform the activities established in their job statements as well as the management processes that involve the

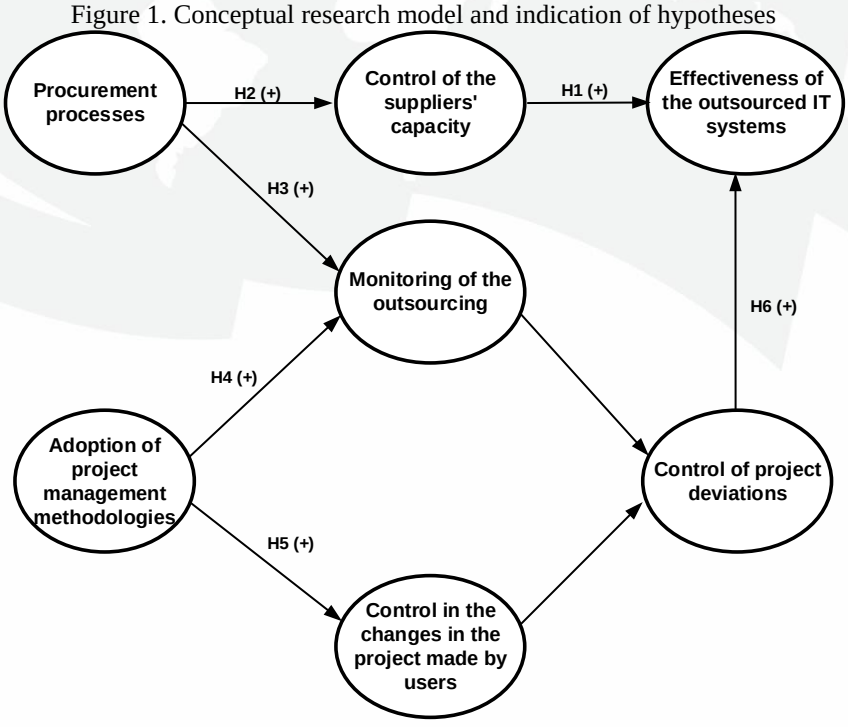
control of project changes requested by users of information systems.

Changing requirements and conducting projects for the implementation of information systems can cause problems in the effectiveness of procured technologies in case the management of stakeholder requests and the execution of tasks by suppliers is not conducted in a way oriented towards the desired objectives (Power *et al.*, 2006). As one of the possibilities to avoid negative effects arising from possible variations during the project life cycle, such as extension of the deadlines for completing tasks, increased costs and loss of effectiveness of the implemented information systems, constant project deviation control is recommended as a valuable tool for managers to manage suppliers contracted in the implementation of projects and as well as to manage requests from users of information systems (Kirsch, 1997). Thus, the sixth hypothesis is conceived:

H6: Controlling project deviations positively influences the effectiveness of outsourced IT systems

After conceiving the research hypotheses to be tested empirically, the conceptual research model with its associations is outlined (Figure 1).

Figure 1. Conceptual research model and indication of hypotheses



Source: Elaborated by the authors.

4 METHODOLOGICAL PROCEDURES

We inform that this single cross-sectional research will be carried out through a survey, of an exploratory nature and will analyze the observed data from a questionnaire designed to collect empirical data.

5 MEASURING INSTRUMENT

The measurement scales used in the research are of the interval type. According to Hair Jr. et al. (2017), an interval scale uses numbers to classify objects or events so that the distance between the numbers is equal. In this work, the Likert scale was adopted as follows: five-point statements about practices adopted by the IT manager in the management of IT service outsourcing.

For the pre-test of the research instrument, the questionnaire was submitted to 10 IT managers who work in the market so they would analyze the applicability in their operating environments and make comments and suggestions on issues that were not concise and clear avoiding ambiguities, dominant issues and misinterpretations. The appendix shows the indicators formulated in conjunction with the referenced authors for preparation of each indicator of the measurement instrument.

We used a database with 8,000 large and medium-sized organizations located in the state of São Paulo. After the end of the electronic survey, the total of questionnaires answered was 358. Of this total, 59 questionnaires were considered discarded because they were incomplete or contained filling errors. Therefore, the sample included data from 299 organizations. The sample included respondents from organizations in 11 cities in the São Paulo Metropolitan Area, most organizations (61.5%) were concentrated in the city of São Paulo. Of the respondents, 107 (35.7%) are in the municipalities that are part of the ABCD region of São Paulo. Other respondents belong to the municipalities of Barueri, Guarulhos and Osasco.

6 DESCRIPTIVE STATISTICS

The companies' revenues were scaled by the ranges proposed by SEBRAE (2010a). Of the respondent organizations, 101 (33.8%) have net revenue above R$ 300 million. Only 11 respondents are allocated to companies that have revenues ranging from

R$ 2.4 to R$ 10 million and represent only 3.7% of the sample. Table 1 illustrates the results by sector.

Table 1. Net revenue of respondent organizations by sector

Sector		Net Revenue					
		A	B	C	D	E	Total
Industry	Absolute Frequency	3	12	27	46	52	140
	% in relation to the sector	2,1	8,6	19,3	32,9	37,1	100,0
	% in relation to the income	27,3	40,0	41,5	50,0	51,5	46,8
	% in relation to the total	1,0	4,0	9,0	15,4	17,4	46,8
Commerce	Absolute Frequency	1	6	5	16	11	39
	% in relation to the sector	2,6	15,4	12,8	41,0	28,2	100,0
	% in relation to the income	9,1	20,0	7,7	17,4	10,9	13,0
	% in relation to the total	0,3	2,0	1,7	5,4	3,7	13,0
Service	Absolute Frequency	7	12	33	30	38	120
	% in relation to the sector	5,8	10,0	27,5	25,0	31,7	100,0
	% in relation to the income	63,6	40,0	50,8	32,6	37,6	40,1
	% in relation to the total	2,3	4,0	11,0	10,0	12,7	40,1
Total	Absolute Frequency	11	30	65	92	101	299
	% in relation to the total	3,7	10,0	21,7	30,8	33,8	100,0

Notes:

A = US$ 1.200.000,01 to US$ 5.000.000,00

B = US$ 5.000.000,01 to US$ 50.000.000,00

C = US$ 50.000.000,01 to US$ 100.000.000,00

D = US$ 100.000.000,01 to US$ 150.000.000,00

E = Above US$ 150.000.000,00

Source: Elaborated by the authors.

Regarding the total number of employees per company, the average, encompassing the three sectors and company sizes, was equal to 3,409 employees. This number is distorted because it encompasses the three sectors of different sizes, which characterizes the sample as having a large plurality of company profiles. Table 2 illustrates this context.

Table 2. Number of employees of the responding organizations

Sector		Number of Employees				
		01 to 99	100 to 499	500 to 999	Above 1000	Total
Industry	Absolute Frequency	3	37	41	59	140
	% in relation to the sector	2,1	26,4	29,3	42,1	
	% in relation to the income	12,5	36,3	65,1	53,6	
	% in relation to the total	1,0	12,4	13,7	19,7	46,8
Commerce	Absolute Frequency	1	18	10	10	39
	% in relation to the sector	2,6	46,2	25,6	25,6	
	% in relation to the income	4,2	17,6	15,9	9,1	
	% in relation to the total	0,3	6,0	3,3	3,3	13,0
Service	Absolute Frequency	20	47	12	41	120
	% in relation to the sector	16,7	39,2	10,0	34,2	
	% in relation to the income	83,3	46,1	19,1	37,3	
	% in relation to the total	6,7	15,7	4,0	13,7	40,1
Total	Absolute Frequency	24	102	63	110	299
	% in relation to the total	8,0	34,1	21,1	36,8	100,0

Source: Elaborated by the authors.

In the industrial sector, the general average of hired employees working in the IT area in relation to the total number of employees in the organization is 4.8% and that of outsourced workers is 2.9%. In the allocation of employees who work exclusively with IS development and/or implementation, the average of hired employees in relation to the total number of IT employees is 8.1% and that of outsourced workers is 1.6%. In the commercial sector, the rates were slightly higher, making it possible to point out that, on average, 5.6% of IT employees are outsourced and, of these, 3.0% are allocated to the organization's IS development and/or implementation.

The service sector is that which outsources the most both in the IT area (12.2%) and in IS development and/or implementation (4.6%). It is possible to state that the number of outsourced employees who work both in the IT area (6.9%) and those allocated exclusively to development and/or implementation (3.1%) is low. This situation presented

in the issue of outsourced workers in development and/or implementation may denote the concern that organizations have in maintaining internal most of their staff in the area, that is, their own resources must concentrate on their essential skills and outsource only those activities that do not have a strategic need.

Regarding the degree of formality in hiring IT services, of the 299 organizations surveyed, 172 (57.5%) use detailed formal contracts with SLA. The sector that adopts SLA contracts the most is the industry, with 82 organizations, followed by the service sector with 70 organizations.

7 ANALYSIS OF RESULTS

For the calculations and validations of the statistical tests, the *SmartPLS v3.0* software was used. The model was estimated by PLS-PM (Partial Least Squares Path Modeling) because it has the advantage of enabling simultaneous estimation of the measurement model (relationship between indicators and latent variables) and of the structural model (relationships between latent variables). The option of using PLS in this study stems from its characteristics, given that it is considered the most appropriate method to be used in studies of an exploratory nature and whose data are less susceptible to deviations from multivariate normality. Additionally, sample size requirements for this method are lower (Hair *et al.*, 2017).

In order to analyze the significance of the loads obtained for the observable variables, we decided to use the bootstrapping technique, which, according to Hair *et al.* (2017), is not based on a single model estimate, but calculates parameter estimates and their confidence intervals based on multiple estimates. In this research, a resampling of 5000 samples was carried out, and all estimates were considered significant.

Tables 3 and 4 present a synthesis of the values of the coefficients of the variables and coefficients between the constructs, estimated by PLS, in order to verify if their values are significantly different from zero and have *p-value* significance values less than 5% for the relationships established in the model.

The *project deviation control* construct was made operational as a second order construct with the indicators of the *monitoring of outsourcing* and *control of project changes by users constructs*, since the authors understand that project deviations can be

caused by these two groups of stakeholders and also for the possibility of analyzing the effects of internal management actions on suppliers and users of information systems.

Table 3. Structural model coefficients – Constructs and Variables

	Loadings	Std. Dev	T-Statistics	p-value
CA1 ← Procurements processes	0,82	0,04	23,30	0,00
CA2 ← Procurements processes	0,84	0,03	31,91	0,00
CA3 ← Procurements processes	0,80	0,03	24,93	0,00
CF1 ← Supplier´s capacity	0,77	0,05	16,12	0,00
CF2 ← Supplier´s capacity	0,91	0,02	51,00	0,00
MO1 ← Outsourcing monitoring	0,85	0,02	44,17	0,00
MO2 ← Outsourcing monitoring	0,74	0,04	17,78	0,00
MO3 ← Outsourcing monitoring	0,66	0,05	12,29	0,00
MC1 ← Change control	0,63	0,05	12,72	0,00
MC2 ← Change control	0,83	0,02	34,33	0,00
DP1 ← Effectiveness of the outsourced IT	0,74	0,05	15,96	0,00
DP2 ← Effectiveness of the outsourced IT	0,77	0,05	17,09	0,00
DP3 ← Effectiveness of the outsourced IT	0,77	0,04	19,04	0,00
DP4 ← Effectiveness of the outsourced IT	0,83	0,03	31,20	0,00
DP5 ← Effectiveness of the outsourced IT	0,72	0,05	14,50	0,00
DP6 ← Effectiveness of the outsourced IT	0,74	0,06	13,06	0,00
DP7 ← Effectiveness of the outsourced IT	0,84	0,03	33,53	0,00
DP8 ← Effectiveness of the outsourced IT	0,85	0,03	26,20	0,00
DP9 ← Effectiveness of the outsourced IT	0,78	0,03	22,39	0,00
DP10 ← Effectiveness of the outsourced IT	0,84	0,03	24,96	0,00

Source: Elaborated by the authors.

Table 4. Structural model coefficients – between constructs

Paths	Loadings	Std. Dev.	T-Statistics	p-value
Supplier's capacity → Effectiveness of the outsourced IT	0,24	0,07	3,34	0,00
Procurements processes → Supplier's capacity	0,60	0,04	13,53	0,00
Procurements processes → Outsourcing Monitoring	0,67	0,05	14,06	0,00
Deviation Control → Effectiveness of the outsourced IT	0,26	0,10	2,64	0,01
Control in the user changes → Deviation Control	0,46	0,02	20,50	0,00
Outsourcing Monitoring → Deviation Control	0,64	0,02	26,72	0,00
Methodologies Adoption → Control in the user changes	0,20	0,07	3,02	0,00
Methodologies Adoption → Outsourcing monitoring	0,09	0,05	1,98	0,05

Source: Elaborated by the authors.

In order to examine the convergent and discriminant validity of the constructs used in the structural model, we performed Confirmatory Factor Analysis (Hair *et al.*, 2017). These results of the factor loads, presented in Table 5 below, enable the analysis of the structural model.

Table 5. Factor loads on the constructs

Indicador da base	Factors	Item	Procurement processes	Supplier's capacity	Outsourcing monitoring	Control in the user changes	Deviation Control	Methodologies Adoption
P02	Procurements processes	CA1	**0,82**	0,44	0,57	0,43	0,56	0,00
P03	Procurements processes	CA2	**0,84**	0,43	0,58	0,39	0,55	-0,05
P04	Procurements processes	CA3	**0,80**	0,59	0,48	0,31	0,45	-0,14
P09	Supplier's capacity	CF1	0,42	**0,77**	0,46	0,29	0,43	-0,06
P19	Supplier's capacity	CF2	0,57	**0,91**	0,43	0,20	0,37	-0,27
P07	Outsourcing monitoring	MO1	0,60	0,46	**0,85**	0,59	**0,82**	0,06
P10	Outsourcing monitoring	MO2	0,53	0,52	**0,74**	0,36	**0,64**	-0,16
P27	Outsourcing monitoring	MO3	0,37	0,17	**0,68**	0,50	**0,66**	0,20
P05	Control in the user changes	CM1	0,23	0,03	0,42	**0,82**	**0,63**	0,34
P06	Control in the user changes	CM2	0,52	0,40	0,64	**0,87**	**0,83**	0,02
P12	Methodologies Adoption	AM1	-0,08	-0,22	0,04	0,20	0,11	**1,00**
R01	Effectiveness of the outsourced IT	DP1	0,42	0,34	0,30	0,21	0,29	-0,08
R02	Effectiveness of the outsourced IT	DP2	0,32	0,19	0,29	0,26	0,31	-0,10
R03	Effectiveness of the outsourced IT	DP3	0,22	0,19	0,29	0,22	0,29	-0,15
R08	Effectiveness of the outsourced IT	DP4	0,42	0,32	0,33	0,23	0,32	-0,13
R09	Effectiveness of the outsourced IT	DP5	0,44	0,32	0,27	0,16	0,25	-0,22
R10	Effectiveness of the outsourced IT	DP6	0,19	0,19	0,20	0,21	0,22	-0,13
R11	Effectiveness of the outsourced IT	DP7	0,38	0,31	0,31	0,25	0,32	-0,21
R12	Effectiveness of the outsourced IT	DP8	0,37	0,34	0,23	0,17	0,23	-0,25
R13	Effectiveness of the outsourced IT	DP9	0,34	0,21	0,31	0,29	0,33	-0,02
R14	Effectiveness of the outsourced IT	DP10	0,36	0,32	0,29	0,24	0,30	-0,22

Source: Elaborated by the authors.

Table 5 shows that most constructs present indicators with high loads in their latent variables, higher than 0.70 and low loads in the other latent variables, which indicates that there is reasonable discriminant validity and convergent validity (Hair *et al.*, 2017). Thus, indicators of the scales that did not obtain discriminant validity between the constructs were excluded from subsequent statistical analyses.

In Table 6, it is possible to observe that the square root of the average variance extracted from the constructs is greater than the correlation between the latent variables

and is an indicator that there is discriminant validity between the constructs (Hair *et al.*, 2017).

Table 6. Discriminant Validity

Factors	Procurements processes	Supplier's capacity	Outsourcing monitoring	Control in the user changes	Deviation Control	Methodologies Adoption	Efficacy of the outsourced IT
Procurements processes	**0,82**						
Supplier's capacity	0,60	**0,84**					
Outsourcing monitoring	0,66	0,51	**0,76**				
Control in the user changes	0,46	0,27	0,64	**0,84**			
Deviation Control	0.64	0.46	0.93	0.87	**0,72**		
Methodologies Adoption	-0,07	-0,22	0,04	0,20	0,11	**1,00**	
Effectiveness of the outsourced IT	0,45	0,35	0,36	0,28	0,37	-0,19	**0,79**

Source: Elaborated by the authors.

According to Hair *et al.* (2017), in addition to examining the loads for each indicator, a main measure used to evaluate the measurement model is the composite reliability of each construct. A reference value used for acceptable reliability is 0.70. In this sense, the measurement model under analysis is validated according to the values shown in Table 7.

Considering the analysis of convergent validity, we used two indicators: the Average Variance Extracted, which must present a value greater than 0.5, and Internal Consistency, with a value greater than 0.70. These indicators are shown in Table 7 (Hair *et al.*, 2017).

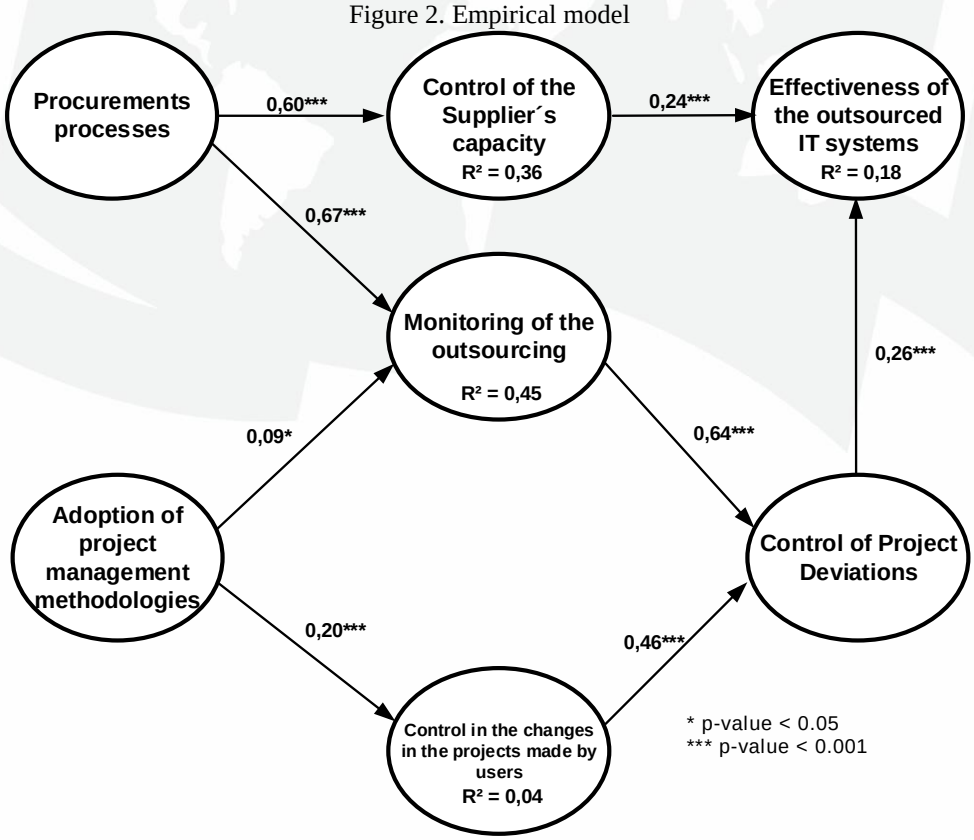
Table 7. Structural Model Indicators

Factors	Average Variance Extracted	Cronbach´s Alpha	Composite Reliability	R^2
Procurement processes	0,67	0,76	0,86	-
Supplier´s capacity	0,71	0,61	0,83	0,36
Outsourcing monitoring	0,58	0,64	0,80	0,45
Control in the user changes	0,71	0,59	0,83	0,04
Deviation Control	0,52	0,77	0,84	1,00
Methodologies Adoption	1,00	1,00	1,00	-
Effectiveness of the outsourced IT	0,63	0,93	0,94	0,18

Source: Elaborated by the authors.

Figure 2 presents the model resulting from the research with the values of the coefficients between constructs with their respective significance and the values of explanatory power of the constructs.

Figure 2. Empirical model



Source: Elaborated by the authors.

The results of this study confirmed that the effectiveness of outsourced information systems depends directly on project deviation control processes and the capacity of suppliers that will be involved in the implementation of these systems.

It is observed that project deviation control and supplier capacity have practically equal influences on the effectiveness of outsourced information systems, since the values of the coefficients resulting from the structural model are similar. These results indicate that managers must validate the skills of contracted suppliers, that is, the managers must guarantee the suitability of external teams that will be involved in the execution of tasks in the project.

The lack of capacity of suppliers can generate costs and problems during the project life cycle and can compromise the viability of the implementation and the performance of the procured technologies. It is understood that trained suppliers can provide users with better quality deliveries due to the knowledge they have in their tasks and reduce the risk of project failures.

This result shows that the supplier's experience and skill in the correct execution of tasks can help achieve the effectiveness of information system projects, such as: complete execution of the planned project scope for complete implementation of the procured technological resources in accordance with the schedule, costs and quality planned by the stakeholders.

The management processes for contracting suppliers also have significant influences on the supplier capacity control and monitoring of outsourcing. These results confirm the performance of the departments responsible for project procurements in terms of the inspection of contracted capacity and contractual governance of suppliers.

That is, the indirect influences of procurement contracting processes on the effectiveness of information systems reinforce the recommendation that project managers conduct efficient processes for selection of suppliers that can fully absorb the demands of information systems projects.

Project deviation control also has significant importance in achieving the effectiveness of outsourced information systems. In this research, project deviation control was represented by the monitoring of outsourcing and the control of changes by users.

It is known that changes during the project can compromise stakeholder satisfaction: for example, in situations where changes in the project deliveries do not meet the planned requirements, mischaracterize the deliveries and frustrate the expectations of customers.

Observing the low influence of the adoption of project management methodologies on their associated constructs in the research model, the results of the study indicate that the processes for monitoring outsourcing and controlling user requests are existing responsibilities in organizations, regardless of the adoption of project management methodologies, presence of offices, or managers, dedicated to conducting the implementation of information systems in organizations.

According to the coefficients of the relationships between the constructs for procurement and for adoption of project management methodologies, it is noted that the procurement processes have a greater influence on the monitoring of outsourcing than the adoption of the methodologies itself, since the values obtained of the coefficients differ by reasonable values.

Therefore, although the methodologies have an important role in guiding the management processes and practices recommended in conducting projects and have worldwide popularity in organizations, the results indicate that the adoption of project management methodologies does not significantly influence the monitoring of outsourcing and control of changes of users.

Finally, based on the validations obtained with the structural model, Table 8 is prepared, with the confirmation of the hypotheses:

Table 8. Hypotheses tests results

Hypothesis	Description	Result
H1	The control on the supplier's capacity positively influence the effectiveness of outsourced IT systems.	**Confirmed**
H2	The procurement processes positively influence the control on supplier's capacity.	**Confirmed**
H3	The procurement processes positively influence the monitoring of outsourcing.	**Confirmed**
H4	The adoption of project management methodologies positively influence the monitoring of outsourcing.	**Confirmed**
H5	The adoption of project management methodologies positively influence the control in the changes in the projects made by the users.	**Confirmed**
H6	The control in project deviation positively influence the effectiveness of outsourced IT systems.	**Confirmed**

Source: Elaborated by the authors.

8 CONCLUSIONS

For decades, project management methodologies have been sets of knowledge that guide managers on management practices that can lead to satisfactory project results. However, the conduct of information systems projects is subject to risks that can increase the difference between the expectations and perceived benefits with the procured resources and lead to user dissatisfaction, among which the risks that concern the suppliers participating in the project.

The study contributes to the information system project and outsourcing management theories in several aspects. First, the study empirically confirms the effect and relevance of managerial practices that monitor supplier capacity as a relevant factor in the effectiveness of outsourced information systems and shows that managers must, in their projects, monitor the skills of suppliers who will work in the tasks assigned to them.

In other words, the research shows that the perceived performance of the procured information systems depends directly on the skills of the suppliers.

The research also shows that practices that manage project changes, whether these changes originate from suppliers or users, contribute to the performance perceived by users on information systems.

Thus, project change control can prevent that the changes may result in deficient deliveries that reduce stakeholder satisfaction: for example, changes that influence the planned specifications, deadlines and costs.

The results suggest that governance practices and project change management policies are resources that can contribute so managers achieve success in the implementation of information systems.

The study also confirms the importance of supplier contracting processes to guide supplier capacity and monitor outsourcing. It is noted that the effectiveness of information systems depends on the initial processes to procure suppliers who will work in the installation of the systems. It is suggested that managers be attentive to the drafting of contracts that should govern the optimal conduction of project activities by their clauses to avoid opportunistic and unwanted behavior by suppliers, among other problems.

In this sense, it is inferred that managers pay attention to standardized procurement contracts with similar clauses for all suppliers, ignoring the specifics of the project, and check whether the contract documents include the nuances and details about the responsibilities of suppliers. Management practices that evaluate the selection of suppliers using multi-criteria decision can also help to contract the best suppliers instead of a decision based only on the prices offered.

The study showed that both practices that involve the control of suppliers' capacities and project deviations contribute with similar impacts on the effectiveness of the procured information systems and should be prioritized in a similar way by stakeholders.

In addition, it is noted that the explanatory power obtained for the effectiveness of outsourced information systems was equal to 18%, which indicates that other variables may contribute to obtain a greater explanatory value for the dependent variable of the study. For example, future studies can assess whether different forms of contract can increase the performance of project deliveries and explore how the effects of different procurement systems can contribute to the effectiveness of information systems projects.

We also observed a low power of explanation for the processes of monitoring outsourcing and controlling users' changes through the adoption of project management methodologies. It is suggested that future researches explore the degree of adoption of project management methodologies in organizations with the aim of assessing how the adoption of management processes and practices occurs, whether partially or completely, guided by the methodologies.

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Some limitations of this research must be pointed out. Although data collection was carried out in organizations throughout Brazil, it was noted that the majority of respondents belong to the state of São Paulo. Therefore, it cannot be stated that the significance and values of the tests performed in this study are constant in organizations located in different Brazilian regions, among other limitations.

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