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Evaluating IT governance practices and business and IT outcomes: A quantitative exploratory study in Brazilian companies

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Abstract

Information technology (IT) governance is an important organizational ability to promote IT-business strategic alignment and IT value delivery to businesses. To implement IT governance, businesses can utilize a set of practices associated with decision-making structures, processes, and relational mechanisms; however, the specific contributions of these different practices remain poorly understood. This paper presents the results of a study that sought to (1) develop a measurement instrument for IT governance practices, and based on this instrument, (2) identify different organizational profiles in terms of IT governance practices, business results, and maturity. Quantitative data were collected from a sample 652 Brazilian companies. Factorial and clusters analyses were applied to develop a measurement instrument and identify the companies' profiles, respectively. IT governance maturity and the achievement of business and IT outcomes were compared. Based on this analysis, this study indicates how businesses can be successful in terms of IT governance practices, and it presents potential deficiencies based on organizations with lower IT and business results.

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Keywords: IT governance practices; business performance and outcomes; IT performance and outcomes.

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1. Introduction

The literature defines information technology governance (ITG) as the specification of decision-making structures, processes, and relational mechanisms for guidance and control. Research uniformly identifies it as an organizational skill of great importance for alignment and organizational value achievement through information technology (IT) [1-3].

However, the development of IT governance remains a challenge to organizations. Research conducted by Information Systems Audit and Control Association (ISACA) with business and IT professionals in Latin America isolated a few core IT governance problems: high costs, low returns, and aggregation value on IT investments [4]. In the Brazilian public organizations context, a 2010 study by the The Federal Court of Accounts of Brazil (TCU) found that 57% of organizations are in the earlier stages of developing IT governance practices [5]. It is verified, therefore, that, in practice, the implementation and achievement of IT governance results still present major challenges, especially for Brazilian and Latin American organizations. Within this context, two research questions become important to gaining a better understanding of the IT governance implementation in Brazil: (1) What are the different profiles of organizations in terms of the maturity of ITG practices along with business and IT results? (2) What characterizes, in terms of ITG maturity, organizations with different IT and business results?

By answering these questions, it may be possible to extend the understanding about differences in ITG maturity for organizations with various business and IT outcomes. This research intends to identify the ITG practices of successful companies as well as the shortcomings of organizations with lower business and IT results.

Given the two research questions, this paper presents the results of a study that sought to (1) develop a measurement instrument for IT governance practices, and based on this instrument, (2) identify different organizational profiles in terms of IT governance practices, business results, and maturity.

This article is organized as follows: Section 2 presents the research methodology, while Section 3 provides the results of this research. Section 4 presents the main conclusions of the work.

2. Methodology

The research was based on quantitative data concerning the maturity of IT governance practices and results achieved by the IT and organization. ITG practices were obtained from the exploratory conducted by De Haes and Van Grembergen [6]. In addition, the study considered IT governance practices reported by Maidin and Arshad [7], Ali and Green [8], Nfuka and Rusu [9], Abu-Musa, [10] and Srimai, Damsaman [11]. In essence, we sought to construct a wide view of the different possibilities for IT governance implementation. These practices were classified according to the IT governance mechanisms proposed by Van Grembergen and De Haes [12] : Decision making structures, processes, and relational mechanisms. Variables regarding IT and business results were obtained from the IT governance assessment proposed by Weill and Ross [2]. Appendix I presents the ITG practices and the variables for measuring IT and business results.

The data were collected from a sample of 652 Brazilian companies. For the organizations studied, a structured questionnaire was submitted to employees in leadership positions. In the questionnaire, respondents assessed the maturity of the IT governance practices (Appendix I) as well as the IT and business results (Appendix I).

The maturity of ITG practices, along with IT and business results, were evaluated using a six-point scale. For questions regarding the maturity levels, we applied the maturity levels proposed by the Capability Maturity Model (CMMI) [13]. The following maturity levels were considered for each IT governance practice: (1) non-existent: the practice is not conducted in the organization; (2) ad hoc: the practice is conducted occasionally, in an ad-hoc fashion; (3) intuitive and repetitive: the practice is not documented, but is repetitively conducted in the organization; (4) implemented and documented: the practice is repetitively conducted and is documented and formally communicated; (5) measured: the performance of the practice is measured on a regular basis; and (6) optimized with continuous improvement: the performance of the practice is measured and improvements are continually implemented. The popularity of CMMI in the IT industry encouraged the choice to use this approach for evaluating ITG practices. Many studies have based maturity on CMMI, including widely-disseminated models and frameworks for IT governance like the Control Objectives for Information and Related Technology (COBIT) [14] and Luftman's strategic alignment model [15].

For the IT and business results, a six-point scale was used to measure respondents' levels of agreement with the items on the questionnaire: (1) strongly disagree, (2) disagree, (3) partially disagree, (4) partially agree, (5) agree, and (6) strongly agree. The data analysis utilized factor analysis and cluster techniques. Factor analysis was applied to promote data reduction regarding ITG practices and results, generating factors representing latent and wide-ranging dimensions to evaluate ITG and organizational results. The factors were generated from the principal components method. In alignment with Hair and Anderson [16], this research conducted Kaiser-Meyer-Olkin's test, Bartlett's sphericity, and Cronbach's alpha to check the adequacy of the data for factor analysis. In order to identify different groups of organizations, cluster analysis was performed using the Ward method. The groups of organizations were analyzed in relation to the factors previously generated. For this purpose, the average of enterprises in each factor were calculated. Afterwards, these averages were compared regarding the full sample averages for each factor.

3. Results

3.1. Samples characterization

The survey obtained a total of 652 respondents from Brazilian companies, including public, private, and mixed capital companies. 470 companies have private capital, 146 were public, and 36 have mixed (public and private) capital. Regarding the number of employees, 30 companies have less than 5 employees, 65 companies have 5-19 employees, 44 companies have 20-49 employees, 134 companies have 50-249 employees, 52 companies have 250-499 employees, and 317 companies have more than 500 employees. Regarding the respondents' profiles, 509 of them have a managerial role within the company; 116 respondents do not have a management function in the company. In terms of the respondents' role in the company's IT sector, 555 work in the IT sector, and 88 do not work in the IT sector.

3.2. Factorial analysis

From the factor analysis, we obtained, six factors that explain 72% of the variance in the data sample (Table 1). Because this variance is more than 60%, this value is shown to be suitable, according to Malhotra and Birks [17].

Regarding the adequacy of the data to the proposed factorial analysis, the KMO index reached 0.891, an amount considered admirable according to Hair and Anderson [16]. The Bartlett's sphericity test confirms the validity indicated by KMO, presenting an index of 3997.182 ($p < 0.0001$). Table 1 illustrates the factors associated with their respective variables.

Table 1. Rotated Component Matrix (Varimax Method)

Practice	F4	F3	F2	F1	F5	F6
IT or institutional performance measurement	**0.617**	0.306	0.217	0.236	0.266	0.084
Service-level agreements (SLA) between IT and areas of the institution	**0.656**	0.376	0.204	0.164	0.199	0.045
Management of budgets and investments or IT investments	**0.689**	0.199	0.204	0.307	0.097	0.063
IT or project portfolio management	**0.693**	0.322	0.238	0.203	0.245	0.034
Project management methodology usage	**0.735**	0.271	0.161	0.239	0.038	0.107
Acquisition and hiring of IT solutions from a third-party	**0.72**	0.262	0.249	0.116	0.03	0.025
Strategic Plan (SP) or Institutional Development Plan (IDP)	**0.755**	0.245	0.145	0.221	0.102	0.136
Information technology strategic plan (ITSP) or IT directive plan	**0.742**	0.258	0.254	0.114	0.086	0.164
Framework for IT governance usage	**0.714**	0.329	0.156	0.128	0.301	0.17
Organizational and corporative governance framework usage	**0.71**	0.337	0.112	0.176	0.291	0.149
Risk management of IT business related	**0.689**	0.398	0.208	0.137	0.31	0.107
Training initiatives and qualifications of employees and leaders in management and IT governance	**0,43**	0.235	0.393	0.208	0.358	0.121

Performance of the steering committee on projects or IT projects	0.395	**0.752**	0.107	0.181	0.147	0.16
Performance of the steering committee on IT architecture	0.367	**0.75**	0.156	0.189	0.187	0.163
Performance of the audit or IT audit committee on administrative council level	0.397	**0.733**	0.099	0.206	0.161	0.098
Performance of specific sectors or committees for governance or IT governance	0.455	**0.702**	0.181	0.169	0.131	0.133
Performance of the steering committee on information security	0.424	**0.726**	0.166	0.171	0.121	0.05
Institutional communication systems	0.377	**0.495**	0.182	0.282	0.265	0.048
Involvement of senior management with IT initiatives	0.369	**0.418**	0.352	0.231	0.285	0.261
Accomplishment of IT actions aligned with the objectives and guidelines of senior management	0.345	0.242	**0.657**	0.217	0.022	0.245
Development of IT actions with strong cost/benefit ratio	0.216	0.084	**0.82**	0.244	0.151	0.177
Development of IT actions with optimized resources to support and attend to activities	0.23	0,144	**0.815**	0.249	0.159	0.119
Development of IT actions of TI contribute effectively to business flexibility	0.218	0,134	**0.82**	0.219	0.114	0.124
Usage of transparency in the management and disclosure of expenses and results	0.166	0,265	0.203	**0.642**	0.027	0.096
Usage of operational efficiency in activities	0.271	0,148	0.271	**0.676**	0.175	0.082
Constant innovation in action	0.225	0.14	0.224	**0.746**	0.217	0.175
Obtaining profit increases in recent years, or increased aggregate value of the shares provided to citizens	0.185	0.139	0.173	**0.69**	0.005	0.127
Cross-training (training IT staff in institutional processes and training employees on IT issues)	0.35	0.394	0.247	0.212	**0.634**	0.088
Rotation of functions among IT employees	0.312	0.243	0.177	0.109	**0.766**	0.138
Direct participation of the IT managers in discussion and in the strategic decision-making of the company	0.152	0.216	0.209	0.256	-0.001	**0.71**
IT leaders have interdisciplinary skills that go beyond IT skills	0,127	0,085	0,229	0,119	0,183	**0,795**

Factor 1: Organizational performance (F1)

This factor represents the latent dimension associated with organizational performance, including the following: the use of transparency in the management and disclosure of costs and results; the usage of operational efficiency in its activities; constant innovation; and obtaining increased profit in recent years, or increased aggregate values of the shares provided to citizens.

Factor 2: IT Performance (F2)

This factor represents the latent dimension associated with IT performance in the organization, including realization of IT actions aligned with the objectives and guidelines of senior management; the development of IT actions with a strong cost/benefit ratio; optimization of IT resources to support and attend to activities; and IT actions contributing effectively to business flexibility.

Factor 3: Structures for IT Governance (F3)

This factor represents the latent dimension associated with IT governance structures used to make decisions about IT. It represents the organization's ability to deal with a set of organizational functions responsible for decisions and results about different areas in IT application. The data obtained shows that the capabilities associated with IT governance structures include the following: performance of the steering committee on IT projects, performance of the steering committee on IT architecture, performance of the IT audit committee, performance of the committee for IT governance, performance of the steering committee on information security, institutional communication systems usage, and involvement of senior management with IT initiatives.

Factor 4: Processes for IT governance (F4)

This factor represents the latent dimension associated with the capability of organizational processes in IT governance, targeted to create systematic approaches addressing decisions and aligning IT activities to organizational demands. According to the data obtained from this research, this capability can be described by organizations' maturity in managing IT portfolios; applying project management methodologies and frameworks for organizational and IT governance; developing and implementing strategic plans; implementing processes for procurement and contracting of IT solutions; and conducting training for employees and leaders in IT governance activities.

Factor 5: Relational mechanisms for IT governance (F5)

This factor represents the latent dimension associated with the capability of organizations to utilize mechanisms that promote a relationship between IT teams and the rest of the organization. The data obtained indicate that this ability can be described by the following variables: cross-training or training IT staff in institutional processes and training employees on IT issues, and rotation of functions among IT employees.

Factor 6: Business knowledge (F6)

This factor represents the latent dimension associated with the knowledge that IT staff has about the business. Thus, the factor is comprised of variables related to the participation of IT senior managers in the strategic decision making of the business and the presence of interdisciplinary skills in IT leaders.

3.3. Cluster analysis

In order to identify the sample's profile, we performed a cluster analysis. From this analysis, the sample was divided into four groups of companies. Three clusters were identified, as indicated in Table 2. For each group, the means and standard deviations in each factor ware calculated. To characterize each cluster, these means and standard deviations were compared with the means and standard deviations of the entire sample (Table 2).

The first cluster (cluster 1) is composed of 220 organizations and is characterized by organizations that have superior performance in IT governance and business by achieving high scores for organizational performance (F1) and IT performance (F2) compared to the overall sample's mean. This cluster also is characterized by a high average use of maturity in ITG practices that ware classified, according to the factorial analysis, in structured for IT governance (F3), processes for IT governance (F4), relational mechanisms for IT governance (F5) and business knowledge (F6). This cluster corresponds to 33.74% of total cases.

The second cluster (cluster 2), composed of 238 organizations, is characterized as underperforming in organizational performance (F1) and IT performance (F2). Other factors—relational mechanisms (F5) and business knowledge (F6)—also showed negative averages, except structures for IT governance (F3) and processes (F4), averaging 4.7591 and 3.8358, respectively.

Table 2. Cluster Analysis Results

	Cluster 1	n = 220	Cluster 2	n = 238	Cluster 3	n = 194	Overall	n = 652
	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D
F1 – Organizational performance	**0.3655**	0.88055	**-0.0154**	0.91698	**-0.3956**	1.07576	**4.5038**	1.001
F2 – IT performance	**0.3867**	0.93113	**-0.0938**	1.06745	**-0.3234**	1.28565	**4.4110**	1.132
F3 – Structures for IT governance	**1.0840**	0.90213	**0.1197**	0.88544	**-1.3761**	0.76111	**3.6751**	1.3029
F4 – Processes	**1.0254**	0.85354	**0.0680**	0.94301	**-1.2463**	0.94709	**3.7678**	1.2863
F5 – Relational mechanisms	**1.1151**	1.03887	**-0.2276**	1.03887	**-0.9853**	1.03887	**3.1940**	1.3758
F6 – Business knowledge	**0.4214**	0.93189	**-0.1632**	1.12648	**-0.2777**	1.2114	**4.6695**	1.1322

The third cluster (cluster 3), composed of 194 organizations, is characterized as underperforming in organizational and IT performance, with -0.3956 for organizational performance (F1) and -0.3234 for IT performance (F2). In these organizations, other factors also had a negative average related to IT practices, such as structures for IT governance (F3), processes (F4), relational mechanisms (F5), and business knowledge (F6).

Regarding the factor organizational performance (F1), cluster 1 has above average indexes while clusters 2 and 3, have below average indexes. The cases of cluster 1 were identified as those with the highest average within the sample studied, meaning 0.3655 points above the overall average. Clusters with lower averages include clusters 2 and 3. Cluster 3 has the worst rates of organizational performance, averaging 4.1082, or -0.3956 points below the overall average. For its part, cluster 2 has a lower average index of 4.4884, but it has a higher average when compared to the cluster 3 average for this factor.

Comparing clusters of factor IT performance (F2), the cases of cluster 1 are 0.3867 points above the overall average (4.4110), with an average of 4.7977. Clusters 2 and 3 are below the overall average. Cluster 2 is 0.0938

points below the overall average, with an average of 4.3172, but it has better rates compared to cluster 3. Cluster 3 has the worst rates in IT performance, 4.0876, falling 0.3234 points below average. From these data, it can be concluded that the cases of cluster 1 maintain the highest rates in IT performance. Cluster 2 has lower rates, but they are better than cluster 3, which has the worst record in IT performance.

Considering the factor structures for IT governance (F3), the cases in cluster 1 are characterized as those obtaining the highest rates for this factor, with an average of 4.7591, or 1.084 points above average (3.6751). Cluster 2 also obtained good rates for factor F1, but it presents a lower average than cluster 1; in other words, it is 0.1197 points above average, presenting an average of 2.2990, or 1.3761 points below the overall average. From the sample studied, we can conclude that cluster 1 showed the highest rates in structures for IT governance, cluster 2 had good performance, and cluster 3 included the cases with the worst performance.

When comparing the cases of factor processes (F4), organizations belonging to cluster 1 had high rates on processes, achieving an average of 4.7932, or 1.0254 points above the overall average (3.7678). Organizations belonging to cluster 2 also had good rates on these processes, but they had lower averages in comparison with cluster 1, with an average of 3.8358. However, the cases that have the lowest averages are -1.2463 points below the overall average, meaning that cluster 3 presents an average of 2.5215. According to the sample studied, it can be concluded that the cases maintaining the highest rates in processes are from cluster 1, and those maintaining the worst rates are from cluster 3.

While comparing the averages of the factor relational mechanisms (F5), the cases of cluster 1 have the highest rates. These cases have an average of 4.3091, or 1.1151 points above the overall average (3.1940). It may be noted that clusters 2 and 3 fall below the average. Cluster 2 has an average of 2.9664, or 0.2276 points below the average. However, the third cluster has an average of 2.2087, or 0.9853 points below the average (1.7908). From these data, it can be concluded that the cases of cluster 1 have high rates in relational mechanisms. Among the lowest rates, clusters 2 and 3 have the lowest levels on relational mechanisms. Cluster 2 includes cases with low rates, but it has higher rates than those of cluster 3, which in turn, contains the worst cases.

Furthermore, in the business knowledge factor (F6), cluster 1 cases are characterized as those obtaining the highest indexes, showing an average of 5.0909, meaning that they are 0.4214 points above the overall average (4.6695). On the other hand, the cases that have averages below the overall average come from clusters 2 and 3. The cases of cluster 2 obtain an average of 4.5063, or 0.1632 points below the average. Cluster 3 had an average of 4.3918, the lowest index within the sample surveyed. It can be concluded that cluster 3 has the lowest rates in the business knowledge factor; cluster 2 also has low rates, but it has higher-than-average scores when compared to cluster 3; and finally, cluster 1 has the highest rates for this factor within the research sample.

4. Conclusion

The results obtained suggest that business knowledge and relational mechanisms are central components to superior IT and business performance. This conclusion is supported by the cluster with superior performances (cluster 1) in which relational mechanisms and business knowledge score above the sample's average. Processes and structures for IT governance, on the other hand, do not necessarily lead to superior performance. This finding is apparent in cluster 2, where, despite superior levels of maturity in processes and structures, there is not superior performance in IT or business. Therefore, having positive results for these two mechanisms does not necessarily imply success in business or IT performance.

In alignment with previous studies [23], our findings provide further evidence regarding the importance of relational mechanisms in promoting the alignment between IT and business, including practices that promote synergy between senior management, IT, and other organizational areas. Business strategy should be aligned with IT decision making, mixing staff skills, both in business and IT. IT decisions made by managers affect the entire company; if IT governance is well-planned, it provides a clear and transparent decision-making process, resulting in consistent and desirable behavior and organizational profits [12, 18]. This research suggests that factor relational mechanisms (F5) and business knowledge (F6) are crucial to providing satisfactory organizational and IT performance, as can be seen from the clusters.

Organizations' poor development in IT governance stems from a lack of communication and synergy to encourage the proper functioning of processes and structures. Therefore, promoting relational mechanisms can be

one of the first steps to developing appropriate IT governance in organizations, as they are easier to implement [2], as can be seen in cluster 3 results.

The development of an assessment tool to measure IT governance capacity and results can contribute in two ways. Firstly, the instrument can serve as an important tool for organizations in evaluation processes involving IT governance structures and relational mechanisms, informing organizational and IT actions. Secondly, from the academic point of view, the assessment tool assists in developing an explanatory model of IT governance and business performance results by considering the correlations among capacities in processes, structures, and relational mechanisms.

4.1. Future works

This research was conducted in the Brazilian context. Therefore, future studies could apply this research to other regions or countries for comparison. Confirmatory research also could be conducted on the factors identified in the current study.

As the factor analysis generated an assessment tool of IT governance, in the future, this tool could be applied in order to develop theoretical results for IT governance models. Moreover, the profiles that were identified with cluster analysis can provide support to formulate hypotheses regarding the effects of IT governance practices, hypotheses that can be tested in subsequent work.

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Appendix A. IT Governance Practices

Practice	Empirical Results	References
IT Steering committee	No significant results	[7]
	Negative results or low effectiveness	[8]
	Positive results	[19]
	No significant results	[20]
	Positive results	[21]
IT Strategic committee	No significant results	[7]
	Positive results	[8]
	Positive results	[21]
	No significant results	[20]
IT architecture committee	No significant results	[21]
Positioning of the CIO on the executive committee	Positive results	[21]
Presence of IT audit committee at senior management	No significant results	[21]
IT governance unit	No significant results	[21]
Involvement and support of senior management	Positive results	[9]
Consolidating structures to ensure IT responsiveness and responsibilities	Positive results	[9]
Performance measurement system	Positive results	[7]
	No significant results	[8]

	Positive results	[11]
IT strategic planning	Positive results	[10]
	Positive results	[21]
IT cost management	Positive results	[21]
Reservation charge arrangements	Positive results	[21]
Mechanisms of self-assessment in IT governance	Low effectiveness	[21]
Knowledge management for IT governance	No significant results	[21]
IT portfolio management	Positive results	[21]
Governance projects	Positive results	[21]
Service-level agreements	No significant results	[21]
Defining IT strategy and alignment with organizational strategies	Positive results	[9]
Enterprise communications systems	Positive results	[7]
	Positive results	[20]
	Positive results	[8]
Policies and practices of communication	Positive results	[19]
CIO reports to the CEO	Positive results	[21]
Co-location	No significant results	[21]
Cross-training	No significant results	[21]
Good examples from senior management	Positive results	[21]
Informal meetings between IT executive and senior managers	Positive results	[21]
IT expertise in senior management	Negative results or low effectiveness	[21]
Awareness campaigns of IT governance	No significant results	[21]
	Positive results	[22]
Job rotation	Negative results or low effectiveness	[21]
IT leadership understands business strategies and IT contributions, bringing them to the attention of the leader	Positive results	[9]
Encouraging communication between IT and business	Positive results	[9]
Training in IT governance	Positive results	[9]

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