IT Governance Practices for Electric Utilities: Insights from Brazil and Europe

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ABSTRACT

We propose a framework of 14 IT governance practices tailored for the electric utilities sector. They were selected and ranked as "essential", "important", or "good" by top executives and IT staff from two multi-billion dollar companies – one in Brazil and another in Europe – from a generic set of 83 collected in the literature and in the field. Our framework addresses a need of electric utilities for which specific guidance was lacking. We have also uncovered a significant impact of social issues in IT governance, whose depth seems to be missing in the current research. As a byproduct of our work, the larger generic framework from which we have departed and the tailoring method that we have proposed can be used to customize the generic framework to different industries.

TYPE OF PAPER AND KEYWORDS

Full paper: *IT governance; best practices; ranking; socio-technical; electric utility; Brazil; Europe*

1 INTRODUCTION

By adopting best practices, companies with good IT governance can expect an increase of at least 10% in market value [33]. However, selecting and adopting the best practices for a given company or industry is not simple. Surprisingly, one of the first roadblocks is the absence of a unique and broadly accepted definition for IT governance. During the last decade, different authors have proposed diverse views on the subject. COBIT [12], one of the most cited frameworks, mainly focuses on processes to control the IT function. Other works focus more on the distribution of decision-making rights and responsibilities to govern the IT function [7]. Once a suitable definition is agreed upon, the selection of the practices to be adopted must take into consideration factors such as the target industry,

the market of operations, the style of management, and the organizational and operational characteristics of IT. Sambamurthy and Zmud [30] point to the determinant role of the corporate context, discussing the influence of aspects such as corporate governance, economies of scope, and absorptive capacity.

We aim to address a gap in the literature in what concerns IT governance in the electric utilities sector, namely the selection and ranking of best practices for this specific context. Regulation and competition in this industry are relatively stable, with sparse changes in the external environment. Electric utilities depend heavily on IT infrastructures and services that are complex and expensive to operate. If misaligned with business goals, this can be a major source of waste. However, traceability between business and IT is notoriously difficult. Some companies rely on

outsourcing contracts to keep the IT infrastructure operating at, hopefully, acceptable levels, but specific guidance for IT governance in this sector is needed.

In order to minimize this gap, our investigation looked into the IT Governance needs and practices of electric energy utilities in Europe and in Brazil to come up with a first set of fourteen "IT Governance best practices" for this industry, which were distilled from a much larger pool of eighty-three. The work reported here details, enhances, and expands the contents of a previous paper [20], namely it discusses the process of building and validating a generic framework of IT governance practices and its adaptation to a specific industry. The role of the social aspects of governance is more elaborated, as are the contributions and limitations.

Preliminary validation efforts provide evidence that the work reflects the industry's state-of-the-practice. Evidence is in the form of face validity perceptions of IT professionals and executives from two electric utilities with multi-billion dollar yearly turnover, one in Europe and another in Brazil, which contributed directly for the selection of the practices.

This paper is organized as follows: in the next section we provide a brief literature review about the key aspects of IT governance underlying this paper. In section 3 we describe a method to construct frameworks of IT governance practices, both generic and tailored to specific sectors, after which, in sections 4 and 5, we present a generic framework of IT governance practices and its tailoring to electric utilities in Brazil and Europe. In section 6 the practices are distilled into a more manageable and relevant set, distributed across three tiers: essential, important, and good, and, in the following section, we discuss the relevance of social aspects in IT governance. In section 8 we address the validation of our work, after which we present our conclusions with a mention to contributions, limitations, and future work.

2 LITERATURE REVIEW

IT governance is addressed from different perspectives by academics and practitioners. One of its major goals – the alignment of business and IT – has been the object of a classic debate, in 1990s, led by Henderson and Venkatraman [10]. Then, Sambamurthy and Zmud [30] drew the attention to patterns of decision-making authority for IT activities in companies, including IT infrastructure, IT use, and project management. They suggested that factors such as firm size, economies of scope, and IT knowledge influence three IT governance modes: centralized (corporate IT has authority for all

IT activities), decentralized (divisional IT and line management assume authority), and federated (corporate IT and the business units share authority). Expanding on this approach, Weill and Ross [33] see IT governance as "specifying the decision rights and accountability framework to encourage desirable behavior in the use of IT". Although this work identified best IT arrangements, the authors acknowledge that companies with outstanding results deviate to some extent from the identified patterns. Later, Xue and Boulton [35] argued that allocation of decisions rights is only part of IT governance in the IT investment decision processes. For the IT Governance Institute, governance "ensures that enterprise objectives are achieved by evaluating stakeholder needs, conditions, and options; setting direction through prioritization and decision making; and monitoring performance, compliance, and progress against agreed-on direction and objectives", as stated in COBIT [12]. Due to its complexity, however, COBIT has been mostly used by large companies, which tailor its recommendations to their specific contexts with the help of consultants [8]. For instance, for a Swedish electric utility with a reduced in-house IT team and where most of its IT activities are outsourced, Simonsson and Hultgren [31] pointed out that there is only a small collection of COBIT processes in place, namely, those related to planning, quality, and risk management.

According to Grembergen and Haes [7], the definition of decision-making structures and the use of control processes are not enough for effective IT governance. They posit that IT governance consists of a mix of structures, processes, and relational mechanisms. In their view, these mechanisms are necessary to intensify the relationships and knowledge sharing between business and IT. They include user engagement in software development, IT training for executives, relationship management, and other liaison activities. In this sense, Peterson [26] argues that a relational capability is achieved by alliances among corporate executives, IT management, and business management. Still on the topic of "people issues", Reich and Benbasat [29] investigated how several social factors interfered on the social dimension of IT-business alignment, which is defined as "the state in which business and IT executives understand and are committed to the business and IT mission, objectives and plans". The alignment between people and technology in IT governance has also received contributions from other fields, such as social capital analysis [9], social contracts [2], psychology, and sociology [1].

3 BUILDING A FRAMEWORK OF IT GOVERNANCE PRACTICES

We formulate the research question (RQ) this paper addresses as: "Does the identified set of practices address the IT governance issues at electric utilities effectively and efficiently?"

We assume this question to be answered affirmatively if the stakeholders from electric utilities declare they are satisfied that the specified practices will help them address IT governance issues successfully in a cost-effective manner. Since work on eliciting best IT governance practices for electric utilities is mutating and on-going, and since this paper considers answers from professionals and executives of two electric utilities only, the answer to the RQ provided here must be formally considered preliminary and restricted to the context of the two consulted utilities. On the other hand, even though preliminary, the result suggests an answer with greater confidence can be obtained with further statistical work using a longer observation interval – to collect impact results of selected practices – and input from a larger number of contributing utilities.

In what follows, we describe a method to support the collection, analysis, selection, and comparison of IT governance practices and their consolidation into coherent frameworks, both general and for specific industries. The method was used to create a general framework of IT governance practices that later became the starting point for customization by an electric utility from Brazil and another from Europe.

We define a generic framework of IT governance practices as a collection of recommendations (also known as "best practices" in the literature) for action by corporate professionals to improve IT contribution to a company's business results in general. Correspondingly, we define a specific framework of IT governance practices as the collection of recommendations specially tailored for use by a company in a specific industry – such as that of electric utilities. Notice that a specific IT governance best practice may be identical to a more general practice; or it may result from adjustment of an already existing generic practice; or it even may be defined and inserted into the specific framework anew.

A generic framework may, thus, be obtained by compiling IT governance recommended or "best" practices amassed from multiple sources. Generic (i.e., industry-independent) practices may be gathered from specialized technical literature on IT governance, both from the industry at large and the academia, and recommendations from IT governance practitioners (consultants and companies) in the field.

To proceed with the customization of a framework to a specific industry, additional (if any) practices adopted by the specific industry are elicited from documents and interviews with experts (both executives and technicians) from the industry of interest in the form of face validity perceptions. Although the framework devised here is used in the next section to select and compare IT governance practices at companies in the electric utility industry in Brazil and Europe, it may be applicable to other countries or industries as well, provided their industry-specific practices are properly revised, substituted or adjusted.

The framework – be it generic or specific – may be presented in the form of an unstructured list of collected practices. The list may fill out a table whose entries are the gathered practices and the associated references to their sources, for instance (as done in this paper); or, for more clarity and ease of analysis, as a structured set of taxonomic classes of IT governance practices (as it is also done here). Still, an ordered (according to some preference or priority scheme) or a more compact representation of the framework may result from the analysis of its contents by professionals of a company in a given industry. Major IT governance stakeholders from this company may rank and even discard listed practices in the framework influenced by the characteristics or according to the importance the practices may have to the priorities and requirements of the social, environmental, legal, and market contexts they operate in. Such a compaction and ranking of the proposed framework produces a selection of "key practices" for that given company (or industry). The key practices for electric utilities are obtained in the next section, when stakeholders analyze the listed / classified practices by picking and ranking them from the presented framework. Ranking was carried out according to the stakeholders' perception of the importance of each practice for their in-house, company-wide IT governance inner workings or policies.

An IT governance practices framework is built following the methodological steps in Figure 1.

It is important to notice that some of the steps need not be sequential (some of them may be taken simultaneously) nor be taken in the order they appear. The validated set of key IT governance practices for a given industry may then be used for benchmarking internal practices or, if the selection applies to given companies, for comparison of IT governance requirements, needs or approaches. The selection of key IT governance practices we arrive at in this paper serves to illustrate the proposed method and framework, and, more importantly, to benchmark or

Steps i) to v) produce a generic framework of practices:

i) Compile a list of IT governance practices from the technical literature from industry in general;

ii) Add IT governance practices collected from academic literature to the above list;

iii) Complement the list in i) with practices suggested by consultants and professionals from companies engaged in IT governance;

iv) Parse the resulting list for semantically equivalent practices but with different syntaxes (only one of these is to be left in the parsed list);

v) If required, organize listed practices into classes according to selected IT governance dimensions.

Steps vi) to vii) customize the practice set to a specific industry:

vi) Consult with key stakeholders from the industry of interest to specify additional practices or to evaluate the importance (rank order) of each listed or classified generic practice for their industry or company (materials such as scripts or questionnaires for interviews, briefings or presentations may have to be prepared in advance to support consultation). Consolidate results from step vi) into an ordered set of "key IT governance practices" for a company or industry of interest. Consolidated ordering may be achieved through the "Delphi Method" [18]. Using this approach, the stakeholders rank practices and justify their rankings in writing, anonymously. The results are then shown to all involved, giving them the opportunity to revise their rankings. Knowing other stakeholders' rankings and justifications tends to reduce discrepancies among those of each individual. One alternative to the Delphi ranking method is to attribute weights to individual stakeholders' opinions (according to their experience or company position, for instance) and have a weighted sum or average of the produced ranks, as indicated in Equation 1.

$$(1) \quad rank_{overall}^{P_i} = \sum_{\forall stakeholder} w_{stakeholder} * rank_{stakeholder}^{P_i}$$

Where:

$rank_{overall}^{P_i}$ is the overall rank of Practice Pi (i=1,2, …, N) included in the framework;

$w_{stakeholder}$ is the weight attributed to stakeholder;

$rank_{stakeholder}^{P_i}$ is this stakeholder's rank for Pi.

We assume that each individual weight is such that:

$0 \leq w_{stakeholder} < 1$ and $\sum_{\forall stakeholder} w_{stakeholder} = 1$.

Without loss of generality, this paper uses Equation 1 with equal weights.

vii) Validate consolidated selection of "key practices" with major stakeholders at companies or industries of interest. Triangulation [14], using specialized literature, corporate documentation, and the opinions of executives in form of face validity, enhances the validation efforts, increasing the confidence on the final consolidated data – in this case, the set of specific key IT governance practices.

Figure 1. Method to build an IT governance practices framework

simply to analyze, compare, and gain insight into the IT service provisioning structures and approaches adopted by different companies.

Next, we will illustrate the application of steps i) to v) to produce a generic framework of IT governance practices. Then, steps vi) to vii) are carried out for the electric utility industry in Brazil and Europe.

4 A GENERIC FRAMEWORK OF IT GOVERNANCE PRACTICES

For steps i) and ii), besides the general academic literature review [25]; [7]; [10]; [29]; [6]; [15]; [32]; [19], we included information from the industry framework COBIT [11] and that of MIT [33]. For iii), we collected recommendations from documents of

Table 1: Generic "best" practices for IT governance (73 in total)

ID	Practice	Source (industry)	Source (Academia)
Pr1	Adopt recommendations of best practices from guides of IT governance (such as COBIT); of IT service management (such as ITIL); and of project management (such as PMBOK).	[22]	
Pr2	Align IT strategies and objectives to those of the corporation.	[11] [33]	[10]
Pr3	Assign experts on projects' topic and allocate enough time for their participation.		[15]
Pr4	Automate monitoring so that IT is able to evaluate itself according to selected performance measures, the efficiency of internal control systems, and the status of the evolution of activities.	[11]	
Pr5	Avoid annual changes in the IT governance structure.	[33]	
Pr6	Be SOX compliant.	[11]	
Pr7	Centralize strategic decisions on architecture, outsourcing, application certification, investments, and technological infrastructure in the IT Management Team.	[11] [27]	
Pr8	CEO supports and works closely with CIO, harmonizing urgent business and IT matters.	[11]	[6] [29] [5]
Pr9	CIO plays technical, business, and leadership roles comfortably.		[25] [28]
Pr10	CIO sits in the corporate board.	[11]	[25] [29]
Pr11	Coach top management to increase knowledge on IT potential - workshops and frequent communication are needed to increase shared knowledge on the use of IT.		[7] [25]
Pr12	Communicate IT governance actions, goals and objectives to people at all levels and throughout the company, ensuring that they are understood and have clear value proposition to all stakeholders.	[11]	[15]
Pr13	Create a channel for frequent and open communication between the IT department and its users.	[11] [33]	[11]
Pr14	Decentralize decisions on applications to the IT function at business units.	[27]	
Pr15	Reduce risk by appointing a manager of relationships with IT providers; thus enabling a better allocation of resources, the identification of alternative suppliers or even the acquisition of some level of control in	[27]	

	those companies.		
Pr16	Define clear IT performance indicators trying to link them to business activities.	[27]	[32]
Pr17	Develop an explicit process with measures to evaluate return x risk level as well as failure / acceptance rate of the innovative project portfolio.	[11]	
Pr18	Develop and apply control practices over IT assets that reduce complexity and promote transparency, learning, and flexibility.	[11]	
Pr19	Do not separate the Corporate IT infrastructure from the infrastructure that supports operations or production.	[11]	
Pr20	Embed clear responsibilities for IT control and risk management within the organization, balancing disciplinary actions and rewards, enabling quick and professional responses to IT governance issues.	[11]	
Pr21	Ensure that business and IT executives share knowledge of their respective domains.		[6] [10] [19] [25] [29]
Pr22	Ensure that efficient and reliable IT services are consistently offered to user departments, with better cost-benefit ratios than the market's.	[22]	
Pr23	Ensure that IT and business collaborators are made responsible and credited jointly for the value IT adds to the business.	[3] [33]	
Pr24	Ensure that IT staff establishes and disseminates continuing care in IT usage and evolution, in maintaining alignment between IT and business interests, and in learning new skill for future utility.		[21]
Pr25	Ensure that IT staff clearly understands IT demands and expectations of executives from other areas, so that they may take required actions and grasp the implications to the company.	[11]	
Pr26	Ensure that IT users trust the IT staff's work quality and efficiency.	[22]	[32]
Pr27	Ensure that risk analysis is part of the strategic planning process and take into account vulnerabilities of the IT infrastructure and IT intangible asset exposure.	[11]	
Pr28	Ensure that the CIO and IT staff get involved in the definition of IT strategic metrics and useful performance measures.	[11]	
Pr29	Ensure that the CIO has a strong personality and has the ability to circumvent or surpass difficulties.	[27]	
Pr30	Ensure that the CIO has interest and is engaged in measuring IT performance and its relations to other areas.	[11]	
Pr31	Ensure that the CIO participates in the development of the corporate business plan and that it is made available to the IT department.		[25]

Pr32	Ensure that the corporate board trusts the CIO and the IT staff.	[22]	[32]
Pr33	Ensure that the IT department always provides creative ideas for the strategic usage of IT.		[32]
Pr34	Ensure that the IT department is able to absorb (new) technology efficiently.		[32]
Pr35	Ensure that the IT department responds to users' requests quickly.		[32]
Pr36	Ensure that top management brokers negotiations with client areas to define applications and infrastructure.	[3] [27] [33]	
Pr37	Ensure that top management promotes strategic usage of IT for all users.	[3]	[32]
Pr38	Ensure that users participate in the development of the IT strategic plan. This plan must include a set of corporate objectives for the IT department.	[3]	[6]
Pr39	Ensure that the CIO possesses the skills to manage relationships with stakeholders at various corporate levels.	[3]	[10]
Pr40	Establish adequate change control.		[15]
Pr41	Establish an IT Audit Committee to identify, evaluate, prioritize, and manage risks.	[11]	
Pr42	Establish an IT Balanced Scorecard, approved by stakeholders, to evaluate IT performance.	[11] [22]	
Pr43	Establish an IT Steering Committee at executive level – composed of the CIO, key advisors, and other business executives – to assist the executive management in the delivery of IT strategy.	[11] [33]	
Pr44	Establish an IT Strategic Committee at board level – composed of board members and (specialist) non-board members – to advise the board and management on defining IT strategy (this committee focuses on current and future IT issues).	[3]	[7]
Pr45	Establish an IT Supervisory Committee to oversee outsourcing.	[27]	
Pr46	Evaluate performance of senior management with respect to ongoing strategies and whether clear and strong messages about these strategies are being sent and understood throughout the company.	[3] [11]	
Pr47	Evaluate the scope and quality of management regarding the actual monitoring of risks and IT controls.	[11]	
Pr48	Hire IT professionals with technical expertise and knowledge of the company's business.		[25]
Pr49	Identify "quick win" options to show results and facilitate acceptance for new projects.	[27]	
Pr50	Identify IT roles within the organization to solve different IT expectations. Evaluate expectations in terms of value delivery, service level, level of		[25]

	developed applications, performance, reputation, and user and top executive relations.		
Pr51	Institute control practices that avoid control and supervision breakdowns and thus increase efficiency and optimal usage of resources and, in addition, increase IT process efficiency.	[11]	
Pr52	Integrate and promote continuous interoperability of the most complex IT processes (problem, change and configuration management).	[11]	
Pr53	Integrate IT and company plans, synchronize planned activities and time schedules, and engage top management.		[6] [32]
Pr54	Integrate IT governance actions into those of corporate governance.	[11]	
Pr55	Ensure IT governance concepts are understood by a growing number of corporate executives.	[22]	[25]
Pr56	Ensure that IT management is able to sustain the motivation and commitment of the teams.		[15]
Pr57	Leverage IT by ensuring that IT staff manages relations with business units.	[3] [11]	[7]
Pr58	Maintain a growing client, product, market, and process knowledge base.	[11]	
Pr59	Monitor how management allocates IT resources to achieve strategic goals.	[3] [11]	
Pr60	Negotiate the IT budget between the IT function and the business; allow for flexibility to alter budget to exploit opportunities.	[33]	[25]
Pr61	Pay particular attention to failures and weaknesses of IT controls and to their real and potential impact. Also consider when management should act immediately to address these issues and when additional monitoring will be required.	[11]	
Pr62	Present IT issues clearly to executives from other areas so that they may have an adequate perception of their benefits and impact.	[11] [33]	
Pr63	Prioritize projects using criteria and common sense (this will also help handle technology "fads").		[29]
Pr64	Choose Project managers for their technical and interpersonal skills.		[15]
Pr65	Promote cost transparency and reverse charging to increase perception of IT value.	[27]	
Pr66	Properly specify success requirements and criteria.	[22]	[15]
Pr67	Provide an infrastructure that eases creation and sharing of business information and that is flexible and capable of being integrated and maintained; functional, cost-efficient, available whenever needed, secure and fault-tolerant; capable of extending, maintaining and managing legacy systems and new applications; compatible with standard and re-usable components and modular applications.	[11]	

Pr68	Specify and monitor the work for internal audits with direct communication channels to the CEO and IT Audit Committee and eventually, to independent, external auditors.	[11]	
Pr69	Specify the scope and the head of the IT Audit Committee. Ensure that annual stakeholders' satisfaction surveys and conformity checks are executed (including security aspects).	[11]	
Pr70	Ensure that stakeholders are engaged in IT actions.		[7] [25]
Pr71	Ensure that top-level management endorses strategic IT usage in what concerns resource prioritization, change implementation, and project execution support.		[6] [19] [32]
Pr72	Try to add value to the business with major IT projects. Use business cases with clear measurement criteria to demonstrate their value.	[11]	
Pr73	Use internal and external Service Level Agreements (SLA). Specify SLA limits and restrictions carefully.	[27]	

practitioners and consultants [3]; [13]; [22]; [27]. Other important sources also include many IT governance and IT leadership/CIO role studies published in major IS academic journals over the past two decades – such as the works published in MISQE [19], CAIS [28] and IJITBAG [5].

The resulting parsed list (step iv) contains seventy-three IT governance practices recommended for general adoption by corporations at large. These practices appear in Table 1, with each line containing a summary description of each and respective references from where it was picked up.

In order to facilitate the analysis, and as prescribed in step v), the best practices in Table 1 were organized into five classes representing distinct dimensions of IT governance: leadership, decision-making structure, process [11], social [29], and relational mechanism [7]. Other dimensions can also be found in the literature – e.g.: metrics [24] and communication [34]. Here we chose to focus on the above five to highlight social and technical aspects, since these were of interest to the electric utilities in the case study. Figure 2 shows the distribution of practices among the chosen classes.

The distribution of the seventy-three practices by the five classes is as follows.

Leadership = {Pr8, Pr9, Pr55, Pr56, Pr64, Pr70, Pr71}

Decision-Making Structure = {Pr7, Pr10, Pr14, Pr19, Pr41, Pr43, Pr44, Pr45, Pr5, Pr68, Pr69}

Process = {Pr1, Pr2, Pr4, Pr6, Pr16, Pr17, Pr18, Pr22, Pr27, Pr40, Pr42, Pr46, Pr47, Pr49, Pr51, Pr52, Pr54, Pr58, Pr59, Pr60, Pr61, Pr63, Pr65, Pr66, Pr67, Pr72, Pr73}

Social = {Pr12, Pr13, Pr20, Pr24, Pr25, Pr26, Pr28, Pr29, Pr3, Pr30, Pr32, Pr33, Pr34, Pr35, Pr48, Pr50, Pr62}

Relational Mechanism = {Pr11, Pr15, Pr21, Pr23, Pr31, Pr36, Pr37, Pr38, Pr39, Pr53, Pr57}

This generic framework of IT governance practices was used as the foundation for the customization to the specifics of the electric utility sector. To that effect, we used steps vi) to vii) of the method proposed in Figure 1.

5 IT GOVERNANCE PRACTICES IN ELECTRIC UTILITIES IN BRAZIL AND EUROPE

To customize the generic framework of IT governance practices to the specifics of the electric utility sector, we conducted a field research at two multi-billion dollar electric utility companies, which we identify as "B" (Brazilian) and "E" (European). We choose them for their dissimilarity – both internal and in their environment – to enrich our study, as suggested by Yin [36].

As shown in Table 2, E is a European private company with operations also in North America, Africa, and Latin America. Besides electricity generation and distribution, this company also focuses in gas and renewable energies. Historically, this company had a large internal IT group to develop in-
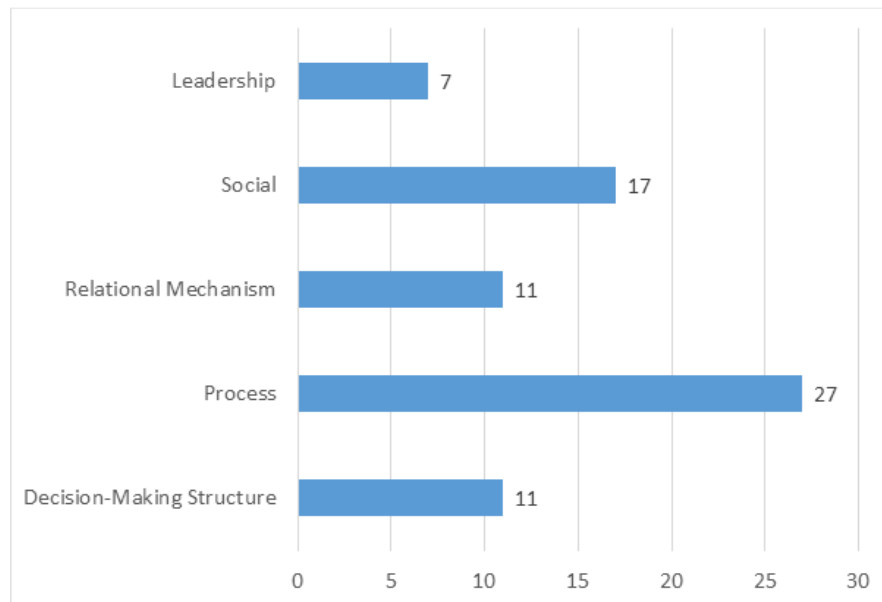
Figure 2. Classification of IT governance practices (73 in total)

house applications. Taking into account the mission of the company, the costs involved, and the potential of the IT group, the corporate governance decided to create a new IT company with its then current members. The spinoff was made responsible for the development and support of company E's IT service portfolio and was also allowed to offer IT solutions to the market at large. Nowadays, it no longer belongs to the Company E, but it is still responsible for 70% of its IT service portfolio. In fact, the IT function of company E is taken care of by (only) 60 IT professionals in the four continents where the company operates. This internal IT staff mainly manages outsourcing contracts from several IT suppliers. The global IT governance of this company is driven by a central group at the headquarters, which oversees aspects of architecture, interoperability, information security, norms, outsourcing, and service management. At the other side of the Atlantic, in Brazil, Company B is stated-owned and its revenues are 1/4 to 1/3 of those of Company E. Slightly different from Company E, its main activities are electricity generation and distribution, telecommunications, and water resource management. Company B has a permanent 500 strong internal IT staff that tends to favor in-house solutions. There is also an internal IT governance group that is charged with conceptualizing and applying a new, Company B-wide, IT governance program. This group focuses on process modeling, better IT project management practices (using PMBOK as reference), infrastructure management, and risk analysis. This group was much interested in the outcomes of this investigation – i.e.: the electric utility specific IT governance practice framework – to use them in the design of the IT governance program. Table 2 summarizes the profiles of Companies B and E.

6 CUSTOMIZING IT GOVERNANCE PRACTICES FOR THE ELECTRIC INDUSTRY

Having obtained the generic framework of IT governance practices presented in the previous section by using steps i) to v) of the method in Figure 1, we moved to steps vi) to vii) to customize it to the reality of the electric utilities. As recommended in step vi), we consulted with key stakeholders from the two companies in order to evaluate the generic practices and add any additional ones. Both executive groups, in Brazil and in Europe, were led by the CIO of the companies and had the presence of members of the IT Governance Committee. In order to provide a deeper discussion of IT governance practices, managers of technical areas such infrastructure, information system, integration, process modeling, and information security also attended. There were seven executives present for the European Company and five for the Brazilian. Formal introductory meetings, followed by presentations and workshops with the executives of each company were used to identify each one's IT Governance model and adopted practices. The process of triangulation [14] of distinct sources of evidence – such as corporate document analysis, literature research, presentations, R&D reports, and formal

Table 2. Diverse profiles of the electric utilities involved in the study

	Ownership	Places of operation	Installed capacity (MW)	Areas of operation	Employees	IT staff	IT focus	Adopted IT Standards and Frameworks
Company B	State	Latin America (Brazil)	10.000	Electricity generation and distribution Telecommunications Water resource management	5.600	500	Software development, project management, infrastructure optimization, and process modelling	PMBOK, ISO 27000, SOX
Company E	Private	Europe, North America, Africa, and Latin America	20.000	Electricity generation, distribution, and supply Renewable energies Gas	12.000	60	Outsourcing, Portfolio Management, Architecture, Interoperability, and Service Management	COBIT, SOX, ITIL

Table 3. Additional practices for IT governance suggested by companies B and E (10 in total)

ID	Practice	Source Company
Pr74	Define a process modelling structure to analyse, prioritize, and integrate applications into the organization.	B
Pr75	Outsource IT operations that clearly have a better cost-quality relation with third party services and which are not critical for the company.	E
Pr76	Establish an integrated methodology for modelling, process automation, and infrastructure selection.	E
Pr77	Model processes prior to information system development or acquisition.	B
Pr78	Certify information systems by the IT management team together with users prior to production phase-in.	E
Pr79	Establish corporate policies and guidelines for the management of decentralized IT resources.	B
Pr80	Standardize applications and architectures to ensure ease of evolution; establish corporate platform standards (Lotus Notes with Oracle database or Domino, Java with Oracle database and BPM, for instance).	B
Pr81	Allow for the possibility to negotiate standard architecture and application exceptions if business value is proven.	E
Pr82	Ensure that infrastructure optimization starts from real needs of IT clients, user profiles, and related equipment standards.	B
Pr83	Check user acceptance levels of IT, identifying possible resistances to be overcome.	E

opinions – was used to improve the confidence on the data.

At the end of this process, ten additional practices were identified as relevant for IT governance in electric utilities. This new set – see Table 3 – complements the generic list in the previous section and, thus, the entries are numbered consecutively from Pr74 to Pr83.

The set of recommended generic practices listed in Table 1, complemented with those suggested by the two companies, listed in Table 3, constitute the general and comprehensive list that was used when addressing IT governance for electric utilities. In continuing to step vii) of our method, we moved to identify a smaller set of key practices – which are usually termed "best practices" [3]; [11]; [13] – for the electric utility industry. Discussions with top executives and IT professionals with responsibilities for IT governance at the two companies enabled us to narrow down the set to eighteen candidate practices. The whole list of practices was presented and discussed personally with the above-mentioned teams from the two companies. They pointed out which ones were considered important to their respective companies. After, we selected the practices considered important from professionals of both companies.

The participants in the process agreed to organize them into three classes, A, B, and C, according to their importance, as follows:

- A – Essential for the success of IT governance;
- B – Important for IT governance;
- C – Good practice, but less important;
- An additional category – N – was used for practices deemed non-relevant by the companies.

Due to time restrictions of the top executives and IT staff involved in the process, we used oral answers in a presential Delphi-based meeting. Differences of opinion in the classification of some practices were later discussed by e-mail or by phone in order to obtain consensus. We assigned equal weights to the opinions from the various participants. The resulting smaller set of key practices for the electric utilities is shown in Table 4. The rightmost column presents the ranking of the key practice within its class (A1 being the top ranked essential practice, B1 the top ranked important practice and so on).

Note that the classification of a practice is sometimes dependent on the company's characteristics and context, as can be seen in Table 4, in lines 3, 7, 9 (classification is just one class apart in each line, but

most notably in lines 13, 14, where there are evident disagreements (classification is two classes apart). Having a lean IT staff, Company E prefers to hire IT professionals who already know its business (Class B in Line 13); company B can afford to offer training as they go, possibly by pairing new with more experienced staff (Class N). SOX compliance is a must for Company B in order for it to be listed in the New York stock exchange (Class A in Line 14); Company E gets its investment somewhere else. Lines 3, 7 and 9 display minor discrepancies in classification (from one Class to the adjacent one): Company E seems to assume these practices by default since it usually outsources. More importantly, though, there were 13 identical classifications by both companies out of 18.

If one attributes a value of "1" to each classification match; "1/2" to each classification that is only 1 class apart (meaning "partial match"); and, "0" (zero) otherwise, one observes that an IT governance practice classification alignment of $\{[(13 \times 1) + (3 \times \frac{1}{2})]/18\} \times 100\%$ or over 80% (the maximum being 100%) was achieved between the two studied companies. This high index appears to indicate that the resulting selected and ranked practices may indeed be critical for IT governance for (large) electric utilities.

The resulting class breakdown of the most important practices for the electric utility industry is illustrated in Figure 3. The selected practices are presented below, grouped by class. Some appear slightly reworded to fit the electric industry profile more appropriately. Where warranted, we also provide additional insight associated to a given practice, offered by either company during the selection process.

6.1 A-class practices (essential)

A1. "A representative from the IT function (preferably the CIO) should participate in the meetings of the corporate board, have the trust of the CEO and chairman of the board in strategic planning sessions, understand the business, be proactive and have leadership characteristics."

One interviewee disagreed with this practice being classified as essential. The argument was that sitting on the board was not critical since discussions focus more on financial and corporate policy matters than on IT guidelines. The others, however, were unanimous in asserting that the presence of the CIO on board meetings would be helpful to clarify and widen the discussions on IT goals, needs and actions. The part on strategic planning, proactive and leadership behavior was accepted unanimously. Practices ID: Pr09, Pr70.

Table 4. Rankings of the practices considered most important by the electric utilities (18 in total)

Practice	Original practice	Company B classification	Company E classification	Final classification
Do not separate the Corporate IT infrastructure from that supporting operations and/or production (in the electric utility sector operations relates to generation, transmission and distribution; the corporate IT infrastructure relates to administration aspects).	Pr19 from Table 1.	N	N	N
A representative from the IT function (preferably the CIO) should participate in meetings of the corporate board, have the trust of the CEO and President of the board in strategic planning sessions, understand the business, be proactive and should have leadership characteristics.	Pr09 and Pr70 from Table 1.	A	A	A1
Establish an IT Steering Committee at the executive level – composed of the CIO, key advisors, and other business executives – to assist the executive management in the delivery of IT strategy.	Pr43 from Table 1.	B	A	B1
Centralize strategic decisions on architecture, outsourcing, application certification, investments and technological infrastructure in the IT Management Team.	Pr07 from Table 1.	B	B	B3
Define clear IT performance indicators trying to link them to business activities.	Pr16 from Table 1.	N	N	N
IT staff must manage relations with business units. Workshops and frequent communication should be promoted to increase shared knowledge on the use of IT in electric utilities.	Pr11, Pr21, and Pr57 from Table 1.	A	A	A2
Try to add value to the business with major IT projects. Use business cases with clear measurement criteria to demonstrate their value.	Pr 72 from Table 1.	C	N	C4
Certify information systems by the IT management team together with users prior to production phase-in.	Pr78 from Table 3.	C	C	C1
Outsource IT operations that clearly have a better cost-quality relation from third party services and which are not critical for the company.	Pr75 from Table 3.	C	N	C3

Manage outsourcing contracts efficiently by means of strict Service Level Agreements (SLAs) and through diversification of providers.	Pr73 from Table 1 and Pr79 from Table 3.	C	C	C2
Adopt recommendations of best practices from guides of IT governance (such as COBIT); of IT service management (such as ITIL); and of project management (such as PMBOK).Maturity levels and mechanisms should be customized for the most relevant processes for the electric utility sector.	Pr1 from Table 1.	B	B	B4
Define a process modeling structure to analyze, prioritize and integrate applications into the organization.	Pr74 from Table 3.	B	B	B5
Hire IT professionals with technical expertise and knowledge of the company's business.	Pr48 from Table 1.	N	B	B6
Be SOX compliant.	Pr6 from Table 1.	A	N	A4
Allow for the possibility to negotiate standard architecture and application exceptions if business value is proven.	Pr81 from Table 3.	N	N	N
Communicate IT governance actions, goals and objectives to people at all levels and throughout the company, ensuring that they are understood and have clear value proposition to all stakeholders.	Pr12 from Table 1	A	A	A3
Integrate IT and company plans, synchronize planned activities and time schedules, and engage top management.	Pr53 from Table 1	B	B	B2
Create a channel for frequent and open communication between the IT department and its users.	Pr13 from Table 1	N	N	N

A2. "IT staff must manage relations with business units. Workshops and frequent communication should be promoted to increase shared knowledge on the use of IT in electric utilities."

This was unanimously voted as essential for IT governance. Company B holds only one formal, annual meeting to promote closer integration amongst company areas. Company E distributes its business analysts so that they understand each business area intimately for better support of development and maintenance of high value adding information systems. Practices ID: Pr11, Pr21, and Pr57.

A3. "Communicate IT governance actions, goals and objectives to people at all levels and throughout the company, ensuring that they are understood and have a clear value proposition to all stakeholders."

This practice aims to make messages uniform and increase the understanding of IT governance actions. Company B, for instance, established a group to communicate standards and progress of its SOX compliance project throughout the company, which has been accomplished with great success. Practice ID: Pr12.
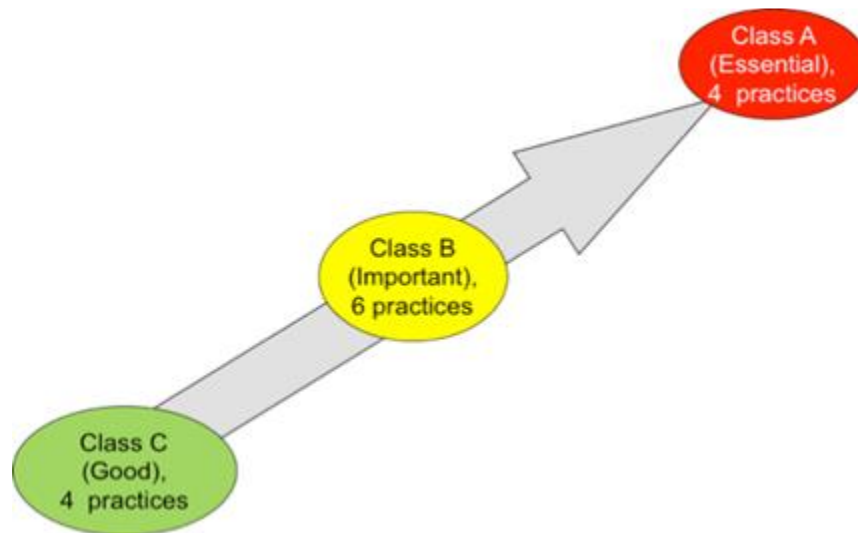
Figure 3. Class breakdown of the most important IT governance practices for electric utilities.

A4. "Be SOX compliant."

Company B adopted this practice as a necessary measure for company growth. In fact, this is a guideline dictated by its holding company. Company E discarded this practice. The inclusion of this practice into the A-Class group was not unanimous initially, but it was elected by consensus in the final round of the Delphi method. Practice ID: Pr6.

6.2 B-class practices (important)

B1. "Establish an IT Steering Committee at the executive level – composed of the CIO, key advisors, and other business executives – to assist the executive management in the delivery of IT strategy."

Both companies informed that such a committee had been set up and functioned in the past but its actions concentrated in distributing equipment and other infrastructure issues. The existence and role of such a committee, together with those of a strategic committee, are being discussed with top management. Audit and control consultants are also recommending this practice. Practice ID: Pr43.

B2. "Integrate IT and company plans, synchronize planned activities and time schedules, and engage top management."

In the context of Company B, building integrated and more participative plans is a trend being stimulated by its holding for a higher degree of homogeneity of processes and standards amongst its various electric companies. In Company E, since IT transverses all company areas, the IT department begins working on

the impact of technological options three months ahead of the start of the corresponding strategic planning activity. Practice ID: Pr53.

B3. "Centralize strategic decisions on architecture, outsourcing, application certification, investments and technological infrastructure in the IT Management Team."

Both companies agree that this practice allows for faster and better IT decisions that lead to solutions that are more tightly integrated and that add higher value to the business. Practice ID: Pr7.

B4. "Adopt recommendations of best practices from guides of IT governance (such as COBIT); of IT service management (such as ITIL); and of project management (such as PMBOK). Maturity levels and mechanisms should be customized for the most relevant processes for the electric utility sector."

Both companies acknowledge the usefulness and importance of frameworks for setting up IT governance guidelines and policies. Extensive adoption of recommendations in these frameworks however is not viewed as critical. Quite on the contrary, excesses in the adoption of control mechanisms may increase costs and hinder freedom of action or customization in some processes. Practice ID: Pr31.

B5. "Define a process modeling structure to analyze, prioritize and integrate applications into the organization."

Both companies agree that making IT decisions based on their impact on business processes is a major factor for IT-business alignment. Practice ID: Pr74.

B6. "Hire IT professionals with technical expertise and knowledge of the company's business."

This practice is more applicable to Company E, which has higher flexibility to hire professionals and allocate them to specific areas. Hiring procedures enforced by the state-owner restrict the leeway of Company B in this respect. Practice ID: Pr48.

6.3 C-class practices (good)

C1. "Certify information systems by the IT management team together with users prior to production phase-in."

This is a SOX requirement but it is not yet a generalized practice throughout all of Company B's business units. Certification implies formal acceptance by clients and should lead to reverse billing or budget allocation by the business units. Practice ID: Pr78.

C2. "Manage outsourcing contracts efficiently by means of strict Service Level Agreements (SLAs) and through diversification of providers."

This practice highlights the importance that internal and external SLAs have for IT governance maturity. Company B already uses external SLAs and plans to adopt internal SLAs soon. Practices ID: Pr73 and Pr79.

C3. "Outsource IT operations that clearly have a better cost-quality relation from third party services and which are not critical for the company."

Due to its culture and legacy systems, outsourcing is not as common at Company B as it is at Company E, except for its software factory effort, which is heavily outsourced. Company E even tries to outsource full IT processes, but retains proper intelligence control by IT top management. Practice ID: P75.

C4. "Try to add value to the business with major IT projects. Use business cases with clear measurement criteria to demonstrate their value."

Company E's IT management tries to understand IT value to the business by means of business cases for major projects. Company B also considers business cases important but their use is not yet widespread. Practice ID: Pr72.

6.4 N - not used practices (considered non-relevant)

Top executives of both companies, B and E, did not consider four originally listed practices as relevant:

N. "Do not separate the Corporate IT infrastructure from the infrastructure that supports operations or production (in the electric utility sector operations relates to generation, transmission and distribution; the corporate IT infrastructure relates to administration aspects)." Practice ID: Pr19.

N. "Define clear IT performance indicators trying to link them to business activities." Practice ID: Pr16.

N. "Allow for the possibility to negotiate standard architecture and application exceptions if business value is proven." Practice ID: Pr81.

N. "Create a channel for frequent and open communication between the IT department and its users." Practice ID: Pr13.

7 THE RELEVANCE OF SOCIAL ASPECTS IN IT GOVERNANCE

After selecting and ranking the key IT governance practices for electric utilities, it is instructive to investigate the relative importance of the five dimensions of IT governance for the companies studied here. This is because we had the impression, during our contacts with the companies, that the focus of the literature was not sufficient to properly address their most relevant IT governance needs. For that investigation, we collapsed the five dimensions into two distinct "super-dimensions". The first one, composed of decision-making structure [33] and process [11], reflects the current focus of the IT governance literature in its "normative" approach. The second one, derived from the relational mechanisms, leadership, and social dimensions, was labeled "socio-technical", because these dimensions essentially relate to stimulating desired behaviors of people when dealing with IT issues. Note that the distinction between normative and behavior aspects of IT governance is not a novelty and it has been mentioned before by relevant authors [33], [23]. The result of our aggregation is illustrated in Figure 4. It is telling that it shows that 75% of A-Class practices (essential) are of socio-technical nature, encompassing key practices A1, A2, and A3. It also shows that the majority (67%) of B-Class key practices (important) are "normative" – i.e., those related to the decision-making structure and process dimensions of IT governance (key practices B1, B3, B4, and B5) – and 33% are socio-technical (key practices B2 and B6).

This analysis highlights the fact that even though the interviewed companies recognized the relevance of the most known frameworks (COBIT, ITIL, PMBOK) in the literature, they did not consider those frameworks as essential (A-Class) for the success of IT governance programs. Both companies stated that COBIT, for instance, was considered as an excellent reference guide, but its full implementation was not a critical success factor. In fact, Company E went further and abandoned its implementation of COBIT because
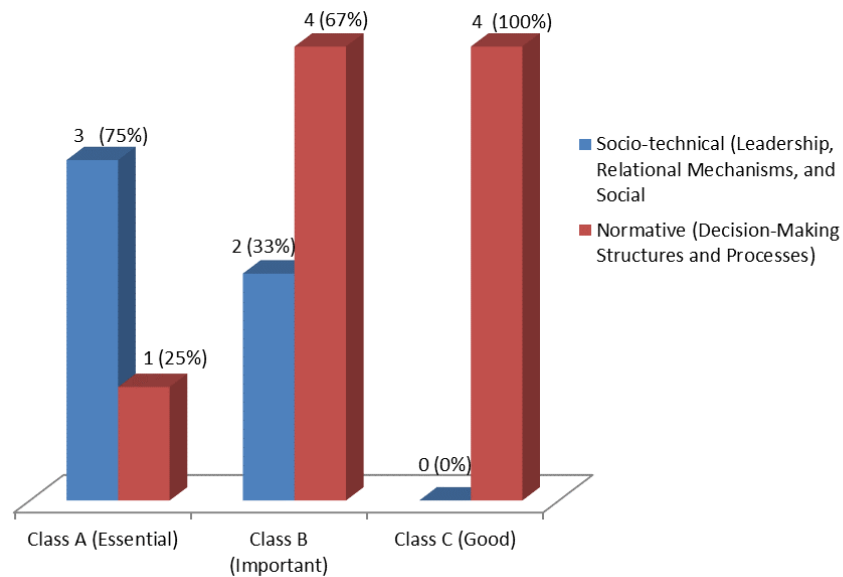
Figure 4. Normative and socio-technical key IT governance practices

"it was time consuming" and although it had invested considerable human and financial resources to adopt the this framework, it did not achieve the expected benefits. Company B was only beginning COBIT adoption at the time of our research.

Finally, all C-Class key practices, shown in Figure 4, are normative (in this case, related to the process dimension: C1 to C4). This set of practices focuses on IT control, productivity, and efficiency. These key practices concern activities required for service level agreements, information security, and information system certification.

8 VALIDATION

Given the exploratory nature of our proposal, we have opted to follow a phenomenological approach that tried to build plausibility – in Popper's critical rationalist sense – as we progressed. Our aim is that this work inspires readers who wish to extend our proposal to other cases and those who wish to reflect on their own practices, but we did not feel we had enough room to build content validity or criterion validity into our case.

Thus, we have resorted to face validity, which can be described as the extent to which a test is perceived by participants as adequate for assessing an issue at play [37], [38]. Although face validity has a subjective component to the judgment involved, this is minimized by resorting to a panel of experts in the subject matter.

We say the proposed set of IT governance best practices has face validity since it "looks like" it is going to lead to a positive answer for the research

question "Does the identified set of practices address IT governance issues at electric utilities effectively and efficiently?" To test the set for face validity, we presented the set's initial practice specification to the utilities' IT professionals and executives we interviewed. They were then asked to comment on the specification and to indicate what they thought the answer to the research question would be. The respondents unanimously answered "yes". Again, note that face validity means that the practices in the (final, electric industry-customized) set "look like" they will work, as opposed to "have been shown to work".

The Delphi method [18] was key in ensuring the quality of the conclusions. This communication technique is structured into rounds where experts provide answers, which are then summarized and fed back to the panel to encourage revisions, thus converging to the "correct" ones.

9 CONCLUSION

We have collected eighty-three IT governance practices from academia and industry and organized them in a framework from which we have derived a more manageable set of fourteen for the electric utilities sector. These practices were classified according to their importance by a team of top executives and IT staff from one company in Brazil and another in Europe. Four practices were considered essential, six of them important, and four others were ranked good. An analysis of these practices reveals that 75% of those in the essential class and 33% of those in the important

class are strongly related to social issues. This suggests that major concerns in IT governance differ somewhat from the current main focus of the literature, whose emphasis resides more on decision-making structures and processes.

9.1 Contributions

One of the key contributions of this paper is the set of fourteen IT governance practices deemed more relevant for the electric utilities sector. This manageable set was obtained from a much larger pool of eighty-three practices, and constitutes specific guidance for this industry, that traditionally has been lacking in the literature.

Also important is the larger set of IT practices from which we departed. Resulting from a thorough analysis of the literature and the contributions of the stakeholders of two companies involved in the study, it provides a generic frame of reference from which customized sets for other specific industries or companies can be derived.

A third contribution is the method that we used to come up with the original set of IT practices and its adaptation to a specific sector. The tiered class structure we used to group practices seemed to ease communication among the IT governance stakeholders involved in the process. The application of a similar approach to other industries may prove useful.

Lastly, the findings that point to a strong relevance of social aspects in the practices considered most critical for effective IT governance (A-class and B-class), deserve special attention, since most of the literature focuses on normative aspects of decision-making structures and processes.

9.2 Limitations

Although the generic framework of IT practices we presented in this paper resulted from a comprehensive systematization of contributions from academics and practitioners, it should, nevertheless, be considered open. In fact, as reality changes over time, due to factors such as market volatility, new regulations, and technology evolution, frameworks like this should be revisited and updated. Occasionally, they may need to be rebuilt.

Regarding the customization of the IT governance practices to the electric utilities sector, we should keep in mind that it reflects the views of two companies. To mitigate the risk of too narrow a perspective on the topic, we selected them for their diversity: besides being based in different continents, company E is privately owned, has a small IT team that centralizes key IT governance decisions and knowledge while making extended use of outsourcing. Company B is state-owned, has a large IT team, and focuses on optimizing the existing infrastructure and in in-house development and process execution.

9.3 Future Work

Considering the relevance of the social issues in setting up an effective IT governance framework, and considering that current literature is scarce in this matter, this is an avenue for research that we are continuing to explore. Namely, we are investigating how Actor-Network Theory [4]; [16]; [17]; [21] can help us understand the dynamics of interaction of the various stakeholders and assist in its design.

A complementary thread of inquiry is concerned with the effort to keep the proposed frameworks of IT government practices current – both, the generic and electric-industry specific. For that, a permanent attention to the IT governance body of knowledge is required, as well as an effort to identify electric utilities with different profiles willing to discuss our results.

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