NEED FOR EVALUATE TRANSPARENCY IN SOFTWARE PROCUREMENT PROCESSES

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Abstract- Governments have promoted the implementation and use of information technologies with regard to electronic government using electronic procurement systems. Public procurements via e-government systems play an essential role in national government programs, since their purpose is to enable active transparency and promote efficient relationships with suppliers. Among public acquisitions, the area of information technologies is one of the most frequent cross-sectional tenders, and of these, software development projects, which move money between the software industry and the Government. In this article, we indicate the need to assess transparency and government software tenders. As methodological support, we administered an electronic survey to stakeholders, and have analyzed how legislation in some countries has added a section dealing with tenders for software development projects.

Keywords- e-procurement, e-government, transparency, maturity models, public tenders, software requirements.

I. INTRODUCTION

In the last two decades, governments have promoted the implementation and use of information technologies with regard to electronic government to improve the quality of the services they offer citizens and to increase the transparency of government processes [1], [2], [3]. Thus, when governments acquire goods or services, they are seeking to make good use of public resources, using electronic procurement systems as the mechanism for externalizing services.

Externalization imposes procedures on States, and consequently on their organizations, i.e., ministries, municipalities, public services, hospitals, etc. These procedures include a public call to companies to compete by offering a proposal on the needs formulated, fulfilling certain quality criteria in support of their main services [4]. The logic behind the process is the efficient use of public resources, considering that there may be the threat of corruption.

Therefore, in the case of public procurement, several countries are obligated by law to conduct public tender processes [5]; already by 2005 more than 30 countries had established anti-corruption agencies [6], and if it is considered that efforts to promote transparency and reduce corruption are associated with a society's culture [7], we can think about the need for formal mechanisms to assess transparency.

When effort (time, money) is wasted on a call for tender, it is also a clear indicator of the poor use of public resources; for example, in a call where the best supplier was not chosen, or the participation of other competitive suppliers was not permitted, this is a loss of the State's resources.

Public procurements via electronic government systems play an essential role in national government programs, since their purpose is to enable active transparency and promote efficient relationships with suppliers [8]. Government electronic public procurement systems are expected to contribute to increased transparency [9], which might lead to possible reductions in corrupt practices, as well as increased confidence in the procurement system, increased productivity of procurement activities and attracting of new suppliers to do business with the government.

Despite these expectations, one of the areas in which corruption operates is exactly in public sector procurements [10],[11],[12],[13]; therefore, transparency in public procurement or acquisition processes by the State, whatever it may be, promotes monitoring by the citizenry. Among public acquisitions, the area of information technologies is one of the most frequent cross-sectional tenders, and of these, software development projects, which move money between the software industry and the Government [14].

Transparency in governments is considered an essential mechanism of public enforceability and responsibility towards the society [15]. Transparency is also considered a practice that governments use mainly to publish certain types of information or make public some decision-making processes [16].

With the idea of increasing the transparency of public procurement, as well as identifying and disseminating best practices in electronic procurement, the measurement of transparency of government agencies in public tender processes could be part of the solution or mitigate part of the problem [8]. It is for this reason that some governments have taken the initiative of establishing regulations differentiated in terms of transparency when dealing with software development contracts, as in the European Union, Australia and Brazil.

The aim of this article is to point out the need for a mechanism to assess transparency in government software tenders. To this effect, as methodological support, two qualitative analyses

were performed: first, a semi-structured interview of experts, both software suppliers and the civil servants who put out the tenders, and then an analysis of the regulations in some countries regarding software acquisitions.

Thus, our work is structured as follows: in section 2 we present works related to the importance of measuring or evaluating transparency in software tenders. In Section 3 we present our research design and data collection procedures. In section 4, we present the results and discussion, and finally in section 5 the main conclusions.

II. RELATED WORK

The term transparency in government refers to information which has not necessarily been historically available for the citizenry; for transparency to exist, the information must be accessible, relevant, reliable and of good quality [17].

A lack of transparency and accountability in the public sector usually contributes to macroeconomic destabilization, distortions in resource allocation and economic inequalities. These effects merit attention [18]. Therefore, in the last decade governments have worked to increase access and transparency in their actions through information and communication technologies (ICTs), which is expected to lead to a possible reduction in corruption [19].

One of the areas where corruption operates is precisely in public sector procurements [13]; making public tender processes transparent, whatever they may be, is recognized by the citizenry. The case of tenders related to ICTs, and more specifically software development tenders, where large amounts of money are moved between the software industry and the government [14], merits attention.

Transparency is presented as an indicator of market symmetry [17]; as a result, it represents relevant information for stakeholders to make decisions about software development project applications, and for governments to show their citizens they are making rational decisions in their work.

Transparency parameters do not take into account the variety of situations in software development projects, and there are no transparency or maturity models for software development tender processes.

One way to provide frames of reference to measure the performance of organizations in their different work areas and in particular in the technological area [20] are maturity models. There are also academic disciplines that use the term maturity and develop maturity models as classification schemes. Authors such as [21],[22],[23],[24] use them to develop diagnoses and define progress measures. Maturity models are used to measure IT management in the public sector, as reflected in Uruguay, Brazil, Chile, Colombia and Mexico, among other Latin American and Caribbean countries [25]. We will now briefly describe maturity models contextualized in e-government and open government, which we have used as an important reference in our proposal.

Previous studies have put forward several contextualized maturity models to develop e-government [22]; for example, [26] proposed a growth model consisting of four stages for e-government: cataloguing, transaction, vertical integration and horizontal integration. This model is focused on functionality, technical capacity and integration of e-government. Andersen [20] suggested a maturity model that extended the Layne and Lee model by incorporating a customer-centered approach.

Gottschalk [27] proposed a maturity model consisting of five levels, focusing on the interoperability of digital government: ICT interoperability, process interoperability, knowledge interoperability, value interoperability, and goal interoperability. Klievink [28] developed a progressive maturity model with five stages for joint government based on dynamic capability. These maturity models can be usefully applied to electronic governments in general, but were not designed to guide open government initiatives focusing on transparency, interactivity and participation [29].

Iribarren [30], proposed a model for e-government which integrates technological, organizational, operational and human capabilities, with a multidimensional integrated and evolutionary approach. The model includes adjustment mechanisms to align it with national guidelines on e-government. It is based on international experience in maturity models, together with specific e-government models that measure the capabilities of public agencies. The proposed model consists of the three axes of a cube: the information criteria that support business processes, IT resources and leverage domains. The authors changed the traditional IT approach and defined four leverage domains: e-strategy, IT governance, process and people management and organizational capabilities. Furthermore, the maturity model produced by Di Maio [31] incorporated some open government initiatives within its proposed five levels: casual, transparent, participatory, collaborative and engaged. Lee [29] developed a model specifically to evaluate and guide open government initiatives that focus on transparency, interactivity, participation and public commitments to collaborate that have become possible largely due to emerging technologies such as social networks. The model consists of five levels: initial condition, information transparency, open participation, open collaboration and ubiquitous engagement.

However, Leite and Cappelli complement our proposal by indicating the importance of software system transparency. They propose that to ensure

transparency, it should be addressed within the context of the requirements, i.e., transparency should be treated as a non-functional requirement. Serrano et al. [32] further investigated the characteristics of transparency proposed by do Prado Leite [33]; these authors stressed the importance of ensuring that transparency is accessible, as other quality attributes cannot be achieved without access to a software system.

III. RESEARCH DESIGN

Software engineering practices in organizations cannot be successfully improved unless both the problems caused by the existing poor practices and the context where such practices occur are understood. One way to obtain this knowledge systematically is through the application of qualitative research methods.

In our study, we have used two qualitative methods: the consultation of expert opinions and an analysis of regulations in some countries that we have identified.

Qualitative research is particularly suitable when the study aims are complex, variable, real-world phenomena, as is the case of the assessment of transparency in government software tenders, which cannot be reduced for examination with more positivist approaches. This difficulty in reducing the problem is closely related to unknown variables. Therefore, qualitative research has been presented as the process of discovering variables (not a priori the observer's variables) and quantitative research as the process to link these variables. It has been suggested that the two methodological approaches be blended in software engineering research [34].

Our methodology consisted of a semi-structured interview to obtain the judgment of experts, both software suppliers and the civil servants who put out the tenders, and an analysis of some countries' regulations on software acquisitions.

3.1 Research Method

This study could be presented from the perspective of different approaches in qualitative research starting with a general framework and moving to a particular research technique. From a general point of view, we used the principles of grounded theory. It inductively discovers the variables by meticulously collecting and analyzing qualitative empirical data. The aim of the research field is to develop a theory that is grounded, that is closely and directly relevant to the particular study environment. Therefore, this method does not begin with a theory or a conceptual framework. Instead, it begins with a study area and allows the relevant theory to emerge from that field [35]. According to these principles, our objective is to determine if there is a need to measure or assess transparency in government software tenders and what features such a measurement might have.

3.2 Data Collection

We designed an electronic survey, using short-answer questions to become familiar with the role of stakeholders in an organization (see Fig. 1), specifically to learn their opinions and views with respect to the evaluation of transparency in general and software tenders specifically. We used variables we identified of the behavior of software tender processes, and also added an open question to bring in additional variables.

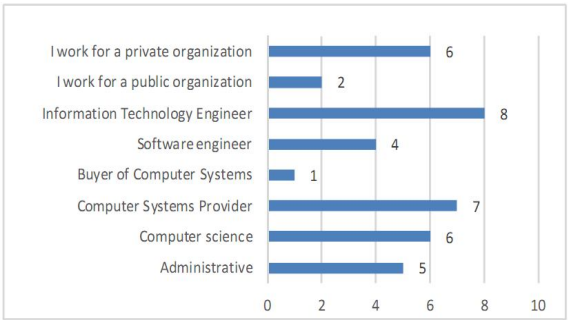

Fig.1. Role of respondents

The questionnaire was answered by 15 stakeholders. They were selected by convenience, since all of them belonged solely to the companies that participated in the tender processes, as were the civil servants who could be contacted by electronic mail. The form was applied through the Google Forms platform.

We reviewed international regulations with respect to software tenders, reviewing the regulations in the European Union, Australia and Brazil.

IV. RESULTS AND DISCUSSION

4.1 Surveys

Next, we present the results of the electronic survey that reflect the stakeholders' perceptions of the need to assess transparency in software tenders.

With respect to the question: Do you think it is advisable to have a qualification on different levels of transparency of government units and agencies? Only 2 said no.

For those who responded positively, we asked them to indicate their perception of transparency in the tender process. We have categorized the level of transparency in Table 1: 0 = 'not transparent', 1 = 'somewhat transparent', 2 = 'transparent', 3 = 'very transparent' and n: 'not an element of transparency'.

Table1: Perceptions of transparency

Situations	0	1	2	3	n
Ease of distinguishing between Administrative and Technical bases.		2	3	6	2
Questions and answers are accepted.		3	3	7	
The companies asking questions are visible.	2	5	2	2	2
An exact budget is presented.		2	7	3	

There is a brief period to make offers.		3	9	1	
The delivery time for the offer is short.	1	4	5	3	
Certifications are required that are not pertinent to the nature of the acquisition.		8	3	1	1
There is a visible and public act of awarding with the score obtained by each participating company.	2	1	3	6	1
There is a range of admissible prices for the total amount of the project.		2	7	4	

In Fig 2. we show how the number is concentrated in 1, 2 and 3, i.e., in the perceptions: somewhat transparent, transparent and very transparent.

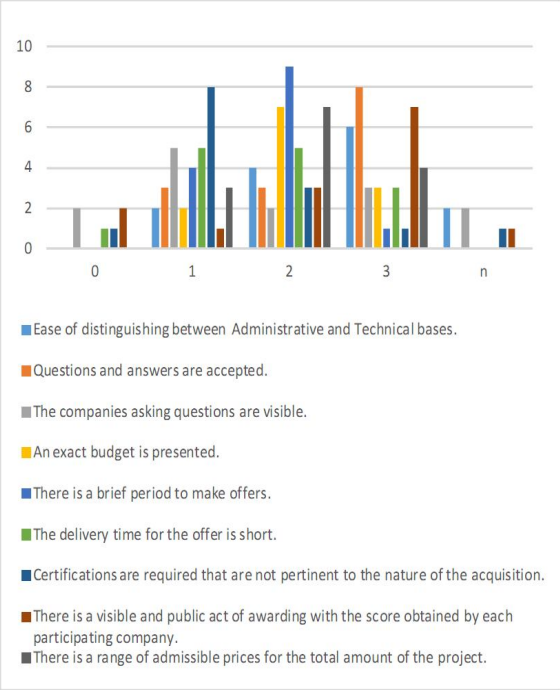

Fig.2. Perceptions of the respondents

Limiting our survey to the discipline of software engineering, we asked: Do you think that procurements (acquisitions) involving the construction of computer systems must have their own technical elements in the evaluation of their transparency levels? The responses were: 13 stated it was necessary, 1 said no, and 1 did not understand the question.

For the 13 who responded positively, we asked them to indicate their perception of transparency in the tender process when dealing with software tenders. We have categorized the level of transparency in Table 2: 0 = 'not transparent', 1 = 'somewhat transparent', 2 = 'transparent', 3 = 'very transparent' and n: 'not a transparency factor'.

Table 2: Perceptions of transparency in software tenders

Situations	0	1	2	3	n
The software requirements have been approximated and they appear in a technical language.		3	7	3	
There is a strict delivery and implementation schedule.		2	9	2	
The diplomas and degrees of the buying counterpart's team are clearly specified.	1	2	5	5	
The test cases to be executed in the validation of the product are specified.	2	4	2	4	1
The schedule of each of the members of the external team is required.		5	4	2	1
A professional qualification belonging to the project manager is requested.			8	4	1

Next, in Fig 3. we show how the number is concentrated in 1, 2 and 3, i.e., in the perceptions: somewhat transparent, transparent and very transparent.

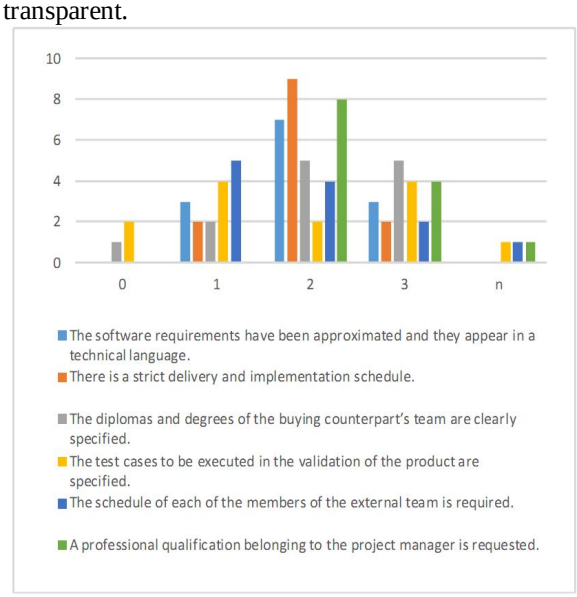

Fig.3. Perceptions of transparency in software tenders

We asked as an open question: Do you think there is a relevant factor that affects transparency in the acquisition of a computer system that can be solved by an observable element? Please write it down. We received 5 responses which are described in Table 3.

Table 3: Perception Factors

n	Respondents' answers
1	Experience of the company and the team in software development (curriculum and contact lists of clients for similar projects).
2	Knowing if it is possible to have the source codes is critical.
3	Guarantee architectures and properties

4	The way to assess and assign scores according to established rules. 2. Information regarding whether there is a current provider and who that is.
5	Bear in mind that today procurements are largely through framework agreements without tender; procurement occurs with no technical bases.
6	- There should be a resolution of the complaints made by the suppliers. What's happening with them? do they have any effect on the buyer? Is there a qualification to know which buyer is reliable? - There should be monitoring of the assessment process. This should be public and appealable, since other companies often present false documents that are not verified by the buyer, or they do not want to verify them to make the award go in a particular direction. - Monitoring of the fulfillment of offers during the contract. Public curriculum of the companies in Chileproveedores and a certificate provided by them. They should be dedicated exclusively to certifying the experience of the companies and have a curriculum online that cannot be decorated for each event. - I must have lost more than 100MM in deals that were previously arranged

4.2 Regulations for Software Tenders

The existing regulations can be considered a response to the need to distinguish that general transparency regulations require an extension for the case of software development tenders. This is because the public tender processes for software products have aspects such as the requirement creation and analysis, which are comprised of a set of practices commonly related to software engineering. The scenario of software development tenders includes the specification of requirements, which considers the main functionalities of the system requested as well as nonfunctional requirements, which makes it a difficult process for civil servants.

The Commission of the European Union, Communications Networks, Content & Technology Directorate-General, development a Guidelines for Public Procurement of ICT Goods and Services SMART 2011/0044[1]: One section of the report describes the difficulties that civil servants in government organizations face when putting out a tender in the ICT area, and therefore they raise the need for political reform with respect to ICT tenders. The focus is on developing market competition among ICT suppliers through the correct use of standards, thereby avoiding dependency on suppliers and salespeople. On the other hand, the focus is on the practices in the tender process terms, so restrictive or discriminatory specifications can be avoided and competition promoted. For example, in Italy on July 1, 2006, the Italian Council of State rendered a decision (Consiglio di Stato, sez. V, n. 5181/2005)[2] focusing on the rules governing the public e-procurement of software and ways to limit the risks of software products becoming out of date during an e-procurement.

In Brazil, the Office of the Chief of Staff published Decree 7174 on May 12, 2010[3], which regulated the procurement procedures for information technology by government agencies in Brazil. Note that this decree contains further details on subjects related to the acquisition of hardware and software, such as requiring the development approach and a survey of all the project features while still in the planning phase; these remained obligatory by virtue of this decree as seen in the following article: "Art. 2º Acquisition of goods and services for information technology and automation must be preceded by contract planning, including the basic project or terms of reference containing the specifications for the object to be contracted, Decree 7174, Brazil, 2010".

The government of Australia established a working group that drafted the Report of the ICT Procurement Taskforce[4], which recommends the development and implementation of a new framework for government procurement of ICT.

We can see that there are initiatives by different governments regarding how to approach the behavior of software acquisition processes with their respective legislations. With this background, we can state that software acquisition processes as they are currently being conducted are in need of a legislative change. Therefore, we have proposed the need to assess transparency in software tenders.

4.3 Limitations of the study

The respondents were only suppliers and civil servants responsible for the acquisition process. The respondents were only Chilean. This work is intended to establish the need to assess maturity in software tenders.

CONCLUSIONS

In this article, we have pointed to the need for a mechanism to assess the transparency of government software procurements through surveys and reviewed some international regulations that differentiate government software tenders.

We have identified that assessing transparency in the public tender process is recognized as a need by the stakeholders, and also specifically when dealing with software development

1.http://cordis.europa.eu/fp7/ict/ssai/docs/study-action23/d2-finalreport-29feb2012.pdf

2.https://www.twobirds.com/en/news/articles/2006/public-eprocurement

3.http://revista.tcu.gov.br/ojs/index.php/RTCU/article/viewFile/101/315

4.https://ict-procurement.digital.gov.au/assets/documents/ICT-procurement-taskforce-report_WCAG.pdf

tenders. On the other hand, as far as government regulations are concerned, there is also consistency in our hypothesis, since we have found regulations that identify the complexity of the requirements analysis stage of software development tenders as a highly specialized area. Finally, the technical literature contains works that touch on the subject of assessing transparency in governments, and on this point we may conclude that maturity models perform an important role, specifically in terms of software development tenders. In the future, we wish to investigate further still the importance of maturity models as a mechanism to assess transparency specifically in software development processes.

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