Stakeholders of Web Applications Requirements

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Abstract. Stakeholders play an important role to establish the requirements of a software system. In fact, systems are built to meet the needs of some stakeholders. They are also source of key requirements; not reaching to all the stakeholders of a system jeopardizes its completeness since the requirements are not detected. In Requirement Engineering, the matter has not been dealt with the required depth and consistency, thus the notion of "stakeholders" remained ambiguous as well as their associated processes. Especially, there is a lack of clear concepts regarding their role in Web applications, a subject that seems controversial (as confirmed by literature). We made ourselves the following question: who are the web application stakeholders and how should we manage them? Our special interest focuses on the local web applications development organizations. For this, we have conducted some field research that covered not only the stakeholder-related aspects, but also other areas of the requirement processes. This field research is a first approach to the problem and provides some answers, but also raises questions and suggests possible answers to some others.

Keywords: Stakeholders, Requirements Engineering, Web Applications

1   Introduction

Within the framework of a requirements engineering research project on web application development [1], a field study was conducted on the practices used in the local industry for web applications requirements elicitation, specification and validation. Developers were surveyed through a web application supported questionnaire on a wide range of web application development requirements engineering activities.The details of the survey, its contents and procedures are available in [2] while this article focuses on the stakeholder-related aspects.

In general, the methodological approaches used in the development of Web applications underestimate the aspects related to the requirements engineering [3]. The experimental studies about the web application development practices [4], [5], have shown that in these practices there is also a subordinated or null role of the Requirements Engineering. This relegated position raises our matter of interest: the stakeholders of these applications. We are particularly interested in the actual approach to the aspects related to their characteristics, identification, analysis and management during the development process.

The rest of this paper is arranged in the following way. In the next point, the general problem of stakeholders in the Requirements Engineering is reviewed; then the web applications concept is established to be used as a framework, emphasizing the requirements of said applications, particularly, the role played by the stakeholders in them. Next, the conducted field research is described. Point 5 includes the research findings, the conclusions and the future work.

2   Stakeholders in Requirements Engineering

2.1   Role of stakeholders in Requirements Engineering

Software systems are built to meet the stakeholders'requirements; this is why they play a key role in the software requirements elicitation, specification and validation processes. Within the most important and hardest activities required by the software process building are the ones related to understanding the stakeholders' needs [6] in order to establish what is actually required to be done.

The Software Requirements Specification (SRS) is a resource that serves on which the system development is based. It provides the stakeholders with the opportunity to express what they really want and shows their needs. This is partly why the stakeholders play such a relevant role in the specification process and the almost exclusive role that they have in the validation process [7]. The requirements come from the stakeholders [8] in a deeper sense than their requests: the requirements engineer researches to elicit the requirements that may not have been expressed by them. In any case, the stakeholders (including the developers) must agree on the content of the SRS at some point or, during its validation [6]. In addition to the Requirements Engineering processes as a broader level of the software development process as a whole, the project stakeholders play a key role in its success [9].

2.2   Origins of the Stakeholder Concept

The stakeholder notion is originally found in Freeman's theory [10]: "a stakeholder is anything influencing or influenced by the firm's purposes." It is a concept that extends the business responsibility beyond the one it holds with the shareholders or stockholders. The stakeholders approach applied to the business strategy started growing in the '80s[1]. Freeman's book, *Strategic Management: A Stakeholder Approach* was issued in 1984. The approach tried to provide answers for the new requests by the corporations, generated by the business environment. Freeman defined stakeholders as "any group or individual who is affected by or can affect the achievement of an organization's objectives" [11]. The concept was not new as it was already used in the '60s in two areas. In *Corporate Planning*, stakeholders were considered a constraint for the company's development. It was also used in the Stanford Research Institute (SRI) vision, which considered stakeholders as a key to the company's success. In Freeman's approach there was involved the *Systems Theory* and *the Organizational Theory*. The stakeholder approach added an important set of new players to be taken into account by corporations:

- Governments
- Local community organizations
- Owners
- Consumer advocates
- Customers
- Competitors
- Media
- Employees
- Special Interest Groups
- Environmentalists
- Suppliers

Corporations were in need of managing the environment. This approach, developed by Freeman, has several characteristics that distinguish it from the previous uses of the term in the business strategy field. Particularly, its approach is about the concrete "names and faces" of the stakeholders and not of abstractions: it is about understanding the real, the concrete stakeholder.

2.3   The Concept of Stakeholder in the Requirements Engineering (RE)

This concept rapidly expanded to other areas beyond the firm's theory and also to software engineering, where is now fully incorporated. A first approach of the concept in the Software Engineering field can be found surfing through the ACM digital library. A search was carried out in the *Publications from ACM and Affiliated Organizations*, looking for all the works containing the word "stakeholder" in their title. 203 articles were found, with the first one issued in June of 1993. By extending the research to the

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[1]Regarding the origin of the theory, [11] was followed.

ACM Guide to Computing Literature (Bibliographic citations from major publishers in computing), 407 articles were found with the word "stakeholder" in the title, with the first one issued in 1985. In Engineering Requirements conferences, the first time this word appears in the title of a paper was in 2001 in the *Fifth IEEE International Symposium on Requirements Engineering (RE'01)*. The number of papers in this conference containing this concept and the times mentioned has constantly grown since its first appearance[2]. Even though the word "stakeholder" was not used, that does not mean that the concept instances were not used, such as *user*, *consumer*, *client*, etc.

The "stakeholder" notion has not been consistently treated in the requirements engineering literature [12].Inconsistences and contradictions were found in the use of the notion of stakeholder. Some authors consider stakeholders as individuals [13], [14], [15]; others consider they are groups or individuals [16], [17], [18], [19] and others think stakeholders are individuals or organizations [6], [18], [20]. Some authors consider individuals, groups or organizations as stakeholders [8], [21], [22]; others accept as a stakeholder a "thing" [23] or interface [18].

A software development project has three interacting basic components: the *requirements of the product* to be built, the *activities* executed in the product building and the *product* resulting from the development. They are three clearly different components that strongly interact among them. There are other components but we will focus on these three. The *requirements* are statements that describe the stakeholders' needs and objectives and should be met in the product. The *activities* are the actions or the steps taken to build the product. The *product* is the software to be built thanks to the *activities*, which should meet the *requirements*. These three components have a different nature, are strongly connected, interact dynamically among demand are modified and redefined throughout the development.

If we consider an external entity to these three, such as the stakeholders, the relationship with the project can be done through one or several of these entities. In other words, is the stakeholder that is considered by the software project management the same one that is considered by the RE? If, for instance, we take a project that is not in the financing area, the Finance Manager, who manages the budget to spend on the project, is concerned about the product and its final cost. Obviously, this cost is associated to the requirements, but his concern is the financial impact of the requirement and not its functionality. This is an example of stakeholders involved in the product but not in the requirements.

A non-structured review of texts of Requirements Engineering or related with shows great differences between these entities and their relationships with stakeholders. Stakeholders:

- have an interest in the new system [6];
- will be involved by the system and who have an influence on the system requirements [24];
- influence the requirements [7];
- have an interest in the system or are affected by the development and implementation of the system [25];

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[2]This information derives from a current research on the meaning of the stakeholder notion [12].

- are person whose opinions, needs, or preferences could be relevant to the Project [13];
- determine requirements [23];
- are affected by or are accountable for some output of the project [16];
- have an interest in the product or knowledge about to the product [17];
- obtain benefits from the system under construction [26];
- have indirect influence on the system requirements [27];
- are actively involved in the Project, or are affected by the end product [9];
- are interested in the behavior of the use case [28] or the system [21];
- have a "stake" in the success of the system [14];
- are affected by the system and are critical for its success [8];
- are affected by the implementation of the system [20];
- have a stake in the operation of the system [29].

Therefore, any external entity could be interested in different components of the project to develop. This research focuses on the requirements stakeholders, who are interested in how much they can win or lose with the change considered [6]. Literature does not agree on whether stakeholders are individuals, organizations or groups, or several of these categories. This is why taxonomy of the possible types of stakeholders was adopted for this research.

2.4   Identification of the Stakeholders

The first process to obtain the software requirements is identifying the stakeholders [6]. In web applications there is uncertainty regarding who are the stakeholders [30] and Gu taxonomy [31] shows that there are multiple and different web stakeholders. Thus the identification of the stakeholders is one of the RE success factors [32]. On the other hand, the concept of "stakeholders identification" is found heterogeneously in literature [33].

The main characteristics of the software requirements specification quality are *Correctness, Completeness*, and *Consistency*. Not identifying all stakeholders goes against *Completeness*. If the stakeholders are misidentified, there will be collected incorrect or unnecessary requirements, which go against *Correctness* and *Consistency*. This is why the stakeholders *identification* [33] is so important to reach all the stakeholders that are relevant.

The main aspect of ensuring the access to all the stakeholders is not missing any requirement: the completeness of the requirements specification is strongly associated to reaching all the stakeholders [17]. The concern of the requirements completion should start by accessing all the stakeholders. However, although there is a need to identify the stakeholders, the identification processes are not often proposed [8]. In general, the treatment of the stakeholders is one of poorest of the web applications requirements engineering [30] and of the RE in general.

Figure 1 exhibits the consequences of the requirements partially or incorrectly considering the stakeholders without taking into account the effects of an eventual error in the use of the RE processes.

In the stakeholders' identification, the taxonomies play an important role. In literature there appear different stakeholders taxonomies (more precisely, of types of stakeholders). As above mentioned, there is no consistency whether they are individuals, groups or organizations and, in some cases, they are considered indistinctively [12]. For this research, on the base of [17], a list of types of stakeholders was made and added to the questionnaire. The completeness of the types in the list was validated, to some extent, by the interviewees since none of them chose the option "other" when selecting the *types* of stakeholders with which they identify.
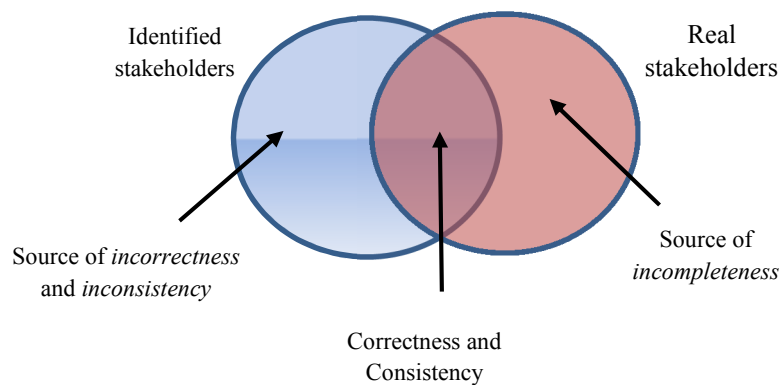
Figure 1. Stakeholder-requirements relationship

2.5   Types of Stakeholders

Taxonomies are a means to structure and to help the understanding and to communicate the knowledge [34]. The maturity in a knowledge area is associated with the possibility to structure the concepts in a taxonomy. In their practical use, the taxonomies are useful to guide the development process, frequently in the shape of a check-list.

To ask about the types of stakeholders who were interviewed, a list was produced from [17]. It cannot be said that the basic list has a generalized acceptance but it is one of the few available. The original list is arranged in an informal structure of the concept *denomination*, *description* and *rationale*. Table 1 shows the denomination and the description of [17].

Table 1. Original list of types of stakeholders.

Type	Description
Client	The client pays for the development of the product
Customer	The customers buy the product.
Users	Get to Know Them. The purpose of identifying the users is so that you can understand the work that they do
Consultants	Consultants both internal to your organization and external are people who have some expertise you need to help you uncover the right requirements.
Management	Consider any category of management.
Subject Matter Experts	This constituency, represented by the classes of internal and external consultants, may include domain analysts, business consultants, business analysts, or anyone else who has some specialized knowledge of the business subject.
Core Team	The core team is the people who are part of the building effort for the product
Inspectors	Consider safety inspectors, auditors, firefighters, technical inspectors, and possibly government inspectors.
Market Forces	The marketing department of your organization probably represents this constituency.
Legal	Consult your lawyers, or possibly the police, for legal requirements. Also include in this constituency any standards that are relevant to your product.
Negative	Negative stakeholders are people who do not want the product.
Industry Standard Setters	Your industry may have professional bodies that expect certain codes of conduct to be followed or certain standards to be maintained by any product built within the industry or created for use by the industry.
Public Opinion	For any product intended for the public domain, consider polling members of the public about their opinion.
Government	Some products rub up against government agencies for reporting purposes, or they receive information from the government. Other products have requirements that necessitate consulting with the government.
Special-Interest Groups	Consider handicapped-interest groups, environmental bodies, foreign people, old people, gender-related interests, novices, or almost any other group that may come in contact with your product.
Technical Experts	For the stakeholders from this constituency consider usability experts, security consultants, hardware people, experts in the technologies that you might use, specialists in software products, or experts from any technical field that the product could use.
Cultural Interests	This constituency is more applicable to products intended for the public domain.
Adjacent Systems	The adjacent systems on your work context diagram are the systems, people, or work areas that directly interface with the work you are studying.

Within the RE field there are different types of taxonomies: requirements, domains, requirements characteristics, requirements management, etc.[3] In the RE field, the taxonomies are very useful in the stakeholders' identification process to ensure the identification of all the stakeholders. Gu made a list of types of stakeholders for the

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[3] Source: search in the ACM Digital Library (*Requirements + taxonomy* within Title or Abstract, 2-1-2015)

Services Based Applications [31], but centered on the developers, with only two that are not developers: the *End user* and the *Service Consumer*. Pacheco and Garcia [33], and Pacheco and Tovar [35] established that the studies focused on the stakeholders' description provided a potential list of stakeholders. Even though this approach helped to obtain a final list, it did not ensure that all the stakeholders were detected.

Some changes were made to the original list to create the base that was used to make the options contained in the used questionnaire:

- As it was held in Argentina, it was localized and not literally translated into Spanish.
- Some terms were changed: *Core Team* was expressed as "desarrolladores" (*developers*), which is more common in the Argentinean industry; *Legal* was expressed as "Legislación" (*legislation*) (generally, nouns were preferred).
- Some types were not described since they were considered self-explanatory: desarrolladores (*core team*); gerentes (*management*).
- *Adjacent systems* were omitted because it was not considered a stakeholder but a constraint.
- The questionnaire was made with shorter definitions than the original ones [17].

The proposed options and definitions provided in the questionnaire are shown in Table 2 (in Spanish as in the original).

Table 2. Types of stakeholders used

Tipo	Descripción
Clientes	Paga por el producto
Consumidores	Compra el producto
Usuario	El que en última instancia operará el producto
Consultores	Internos o externos, son los que tienen el expertise para ayudar a abarcar los requerimientos correctos
Gerentes	
Expertos	Incluye consultores de negocios, analistas de negocios y cualquiera que tenga conocimiento especializado de que puede contribuir al Sistema
Desarrolladores	
Inspectores	De seguridad, auditores, eventualmente del gobierno, etc.
Fuerzas del mercado	Posiblemente representado por el Depto. de Marketing
Legislación	Representado por abogados o exigencias legales, se incluyen los estándares
Negativos	Stakeholders que no quieren el sistema
Estándares industriales	Códigos que deben satisfacerse para los productos que se consumen en una industria
Opinión pública	En el caso que existan grupos de usuarios del producto
Gobierno	Para el caso de los productos que generan o reciben información del gobierno
Grupos especiales	Extranjeros, tercera edad, adolescentes, etc.
Expertos técnicos	Requeridos para asesorar en la construcción técnica del producto

3   Web applications overview

3.1   General characteristics

A Web application is a software system that can be accessed through the Internet or Intranet and is built following certain technologies and standards. There are several types of web applications; a typology [36] establishes the following categories:

- Document centric Web sites
- Interactive Web applications
- Transactional Web applications
- Workflow-based Web applications
- Collaborative Web applications
- Portal-oriented Web applications
- Ubiquitous Web applications
- Social Web
- General portals
- Specialized portals
- Semantic Web

These categories of Web Applications have appeared sequentially with growing complexity. The classes are not disjoint, i.e. there are applications that are instances of one or more classes. Some applications change their category when they become more complex and the categories are not exclusive of a domain.

The quality of web developments has been severely questioned because of the deficiencies in the type of problems that RE deals with: failing to meet the business needs, lack of functionality and low quality deliverables [3]. The state of the art of the web applications development is far from taking advantage of the Software Engineering progress in recent years [37].

For the success of a web application, in addition to luck, it is vital to have an accurate definition of all the requirements of the site to develop. This includes aspects such as the objectives of the site to develop, the stakeholders involved in it and its communication objectives. The RE establishes an engineering process for the capture, analysis, understanding, documentation and representation of the software system requirements (e.g. a website).

Some of the characteristics of the web applications related to the requirements are [2]:

- high quantity and variety of stakeholders profiles;
- design of the navigation structure;
- user interface highly affected by the quantity and variety of user profiles;
- demand for personalization by the user.

In general, the web application stakeholders have a wider *diversity* and the highlighted aspects to be considered are the language, the culture, the timezones, the measuring units, the currency, etc. [38].

4   Conducted Research

The general question that guided the research was expressed with the following terms:

- Which methods are used by the organizations in the web applications requirements process?

The main question of the research was broken down into different research questions that, in turn, led to the questionnaire. As regards the stakeholders, the specific question that we made ourselves was:

- Who are the web application stakeholders and how should we manage them?

Within the requirements process, there were considered the elicitation, specification and validation processes [6] and the requirements management processes. An experimental research was conducted by means of a survey to the web applications developers. The base instrument was a questionnaire made with the objective to start understanding the behavior of the web application development in order to generate a research strategy from there. The intention was to ensure that no variable was overlooked for the definite research and to be open to new analysis possibilities.

4.1   Sample

The universe under study was made up by local software development organizations that build web applications, i.e., organizations that develop web applications in Argentina. The organizations were selected regardless of the origin of their capital. Similarly were included companies that develop applications to market or for the internal use of the parent company.

Due to several reasons, it is impossible to identify the whole population of organizations that might be interesting for us: many organizations are subsumed into others, do not work publicly as developers, work exclusively for other countries or are not present in the local market, etc. This is why it is not possible to generate a probabilistic sample and hence, the conclusions cannot be generalized to the entire universe. This restriction does not affect the work since it is exploratory research.

The sample was made up by a combination of *Convenience Sampling* and *Snowball Sampling* [39]. To create the sample, the following activities were performed:

- Contacting the companies that met the research requirements and were known by at least one of the researchers;
- Identifying the eligible persons to answer;
- Communicating the invitation to participate through the *Cámara de Empresas de Software y Servicios Informáticos* (CESSI);
- Inviting some colleagues from the professional and university life.

In the case of the interviewees that spontaneously signed up to answer, they were contacted before authorizing them to fill in the form to ensure the fulfillment with the criteria established. There was no case of two persons answering on behalf of the same organization. However, if so, the strategy was to rule out the second answer. The accepted profiles were: Web development chief/Development chief, Web applications

developer/Applications developer; Requirements Specialist; System Manager or similar.

A panel was generated with 25 organizations that answered the questionnaire, although, as usual, not all its questions. As regards other Requirements Engineering field research, its scope is similar [40] as well as the panel composition method [41]. The main difference of this research is the use of an online form as an instrument to collect the data.

It is important to highlight that the panel was only integrated by companies located in the City of Buenos Aires and Great Buenos Aires. The final sample was integrated by 16 companies that develop applications to market and 9 that develop applications just for internal use of the parent company.

The size of the companies was measure in terms of people. We considered all the working people in case of companies that develop applications for market. In case of organizations which develop only for internal use was considered just people within developing organizations. In the sample there were 5 companies in the range 1 to 5 people; 13 in the range 26 to 100 people and 4 companies over 100 people. Three companies did not report the size.

5   Findings

5.1   Types of stakeholders

The interviewees were asked about the *types* of stakeholders (TS) that are related to the web application organization. For this purpose, the typology showed in Table 3 was used.

Table 3 contains the number of organizations that indicated to have been connected to each of these TS. There were registered responses by 20 organizations because 5 of them did not answer. For each TS, there is the number of organizations that interacted with him/her (*frequency*) and the group (1, 2 or 3) to which he/she belongs (this is explained later on).The interviewees expressed the *duration* of the majority of the organization projects: In the last columns, we can see the percentages corresponding to the distribution of this variable into more or less than 6 months and the percentage of organizations that did not provide this information.

The TS were organized according to their frequency ranges in three groups. Group 1 includes the higher frequency TS, who can be labeled as traditional. They are the ones that have been involved in the software system before the existence of web systems. On the other hand, Group 3 is the lower frequency TS, who are less traditional, for example, special groups or cultural interests. This could suggest that the stakeholders of the web applications add new Web stakeholders to the ones in the traditional applications but keeping the usual traditional application stakeholders.

Table 3. Organizations that interact with each type of stakeholder

| TS | Freq | Group | Duration | | With no info on duration |
			Less than 6 m	Higher than 6 m	
Clients	16	G1	50.0%	50.0%	0%
Consultants	8	G2	25.0%	62.5%	12.5%
Consumers	5	G2	20.0%	60.0%	20%
Developers	12	G1	41.7%	50.0%	8.3%
Industrial Standards	5	G2	40.0%	40.0%	20%
Experts	9	G2	22.2%	77.8%	0%
Technical Experts	8	G2	50.0%	37.5%	12.5%
Market Forces	2	G3	50.0%	50.0%	0%
Management	11	G1	27.3%	63.7%	0%
Government	6	G2	16.7%	83.3%	0%
Special Groups	2	G3	50.0%	50.0%	0%
Inspectors	3	G3	33.3%	33.3%	33.4%
Cultural Interests	1	G3	100.0%	0.0%	0%
Legal	3	G3	66.7%	33.3%	0%
Negative	3	G3	33.3%	66.7%	0%
Public Opinion	1	G3	100.0%	0.0%	0%
User	14	G1	42.9%	50.0%	8.1%

Table 3 also includes the percentages corresponding to the companies that interact with the TS as long as the majority of the projects last more or less than 6 months. For example: 11 organizations interact with the TS *manager*, out of which 27.3% of the cases are less than 6 month long projects.

Table 4 groups the TS into three frequency ranges. The ones with the higher frequency are predictable and almost natural to the software development. The second group is formed by the *experts*, which, according to our definition, are business experts, who are concerned about knowing the business processes. This group also includes the *Government* TS, which suggests an impact by the regulatory aspects in the web application development. In the lower frequency types, the presence of more "sophisticated" types, such as the *market forces* and *the public opinion*, conveys that the applications aspect is linked to its own impact. It is surprising that *consumers* are in this range of frequency.

Table 4. TS per frequency classification

| #	Description	Members	Frequency
1	TS with whom most organizations relate.	Clients, Users, Developers, Managers.	10 < F
2	TS with whom the average of organizations relate	Experts, Consultants, Technical Experts, Government, Consumers, Industrial Standards.	5 ≤ F ≤ 10
3	TS with whom the minority organizations relate.	Inspectors, Legal, Negative, Market Forces, Special Groups, Cultural Interests, Public Opinion.	1 ≤ F < 5

Using this individual indicator of percentages of projects higher or lower than 6 months long, there can be calculated an indicator for the TS groups with the *median* of the percentages of the projects according to their durations. Figure 2 shows these values. It can be seen in this figure that the median of the percentage of the organizations whose projects duration is lower than 6 months for both group 1 and 2 together is 33%, while with a project duration greater than 6 months is around 50%. On the other hand, for Group 2 percentages are quite the contrary. The conclusion allows associated the higher frequency TS with the lower duration of the projects and the lower frequency TS with the higher duration ones.
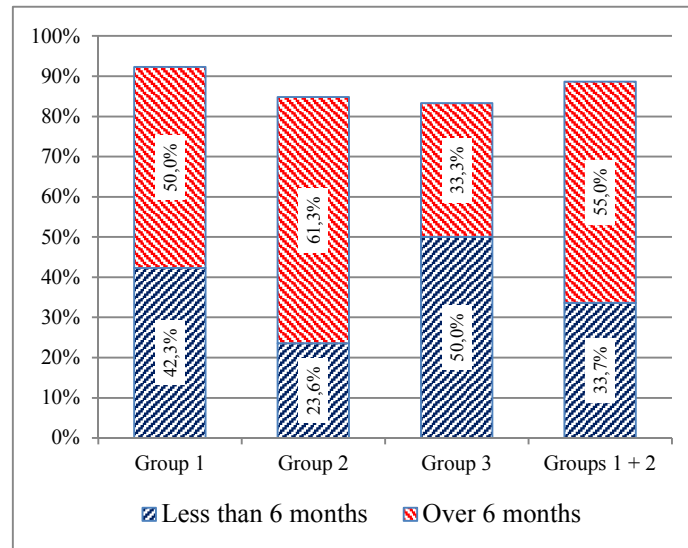
Figure 2. Median of the distribution of the projects duration per group.

The companies can be analyzed in terms of the number of stakeholders with whom they interact. Another possible view is to establish the classification of the TS according to the number of TS with whom the companies interact. This can be seen in Figure 3.

There is a predominance of the organizations that interact with less than 10 stakeholders and are equally distributed among the organizations that interact with 5 or less TS.
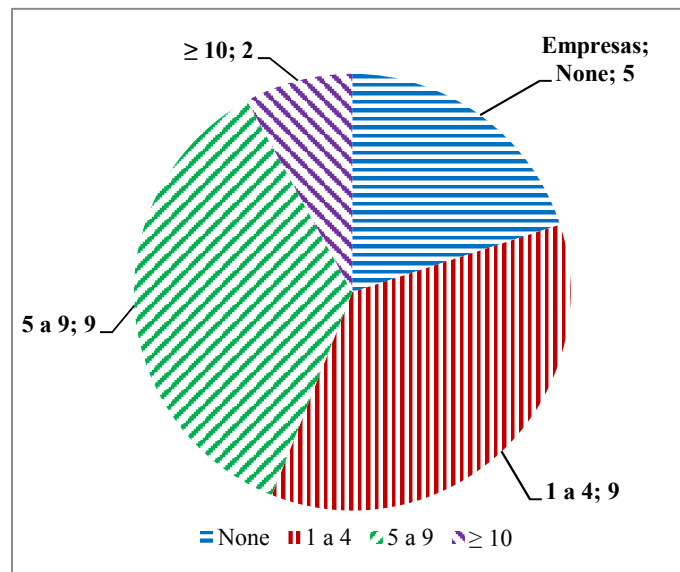
Figure 3. Classification of the organizations per TS quantity.

The average number of TS with whom they interacted was of 5.45 per company, for all the companies that claimed to be in contact with at least 1 TS. This grows when the duration of the majority is longer: for the organizations whose majority of projects is less than 6 months long, it is 4.67, and for those in which the majority of the projects last more than 12 months, it is of 6.56 TS per company. The association of the number of TS with the duration of the projects could be used as an estimator of a project effort.

5.2   Stakeholder Identification

The identification of stakeholders is vital in every requirements development process. It could be a proactive and conscious process or it could result from omission, but it always includes an identified set of stakeholders. Since developers are stakeholders, omitting any of them could mean that some of them may be in the user category. If these are non-existent, the process can have an unreal bias, since the requirements are obtained from a stakeholder's replacement. On the other hand, the incompleteness of

the stakeholders considered directly impacts on the completeness of the system under development.

In our case, a little less than 50% of the organizations (12 out of 25) claim that they run an analysis to identify them. Table 5 registers the organizations that conduct an analysis to identify the stakeholders classified per Software Development and Maintenance Area size (the organizations that did not inform the duration of the majority of their projects were omitted). To measure the size of the organizations, their number of human resources was used.

Table 5. Execution of the analysis to identify the stakeholders[4]

	Maintenance and Development Area Size				
	1 to 25	26 to 100	101 to 500	More than 500	N/A
Yes	1	6	3	0	2
No	3	1	0	0	1
Total	4	7	3	0	

The organizations that at the beginning of the requirements collection carry out an analysis to identify the stakeholders are in the range of the companies with between 26 and 500 developers, especially, in the range of 26 and 100 developers. These data suggests the association of the conduction of stakeholders' identification with a certain range of development and maintenance size.

The number of TS that interact with the organizations when establishing the requirements is not connected with whether a stakeholder identification analysis process is carried out or not: The correlation of both data series is -0.02. Possibly, this relationship changes according to the level of the projects.

A significant variable regarding the stakeholder identification analysis process is the duration of the projects; the variable we used for the duration was the *duration of the majority of the projects*. Out of the 12 organizations that execute the stakeholder identification analysis processes, we have the information of the projects duration of 11 organizations (Table 6) and all of them have projects longer than 3 months. On the other hand 3 out of 5 that do not identify the stakeholders last less than 3 months. This leads to confirm an intuitive view: the execution of the stakeholder identification processes is related to the (higher) duration of the projects.

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[4] Only the organizations that provided information on the identification analysis and the software development and maintenance area size were considered. They were 14 in total.

Table 6. Identification of stakeholders and duration of the projects

Duration of most of the projects	Identifying the stakeholders		
	Yes	No	Not available
Less than 3 months	0	3	0
Between 3 and 6 months	4	1	3
Between 6 and 12 months	4	0	2
More than 12 months	3	1	2
N/A	1	0	1

Ten organizations out of the total number do not identify new stakeholders beyond the identified in the moment of the requirements establishment, which goes against the idea that the stakeholders are identified iteratively. Table 7 shows the classification of the organizations according to the phase in which it is performed. Half of them identify the stakeholders in the start-up process and two of them do it in the operation phase. We lack comparative terms but the identification of stakeholders, the start-up and the operation can be beyond the iterative detection of stakeholders and close to a try and error concept.

Table 7. New stakeholder identification phase

New stakeholders are identified		Project phase in which new stakeholders are identified			
		Design	Coding	Start-up	Operation
Yes	8	3	2	4	2
No	10				

The identification or not of new stakeholders is connected with the execution or not of an identification process at the beginning of the project: Out of the 10 organizations that claim not to identify new stakeholders, 8 conduct an identification process in the requirements phase; on the other hand, out of the 8 organizations that do identify new stakeholders, only 4 do so in the requirements phase. It is important to highlight that the execution of requirements would reduce the number of new stakeholders to add in the following stages.

5.3   Documentation of theStakeholders

One example of the documentation to be produced regarding the identification and analysis of the stakeholders can be found in *Volere Stakeholder Analysis Template Classes Knowledge* [17]. These types of resources are necessary when it is intended to connect with many stakeholders.

As regards the stakeholders information documentation -for example the registration of identification, job, profile data, etc.- 10 out of 25 organizations said they documented the data, while 9did not.

It is interesting to see the relationship between the documentation effort and the number of stakeholders. Table 8 shows the organizations per number of TS with whom they are connected in two segments. The majority of the organizations connected with less than 5 TS document the stakeholders information; while the majority of the ones connected with 5 or more TS. Establishing the explanation for this classification requires further research.

Table 8. Documentation of the stakeholders by organizations

Number of TS that relate to them	The stakeholders 'characteristics are documented			
	Yes	No	Not available	Number of organizations
0 to 4	6	3	5	14
5 or more	4	6	1	11

When analyzing the documentation in the segment of companies whose majority of projects last less than 6 months, the percentage of the ones that document and the ones that do not is the same in both segments. The data suggests that the documentation on stakeholders is independent of the duration of the projects. As regards the *size* of the organizations, 5 out of 10 organizations that document the stakeholders' characteristics have more than 100 employees. It seems that the size of the organizations and the stakeholder documentation are connected.

5.4   Stakeholders comparison

Taking the software development in traditional environments as a reference, there was researched about the comparison between the web application stakeholders and other types of applications. For this purpose, 3 variables were considered:

- ○ Number of TS
- ○ Number of stakeholders
- ○ Frequency of changes of the stakeholders' opinion

The first two refer to the potential dimension of the stakeholders' universe in terms of variety and quantity; the third variable means the volatility of web applications. Table 9 shows the answers. As regards the TS variety and the number of stakeholders, the *equal or higher* consideration greatly exceeds the *lower* one. The hypothesis that there is a greater number of stakeholders in web applications is not confirmed or at least requires further research: the *equal* is more than twice than the organizations that consider the *higher*. As for the *TS frequency of opinion change*, also the *equal or higher* category greatly exceeds the *lower* one. It seems to confirm that the there is higher volatility of the stakeholders' opinion in web applications than in traditional applications.

Table 9. Traditional versus web applications

	Lower	Equal	Higher	∑
Variety of TS	1	6	7	14
Number of stakeholders	2	9	4	15
Frequency of opinion changes	1	6	8	15
Total	4	21	19	

6   Conclusions and future work

Web application development organizations interact with a wide range of TS. Some of the latter are involved with several organizations and others are involved with just one. The distribution of the companies per TS range shows that the number of companies that interact with less than 5 or more TS. It seems that interaction with 5 TS is a cut-off point to consider.

The available evidence supports the idea that the TS range with which an organization interacts is associated to the duration of the projects.

50% of the organizations execute processes to identify the stakeholders, especially those with 26 to 100 developers. These stakeholder identification processes are executed depending on the duration of the projects.

As for the identification of new stakeholders after the establishment of the requirements, a significant number of companies do not carry out this process (which would contradict very set concepts) and, on the other hand, there is a great number of companies that conducts it during the start-up and the operation phases. This would definitely impact the quality of the finished product.

Less than half of the organizations document the stakeholders' information, but unlike what common sense suggests, the number of those who do is higher among the ones with less than 5 stakeholders than with 5 or more. The available evidence suggests the independence of the documentation from the duration of the project.

The common statement that there is more variety (TS) and number of stakeholders in web applications than in traditional applications is not confirmed by these data. On the other hand, they suggest that the frequency of the change in the stakeholders' opinions is greater than in traditional applications.

Our future work will be to replicate the survey to dig into the developed analysis. Another research path is the development of a Case Study to deepen the analysis of the specific stakeholder-related processes. Finally, the idea is to continue researching from the organization level to the study of specific projects.

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