ABSTRACT. This paper presents a systematic review of empirical studies in Requirements Engineering, specifically, concerning the usefulness of stakeholder identification methods, and the subsequent empirical evidence gathered from those studies. The objective of this review is to plot the landscape of current reported knowledge in terms of motivating requirements engineers into producing high-quality software through identifying and understanding the software requirements. In the requirements acquisition, one of the crucial parts is the stakeholder identification. The paper reports experiences with applying the practice of systematic literature review, to the published studies relevant within stakeholder identification. Also, the present paper aims to describe the studies analyzed uniformly and show their contributions in this field.

KEYWORDS: Systematic review, requirements engineering, stakeholder identification, elicitation, software engineer.

1 Introduction

In this paper, we present and discuss our experiences of applying the systematic literature review in order to gather and evaluate the available evidence pertaining to Stakeholder Identification Process (SIP) in Requirements Engineering. Only a few methods or techniques have proposed a process to identify the stakeholders in the requirements elicitation. However there has not been any SIP framework or uniform description.

So, our systematic approach to analyzing published studies enable us to identify reliably where the literature presents the different practices developed to carry out this task. In view of this, the present paper offers a uniform description of SIP as a first step towards developing a methodology that would cover all necessary aspects of stakeholder identification.

The fact that software requirements have a big impact on final software product quality implies that it is reasonably well documented (Standish 2005; IEEE 2004; SEI 2006). The area of Requirements Engineering (RE) is an essential part of any software development project that specifies, analyzes, and defines the product goal, functionality, and limitations of the final product (IEEE 1998; Wiegers 2003; Hofmann 2001). Three of the most important categories of problems affecting the correctness of software requirements are defined in the literature: gaining, comprehension and volatility (Sommerville and Sawyer 1997; Kotonya and Sommerville 2000). This paper focuses on the first of these problems, namely: information or knowledge elicitation; particularly in the stakeholder identification phase. In
the case of requirements elicitation activities - in which the problem to be solved is identified, the most important thing is that the stakeholders be identified (SEI 1992). Relationships and ways of communicating between the development team and the customer are thereby established (ISO 2004; Sommerville 2002).

However, identification of stakeholders as well as their needs and expectations is poorly done in software projects (Sommerville 2002; Pressman 2005), probably because this process is mistakenly viewed as a self-evident task in which direct users, clients, and the development team, are the only stakeholders. It could also be due to the fact that the identification area can be obviated or substituted by opinions or knowledge obtained from other more accessible sources of information. In the short term, this would create less conflict of interests resulting from different points of view (Smith 2000).

This paper is organized as follows. In Section 2, we describe the method we used for our systematic literature review. We also report on the quality of the included papers in this section. Section 3 presents results of our synthesis of the literature, including geographical spread, temporal aspects and publications details. Section 4 reports the results of our synthesis of identified themes based on our four research questions. In section 5 we discuss or key findings. Section 6 presents some limitations of this study. In Section 7 we give suggestions for further research and finally in Section 8 we present our conclusions.

IN REVIEW PROCESS TO BE PUBLISHED

2 Research Method

In accordance with systematic review guidelines (Kitchenham 2004; Kitchenham et al. 2004) we take the following steps:

2.1 Identify the need for a systematic literature review.

To achieve the objective of this research we analyzed pertinent literature that can help us to determine the effectiveness of stakeholder identification methods or techniques. Given the importance of SIP, we conducted a systematic literature review of why the Software Engineers need to identify, characterize, and handle all the viewpoints of the different types of stakeholders\(^1\) (Mitchell et al. 1992). A systematic literature review evaluates and interprets all available research relevant to a particular question or topic area. It aims to present an evaluation of the literature relative to SIP to research a topic by using a rigorous and auditable methodology. We have followed guidelines derived from those used by medical researches, adapted and applied by Kitchenham et al. (Kitchenham 2004, Kitchenham et al. 2004) to reflect the specific problems of SIP research. We summarized evidence in order to know what aspects need to be adapted to improve the SIP and what process is necessary to carry out an adaptation of stakeholders’ assessment, their contributions and vested interests in a project.

In this review it was not easy to locate articles about this issue; there is a very little existing literature and the descriptive framework does not exist.

---

\(^1\) Stakeholders, meaning all those who are involved in a project and have some interest in the software to be developed, may vary from one project to another.
Consequently, the best method to achieve the research purpose is the systematic review of the literature available, which is specifically ordered into a common framework or uniform description. To achieve the objective of this research we analyzed pertinent literature that can help us to determine the effectiveness of stakeholder identification methods or techniques.

2.2 Formulate review research question(s).

We look to the literature to answer this research questions:

*Question 1*: How is the current status of the stakeholder identification in Elicitation Requirements?
*Question 2*: How is carried out the stakeholder identification for the Software Engineer (SE)?
*Question 3*: What aspects of stakeholder identification needs be improved?
*Question 4*: What methods or techniques exist that carry out the stakeholder identification?

2.3 Search terms.

Our four questions contain the following keywords: “Requirements elicitation, Stakeholder identification, Software engineer, Method, Technique”. A list of synonyms was constructed for each of these words, as in the example for research question 1 which contains keywords “stakeholder identification” and “elicitation requirements”:

Keywords ((elicitation*OR obtaining* OR gaining* OR extracting*) AND Stakeholder* OR interested party* OR person involved* AND Identification* OR classification* OR categorization*).

Our list of search terms were adapted to match each research question and the individual requirements of each search engines on our resource list, some search engines allowed Boolean searches, some did not, some allowed nesting, whereas other did not.

2.4 Resources searched.

The following databases were searched using the keywords noted in the “search terms” section above:

- ACM Digital Library
- IEEE explorer
- Springer Verlag
- Google scholar
- ScienceDirect

To ensure we did not overlook any important material, additional searches were performed directly on key conference proceedings, journals and authors. Also, corresponding authors...
of main texts were e-mailed directly to find out whether they had any material in press. Furthermore we conducted secondary searches based on references found in our primary studies.

2.5 Document selection.

The selection of material for our systematic literature review is based on the following inclusion and exclusion criteria. We include texts that:
- Directly answer any one or more of our research questions;
- Relate to any practitioner directly producing software
- Focus on culture in terms of how SE carry out the SIP

We excluded texts:
- In form of books and overhead presentations
- Relating to cognitive behavior
- External to Software Engineering
- Opinion pieces, viewpoints or purely anecdotal

2.5.1 Repeat studies.

Before accepting a paper into the review we check for repeat studies to ensure there is no duplication; for example if the same study is published in two different journals with different first authors, only one study would be included in the review; usually the most comprehensive study or the most recent study. Where we need to make this choice, we include the most comprehensive study or the most recent study.

2.6 Study quality assessment checklists.

Each accepted study is assessed for its quality against a checklist (Tables 1 and 2). The assessment measures were agreed by the team of experienced researches and validated by our independent reviewer. However, the scoring is heuristic only- to be used as a guide where no study is rejected on the basis of its quality score. For a fair comparison across studies we normalized the data by recording the percentage score.

Quality scores for the 45 papers are given in Table 3.

2.7 Carry out a comprehensive, exhaustive search for primary studies to identify the current status of SIP.

In spite of the importance of the SIP, there is a lack of interest in this process. Up to now, within the RE area, there are no guidelines or standards to help and guide software engineers. RE literature only suggests examples and categories of stakeholders but does not provide a helpful guideline for the identification of them, e.g. (Lauesen 2002; Liscomb
29/OCTUBRE/2009

CARLA LENINCA PACHECO AGÜERO


Table 1. Quality Assessment

<table>
<thead>
<tr>
<th>Assessment criteria</th>
<th>Score</th>
<th>Response options for Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does the study report clear, unambiguous finding based on evidence &amp; argument?</td>
<td>Yes=1/No=0</td>
<td></td>
</tr>
<tr>
<td>Is the sample unbiased?</td>
<td>Random Sample=1/Non-random sample=0.5 Not representative=0</td>
<td></td>
</tr>
<tr>
<td>Could you replicate the study?</td>
<td>Yes=1/No=0</td>
<td></td>
</tr>
<tr>
<td>Number of participants</td>
<td>See scores- Table 2</td>
<td></td>
</tr>
<tr>
<td>For a questionnaire, what is the response rate?</td>
<td>No response rate given =0 Over 80%=1/Under 20%=0/ Between=0.5</td>
<td></td>
</tr>
<tr>
<td>Is the paper well/appropriately referenced?</td>
<td>Yes=1/Moderately=0.5/No=0</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>Enter % score in Quality assessment field in Endnote</td>
<td></td>
</tr>
</tbody>
</table>

IN REVIEW PROCESS TO BE PUBLISHED

Table 2. Criteria for assessing empirical studies

<table>
<thead>
<tr>
<th>Data collection Method</th>
<th>Score (Sample No)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Questionnaire/Survey</td>
<td>Unit=1 person</td>
</tr>
<tr>
<td>Face to face interviews</td>
<td>Unit=1 person</td>
</tr>
<tr>
<td>Observation</td>
<td>Unit=1 person</td>
</tr>
<tr>
<td>Focus group</td>
<td>Unit=1 person</td>
</tr>
</tbody>
</table>

Table 3. Quality scores of accepted papers

<table>
<thead>
<tr>
<th>QUALITY (scores)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor (&lt;26%)</td>
<td>4</td>
</tr>
<tr>
<td>Fair (26%-45%)</td>
<td>8</td>
</tr>
<tr>
<td>Good (46%-65%)</td>
<td>25</td>
</tr>
<tr>
<td>Very Good (66%-85%)</td>
<td>3</td>
</tr>
<tr>
<td>Excellent (&gt;86%)</td>
<td>3</td>
</tr>
</tbody>
</table>

| Number of studies | 45 |
| Percentage of papers | 100% |

At this moment, only a few authors have proposed theories, methods or techniques to illustrate stakeholder identification in a software development project but, there is no uniform description that facilitates their later comparison because authors describe the performance process in different ways.
The methods analyzed in this systematic literature review, are those that, up to now, only partially solve the identification of stakeholders.

- **Method1: Theory of Stakeholder Identification and Salience.** Mitchell et al. (Mitchell et a. 1997) developed a theory of stakeholder identification based in the premise that the identification of these people is done through an analysis of ‘what’ and ‘who’ affects the organization. This identification is performed by analyzing stakeholder interests in the project and considering three dynamic qualities: the power - that the stakeholder has to propose requirements within the organization, legitimacy - about the actions which this person performs within a certain social system constructed with the definition of norms, and the urgency - is the degree or attention that a stakeholder claims from the project manager. Later, possible stakeholders are grouped into three classes based upon the requirements priority degree: (a) latent or low salience, (b) expectant or moderately salient, and (c) definitive or highly salient. Any stakeholder can become a definitive stakeholder by acquiring the missing attributes. Finally, the project manager determines who will be the ‘feasible’ stakeholder to include in the project, by analyzing diverse existing stakeholder classes. This method has never been applied.

- **Method2: Stakeholder Identification in RE.** Sharp and Finkelstein (Sharp et al. 1999) proposed an approach to discover all stakeholders in a specific software project development. This identification is realized by establishing a set of stakeholder denominated “baselines”. From these, we can recognize the “supplier” stakeholder - who provides information or supporting tasks to the baseline, and “client” stakeholder – who examine products. There are other stakeholders called “satellites” who interact with the baseline in many ways. “Interaction” may involve communicating, reading a set of rules or guidelines, searching for information, and so on. Roles are assigned through an analysis of the interactions that can exist between different stakeholders and between the stakeholder and the system. Nevertheless, only the stakeholder baseline is identified. The roles that they can perform are: users, developers, legislators, and decision makers. This method has never been applied.

- **Method3: The Stakeholder Web.** Coakes and Elliman (Coakes and Elliman 1999) developed a method to identify stakeholders and their different viewpoints within a computer information system using a legacy system. The authors used a web that showed a classification and grouped stakeholders using a holistic view of the situation. This allowed an understanding and identification of agreements between stakeholder interests. The web not only identifies stakeholders, it is also used to analyze the relationships between the activities that the stakeholder must perform and the members of a new system, with the objective to assign priorities to the proposed requirements. The system must be defined in terms of automation, technical, and total or human boundaries; each boundary represents a wider view of the system and its impact. Stakeholder identification is a process that explores the web plane looking for interested parties. If stakeholders are identified, they are added to the web making it possible to recognize groups of stakeholders needs and interests. The stakeholder web was used as a prototype to analyze the relationship between the activities and memberships of university information systems steering a group over a five years period. This method was validated in Hertfordshire University in England.
• Method4: Method Engineering with Stakeholder Input and Collaboration (MEWSIC). The purpose of MEWSIC (Young et al. 2001) was to provide software developers with a practical tool to identify stakeholders. The method grouped all the people involved in a project depending on the priorities of their interests. In stakeholder analysis, the MEWSIC approach suggests the identification of people related to the project and an assessment of their relevance to the development project to determine if they need to be considered or not. Appropriate stakeholders are those who have not only relevant knowledge and skills but also suitable attitudes to the process, since some stakeholders are not suitable for negotiation. For this reason, this method proposes the use of personality tests to complement the stakeholder analysis and makes it possible to achieve a fit process between the stakeholder, the system context and development method characteristics. Furthermore, the method introduces group dynamics to observe stakeholder behavior within groups and how this affects members’ performance. Success in a group task depends on the interaction between team members and the working environment; that is why this method includes a personality test to determine the way in which group members communicate and carry out their activities within the group. This method has never been applied.

• Method5: Stakeholder Discovery and Classification Based on Systems Science Principles. The goal of this research is to adopt some fundamental principles of systems science, to provide a generic, scientifically recognized basis that can aid stakeholder discovery and classification (Preiss and Wegmann 2001). By adopting the systemic view of systems theory, this method provides a framework that theoretically guarantees the identification of the complete set of relevant, abstract concepts and also of all the stakeholders. The authors propose a generic stakeholder classification that is based on three principles: two systems, two viewpoints and two domains of inquiry. The life cycle based domains constrain the universe of discourse, that is, the software development life-cycle is divided into two stages: creation and operation, more concretely, in the system development stage (which includes conception, design and implementation) and in the system operation stage (which includes system execution in a real environment). The classification scheme has a generic layout. It is very important to understand that the system under consideration may be an individual software component that is a part of the application- the suprasystem. Using this generic scheme, the external or internal stakeholders can be identified. This method was validated in an e-commerce application for a virtual supermarket.

• Method6: A Stakeholder Perspective within Software Engineering Projects. This approach analyzed the guide proposed by the World Bank (WB) model in 1996 for stakeholder identification (McManus 2004). The goal of this stakeholder analysis is to identify stakeholders’ categories using a WB questionnaire, develop a strategic view of the situation and the relationship between the different stakeholders and identified objectives, and explain the stakeholder’s interests and roles. The questionnaire results should provide information about stakeholders and their interests, the relationship between them, their motivations, and their ability to influence outcomes. The WB model proposes four groups of stakeholders: 1. Primary stakeholders - includes those who, because of power, authority, responsibilities or claims over the resources, are primordial to any project initiative. As the outcome of any action will affect them directly, their participation is critical. 2. Secondary stakeholders - are those who have an indirect interest in the outcome.
may need to be involved periodically in collaboration processes but their role may be peripheral to that of primary stakeholders. 3. External stakeholders - come from outside the project and will be expecting something from the project team- and 4. Extended stakeholders – may often be helpful in assisting primary and secondary stakeholders to reach a unified vision and develop realistic action plans that are feasible. The roles of the four groups are established using the following activities: collection and analysis of information, definition of priorities and establishment of goals, assessment of available resources, projects planning, design of strategies to implement these programs and divide responsibilities among participants, manage projects, monitor the progress, and evaluate the results and impacts. This method has never been applied.

2.8 Classify studies and data needed to answer the research questions.

The aforementioned studies confirm the variety of existing stakeholders involved in software development, each having different priorities and interests. However, all of these studies take SIP for granted and don’t go beyond indicating “who” the stakeholders may be. They do not mention “how” the process must be carried out to properly identify stakeholders as a prerequisite to obtaining exact and complete requirements. In spite of this, the Software engineers need to identify, characterize, and handle all the viewpoints of the different types of stakeholders (IEEE 2004; Kotonya and Sommerville 1997; Pressman 2005; Sommerville 2002; SEI 2006).

At present, stakeholder identification specific methods are few and since each author describes the process the SIP lacks a common framework of study and a uniform description. In the details described in this study (Tovar and Pacheco 2006) we can see to this methods only partially solve the issue of stakeholder identification.

2.9 Data extraction and synthesis.

We used Endnote version 9 to record reference details for each study. How each study answers the research questions(s) was recorded on a separate results form. We synthesized the data by identifying themes emanating form the findings reported in each accepted paper (section 6). These identified themes gave us the categories reported in our results section. In our results section we present frequencies of the number of times each theme is identified in different studies. We give each occurrence the same weight. The frequencies merely reflect how many times given characteristics or motivators are identified in different papers, and not how important it may be.

Sensitive analyses were performed on these studies based on population, location, year and type of study. The sensitivity analyses gave us information on where the data might be biased. They are also reported in our results section.
2.10 Document retrieval.

Our searches elicited over 980 references. Evaluating the title and abstract enabled us to reject approximately 735 of these. We then looked at 245 papers in full to establish a final list of 45 papers. The different stages involved in the selection process are shown in Table 4.

<table>
<thead>
<tr>
<th>Selection Process</th>
<th>#Papers</th>
<th>Papers used in validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Papers Extracted from Databases</td>
<td>&lt;980</td>
<td>n/a</td>
</tr>
<tr>
<td>Sift based on Title and Abstract</td>
<td>245</td>
<td>n/a</td>
</tr>
<tr>
<td>Papers – full versions available [245-9]</td>
<td>236</td>
<td>(28 papers randomly selected from this set for validation 1)</td>
</tr>
<tr>
<td>Papers accepted (by primary researchers)</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>Papers rejected by independent researcher</td>
<td>46</td>
<td>[1 paper rejected from the 28 paper sample that formed part of the 44 accepted papers]</td>
</tr>
<tr>
<td>(validation 1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Papers added by independent researcher</td>
<td>48</td>
<td>[2 papers accepted out of the 28 randomly selected papers that were previously rejected by primary researchers]</td>
</tr>
<tr>
<td>(validation 1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Papers rejected in Validation 2 (45 papers</td>
<td>45</td>
<td>All 48 paper assessed and qualitative forms completed by two independent researchers – 3 rejected</td>
</tr>
<tr>
<td>remain in our review)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.11 Validation.

We performed two validation exercises:

a) Inter-rater reliability: We ran inter-rater reliability tests on the 245 paper references we found in our initial search. A group of primary researchers looked at each of these papers in great detail (4 papers proved unobtainable). The primary researchers accepted 48 papers. An independent researcher looked at 29 randomly selected rejected and accepted papers (approx 8th paper from an alphabetical list of the 245 papers). A 99.4% agreement was recorded with the original assessments. This high level of agreement gives us considerable confidence in our acceptance/rejection decisions.

b) Independent assessment: We performed a final validation exercise on the 48 ‘accepted papers’. An independent exercise in Stakeholders Identification recorded how each paper addressed our research questions. Again there was a high level of agreement between the primary researchers and the independent expert (99.8%), and any disagreements were discussed. There were only three papers that could not be agreed on, and these went to arbitration with a third, independent researcher who determined whether the papers should be included and how each study addressed our research questions. This process resulted in 100% agreement. Three of the accepted papers were rejected as a result of this exercise, leaving 45 papers for inclusion.

IN REVIEW PROCESS TO BE PUBLISHED
3 Results - experience

3.1 Type of study.

Figure 1 shows that out of the 45 studies, 90% are empirical, i.e. findings are based on direct evidence or experiment. The 8% theoretical or conceptual studies are based on an understanding of the field from experience and reference to other related work. There are a small number of studies (2%) that are either reviews of the literature or secondary studies, where empirical work is re-examined.

Data collection methods used in the empirical studies include: surveys and questionnaires, field studies, structured and semi-structured interviews (face-to-face and by telephone), analyzing results of programming tests, data reviews, case studies, focus groups and controlled experiments.

Out of the 36 studies that are empirically based, only five studies do not include questionnaires. Figure 2 shows how these data collection methods are divided with 94% (78%+16%) of the empirical studies employing questionnaire survey instruments.

![Figure 1. Types of studies in our accepted papers](image-url)
3.2 Temporal view of publications.

Figure 3 shows that over the last 19 years there is a recent increase in published papers covering SIP. The increase may be a reflection of a growing awareness of the importance of motivation on Requirements Engineering. Alternatively, this increase may just match a general rise in published papers in SIP in RE.

3.3 Data sources.

Figure 4 gives a breakdown of where our papers are published. The majority are published by the special interest group on requirements engineering research with fewer paper reaching the more widely know journal publications.
### 3.4 Geographical distribution of papers.

![Figure 4. Number of papers included in the review by 5 year intervals](image1)

![Figure 5. Countries represented in the empirical studies](image2)

A high percentage of the empirical studies in our review are concentrated on work carried in the USA (48%), as shown in Figure 5.

#### 4 Results - SIP in RE

This section reports on how the literature represents the SIP and based on the previous methods described, we can identify the main contributions of each one. This will help us to define what a SIP must contain. In view of the foregoing description, we define the SIP as: “A
process that contributes to the identification of relevant stakeholders in RE” (Conger 1994; Macaulay 1996; Finkelstein 2000; Zowghi and Paryani 2003), and must:

- Assign appropriate roles to stakeholders through an analysis of behavior in a dynamic group and doing personality tests (aspects that can give the SIP repeatable and verifiable quality);
- Classify requirements for the stakeholders according to an evaluation of their priorities in relation to the project goal in order to define interactions between the stakeholders, and between the stakeholders and the project. This enables us to verify whether the initial project goal has been satisfied.

So far, we have explained how each software project may have different types of stakeholders, and how selecting them appropriately has a strong impact on software requirements quality, and consequently, on the success of the software project itself. The studies reviewed could give the impression that many attempts have been made to define and give detailed explanations of how the SIP is done. This, however, is not the case. Currently, stakeholder identification methods are few and since each author describes the process the SIP lacks a common framework of study and a uniform description. The studies described so far in this paper seem to only partially solve the issue of stakeholder identification.

Based on RE systematic literature review relating to SIP, we propose to group the existing methods into three categories. Section 4.1 gives the first category of studies that limit themselves to only proposing a list of possible stakeholders. Section 4.2 presents the second category of studies that not only indicate who the stakeholders can be, but also studies their interactions. The third category, in section 4.3, deals with studies that include an assessment of stakeholders.

### 4.1 Studies that exclusively describe stakeholders.

These studies provide a list of potential stakeholders from which it is possible to determine which ones are really relevant and how each one may be contacted. These, however, are incomplete because they only provide a helpful guide to establish a final list of stakeholders. What must not be overlooked is that stakeholders will normally have to contribute their effort, time and/or money, and they must therefore know what benefits can be gained in return. Potential stakeholders must therefore be characterized by gathering relevant information about them. This information may also be useful for evaluating a set of identified stakeholders, and for obtaining new and more appropriate configurations. Some examples are:

- Lauesen (Lauesen 2002) only summarizes this information from responses to just three questions: what goals do they identify for the system? Why would they like to contribute? And, what risks and costs do they envisage?
- Robertson’s VOLERE template (Robertson 1999) is used during the whole requirements process for other purposes such as assessing quality and specifying business requirements. The template is a tool that helps to discover the difference between a stakeholder’s wish and a real need, and helps to establish the range of a system. This fundamental aspect of the process ensures that all stakeholders know what is and what is not within their domain. However, it can also be used to get a general idea about the stakeholders who
are participating in the development of a system. This method only differentiates between the client and the buyer, and thereby ignores other stakeholders. Other stakeholders may be found in the following categories: users, sponsors, test staff, business analysts, technology experts, system designers, marketing experts, legal experts, usability experts, representatives of external associations, etc. Each of the stakeholders taken into account is identified in terms of who he/she is and what role he/she will play. They are selected from a list of stakeholders initially proposed and on the basis of knowledge, which may be necessary for the project.

In general, these studies cannot be regarded as identification of stakeholders because they only provide information that makes it easy to identify them. They do not ensure that all the necessary stakeholders are detected.

4.2 Studies focusing on interaction between stakeholders.

Once we have an idea of who the main stakeholders are, the basic interactions between these actors should be identified. This enables stakeholders to clarify which part of the problem falls within each one’s scope. The following range of studies deal with this aspect.

- Smith (Smith 2000) proposes a context diagram to enable stakeholders to see what is happening in the system. This starts with a brainstorming activity in which all stakeholders must be taken into account. At the center of the diagram, an oval represents the project itself and a horizontal line divides the stakeholders. The upper section contains stakeholders who belong to the organization such as clients, functional departments, team members, etc. The lower part contains external staff such as advertising agencies (press, radio and television), competitors, citizens, government organizations or representatives.

- Coakes and Elliman (Coakes and Elliman 1999) develop a method to identify stakeholders and their different viewpoints in a computer information system using a legacy system. The authors use a web that has a system of classification and stakeholders are grouped by using a holistic view of the situation. This facilitates an understanding and identification of agreements between stakeholder interests. The web not only identifies stakeholders, it is also used to analyze relationships between activities that must be performed by the stakeholders and the members of the new system, with a view to prioritizing the proposed requirements. The system must be defined in terms of different boundaries: automation, technical, and total or human boundaries. Each boundary represents a wider view of the system and its impact. These limits are very generic and provide a general guideline as to who may be found within each limit. Stakeholder identification is a process that explores the web plane looking for interested parties. If stakeholders are identified, they are added to the web and thereby groups of stakeholders, needs and interests can be recognized.

- Sharp, Galal and Finkelstein (Sharp et al. 1999) propose an approach to discover all stakeholders in the development of a specific software project. Establishing a set of “baseline” stakeholders carries out this identification. From these, the “supplier” stakeholder (who provides information or supporting tasks to the baseline stakeholders) can be recognized, and also the “client” stakeholder (who examines products). Other stakeholders called “satellites” interact in various ways with the baseline stakeholders. “Interaction” may involve communicating, reading a set of rules or guidelines, searching for information, etc.
Roles are assigned on the basis of an analysis of the interactions that can exist between different stakeholders and between the stakeholder and the system. Only the baseline stakeholder, however, is identified. The roles that they can perform are: users, developers, legislators, and decision makers.

- Preiss and Wegmann (Preiss and Wegmann 2001) adopt some fundamental principles of Systems Science to provide a generic, scientifically recognized basis that can aid stakeholder identification and classification. This method provides a framework that theoretically guarantees the identification of a complete set of relevant, abstract concepts and also all the stakeholders. The authors propose a generic stakeholder classification that is based on three principles: two systems, two viewpoints and two domains of enquiry. The software development life-cycle is divided into two stages: creation and operation, or in more concrete terms, the system creation stage (which includes conception, design and implementation), and the system operation stage (which includes system application in a real environment). Using this generic scheme, external and internal stakeholders can be identified.

IN REVIEW PROCESS TO BE PUBLISHED

4.3 Studies that include assessment of stakeholders.

- Mitchell, Agle and Wood (Mitchell et al. 1997) developed a theory of stakeholder identification based on the premise that identification is realized through an analysis of ‘what’ and ‘who’ affects the organization and also taking their salience into account. This identification is performed by analyzing stakeholders’ interests in the project and considering three dynamic qualities, a) the power that the stakeholder has to propose requirements within the organization, b) legitimacy of the actions which a person performs within a certain social system constructed with the definition of norms, and c) urgency – meaning the degree of attention that a stakeholder claims from the project manager. Afterwards, possible stakeholders are grouped into three classes based on the degree of requirements priority: (a) latent or low salience, (b) expectant or moderate salience, and (c) definitive or high salience. Any stakeholder can become a definitive stakeholder by acquiring the missing attributes. Finally, the project manager determines who will be the ‘feasible’ stakeholder to include in the project, by analyzing a variety of existing stakeholder classes.

- The aim of the Method Engineering with Stakeholder Input and Collaboration, MEWSIC (Young et al. 2001), was to provide software developers with a practical tool to identify stakeholders. The method groups all the people involved in a project depending on the priorities of their interests. In stakeholder analysis, the MEWSIC approach suggests the identification of people related to the project and an assessment of their relevance to the project being developed to determine if he/she should or should not be taken into account. Appropriate stakeholders are those who have not only relevant knowledge and skills but also have suitable attitudes towards the process; some stakeholders, for example, are not suitable for negotiating. For this reason, this method proposes the use of personality tests to complement stakeholder analysis and make it possible to achieve an adequate fit between the stakeholder, the system context, and the characteristics of the development project. Furthermore, the method introduces group dynamics to observe stakeholder behavior within groups and how this affects a member’s performance.
McManus’ approach analyzes the guide proposed by the World Bank (WB) model in 1996 for stakeholder identification (MacManus 2004). The goal of this stakeholder analysis is to identify stakeholder categories using a WB questionnaire, to develop a strategic view of the situation and the relationship between different stakeholders and identified objectives, and to explain stakeholder interests and roles. The questionnaire results should provide information about stakeholders and their interests, the relationship between them, their motivations, and their ability to influence outcomes. The WB model proposes four groups of stakeholders. Primary stakeholders include those who, because of power, authority, responsibilities or claims over the resources, are primordial for any project initiative. Secondary stakeholders are those who have an indirect interest in the outcome. External stakeholders come from outside the project and expect something from the project team. And finally, the Extended stakeholders may often be of help to primary and secondary stakeholders to reach a unified vision and develop feasible plans of action. The roles of the four groups are established by means of the following activities: collecting and analyzing information, defining priorities and establishing goals, assessing available resources, project planning, designing strategies to implement these programs and dividing responsibilities among participants who manage the project, monitor progress, and evaluate results and impacts. However, since the identified stakeholders may not have enough capacity to participate in the project, each one’s strengths and weaknesses is identified in order to form collaboration groups.

5 Discussions

During software requirements elicitation we decide what exactly is to be produced. At this stage, the appropriate identification of stakeholders is vitally important as a means of understanding the environment in which the software project will be developed and operated, and also to identify which stakeholders will participate in the project. This is a key aspect in the process of obtaining the expected quality requirements specifications, in the sense that they must be appropriate, complete, and free of contradictions. This means that all stakeholders need to have appropriate knowledge and no stakeholder can be omitted. Good interaction is vital during the requirements-gathering process, and also between all stakeholders and the system to avoid conflicts and problems of communication arising from different points of view (Dix et al. 2000; Firesmith 2003; Nusebeih 2000; Liscomb 2003).

The current status of SIP referred to in the present paper shows different interpretations of the scope of this process. All of the software initiatives referred to assume a way of contributing to the improvement of the software process by implementing a set of good industry practices for RE that have been identified, acknowledged, and disseminated. However, they have not explained how to carry out the SIP.

Some initiatives provide numerous examples of who can be stakeholders by establishing generic categories into which they may be grouped. Other studies analyzed are more ambitious. However, the studies mentioned in this paper are not standardized and consequently the SIP is not standardized either. Not all of them, however, cover the same aspects and thus are not applicable to the same situations. This makes it difficult to select a correct stakeholder identification method because some methods only characterize stakeholders...
without assigning a stakeholder’s role in a specific project (Lauesen 2002; Robertson 1999); others like (Smith 2000; Coakes and Elliman 1999; Sharp et al. 1999; Preiss and Wegmann 2001) analyze stakeholder interaction but they do not cover human aspects of stakeholder identification (e.g. personality tests, human behavior). Only a few methods include stakeholder assessment (Mitchell et al. 1997; Young et al. 2001; McManus 2004). Furthermore, not all the studies analyzed take into account aspects such as when and how we know that the stakeholders identified are sufficient for the project, and how all the information collected will be documented (Lewis 1991; Lloyd et al.2002).

IN REVIEW PROCESS TO BE PUBLISHED

6 Limitations

6.1 Completeness.

We have conducted a very thorough review of the literature eliciting work from 35 different authors including some secondary studies (where we used the reference in the primary study to lead another study). We note however that with the increasing number of work in this area we cannot guarantee to have captured all the available material in this area. Another area of concern is that few studies have been published on Stakeholder Identification Process in countries like India that are increasingly involved in Software Engineering (Yourdon 2005), suggesting that we cannot present a global view of this area. This not a limitation of our approach, but a reflection of the limitations imposed on us by the available research in this area.

6.1 Potential bias.

The studies included in this review have undergone a thorough selection process that involved several researchers crosschecking the completeness of searches and validating the suitability of each study for inclusion. However, as there is a systematic bias in the way the research is conducted in many of the included studies (often based on convenience samples) we note that our results may not be representative of the all SIP methods. So, we cannot generalize our results.

6.2 Data synthesis.

Different countries, areas in Software Engineering, Software Requirements and Stakeholder Identification studies, have been grouped together in order to identify themes that answer our research questions. However, there is a suggestion in some of the literature that different categories are associated with different stakeholders identified. By grouping all categories together has not have taken into account the project type; we may have lost some of this detail. In this review the term ‘Stakeholder Identification’ encapsulates a multitude of categories in requirements engineering as we include all practitioners who are directly involved in producing software. We may have lost some of the detail of changes over time by grouping all papers together by theme and ignoring the date of publication in the rage of 1990-2009. For example, it
could be that the changing profile of stakeholder has affected some factors; however the number of papers published from the year 2000 onwards (23) represents a large portion (51%) of the overall 45 papers. So we have a sample of papers that are more representative of current trends than those in say 1990’s (that include 18 papers (or 45%) for the whole decade). When we aggregate our themes the reported frequencies need to be treated with caution.

7 Further Research

This review has raised many questions that would benefit from further research. For example, the SIP must take into account the impact of personality types and the roles they may play? Stakeholders must be assessed in terms of their characteristics, the knowledge needed, and their influence on a project? SIP must also contain schemes to characterize and evaluate appropriate relationships between all stakeholders? For example, we could use this research question: the method analyzed contains labels such as “one person is in charge of”, “this person is an assistant to”, “he/she is crucial for”, “he/she provides the information for”? In addition, further work is needed to develop a definitive method or model to carry out the SIP in Requirements Engineering.

8 Conclusions

Our findings, suggest a decreasing awareness of developing methods to SIP since about 2004, as compared to the previous 14 years. Most of the studies in this area rely on the use of questionnaires, with 16% using multiple data collection methods and only 1% using multiple methods without questionnaire. Over half of the studies (56%) were conducted in the USA. In addition, the majority papers were published in the IEEE Proceedings rather than Software or Requirements Engineering journals.

Mixed findings in the literature lead us to conclude that, up to now, the SIP continues to receive very little attention from the different existing initiatives in software development despite the fact that success in software products depends to a great extent on proper stakeholder identification in requirements specification. Furthermore, it must be understood that no matter what method is chosen to identify the stakeholders in a software project, it is vitally important to gain their complete trust so that they are fully committed to the project. Although we found a variety of Stakeholders Identification methods or techniques in the literature, no method considered all the issues like appropriate assignment of roles for stakeholders - ensuring that these people have the appropriate abilities that the project requires; and an adequate classification of stakeholders’ requirements - according to the evaluation of its priority in relation to the project goal. Some methods lack validation while others do not cover technical, social, organizational and human aspects in the identification of the stakeholders involved, or, it only identifies stakeholders without assigning the adequate roles for a specific project. None of the methods for the identification of stakeholders takes into account issues such as, when and how we know that the identification of stakeholders is sufficient, and how all the information collected is documented.
It is clear from the literature that there is a need for a validation of all-empirical studies analyzed in a specific project; this will enable us to determine its effectiveness. Development of a guide, which would recommend the use of a specific method of stakeholder identification based on the particular characteristics of the project to be developed. Or, development of a new methodology to adequately perform the SIP by covering the shortcomings found in this systematic literature review.

IN PROCESS REVIEW TO BE PUBLISHED

9 References


