

# SELECTING THE RIGHT STAKEHOLDERS FOR REQUIREMENTS ELICITATION: A SYSTEMATIC APPROACH

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## ABSTRACT

Requirements elicitation is the most critical phase in software development as it captures the required functionality of a software system. The elicitation process is indeed resource intensive. It involves a number of dedicated stakeholders who are deliberately gathered to confer and stipulate software requirements. The effectiveness of the process is greatly influenced by the credibility and suitability of the stakeholders involved. Correct and complete requirements could only be achieved if they are gathered from the right stakeholders. Therefore, there is a need of systematic approach that could help in identifying and choosing the appropriate stakeholders. As stakeholder participation can be enormous, the approach should also embrace prioritization. This study addresses this issue by collating important elements that contribute to an effective selection of stakeholders for requirement elicitation purposes. The elements were identified through reviews of related work, which were analyzed by using content analysis. The elements were then integrated as a conceptual framework that consists of a step-by-step procedure. The framework can be used by practitioners to execute the selection process. To researchers, the study proposes several mechanisms to support the approach as a guide for future research.

**Keywords:** *Requirements Elicitation, Stakeholder Identification, Stakeholder Selection, Stakeholder Prioritization*

## 1. INTRODUCTION

Requirements elicitation (RE) is one of the most important and critical phase in requirements engineering [1]. It is the stage where user and business needs of a system are identified and captured. An ineffective elicitation process produces poor requirements, which later leads to low system quality, extension of schedule and increase in budget [2]. To be successful, RE process requires active and appropriate participation from stakeholders. Project managers have to identify potential stakeholders by determining who may affect the project and those who are affected by it. This process is indeed the first challenge that a manager has to face in a project.

Undoubtedly, stakeholders play a significant role during RE process. Selecting the appropriate stakeholders from the right subject at the right time is one of the major factors of software success [3]. In particular, the selection process has a big impact

on software requirements quality, namely correctness and completeness [4,5]. Selecting inappropriate stakeholders will lead to the capturing of requirements which are not relevant to the system's real needs [6]. This influences the correctness of the requirements. Similarly, if the identification process misses to obtain stakeholders who are paramount to the project, requirements become incomplete. Missing stakeholders implies missing essential requirements which subsequently increase project costs and promotes project failures [7].

As stakeholders' influence on a project considerably varies from one to another, the possibility of involvement can be immense. For example, the RE process may involve people who pay for the system such as sponsors, clients and customers. On the other hand, it can also include the development team who elicit, design and construct the system as well as the system users who use the system to fulfill their daily tasks. The selection process should thus take into consideration different types, roles and influence



that various stakeholders hold. To satisfy all these criteria however is impossible as projects are bound to tight schedule and limited budget. As a result, stakeholder analysis is necessary so that prioritization can be made [8,9]. This indicates that some kind of selection procedure must take place in order to handle such a dilemma.

To date, the process of selecting stakeholders for RE process is unstructured and unclear. This paper addresses this issue by collating and integrating essential selection elements in a form of procedural framework. The framework is aimed to be as a guide for attaining an effective RE process. The paper is organised as follows. The following section provides the related work on the subject matter that acts as the basis for the proposed framework. Section 3 briefly explains the methodology used. Section 4 elaborates the framework whereas Section 5 provides some ideas on how the framework can be used and applied. Finally, section 6 concludes the paper with a summary of the main findings and future work.

## 2. RELATED WORK

To develop any system, a project team must elicit its requirements from the system's stakeholders. There are several definitions available for defining the concept of stakeholders. For example, stakeholders are defined as "any group or individual who can affect or is affected by the achievement of the organization objectives" [10]. On the other hand, the term also means "all those who have a stake in the change being considered, those who stand to gain from it and those who stand to lose" [11].

Stakeholders in general can be classified into four types: primary, secondary, external and extended stakeholders [9]. Primary stakeholders are vital since the outcomes of the project affect them directly and their interests in the proposed system are high. Missing any primary stakeholders can affect the project development and influence the achievement of the project goals. Primary stakeholders normally include individuals who have the power, authority and responsibility over the resources such as financial. Secondary stakeholders embrace those who are affected by the project outcomes indirectly. They may be the consumers of a product or service. Although they do not participate in project development matters, they monitor the fulfillment of their interests. External stakeholders are not directly a part of the project team but they add values to the project from

outside. Extended stakeholders could be anyone who is often helpful in assisting above-mentioned stakeholders to reach their visions.

When a project commences, there are many stakeholders who desire to be involved in the process. Unfortunately, not all of them should and could be included due to project constraints. Conversely, there are also stakeholders who must be in the process but choose to remain idle. Stakeholders therefore must be identified, selected and prioritized so that the suitable ones can be invited to participate and contribute. This is important as inappropriate participation will lead to incomplete and incorrect requirements to be captured, which later jeopardizes the quality of the software [4,5,6,7].

Stakeholders can be identified by following the definitions mentioned above. They are determined from project initiation documents or project plans that delineate which stakeholders can be affected by or can affect the project [5,12]. The identification can also be based on system types, system goals and strategies to fulfill the goals as well as system domain [3]. Another possible way of identifying stakeholders is by considering their roles. For instance, potential stakeholders can be determined by analyzing their interaction [13]. Each stakeholder plays one or more specific role(s) that interact(s) with other roles in some ways. The interaction can happen in many ways either directly such as verbal communication or indirectly such as reading and searching for information. One example is the Onion model approach [7]. Each ring of the onion represents a context, which contains specific roles. Each ring is connected to its adjacent rings and thus, some roles are interacting. It is believed that the more interaction that a stakeholder has, the more important his or her role is. In addition, stakeholders can also be discovered by complying conventional theory of power, legitimacy and urgency [12]. It is quite apparent that the more authoritative a stakeholder is, the more his or her participation in the project is needed.

Stakeholders are human, thus they bring certain values and preference towards the project. They come from various backgrounds that reflect their specific knowledge. They also possess certain interests. Stakeholder selection therefore must consider stakeholders' knowledge and interests [14]. In terms of knowledge, stakeholders can be classified into two major categories: inner and outer [15]. The inner involves producers who work in the project and deliver some products through technical

knowledge such as developers. The outer are stakeholders who have business knowledge that is needed by the producers, namely sponsors, consumers and consultants. RE in essence requires knowledge transmission between those two entities. Knowledge may also include educational background and experience. Several studies have found that educational background and experience have direct effects on the interaction [16,17]. For the interest, stakeholders may be selected through personality testing and group dynamic principles [5]. Several studies indicate that measuring stakeholders' levels of interest on the project before they get involved is helpful to gauge their suitability [14,18].

Having the knowledge solely is insufficient. Stakeholders should possess interpersonal skills such as negotiation, collaboration and communication. Software development is generally known as a collaborative process that requires intensive communication and intervention between various parties. A study has shown that one of the main problems in RE is stakeholders lack the necessary skills to elicit the requirements [7]. Stakeholders normally have different concerns, priorities and responsibilities. When multiple stakeholders participate in a discussion, requirements often conflict [19]. Negotiation and collaboration skills are necessary for handling those conflicts in order to gain better requirements [20,21]. In fact, negotiation is adopted relatively high in most organizations as it supports the definition of system boundaries and priorities [31], and the establishment of common understanding [22]. On the other hand, communication skills enable stakeholders to interact and express ideas effectively [23]. Communication skills include both written and oral proficiency. One problem during RE is when stakeholders start using specific jargons. Developers normally tend to use technical jargons whereas domain experts prefer to communicate using business jargons. This may force stakeholders to hide some requirements and cause misinterpretations [20]. The stakeholders thus need to possess appropriate oral and writing skills to avoid poor communication.

Based on the reviews above, it can be seen that various elements that influence stakeholder selection for RE process have been discussed by previous studies. However, those elements were identified individually and thus they are narrowed and isolated. It is unclear how these elements are interrelated with each other. This paper is intended to integrate these elements conceptually as a

framework so that their effects on the matter can be clearly seen. This later can direct more fruitful future work.

### 3. METHODOLOGY

In general, this study aimed to answer the following research questions (RQ):

- i. What are the required elements that need to be considered when selecting stakeholders for RE purposes?
- ii. How the identified elements can be conceptualized as a systematic procedural selection process?

In order to answer the questions, this study employed content analysis. Content analysis was chosen because it helped to answer the questions of what and how of the study. Content analysis is a systematic, replicable technique for compressing many words of text into fewer content categories based on explicit rules of coding [24]. The first important step in content analysis is the identification of abstract categories. This step helped to answer RQ (i). The second step involves systematically connecting the identified abstract categories through certain statements of relationship. This step contributed to achieving RQ (ii). Based on the content analysis made on previous studies, several abstract categories that influence stakeholder selection process for RE were identified. The categories were then integrated to form a framework.

The analysis was conducted on previous related work. The reviews were based on articles concerning stakeholders identification and selection in the domain of RE that were published within a period of fifteen years. The articles were searched in online databases. The searching covered both journal and proceeding articles. The keywords used during the searching were "requirements elicitation", "stakeholders", "stakeholder identification", "stakeholder analysis" and/or "stakeholder prioritisation/prioritization". There were about fifty-five articles found. However, twenty articles were chosen to be analysed because they suited best with the interest of the study.

#### 4. RESULTS: THE FRAMEWORK

Figure 1 illustrates the stakeholder selection framework. The framework consists of three essential stages; Identification, Filtering and Prioritization. Each stage comprises a set of elements. The first stage is Identification that uses project definition (goal, type and domain) to recognize stakeholders' types and roles (interaction and authority). This stage gathers as many potential stakeholders as possible that belong to the stipulated types and roles. As the quantity can be massive, the Filtering stage assesses stakeholders' knowledge and interests in order to gauge their efficacy and competency. The Prioritization is the third stage, which finalizes the selection by measuring the chosen stakeholders' interpersonal skills. This is to justify their suitability. The output of these three steps is a list of shortlisted candidates who are eligible to be involved in RE process. The following paragraphs elaborate the stages and elements in detail.

**Stage 1 – Identification:** At the beginning of any project, the main task is to set clear project definitions that include project goals and system descriptions (type and domain). The project goals specify what the business wants to achieve through the project while the system descriptions define the characteristics of the system to be built. The definitions lead to the recognition of which types of stakeholders (primary, secondary, external and extended) are required. Stakeholders have specific roles. They can therefore be categorised based on the roles that they are playing. Stakeholders may also be assigned to more than one role. Moreover, roles have degrees of importance. Some stakeholders' roles are more influential and significant than the others. These roles have higher chances of being considered in the next stage. In order to determine which groups of stakeholders should be considered, they can be classified into the following classes:

- **Mandatory (M)** – Stakeholders that must be included or else the success of the system is threatened.
- **Optional (O)** – Stakeholders that are not necessarily selected. By neglecting their needs does not threaten the success of the system.
- **Nice-to-have (N)** – Stakeholders that do not influence the system's success if they are not selected.

Due to its importance, primary stakeholders are considered as M regardless the roles that they are playing. Secondary stakeholders may fall under M or O, depending on their roles' degrees of importance. External stakeholders are mainly O but they may become N if their involvement or roles towards the project are insignificant. Lastly, extended stakeholders fall under N as their contributions are quite minimal.

The groups of stakeholders to be considered in the next stage are still massive after the classification. There are two possible scenarios: (1) only M, or (2) M and O are included. The first scenario seems to be bias whereas the second scenario looks more promising. By having several stakeholders who are "not so important" (O class) may generate a better insight, as they view the project from different perspectives.

One way to reduce the number of stakeholders to be considered in the next stage is by applying sampling method, which is normally used in studying a population. In this case, the most suitable method is stratified random sampling, with priority is given towards the higher class (M is higher than O). The priority may be based on percentage, for example, 80% of the participants must originate from M class whereas 20% from O class.

**Stage 2 – Filtering:** In this stage, some forms of analysis should be conducted so that the selection can be made fairly. The analysis is based on two factors; knowledge and interest. RE is known as the exchange of two essential knowledge between two parties; business domain knowledge from customers and software domain knowledge from developers. On the other hand, interest is built when a stakeholder's needs match with the project goals. Certain measurement mechanisms have to be introduced to determine stakeholders' levels of knowledge and interest. The former is quite straightforward to measure, for instance, by assessing their educational background, past experience and job scopes. The latter however is a bit tricky as interest is normally implicit and psychological-influenced. Methods in psychology study such as interest inventory [25] or personality testing may be adopted for this purpose. In short, this stage concerns assessing stakeholders' mental aptitude. The results are used to determine which stakeholders are eligible to proceed to the next stage.

**Stage 3 - Prioritization:** Projects have constraints which hinder project managers to



include all possible stakeholders into a project. A kind of sorting process has to be established where certain aspects of the stakeholders enable them to be on top of the list. The sorting is called prioritization. Interpersonal skills are important to ensure an effective RE process [7,20,26]. The skills therefore can be used as the final measures to qualify the selected stakeholders as the best possible participants. The skills include negotiation, collaboration and communication (written and oral). These three skills have to be considered holistically, which can be measured through predetermined tests. Some possible prioritization techniques that can be adopted include the ones that are normally employed in prioritizing requirements such as Analytical Hierarchy Process (AHP) [27], Case-Based Ranking [28] and Hierarchical Cumulative Voting [29].

## 5. APPLYING THE FRAMEWORK

The framework may not be conclusive as it needs to be confirmed and refined further. It however provides a conceptual overview of interrelated elements that are necessary for attaining an effective RE process through proper selection of stakeholders. The framework in particular guides practitioners on what aspects to look for and consider when selecting stakeholders. The framework also proposes some possible mechanisms to use. This may provide practitioners some ideas on how to execute the process. To researchers, the framework triggers the needs to

investigate further the suitable mechanisms to employ. The operational aspects of the mechanisms need to be formulated as a working technical procedure for the practitioners to follow. Moreover, more rigorous methods, techniques or models have to be developed to support the Filtering and Prioritization stages.

## 6. CONCLUSIONS AND FUTURE WORK

This paper discussed the importance of having appropriate stakeholders during RE, as any misjudgment made during this phase may lead to project failures. Elements for an effective selection process of stakeholders were identified through content analysis of the selected literature. The elements were conceptualized as a systematic procedural framework of stakeholder selection. There are three phases involved: Identification, Filtering, and Prioritization. The first phase classifies the stakeholders based on project definition, stakeholder types and roles. The second phase analyses the stakeholders' mental aptitude, namely knowledge and interest. The last phase involves the final selection of stakeholders based on their interpersonal skills. The framework can guide future research by highlighting the important aspects that need further investigation. For instance, future studies may explore rigorous approaches to support the Filtering and Prioritisation stages. Furthermore, the framework needs to be assessed through empirical work in order to confirm its accuracy and feasibility.

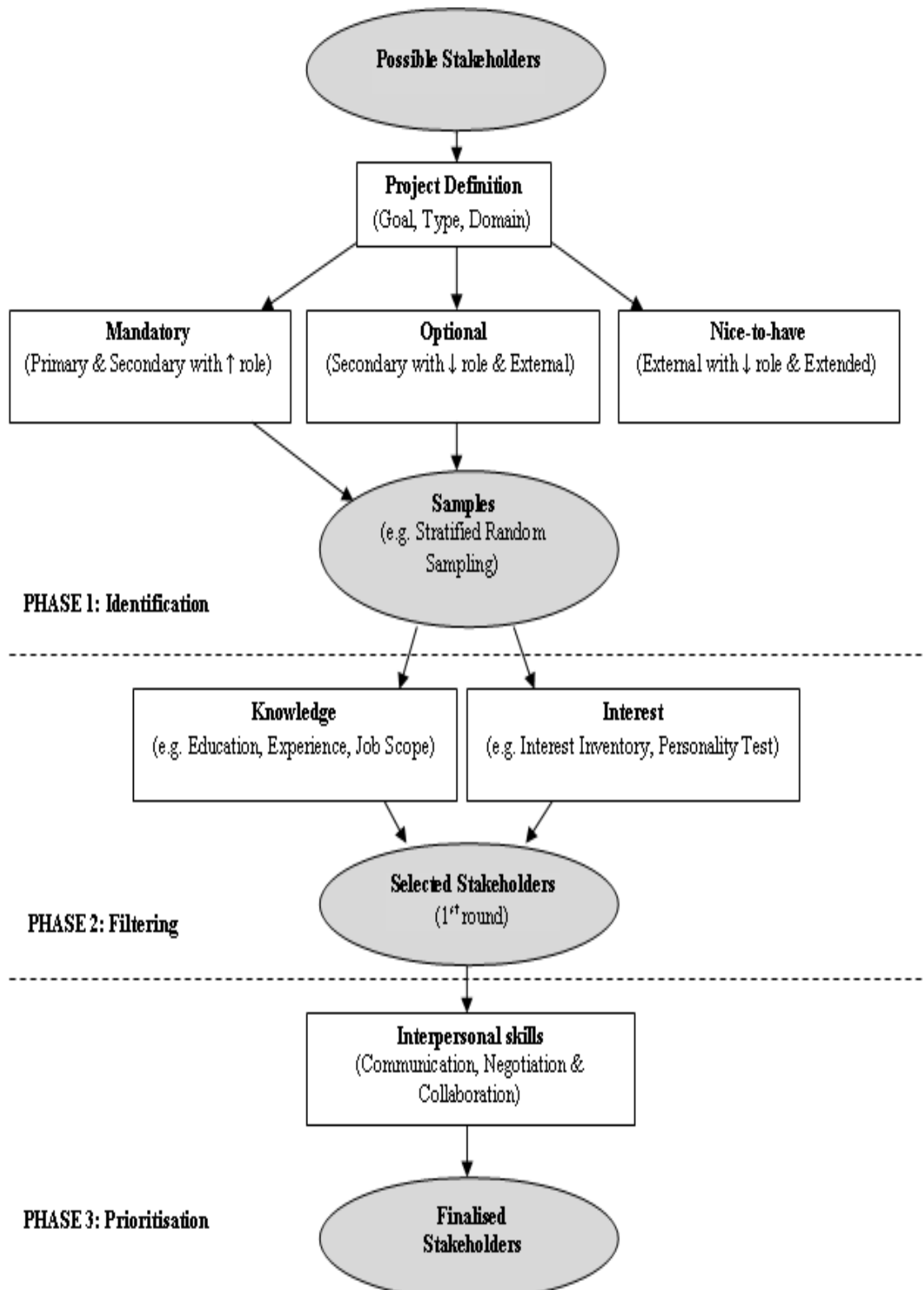


Figure 1. Stakeholder Selection Framework



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