A Practical Guideline of Selecting Stakeholders for Requirements Elicitation – An Empirical Study

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Abstract

Requirements elicitation is widely regarded as the most challenging activity within the scope of requirements engineering. The activity concerns the understanding of problems that a system should address, which later leads to the identification of system requirements. As an abstract process, its effectiveness is greatly influenced by the credibility and suitability of the stakeholders involved. High-quality requirements could only be achieved if they are gathered from the right stakeholders. There are several methods proposed by earlier studies that could guide the selection of stakeholders for requirements elicitation. The methods however are theoretical rather than pragmatic. Therefore, there is a need of practical method that could help practitioners in identifying and selecting the appropriate stakeholders. Prior to having such a method, the contributing factors that influence the selection process should be firstly identified and understood. This study addressed this issue by collating the important factors that contribute to an effective selection of stakeholders for requirement elicitation purposes. The factors were identified through a series of empirical study conducted in two countries: seven in-depth individual interviews and a focus group session with five experienced practitioners. The results were analysed by using content analysis through Nvivo 9. The factors were then merged as a practical guideline that consists of a step-by-step procedure. This guide can be used by practitioners to execute the process of identifying and selecting the appropriate stakeholders for requirements elicitation.

Keywords: *Requirements Elicitation, Stakeholder Selection, Guideline*

1. Introduction

Requirements elicitation is the fundamental part of requirements engineering (RE). It is widely regarded as one of the most challenging activities in RE [1]. Requirements elicitation comprises the necessary activities to understand the problem that the proposed system will address. This phase commonly begins with defining the high-level system goals, identifying the stakeholders, as well as assessing their needs and activities in order to determine the problem space.

As requirement elicitation defines the problem to be solved, it requires active and fruitful participation from stakeholders. Due to that respect, the most important aspect in requirements elicitation is that the appropriate stakeholders must be correctly identified [2-3]. Despite its importance, the identification of stakeholders is poorly achieved in software projects [4-5].

In any software projects, stakeholders play important roles in elicitation, analysis and communication of requirements. Stakeholders go beyond just the system's end users and the development team [6]. Project managers have to identify the 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 [7].

The stakeholder identification process has a significant impact on the quality of systems' requirements. Selecting inappropriate stakeholders leads to the capturing of requirements which are not relevant to the system's real needs. This in turn influences the correctness of the requirements. Similarly, if the identification process omits stakeholders who are of paramount importance to the project, the requirements become incomplete. Moreover, some stakeholders understand the organisation very well [10]. Missing these stakeholders implies missing essential requirements. Failure to involve such stakeholders at the right time can create risks that could affect the success of the project [8-9].

Relationships and communication links among stakeholders are established during requirements elicitation [4]. Having passive stakeholders would constrain the exchange of information. Consequently, the quality of the system to be built would be jeopardised. The appropriate candidates who are able to participate in an active and direct manner should be chosen to establish workable communication links. The lack of clear criteria to select the suitable candidates to share and gather facts is one of the factors that obstructs effective communication during requirements elicitation [11].

Improving requirements elicitation requires first to understand the stakeholder identification process [2]. To date, the process of identifying and selecting stakeholders for requirements elicitation is unstructured and unclear. This paper addresses this issue by identifying and collating the essential selection factors in a form of procedural guideline based on the empirical data collected from two studies. The guideline is aimed to be as a guide for attaining an effective requirements elicitation through the involvement of right stakeholders. The paper is organised as follows. The following section provides the related work concerning methods of selecting stakeholders. Section 3 explains the methodology used in the study. Section 4 elaborates the results. Finally, section 5 concludes the paper with a summary of the main findings and future work.

2. Related Works

Requirements may be spread across many sources and exist in a variety of formats [12]. Stakeholders represent the most obvious source of requirements for any system. Stakeholders are people who have an interest in the system or are affected in some ways by the system development. Stakeholders often includes the key user representatives [13]. They must be consulted during requirements elicitation in order to delineate the requirements of the system to be built. As such, the first step in requirements elicitation is to identify and involve the relevant stakeholders.

Several studies discussed the strategies of selecting stakeholders for requirements elicitation purposes. For instance, an approach emphasises stakeholder interaction as a means to discover the possible stakeholders for a specific software project [14]. The approach consists of a set of elements called stakeholder baselines, which refer to groups of stakeholders. Each of these stakeholders plays a specific role. A study claimed that to identify the stakeholders and their roles effectively, the people who are directly affected by the system, people whose interest in the proposed system is high, people who are responsible for the system development and people who are affected by the system in a negative way need to be searched [15]. Another study proposed an approach for stakeholder identification in an inter-organisational environment [6]. The approach takes into account stakeholders' attributes such as types, roles and interests. As stakeholders are human, a study highlighted the importance of considering stakeholders' knowledge [9], while the others on personality and group dynamic [16-17].

Each of the approaches described above is quite theoretical. In particular, they are not supported by empirical evidence that could prove whether or not the approaches are practical. Moreover, they are incomplete as they cover the selection criteria in isolation. This makes the selection process remains difficult and challenging to practitioners. Currently, there is no documented practical guideline that can guide practitioners in the

process. Further work is needed to develop a method to carry out stakeholders identification and selection in the area of requirements elicitation [3]. Some kind of selection procedure must be put in place in order to overcome this problem.

3. Methodology

The purpose of this paper is to provide a practical guideline that could help practitioners particularly project managers to identify the appropriate stakeholders to be selected for a project. The guideline contains a set of important factors that affect the selection of stakeholders, which were gathered from a series of empirical study. The studies involved in-depth individual interviews and a focus group session with several experienced practitioners from software industry. In general, this study aimed to answer the following research questions (RQ):

- What are the factors that influence the selection of stakeholders for requirements elicitation?
- How do practitioners identify and select the stakeholders during requirements elicitation?

To answer this research questions, the study employed qualitative research methods. Qualitative research is best suited to address a research problem in which the variables are not known and need to be explored [18]. It studies phenomena in a natural environment, concentrates on experiences or perceptions and attempts to understand people or attributes of things in the real world. It entails the use of deductive and inductive techniques for retrieval and understanding of meanings. It is analytical and interpretative in style and employs multiple data sources to reach conclusions. These characteristics of qualitative research suited the nature of this study and thus, it was selected.

This empirical study comprised two phases. The first phase involved individual interviews. The technique was selected because interviews allow researchers to gain access to the subjective experience of individuals [19-20]. They enable the researchers to question the experts directly about their thoughts and opinions, and give the experts the freedom to describe and reflect in detail on their views and beliefs. The interviews were in the form of semi-structured. The questions were formulated based on the theoretical factors found in the literature that were collated as a conceptual framework [21]. The first several questions focused on the participants' experiences and demographics. The remaining questions asked the participants to reflect on their experiences in selecting stakeholders during requirements elicitation. In addition, a set of open-ended questions were prepared to acquire participants' thoughts and opinions relating to the process. The open-ended questions were deemed as necessary as they helped in getting participants' perspectives without any constraints. Prior to conducting the interviews, the interview protocol was tested in a pilot study. The interview protocol was then modified as needed. The participants were interviewed individually at their respective workplace within approximately one hour. The duration was considered to be sufficient due to the need to compromise between coverage and the amount of time that the participants could spare. The interviews were conducted over a span of three months. The audio-recorded interviews data were transcribed and organised in textual forms. They were then properly stored for later analysis and interpretation.

The second phase employed a focus group approach. A focus group involves collecting data from a homogeneous group of individuals using in-depth and open-ended group discussion within one to two hours that explores a specific set of issues on predefined and limited topics between five to eight participants guided by a moderator [22]. It is particularly effective in supplying information about how people think, feel or act regarding a specific topic [23], and can serve as a source of new ideas and hypotheses [24]. This study conducted a 2-hour focus group session. Before beginning the session, the moderator explained the purpose, the procedures and the roles of participants. The

focus group session was video-taped for reviewing and transcribing purposes. The assistant moderator took notes during the session, which provided useful information about intensity of comments, facial expressions and other facets of interpersonal communication. Similar to earlier interviews, the data were then transcribed and stored for analysis and interpretation.

As a qualitative research, the study adopted purposeful sampling. The purposeful sampling is meant for exploring and understanding the "central phenomenon" [18]. In purposeful sampling, it is necessary to identify a sampling strategy, which depends on the research problem and questions. Homogeneous sampling is one of the types of purposeful sampling, which was the strategy used in this study. The study identified a number of characteristics that the potential participants should possess. Later, the criteria for selecting the participants were determined. The criteria consisted of the following: a) The participants possess at least ten years of experience in performing RE, particularly requirements elicitation; b) The participants have been involved in various types of software project. This study managed to find twelve practitioners as participants based on the above-mentioned criteria. The participants were from ten different organisations in Yemen and Malaysia. Seven organisations were from private sector while the rest were government agencies. A participant possessed an average of twelve years of experience in RE. The types of project that they participated comprise finance, human resource, telecommunication, education, healthcare and electronic government systems. Their roles in the projects include analyst, project manager and leader, consultant, general manager as well as director, as shown in Table 1.

The data gathered from both phases were analysed by using content analysis [26]. The content analysis was chosen as it performs thematic analysis that helps to identify factors and the relationships between them [11]. Furthermore, content analysis allows the discovery of trends in existing phenomena [27]. It enables the identification of significant themes in the responses of the experts in terms of existence, frequency and relations between keywords and concepts [28]. To initiate the process of content analysis, the coding procedure was conducted. The coding procedure started by giving a label to each text segment. A text segment may range from few words to a paragraph. The goal of coding is to rearrange and integrate the related words, sentences or paragraphs together in order to draw a meaningful description about the data. The data then form a major idea, which represents a specific theme. In this study, the themes are indeed the factors that contribute to stakeholder selection process. Figure 1 below depicts the phases involved in this study. The tool used to help organising and analysing the data was Nvivo 9 [25]. Nvivo 9 provides an efficient way to handle unstructured data and facilitate the process of indexing, analysing, querying and visualising the data.
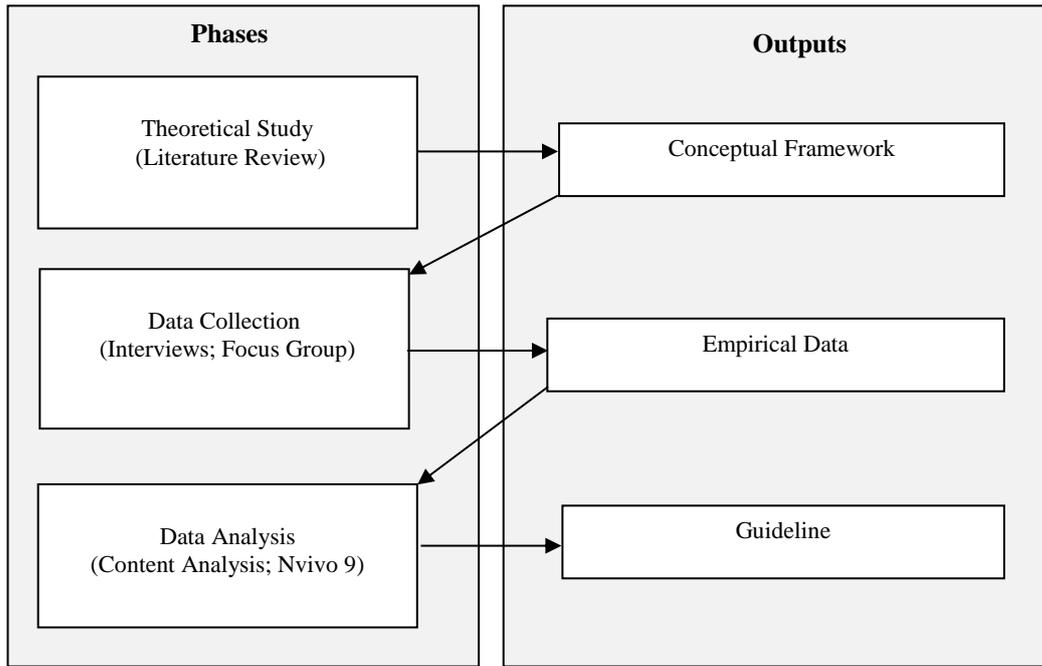
Figure 1. Research Phases

Table 1. Participants' Details

Participant	Position	Organisation	Method	Country
A	General Manager	Private Sector	Interview	Yemen
B	Director	Private Sector	Interview	Yemen
C	Project Manager	Private Sector	Interview	Yemen
D	General Manager	Private Sector	Interview	Yemen
E	Project Manager	Government Agency	Interview	Yemen
F	Project Manager	Private Sector	Interview	Malaysia
G	Project Leader	Government Agency	Interview	Malaysia
H	Consultant	Private Sector	Focus Group	Malaysia
I	Project Manager	Private Sector	Focus Group	Malaysia
J	Analyst	Government Agency	Focus Group	Malaysia
K	Analyst	Government Agency	Focus Group	Malaysia
L	Analyst	Government Agency	Focus Group	Malaysia

4. Result

The analysis has discovered several factors that contribute towards the selection of appropriate stakeholders for requirements elicitation. There are two primary factors: project definition and stakeholder. The former factor entails goal, type and domain whereas the latter concerns type, role, knowledge and communication skills as shown in Figure 2. The following paragraph describes those factors with respondent answers.
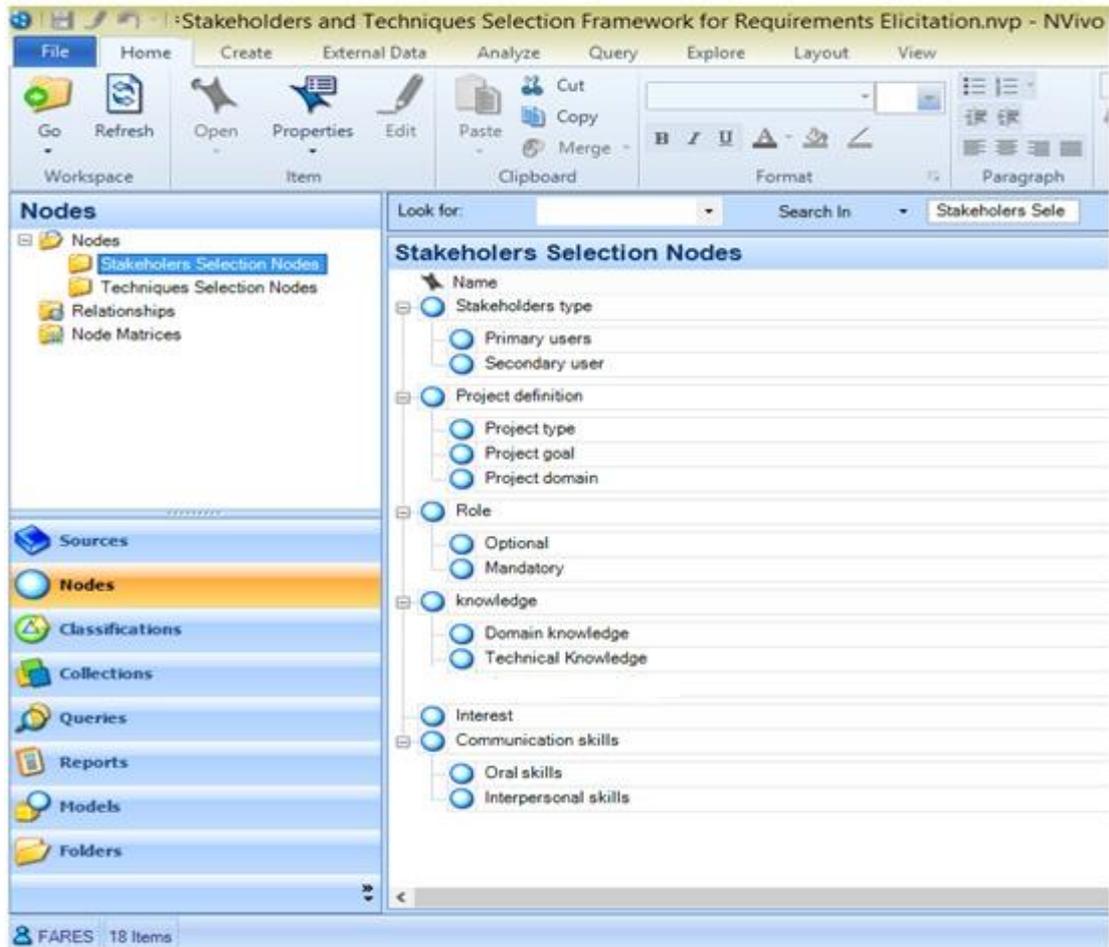

Figure 2. Stakeholders Selection Factors

4.1 Project Definition

At the beginning of any project, the main task is to set clear project definitions that include project goals and system descriptions such as type and domain. The project goals specify what the business wants to achieve through the project while the type and domain define the characteristics of the system to be built.

> *A: "The stakeholders identification depends on the nature of the project itself in terms of the type of the system and for whom. For that, we meet the owner or the manager of the company to know the scope and then we decide which users we need."*

> *C: "We start with determine the strategic goals of the project, and to get a clear overview of the system in terms of how and where the project starts and ends and its future outlook."*

> ***F:*** *"Project domain is important for instance, when our company was asked to build a project to exchange data via the internet for remittance (money transfer), we requested that company to identify the needed stakeholders on the basis of the domain of the project."*

4.2 Stakeholders' Type

For the stakeholder's type, stakeholders can be classified into primary and secondary. 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.

> ***B:*** *"During the user identification stage, we focus on the user type."*
> ***F:*** *"Usually when we talking about the stakeholders, we focus on different kind of user. For that, two types of selected users are primary and secondary users."*

4.3 Stakeholders' Role

Another possible way of identifying stakeholders is by considering their roles. Each stakeholder plays one or more specific role(s) that interact(s) with other roles in some ways. It is quite apparent that the more authoritative a stakeholder is, the more his or her participation in the project is needed.

> ***D****: "Actually when we have some issue with organization policy or we need to improve the development process, we will look for stakeholders who can make the decision. Because in our environment not everyone can take decision, so we will look for person who has the authority to come with new policy. Therefore, the role of the stakeholders is important."*

4.4 Stakeholders' Knowledge

Stakeholders are human, thus they bring certain values and preference towards the project. They come from various backgrounds that reflect their specific knowledge. Stakeholder selection therefore must consider stakeholders' knowledge and. In terms of knowledge, stakeholders can be classified into two major categories: domain and technology. The technology knowledge involves producers who work in the project and deliver some products through technical knowledge such as developers. The domain knowledge are relate to stakeholders who have business knowledge that is needed by the producers, namely sponsors, consumers and consultants. Requirements elicitation in essence requires knowledge transmission between those two entities. Furthermore knowledge may also include educational background and experience.

> ***K:*** *"The user who has knowledge is the most important person because he or she owns the information that we need to build the system with less errors."*
> ***J:*** *"We request for user who are willing to participate and have some required characteristics, such as technical knowledge, because they need to be able to distinguish and isolate the problems resulting from the surrounding environment and the system itself."*
> ***L:*** *"During the selection, we focus on the domain knowledge that the users own."*

4.5 Stakeholders' Interest

Stakeholders are human they possess certain interests. Stakeholder selection therefore must consider stakeholders' interests. Interest is built when a stakeholder's needs match with the project goals. Interest is normally implicit and psychological-influenced

> **E:** *"The selection process considers stakeholders with high interest levels in the concerned project. This is because the interested user is the one who believes that the system will benefit him or her. Therefore, he or she will react positively to the system. The positive reaction is crucial to the overall success of the project as resistance to change is one of the main factors leading to project failure, where the user perceives that the project is a threat to his or her job."*

4.6 Stakeholders' Communication Skills

Software development is generally known as a collaborative process that requires intensive communication and intervention between various parties. Having the knowledge solely is insufficient. Stakeholders should possess communication skills such as interpersonal skills and oral skills.

Stakeholders normally have different concerns, priorities and responsibilities. When multiple stakeholders participate in a discussion, requirements often conflict. For that interpersonal skills are necessary for handling those conflicts in order to gain better requirements.

On the other hand, oral skills enable stakeholders to express ideas effectively. One problem during requirements elicitation 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. The stakeholders thus need to possess appropriate oral skills to avoid poor communication.

> **G:** *"Communication skill is another important factor that the analysts prefer the potential participant possesses during requirements gathering."*
>
> **I:** *"Effective communication skills are very important. This indicator helps us to recognize and select the users who have the potential and the ability to transfer their specific knowledge and communicate with the rest of the project team in an efficient way."*
>
> **H:** *"Good communication skills imply the ability of an individual to communicate well. Such skills in the workplace mean that users can easily express themselves. If the users have ineffective communication skills, it is not worthwhile to spend time to interview him or her."*

Based on the results above, it can be seen that various factors that influence stakeholder selection for requirements elicitation process have been discussed by experts. However, those factors were identified individually and thought focus group session. The next step was to integrate these factors conceptually as practical guideline as shown in Figure 3 so that their effects on the matter can be clearly seen. The guideline consists of two essential stages: Identification and Selection. The following paragraphs elaborate the stages and factors in detail:

- **Stage 1 – Identification**

At the beginning of any project, the main task of project managers is to set clear project definitions. These include project goals and system descriptions, namely type and domain. Project goals specify what the business aims to achieve through the project, while type and domain define the characteristics as well as environment of the system to be built. These project definitions lead to the recognition of specific types of stakeholders.

Stakeholders can be classified into two types: primary and secondary. Primary stakeholders normally comprise key individuals who are affected by the project at the

strategic and tactical levels. They own the power, authority and responsibility for resources towards the project. On the other hand, secondary stakeholders are those who are affected by the project at the operational level such as the system's end users. Each stakeholder plays a specific role, which varies in terms of its importance. Some roles are more influential and significant than the others. Stakeholders who play important roles would be the ones that should be selected.

In order to determine which groups of stakeholders should be considered, they can be classified into the following two 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 because neglecting their needs does not threaten the success of the system.

Primary stakeholders are critical because the project's outcomes affect them significantly and their interest in the proposed system is high. For instance, top management is considered as a primary stakeholder, as they are the ones who make the crucial decisions. Their involvement is very important particularly for issues concerning policy, cost and planning. They have the authority to approve the overall system's functionality. As senior members, they also possess the necessary experience. Since top management knows the organisation well and controls the resources, they could nominate other key members to be included in the project team. It is quite apparent that the more authoritative a stakeholder, the more his or her participation in the project is needed. With this respect, the omission of any primary stakeholders can adversely affect project development and the achievement of project goals. Primary stakeholders are therefore considered as M, regardless of the roles they are playing.

Secondary stakeholders may fall under M or O, depending on the importance of their roles. Secondary stakeholders could be considered as M if their involvement in the elicitation activities is highly required. Without these stakeholders, the analysts could not be able to gather the right requirements. Such stakeholders normally interact with the system directly and/or use its results in daily business operations. Other than these stakeholders, for example occasional users, their role is low and thus can be considered as O.

After considering the above classification, there are two possible scenarios: (1) include M only or (2) include both M and O. In many scenarios, option (1) is likely to be adopted. However, option (2) is also viable. Although trivial, the inclusion of several stakeholders who are 'not as important' (O class) could still be useful. They may generate a better insight into the needs of the system, as they view the system from different perspectives.

- **Stage 2 – Selection**

In this stage, some forms of analysis should be conducted so that the selection can be made fairly based on stakeholders' competency. The analysis is based on two factors: knowledge and communication skills. Requirements elicitation is known as the exchange of two types of essential knowledge: business/domain knowledge and technical knowledge. Stakeholders with business/domain knowledge are those who own organisational information such as sponsors, managers and end users. Stakeholders with technical knowledge include developers or operational people who work on the project and deliver some products using their technical expertise. Technical stakeholders are needed because the realization of a system concerns technical elements. In essence, both knowledge are required during requirements elicitation. Stakeholders' levels of knowledge on both knowledge can be measured based on their educational backgrounds, past experience and job scope. A knowledgeable stakeholder is important because he or she owns the information that the project team needs to build the system.

Requirements elicitation is indeed a collaborative process that requires intensive communication and intervention between various parties. Merely having knowledge

solely is insufficient. Stakeholders should possess communication skills such as oral and interpersonal in order to share that knowledge. The oral skill enables stakeholders to interact and express ideas effectively and avoid poor communication. On the other hand, the interpersonal skill is necessary for handling conflicts in requirements among multiple stakeholders. Stakeholders' levels of competency in these skills can be measured through specific personality tests. Alternatively, it can be based on superiors' or peers' recommendations, who observe and deal with them daily. The output of the analysis is a list of shortlisted candidates who are eligible to be involved in the requirements elicitation process.

Although previous work highlighted the need to consider stakeholder's interest [6, 15, 21], the empirical data of this study do not support it. The participants argued that even if the stakeholders are not interested in the project, they should be selected if they have the needed information and are responsible for the key activities. They may be passive during the process however, the participation of low-interest stakeholders could still help analysts to gather requirements. In this case, the analysts have to use their interpersonal skill to build such stakeholders' interest. Moreover, there is no obvious and practical mechanism to measure an individual's interest towards something. Because of these facts, the factor has been excluded from the guideline.
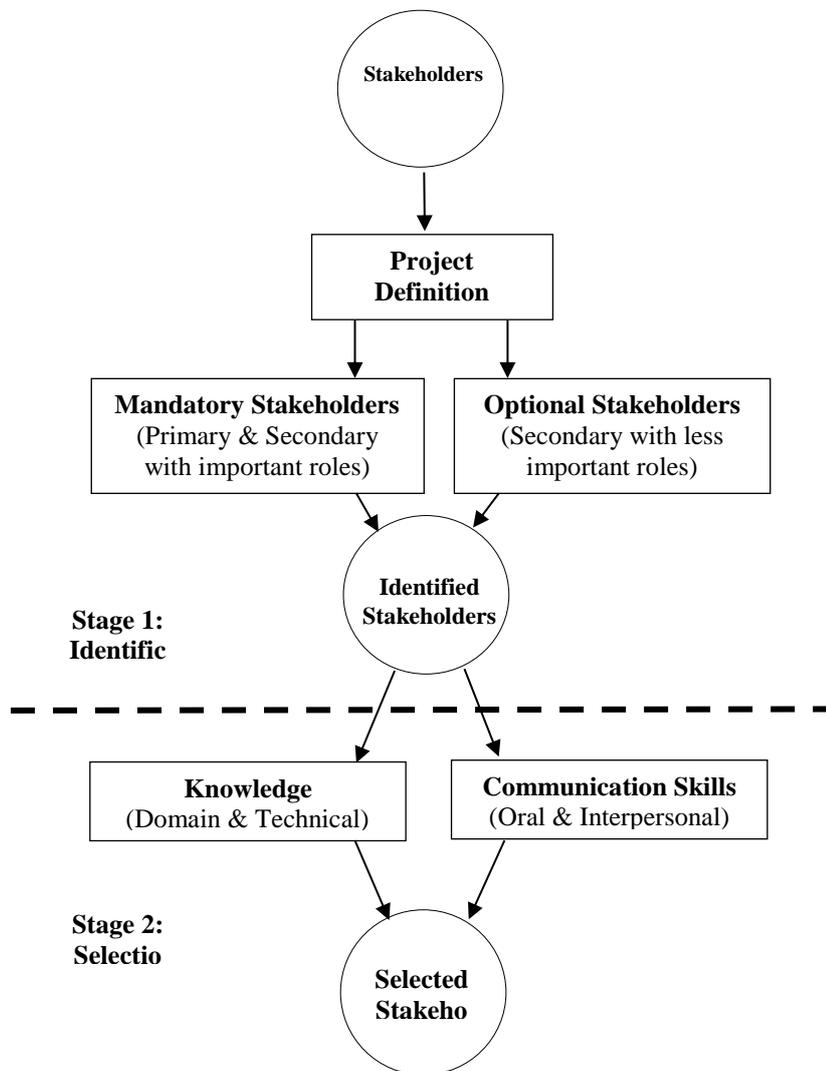

Figure 3. Stakeholder Identification and Selection Guideline

5. Conclusion and Future Work

This paper has discussed the importance of having appropriate stakeholders during requirements elicitation, as any misjudgment made during this phase may lead to project failures. This study discovered several important factors that are normally considered by practitioners when they need to make decisions on which stakeholders should be selected for requirements elicitation phase. In general, practitioners tend to select stakeholders that have certain attributes and support closely the project environment. The factors include project goal, type and domain as well as stakeholder type, role, knowledge and communication skills. These factors form a procedural guideline, which guides practitioners on what aspects to look for and how to select the right stakeholders. The guideline is seen as useful particularly to project managers who are looking for a realistic solution. Unlike previous methods, the guideline does not merely rely on what one believes. Rather, it is based on what is being practiced in industry that seems to be effective and feasible. In terms of future work, one may investigate how to map the stakeholder selection criteria with the choice of specific requirements elicitation techniques. Moreover, specific measures to assess stakeholders' knowledge and communication skills may also need to be derived.

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