Comparison of Stakeholder Identification Methods – The Effect of Practitioners Experience

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***Abstract*—Stakeholder analysis is an important part of Requirements Engineering activities. Since stakeholders affect, and can be affected by, a system under development, it is important to identify them. While several stakeholder analysis methods are available, there has been less discussion about their effectiveness when practitioners have different levels of work experience. This paper evaluates how the stakeholder identification method affects the amount and variation of stakeholders in cases where practitioners have relevant, not relevant or no experience at all. The research investigated this question by conducting a study in a university Requirements Engineering course comparing three different stakeholder identification methods where participants' work experience was known. This paper discusses the results of the experiment and their implications. The results highlight the importance of relevant experience and systematic approach to stakeholder identification.**

Keywords-Stakeholder; Stakeholder identification.

I. INTRODUCTION

Stakeholder analysis is considered an important part of Requirements Engineering (RE). Identifying different types of stakeholders is crucial to creating successful software projects and is recognised by initiatives like IEEE standard 830 [2] and SWEBOK [1]. While many papers emphasise the importance of stakeholders, the identification process itself is not as well defined or documented in the RE literature [5][7]. Several authors, e.g., Sharp et al. [5] and McManus [6], criticise the lack of clear and efficient methods for identifying actual stakeholders.

This problem has gained some attention, and several concrete methods [5][6] have been developed to conduct the analysis, including the identification of the actual stakeholders. StakeNet [8], in addition to providing a stakeholder identification method, also studied the effectiveness of the method. Since the problem is gaining attention, an interesting question arises as to how the effectiveness of different stakeholder identification methods is affected by practitioners' experience. In other words, what is their ability to produce a list or group of stakeholders if different methods are used? The goal of this paper is to answer the following research question:

How the use of a stakeholder identification method does affect the effectiveness of the stakeholder identification process for experienced and inexperienced practitioners?

In this paper, effectiveness is defined as how fast a list of stakeholders can be generated for a single system. The three methods used in this study represent three different approaches to stakeholder identification in order to determine whether the identification results are different. The following stakeholder identification methods were used: a systematic approach from Sharp et al. [5], a question-based approach method used by McManus [6] and a general list of possible stakeholders that should be considered when developing software systems, from Lauesen [12]. In order to answer the research question, a study was conducted in a university RE course. The results of the study were analysed to determine whether a specific method had any advantage. In the study, the level and quality of the students' experience was controlled to determine the role of experience in the results.

The rest of the paper is structured as follows. Section 2 describes the literature regarding stakeholders and how the concept is generally used in RE. Section 3 describes the stakeholder identification methods used in this study and how the study was conducted. Section 4 presents and discusses the results. Section 5 discusses limitations and possible threats to the validity of the findings, and Section 6 provides a conclusion and future directions for research on this topic.

II. LITERATURE

The concept of the stakeholder was popularised by Freeman [9]. Freeman described a stakeholder as a group or an individual who is affected by the achievement of an organisation's objectives or who can affect on them. Stakeholders and stakeholder analysis was first used mostly in management literature and practice to understand the different stakeholder needs in a company [10]. Eventually, the concept made its way to RE.

In RE, a stakeholder can be identified as a person or a group who will be affected by the system either directly or indirectly [11]. Sometimes, there is no clear definition of a stakeholder; instead they are specific groups of people who make demands of a particular system [12]. Depending on the development domain and target market, common stakeholders include various end users, customers, engineers and managers [3][11]. In general, stakeholders are considered persons, groups, or organisations that express needs regarding a particular system, are affected by it, or can somehow affect it.

The importance of stakeholders in RE is most visible in the elicitation process. Stakeholders are one of the main sources of information in the elicitation process that creates actual requirements. However, stakeholders often have conflicting

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views and needs, are unable to express their needs in a detailed manner or they demand a solution that does not match their real need. Even if this makes requirements analysis a hard and tedious task, identifying and understanding stakeholders' needs more comprehensively and reaching consensus among them increases the quality of the software product [3][11][12].

Clearly, identifying stakeholders and analysing their needs is an important task. However, the process of stakeholder identification is often an ad-hoc analysis or left for the practitioners to figure out for themselves. The literature has criticised this lack of guidance for practitioners [5][6][8]. Stakeholder identities are either assumed to be obvious to the practitioners or to fit into categories too broad and generic to be useful. Some studies just present lists or categories of identified stakeholders, such as the most commonly known clients/customers, users and developers [3][11][12]. Other papers expand these lists by adding businesses, projects and products [13][14][15] or government agencies [16], organisations [16] and the general public [17] as stakeholders. Pachecho and Garcia [18] systematically surveyed the contemporary literature for state-of-the-art identification methods and concluded that the stakeholder identification process still lacks standards and proper guidance.

Several authors have addressed the above criticisms by developing concrete methods to aid in the identification process. For example, Lyytinen and Hirschheim [19] provide some guidance in identifying stakeholders; they note that identification itself is far from trivial. Further, McManus [6] uses the question list provided by the World Bank and criticises the lack of exact methods to identify concrete stakeholders. Similarly, Sharp et al. [5] present a systematic approach for identifying stakeholders in the absence of a clearly defined identification method. The latest advances include social media applications like StakeNet [8], a stakeholder identification method based on social networks. In this method, stakeholders are first identified by asking a person to identify an initial set of stakeholders. These stakeholders are then asked to produce another set of stakeholders, and the pattern repeats itself until a stable network of interconnected stakeholders is formed.

III. RESEARCH SETTING

The experiment ran as part of an RE course at the University of Oulu. In order to obtain the necessary data to answer the research question, basic software experiment guidelines [20][21] were followed in designing the study. This section describes the stakeholder identification methods, research setting, execution and how the data were analysed.

A. Experiment setting

The RE course is a part of the 3rd year Bachelor's degree studies in Information Systems and Software Engineering (SE) and is compulsory for every student of the program. One topic in the course is stakeholder analysis as a part of RE activities. The experiment was designed to be the compulsory practice session necessary for every student to pass the course. The students, both Finnish and foreign, were all from the same university and department. The majority of the students were Finnish.

To answer the research question, an experimental setup comparing three different stakeholder identification methods was conducted. Before the experiment, students completed a background questionnaire about their experience. This questionnaire asked students about their work experience, specifically whether the experience was generally related to SE, and how many total years of experience they had. Experience was divided into SE and other experience, since students might be experienced in other fields as well. This information was used to split the students into three different groups: those with experience in SE, those with no previous experience in SE and those who had related experience but not in SE.

The scenario used in the experiment required the students to develop a requirements document for the new department timetable software named LUKKARI. The scenario stated that the old timetable software was unsuitable for today's needs and should therefore be replaced with a new system. This scenario was selected and developed to ensure that each student understood how a timetable system works since they had been using one during their studies. This was also done to avoid situations where some students would not have a specific domain expertise that could affect the results. The minimum basic functionalities of LUKKARI allow users to:

- Log in and out
- Browse their own and course timetables
- Create, edit and remove items to their own timetable
- Access the timetable through a web browser
- Add, edit and remove resources from timetable items

In order to obtain the stakeholder data, an answer sheet was designed for the students, which asked them to name any identified stakeholder, give a short description and provide a rationale for why the student thinks that stakeholder is relevant. In addition, researchers recorded the time when the answer sheet was returned to calculate the amount of time used to identify stakeholders.

Students were informed that their answers would not affect their course scores. However, they were told that they could use their own results when they began working with the Requirements Specification documents required by the course. This helped to remove possible pressure from the students while also providing an incentive to identify stakeholders.

B. Methods Under Experiment

The experiment was designed to present two different types of identification methods: McManus's questionnaire method (based on World Bank's stakeholder analysis) [6], and Sharp et al.'s systematic analysis [5]. It should be noted that only the stakeholder identification part was used from both methods. The control method was based on an analysis process described in Lauesen's textbook [12] because it was already part of the course. These methods fit the restrictions of the experiment because all material had to be in a written format, and all methods had to be designed for or used in SE.

1) Systematic method

The systematic method of Sharp et al. [5] for identifying stakeholders uses four baseline stakeholder groups: users, developers, legislators and decision makers. Users are the people, groups or companies who interact, directly control or use the software. Developers have a stake in the system's final requirements specification but are not themselves users. Legislators are, for example, government agencies, trade unions and legal representatives, all of which act nationally and

internationally, setting guidelines for operations that affect the product's development or its final use. Finally, decision makers direct both development and user organisation. The identification method itself is straightforward:

1. Identify all specific roles within the baseline stakeholder group.
2. Identify supplier stakeholders for each baseline role. The supplier stakeholders provide information or supporting tasks for the baseline stakeholders.
3. Identify client stakeholders for each baseline role. The client stakeholders process or inspect the products of the baseline stakeholders.
4. Identify satellite stakeholders for each baseline role. The satellite stakeholders interact with the baseline stakeholders in a variety of ways.
5. Repeat steps 1 to 4 for each of the stakeholder groups identified in steps 2 to 4.

2) Questionnaire method

The questionnaire method represents the question-based stakeholder identification method used by McManus [6]. Compared to the systematic method, the questionnaire method does not provide any systematic way to address stakeholder categories, presenting only a pre-defined list of questions that can reveal stakeholders. McManus uses a question list developed by the World Bank to identify stakeholders in pre-defined categories. These questions are [6]:

1. *Who might be affected (positively or negatively) by the development concern to be addressed?*
2. *Who are the "voiceless" for whom special efforts may have to be made?*
3. *Who are the representatives of those likely to be affected?*
4. *Who is responsible for what is intended?*
5. *Who is likely to mobilize for or against what is intended?*
6. *Who can make what is intended more effective through their participation or less effective by their non-participation or outright opposition?*
7. *Who can contribute financial and technical resources?*
8. *Whose behaviour has to change for the effort to succeed?*

3) Control method

The control method, which is derived from the course textbook [12], is a simple list of very specific definitions for identifying stakeholders. As all the participating students are familiar with this list, it provides an ideal control method. In addition, it roughly follows the same manner of describing stakeholders as other undergraduate-level SE textbooks.

The control method defined stakeholders mainly as people who are needed to ensure the success of a project, who can be [12]:

1. *The sponsor who pays for the product. He wants value for his money.*
2. *Daily users from various departments. They have to live with the product and, without their support, there will be no success.*
3. *Managers of the departments. They want business advantages from the system.*
4. *The company's customers (clients of the system). Often they will see changes too, and without their support there will be no business advantages.*
5. *Business partners, for instance suppliers, carriers, and banks. If they will see changes, their support is essential too.*
6. *Authorities, for instance safety inspectors, auditors, local government.*
7. *IT people and hotline staff in case the product is to be developed in-house.*
8. *Other people providing resources for the product.*
9. *The daily users of the product at the client's site.*
10. *Managers and sponsors at the client's site.*
11. *IT people at the client's site.*
12. *Distributors and value-adders for our product. (Value adders – or VARs – may for instance be software houses that combine our product with other products or services.)*
13. *Competitors. They are definitely influenced by the product, but usually in an adverse manner. If so, they will not be treated as stakeholders. However, in some cases you depend on their co-operation, for instance if you are going to exchange data with them electronically. These situations may be delicate, and your best change is to create a win-win situation where they benefit too.*

C. Experiment execution

Before the actual session, students were divided into three groups based on their answers from the pre-questionnaire regarding their prior experience. The groups were balanced to include only students with relevant experience, students with no relevant experience or students with no experience at all. Students in these groups were then randomly assigned to one of the three stakeholder identification methods. Each student received a package containing instructions, an answer sheet and a description of the stakeholder identification method.

All students were required to participate in a 2-hour practice session. At the beginning, students were asked to pick up the answer sheet with their name on it and sit down to wait for the session to start without looking at the papers. Students were given a short 15-minute introduction to the experiment and were allowed to ask questions and clarifications about the experiment. Students were told to fill in the answer sheet according to the instructions and return it to the researchers when completed. No other time limit was imposed aside from the maximum 2 hours reserved.

Students were instructed to work alone, and the researchers supervised the session to enforce this rule. In addition, no computers were allowed, but only the given material and writing equipment. Two researchers were constantly present during the session to answer questions and ensure that the rules and instructions were followed.

All answer sheets were returned to the researchers after students completed them. Each answer sheet was then transferred to an Excel file to conduct the analysis.

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D. Data analysis

Before analysing the results, the data needed to be checked for:

- Possible duplicates in case the same stakeholder was mentioned twice in one answer sheet. Duplicates were simply removed.
- A list of stakeholders that appeared as a single stakeholder in the answer sheet. In this case, the stakeholders were marked as separate stakeholders in the answer sheet.
- Plural or single stakeholder terms. All stakeholders in single terms were changed to plural.
- All stakeholder names were in English. In case a name was not given in English, two researchers agreed on the translation that matched the original name as precisely as possible.
- Extra lines or words. Only named stakeholders were considered as such; all other answers were removed, such as 'etc.', 'and so on' and '…'.

After the pre-analysis, the next step was to check how many unique stakeholders were identified. For this step, two researchers checked and compared each identified stakeholder against the others to determine whether they were exactly the same. All stakeholders were considered unique by default, and stakeholders were only considered the same if the name contained a clear typo, the stakeholder description was the same or it was otherwise obvious that the stakeholder itself was exactly the same. The most typical case was that identified stakeholders belonged to the same group but were miscategorised as a sub group or an individual stakeholder within the group. In this case, the stakeholders were considered unique.

Finally, two researchers worked together to evaluate whether the identified stakeholders were relevant stakeholders for the LUKKARI system. The main criterion for determining whether a stakeholder was relevant was the rationale provided for each stakeholder. Stakeholders were excluded from the study if the rationale was not provided or if it clearly indicated that the stakeholder was not connected to the described LUKKARI system.

Time was also measured to determine whether there was any significant difference in analysis time between different student groups or methods.

IV. RESULTS

In total, 51 students participated in the experiment and identified a total of 449 stakeholders, an average of 8.8 stakeholders per student. The results are shown in Table 1. The control method produced a total of 128 stakeholders, averaging 8 stakeholders per student.

There were 54 unique stakeholders, an average of 3.4 per student. These results include all three groups of students and form the baseline performance for comparing the performance of the two stakeholder identification methods. Given the results in Table 1, both the questionnaire and systematic methods outperform this baseline. The questionnaire method produced a slightly better average when comparing identified stakeholders per student while the systematic method was clearly better than the other two. Similar results were found with the unique stakeholders, the questionnaire being slightly better than the control, while the systematic method was superior overall.

Comparing the methods when the students were evenly distributed based on their experience, the questionnaire method was slightly better than the control method, but the systematic method clearly outperformed the others. The results are also similar with unique stakeholders, with the systematic method again outperforming the other two. This suggests that instead of relying on questions and categories, a systematic approach more accurately finds stakeholders and identifies unique stakeholders. Comparing the time spent identifying stakeholders, there is only a slight difference between the control and systematic methods. The questionnaire method took the most time of the three, so in this regard it was less effective.

When experience is measured separately, the students without experience produced a total of 223 stakeholders, with an average of 8.3 stakeholders identified per student. Of all stakeholders, 87 were unique stakeholders, an average of 3.1 unique stakeholders per student. This group forms the baseline for measuring the influence of experience. Table 1 clearly shows that experienced students performed better than the baseline in terms of the average number of stakeholders and unique stakeholders identified per student. The group with no relevant experience performed slightly poorer in regard to average stakeholders per student than the group with no experience at all. However, the totally inexperienced group identified more unique stakeholders.

TABLE I. OVERALL RESULTS FROM THE EXPERIMENT

	Control method	**Questionnaire method**	**Systematic method**
Students:	16	19	16
Total identified stakeholders:	128	165	156
Average per student:	8.0	8.7	9.8
Average time per stakeholder	4 min, 44 sec	5 min, 18 sec	4 min, 52 sec
Total unique stakeholders:	54	74	84
Unique stakeholders per student:	3.4	3.9	5.3
	No experience	**Experience but not SE**	**Experience from SE**
Students:	28	10	13
Total identified stakeholders:	223	72	141
Average per student:	8.3	7.4	10.8
Average time per stakeholder	5 min, 29 sec	5 min, 19 sec	4 min, 1 sec
Total unique stakeholders:	87	39	81
Unique stakeholders per student:	3.1	3.9	6.2

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The experienced group clearly outperformed the other two groups. Experienced students were able to find more stakeholders than students with no experience. The groups with no experience at all and without relevant experience provided fewer stakeholders. What was surprising, however, was that the group that lacked relevant experience managed to find fewer stakeholders than that with no experience at all. Although the group still came up with more unique stakeholders, their experience from different domains might have caused this interference. While this study cannot provide an answer for this finding, it might be useful to experiment to investigate how the different experience affects the identification process. Finally, accounting for the time spent to identify a single stakeholder, there was only a slight difference between those with no relevant experience and those with no experience at all. Those with experience, however, were clearly faster. These results indicate that experience is a key attribute for identifying unique stakeholders, and relevant expertise provides a clear benefit.

TABLE II. AVERAGE OF IDENTIFIED STAKEHOLDERS IN EACH METHOD SEPARATED BY EXPERIENCE GROUPS

	Control method	**Questionnaire method**	**Systematic method**
Experienced	8.8	9.4	14.6
No relevant experience	7.3	6.8	7.7
No experience	7.1	8.3	8.4

The results were also tabulated according to the identification method group based on experience level, as shown in Table 2. While the comparison groups were clearly smaller, the use of a specific method still provided better results. The data shows that students benefitted from the method regardless of experience. The only difference was that the group with no relevant experience that specifically used the questionnaire method identified the least stakeholders. It should be noted that while the difference is not big, the group with no relevant experience showed the least amount of improvement over the other two groups. This result is interesting because general experience should indicate more information about stakeholders, whereas this experiment hints that specifically relevant experience matters more.

The rate at which sets of stakeholders occurred in the different method and experience groups were evaluated, as shown in Table 3. Comparing the frequency of stakeholders found no clear difference between any of the groups. The main stakeholders each group identified were similar in kind; generally, the stakeholders were organisational units of the university, stakeholders related to the university itself and stakeholders related to the LUKKARI system. Mainly, the frequency of their appearance varied. When all stakeholders were ranked according to occurrence, each group received similar results. While some groups' position in the list varied greatly, no group clearly appeared more frequently in one group and less in another. This indicates that identification method and experience did not bias students to select particular stakeholders that would greatly differ from other groups.

V. THREATS TO THE EXPERIMENT'S VALIDITY

Students were expected to do the work individually in order to test whether the method actually helps individual students identify stakeholders. Communication between students and data searches were deliberately denied to control the experiment. In real life, however, work is often done in teams, and several people can work on the same task. In addition, access to company resources and the Internet also provide resources to help the identification process. Therefore, this study cannot be directly compared to a real environment as such.

The study did not consider how valid and important each stakeholder was for the system. This was intentionally excluded because determining validity and importance was beyond the scope of this study. The study concentrated only on determining which identification method is more likely to produce a larger and more accurate set of stakeholders, compared to working without any specific method at all.

TABLE III. COMMON STAKEHOLDERS

Control method	**Count**	**Questionnaire method**	**Count**	**Systematic method**	**Count**
IT Services	10	Students	10	Students	27
Students	9	University of Oulu	5	Student Councilors	15
Teachers	7	Teachers	5	LUKKARI Developer	12
Student Councilors	7	IT Services	5	University of Oulu	11
LUKKARI Developer	6	Student Councilors	5	IT Services	11
University of Oulu	5	Lukkari Developer	5	Teachers	10
Ministry of Education	3	University of Oulu Management	3	LUKKARI Development Team	7
External Consults	3	Course Management System Developers	2	University of Oulu Management	7
Requirements Engineers	3	Department Managers	2	Project Financiers	6
LUKKARI Development Team	3	LUKKARI Administrators	2	Teaching Staff	5
No experience	**Count**	**Experience but not SE**	**Count**	**Experience from SE**	**Count**
Students	17	Students	14	Students	15
Student Councilors	13	Teachers	9	IT Services	10
IT Services	10	LUKKARI Developer	7	LUKKARI Developer	9
Teachers	9	IT Services	6	Student Councilors	8
University of Oulu	8	Student Councilors	6	University of Oulu	8
LUKKARI Developer	7	University of Oulu	5	IT Support	4
Project Financiers	5	University of Oulu Management	5	University Financiers	4
University Administration	5	LUKKARI Development Team	5	Teachers	4
Ministry of Education	4	LUKKARI Administrators	4	University of Oulu Management	4
LUKKARI Development Team	4	LUKKARI Project Managers	3	Teaching Staff	3

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No quantitative analysis was performed on the results due the nature of the study. The rationale behind the decision to use only a qualitative analysis was that the study was designed to be more explorative to see whether the methods provided clearly different results. Each answer provided by the students was therefore analysed separately to understand whether the stakeholders were the same, whether the stakeholder had a rationale to be a stakeholder for the LUKKARI system and what kind of stakeholder groups were formed by the different methods. Therefore, the quantitative analysis was used to gain an insight into whether experience and method had any effect. However, quantitative analysis could provide more insight about the results from this study. Based on the results of this study, a longer study with a larger audience should be conducted.

The experiment was limited only to students, which affects the generalisation of the results. However, this shortcoming was addressed by pinpointing students with relevant experience in software engineering and classifying them as a separate group for analysis. Experimenting in a real development situation should be the next step after this experiment to confirm the large-scale effect of experience.

VI. CONCLUSION AND FUTURE WORK

The current advances in the development of stakeholder identification methods are gaining more attention, and defined stakeholder identification methods for RE have already been published. While the need for these methods is receiving more attention, comparing their effectiveness with practitioners having different types of expertise is less studied. This paper contributes to this issue with an experiment in which different stakeholder identification methods, the systematic method of Sharp et al. [5] and the questionnaire method of McManus [6], are measured against standard RE education literature guidance [12].

When the results from groups using either systematic or question-based stakeholder identification method were compared to a control group, both groups were able to identify more stakeholders than the control group. The results also indicate that the systematic identification method performed slightly better than the questionnaire. Based on this finding, a systematic stakeholder identification method provided more identified stakeholders, although a defined method, like a questionnaire, was found to be better than just a list of possible stakeholders.

The results show that experience is an important factor in stakeholder identification. The main finding was that experienced participants were able to identify more stakeholders than those without relevant experience or with no experience at all, regardless of what identification method was used. In addition, those without relevant experience actually performed slightly worse compared to others, indicating that the type of experience is also relevant. Using a defined stakeholder identification method in this study clearly increased the amount of stakeholders identified by both experienced and non-experienced participants.

One area for future work will be testing these methods with companies working with real customer projects and extending the experiment to determine whether identified stakeholders are actually important for a software product. Another research topic is to study how the guide helps to identify stakeholders and whether the efficiency of a single method depends on the application domain. In this regard, one direction is to analyse approaches like StakeNet [8], where several practitioners participate in the identification process to generate a richer set of stakeholders.

Finally, the quality and domain of the experience itself should be studied. This study demonstrated an interesting anomaly in the results between those that were experienced in SE and those without relevant experience. Therefore, one of the future research activities should concentrate on this particular finding.

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