

A Systematic Analysis of Requirements Elicitation Problems and Challenges

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Abstract. Adequate research and planning for the elicitation process are thus essential to reduce the possibility of major mistakes hampering a project. The elicitation examines how firmly stakeholders are engaged and encouraged to collaborate, as well as how competing opinions are motivated to come to an agreement. Because it is responsible for bringing project needs into focus, elicitation is the cornerstone of each project. One of the most typical causes of project failures and abandonment, which have a negative impact on the bottom line, is elicitation errors. Some of the most problematic aspects are a lack of user contact, poor specifications, and changes in needs. The goal of this research is to conduct a literature review to identify the most prevalent problems and challenges faced during the request elicitation process, as well as the most commonly used demand elicitation methodologies.

Keywords. requirements elicitation, challenges, requirements elicitation methods

1 Introduction

The Standish Group study analysis reveals concerning data about the success of IT projects in the development of software solutions (Clancy, 1995). They surveyed IT executive managers to learn why projects succeed and what problems they face. The sample included 365 respondents from large, medium, and small businesses in important industrial areas such as banking, manufacturing, and retail, among others. Despite the fact that the survey was conducted in the 1990s, the tendency toward ad hoc, spontaneous software development is still noticeable. Only 16.2% of projects were finished on schedule and within the allocated budget. The IT management's approach highlights several essential characteristics that are critical for the project's success, such as user participation, executive support, clear explanations of user requirements, and proper planning. Lack of user involvement, incomplete requirements, and changes in

requirements, on the other hand, are mentioned as some of the most difficult factors. The majority of the issues that arise throughout this process are connected to insufficiently well-executed early phases of software development, such as requirements elicitation.

Requirements elicitation can be placed in the discovery phase of the software development life cycle (Apriorit.com, 2022). The discovery phase is the first stage of the software development life cycle, during which the primary focus is on research with the goal of getting to know the consumers, creating clear objectives, and determining specifications for requirements (Khalimonchuk, 2022).

The practice of gathering user requirements with the goal of identifying and understanding the true needs of users is referred to as requirements elicitation (Apriorit.com, 2022). Incomplete and inaccurate requirements have been identified as one of the primary causes of project failure (Alflen & Prado, 2021). According to a Pew Research study, 4% to 7% of online survey respondents provide false responses, making it even more difficult to extract true customer requirements (Conrad, 2020). As a result, uncovering obstacles and challenges is critical in order to adopt suitable requirement elicitation techniques.

The aim of this work is to undertake a literature review to identify the most prevalent problems and challenges that arise throughout the request elicitation process, as well as the most commonly used requirement elicitation techniques.

The following research questions (RQs) were developed for this purpose:

RQ1: What problems and challenges arise during the requirement elicitation process?

RQ1.1: How are common problems and challenges categorized and prioritized?

RQ1.2: What are some possible solutions to the difficulties and challenges discovered?

RQ2: What are the common strategies for eliciting requirements in software development?

The remaining part of the paper is organized as follows: Section 2 covers the research methodology adopted; Section 3 outlines the literature analysis that was performed; Section 4 presents the results with

regard to the research questions and discusses findings; and Section 6 closes the research article and addresses future work.

2 Research methodology

When reviewing the literature linked to the requirements elicitation, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) approach was applied in three key stages: search, selection, and extraction.

2.1 Search strategy

The search phrase "requirements elicitation" was used to find research publications relevant to the topic of the study. Because other search phrases, such as "specification requirements" or "identification requirements" returned an enormous amount of papers that were not as relevant to answering the research questions provided, it was decided to use only the selected search phrase.

Scopus, WoS, and IEEE databases were searched for articles between January 1, 2018, and November 15, 2022 that satisfied the following selection criteria:

- open access to data
- and a search string in the title of the article.

All articles that satisfied all of the mentioned criteria were selected and downloaded to a local database.

2.2 Selection process

The further selection process was carried out in three phases:

- 1) Initially, all duplicates were removed from the local database.
- 2) All article titles and abstracts were read, and those that did not meet one or more exclusion criteria were removed.
- 3) All articles were read completely, and in order to be considered further, they had to meet both defined inclusion criteria.

Exclusion criteria: does not refer to the request collection procedure, there is no systematic literature review provided, and it is not in English.

Inclusion criteria: it has a clearly stated goal of the paper and identified problems or challenges in the request elicitation process.

It was indicated as an exclusion requirement that the papers must include an obligatory systematic evaluation of the literature; therefore, our literature analysis would become even more important due to the possibility of evaluating a large quantity of previously summarized data from prior research.

2.3 Data extraction

After the papers were chosen, each one was carefully examined to determine whether it addressed some of the research questions that had been posed. Following a summary of the findings, key conclusions from each study were derived. The key observations were presented in tabular and graphic form so that the results could be more easily studied.

3 Literature review procedure

A systematic literature review was carried out using the methodology described in the previous section. Figure 1 depicts the applied research methodology to make it easier to understand.

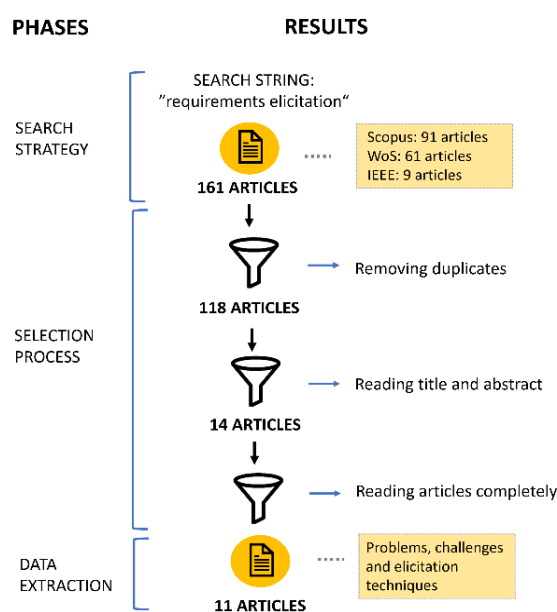


Figure 1. Article selection procedure

Using the PRISMA approach, a total of 161 articles matching the given search strategy were located: 91 in the Scopus database, 61 in the WoS database, and 9 in the IEEE database.

Because the same items appeared in many databases, duplicates as well as articles that could not be accessible despite the selected filter had to be removed. After deleting duplicates from the IEEE and WoS databases, 66 Scopus articles remained, 43 from the WoS database and all nine from the IEEE database.

In subsequent phases, articles were chosen based on the defined exclusion criteria, leaving 14 articles. After reading the articles, it was discovered that three of them did not have documented problems and challenges in the request elicitation process, and one of them did not even have a defined aim for the paper. As a result, a total of 11 articles were included in the subsequent data

extraction and article analysis procedures; the summary results and key observations will be provided in the next section.

4 Results and discussions

This section discusses the findings and responds to the stated research questions. To respond to RQ1, Anwar et al. (2022) state that requirements elicitation challenges with a frequency percentage greater than 50% are considered highly significant, and these are: poor communication, difficulty with identifying relevant stakeholders, ambiguity among stakeholders, lack of awareness of the need, unclear information, expert experience and technical knowledge, insufficient level of request details, communication problems, tacit knowledge, and the possibility of knowledge exchange. Problems with mobile application development are frequently associated with imprecise requirements, limited user interaction, poor planning, and disregarded needs (Dar et al., 2018). Other challenges involve: constant changes in requirements, neglected non-functional requirements, inappropriate architecture, minimal documentation, inaccurate cost and deadline estimates, and difficulties determining the priorities of the requirements themselves (Ferreira Martins et al., 2019).

Regarding RQ1.1, our literature review reveals four of the most prevalent challenges during request elicitation:

- **incorrect requirements** - ambiguous or incomplete requirements, changes in requirements, tacit knowledge
- **lack of communication** - lack of stakeholder involvement, failure in communication

- **choice of elicitation technique** - improper selection, limited knowledge of techniques
- **identification of key stakeholders** - incorrect identification, unknown names of all involved

Table 1 shows the statistics for the most common problems and challenges, with an "x" indicating whether the stated category of problems is mentioned in the selected articles.

The frequency of appearances in publications criterion was used to categorize and prioritize the significance of requirement elicitation problems and challenges.

According to Table 1, the majority of problems in the request gathering procedure are caused by incorrect requirements, which appeared in nine of the eleven examined articles. Then there was a lack of communication in six articles, problems with selecting the proper request elicitation technique in five, and inadequate identification of important stakeholders in five articles.

These findings, which are similar to the earlier Standish Group study (Clancy, 1995), show that the difficulty of identifying the true needs of users continues to present the biggest challenge in the modern world. Because actual client requirements are not fully explored from the beginning, it is more likely that most service development attempts will fail.

Furthermore, the communication issue appears to be the second most important challenge, while other problems are equally represented in the examined articles. This is supported by the fact that in the last two years, problems related to unclear requirements and communication issues with stakeholders have received increased research attention, which can be attributed partially to the impact of the coronavirus disease 2019 (COVID-19), as the term pandemic appeared in the titles of two articles that addressed the aforementioned

Table 1. Problem and challenge categories in request elicitation

	Incorrect requirements	Lack of communication	Choice of elicitation technique	Identification of key stakeholders
Anwar et al. (2022)	x	x	x	x
Gillani, Niaz, & Ullah (2022)	x	x		
Khan et al. (2022)	x			x
Alflen & Prado (2021)	x			
Amin, Shahzad, & Shoaib (2021)	x	x	x	
García-López, Segura-Morales, & Loza-Aguirre (2020)		x	x	
Lewellen (2020)				x
Aldave et al. (2019)	x		x	
Ferreira Martins et al. (2019)	x		x	
Dar et al. (2018)	x	x		x
Pacheco, García, & Reyes (2018)	x	x		x

issues. The analysis's findings will be discussed in relation to the established classification of issues and difficulties in the following section.

4.1 Incorrect requirements

Users frequently provide **incomplete** or **unclear requests**, making obtaining a detailed understanding of what consumers genuinely want one of the most difficult tasks (Aldave et al., 2019). Because there are several stakeholders, their perceptions, interests, and expectations of the final software product differ as a result of their experiences and positions in the specific domain of application (Anwar et al., 2022). Of course, due to the large number of stakeholders involved, meeting all of their requirements is complicated.

Since a large number of critical stakeholders are involved in achieving the same goal, **conflict** is inevitable. This is especially visible in the articulation of needs, which is why requirements may be unclear and ambiguous (Khan et al., 2022). Ferreira Martins et al. (2019) also emphasize that reaching consensus is difficult when the system includes more than one group of stakeholders because each is focused on different aspects of the system. Another issue that may occur is the stakeholders' scepticism that the development team truly understood their needs. As a result, Khan et al. (2022) propose limiting the number of valid requests by selecting just those key stakeholders for the software development process before the request elicitation begins.

While most interactions with consumers occur through dialogue, it is often difficult to extract true requirements from them (Aldave et al., 2019). According to Pacheco et al. (2018), there is no one-of-a-kind method or strategy for quickly identifying user requirements. As a result, each project and stakeholder must be approached on an individual basis.

One issue that arises is **tacit knowledge**. Tacit or hidden knowledge is knowledge that cannot be communicated, which can lead to unclear and inadequate demand elicitation (Anwar et al., 2022). When eliciting requirements, tacit knowledge manifests itself in the form of requests that users did not explicitly specify or simply because they failed to emphasize the essential features of the system based on the assumption that these are widely known features that do not need to be emphasized further (Amin et al., 2021). In order to resolve this issue, it is suggested that the requirements engineer "elicit" these needs in some way, allowing for the creation of a requirements specification document from the hazy concepts (Anwar et al., 2022).

Another issue with requirements, according to Amin et al. (2021), is inconsistent requirements or frequent **changes in requirements**. Even though a variety of approaches and technologies may be used to close the gap between requirements and design, list the ambiguity of requirements related to architecture is identified as one of the problems with software

engineering (Gillani et al., 2022). Although an individual's knowledge is composed of 90% tacit and 10% explicit knowledge, the most typical difficulty is that stakeholders or customers have a hazy understanding of the required or desired functionality (Anwar et al., 2022).

4.2 Lack of communication

Poor communication and a lack of user interaction are other common causes of difficulties (Aldave et al., 2019; Amin et al., 2021). Ferreira et al. (2019) identify several key challenges and problems that arise in agile methodologies, emphasizing that a lack of stakeholder involvement in the process of determining software requirements is the fundamental cause of many of the problems that arise as a result. For example, establishing the actual requirements may be difficult due to a lack of communication.

Clients were unable to communicate directly with system analysts throughout the COVID-19 pandemic, and Amin et al. (2021) think that this lack of communication with stakeholders was one of the key causes of project failure.

Also, most experts agree that several communication issues occurred throughout the COVID-19 pandemic. According to Anwar et al. (2022), a lack of space for undisturbed work from home reduces employee efficiency and attention, making it impossible to share tacit knowledge. Moreover, most customers have difficulty communicating their requirements, which complicates the requirement collection process (Alflen & Prado, 2021).

Collaborative sessions are mentioned as one of the proposals for a better understanding of user requirements, in which all relevant participants, from developers to business leaders, could participate in the "designing" of requirements in agile development projects (Aldave et al., 2019). However, in order for the communication between the requirements engineer and the stakeholders to be effective, the requirements engineer's experience and expertise in the issue domain are also required (Garcia-López et al., 2020).

4.3 Choice of elicitation technique

Regarding RQ2, five articles with a systematic review of the literature were examined to discover which techniques were referenced the most commonly by the authors.

The literature analysis found fifteen popular elicitation techniques: interviews, surveys, brainstorming, prototyping, observation, scenarios, ethnography, joint application development (JAD), introspection, use cases, social analysis, workshops, focus groups, user stories, and similar systems technique. The collected results are displayed in Table 2, number N next to each author represents the total number of publications that have been evaluated using

Table 2. Identified requirement elicitation techniques

		Anwar et al. (2022) N=29	Amin et al. (2021) N=50	Pacheco et al. (2018) N=109	Alflen & Prado (2021) N=61	Sum of articles
Interviews	13	23	12	30	45	123
Survey/Questionnaire	10	21	17	7	34	89
Brainstorming	5	20	12	5	24	66
Prototyping	8	20	7	4	25	64
Observation	10	40	2	0	11	63
Scenarios	0	19	4	10	23	56
Ethnography	4	21	2	4	10	41
JAD	5	9	10	0	10	34
Introspection	0	0	31	0	2	33
Use cases	0	0	0	3	25	28
Social analysis	3	23	0	0	0	26
Workshop	0	0	5	3	17	25
Focus groups	0	0	5	3	17	24
User stories	0	0	0	8	12	20
Similar system	3	16	0	0	0	19

a systematic literature review, whereas the cells represent the number of articles that addressed particular techniques.

As can be seen in Table 2, interviews not only appear in the greatest number of articles in total, but they are also the most commonly used technique. However, before starting a detailed examination of the data for the purpose of comparison, it is essential to investigate which elicitation techniques are widely used and recognized on the market.

A Guide to the business analysis body of knowledge (BABOK Guide) as a standard for the practice of business analysis states nine of the most popular requirements elicitation techniques in software engineering (Apriorit.com, 2022):

- Brainstorming
- Document analysis
- Focus group
- User interface analysis
- Interviews
- Observation
- Prototyping
- Requirements workshops
- Survey/questionnaire.

When comparing the acquired results to BABOK's list of the most often used elicitation techniques, it can be noted that the majority of the mentioned techniques are recognized in the selected articles. The only techniques with non-overlapping results are user interface analysis and document analysis, which were not recognized as widespread techniques in a thorough review of the literature. To make it easier to interpret the previous data, a graphical representation of the results is provided. Accordingly, Figure 1 illustrates the most often used elicitation techniques in

descending order of citation frequency in selected articles.

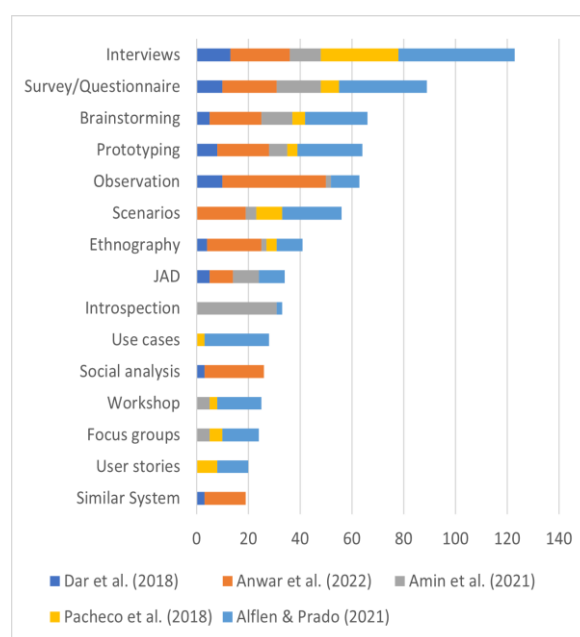


Figure 2. Frequency of elicitation technique

As shown in Figure 2, interviews are by far the most commonly used technique for requirement elicitation, followed by a survey, and finally, brainstorming, prototyping, and observation, which appear in nearly equal proportions. This alone illustrates that interviews in the form of asking questions to elicit responses from users, as well as surveys, are still widely used to identify requirements.

Only the five most popular elicitation strategies chosen will be further explained, with reference to the key results of other techniques.

The characteristics of the five most frequently used elicitation techniques are discussed further below.

- **Interviews:** an interview is a method of direct communication between the interviewer and the user (Dar et al., 2018). From Pacheco et al. (2018) point of view, interviews are the most effective technique since they allow analysts to get far more data than the other elicitation techniques.
- **Survey/questionnaire:** a survey is a traditional elicitation technique for collecting data by asking important questions with the goal of understanding user opinion (Pacheco et al., 2018). It is typically used in the first stages of requirements elicitation to gather as many requirements as possible from various stakeholders who may be located in various locations (Alflen & Prado, 2021). It was also a useful tool during the pandemic era, when face-to-face interaction was impossible (Anwar et al., 2022).
- **Brainstorming:** a brainstorming is a meeting in which each member is free to voice any thoughts they have on the system's needs (Alflen & Prado, 2021). It is often used in the case of extracting tacit knowledge (Amin et al., 2021).
- **Prototyping:** a prototype, as a simplified version of the software, is used when there is a lot of uncertainty regarding the requirements, with the goal of getting a clear idea of how the software will perform in practice and encouraging feedback from stakeholders (Pacheco et al., 2018). When clients want to be involved in the creation of the system and use it, prototyping works better (Dar et al., 2018).
- **Observation:** an analyst examines consumers in their natural environment through observation. It could be active, with analysts asking questions, or passive, with user activities being observed (Amine t al., 2021).

Although there is little research on the subject, the authors strain the significance of picking an appropriate technique for requirements elicitation in order to gather the requirements that will be used to build an appropriate software architecture (Gillani et al., 2022). For example, tactic requirements can be elicited by brainstorming, scenario planning, and prototyping (Anwar et al., 2022).

Introspection, as a technique in which system analysts use their experience to identify user requirements, according to Amin et al. (2021), should be utilized as a starting point in the requirements elicitation process, particularly for large projects. It would be possible to discover all known needs in this manner, significantly decreasing the time and cost of the software development process. Ethnography is used to discover problems; for that purpose, the observer enters the user's environment to collect detailed observations, while the scenario technique can assist in determining which functional needs should be incorporated into the system (Amin et al., 2021). Social

analysis is done when it is unknown what the user's surroundings, especially the political and social ones, are like (Dar et al., 2018).

4.4 Identification of key stakeholders

According to Dar et al. (2018), there is a need to manage stakeholders' requirements due to the difficulty in identifying acceptable stakeholders and the challenges that arise as a result of their involvement in the product development process. According to Lewellen (2020), a critical stakeholder is someone whose late disclosure of requirements may disrupt the early software planning and project development timeframe. Specifically, many software development projects fail precisely because of incorrect stakeholder identification, which results in an inability to identify the true system requirements and hence a software product that does not fulfil the true wants and demands of customers (Khan et al., 2022). However, due to the vast number of stakeholders, it is frequently impossible to identify all significant stakeholders, despite the fact that their accurate identification should ensure comprehension of the most critical needs throughout the software planning phase (Lewellen, 2020).

Khan et al. (2022) identify a potential solution in the compilation of a list of various stakeholders or organizations that may have an impact on the software development project. Then, from that list, interesting stakeholders having direct or indirect contact with software development, such as analysts, journalists, and so on, should be identified. Following the identification of all stakeholders, the process of eliminating those who are not significant and relevant to the software product would begin, leaving just the vital and relevant stakeholders.

5 Conclusion

A business analyst's initial task is to obtain requirements from the client. It refers to an organized strategy aiming at "drawing out" information and forging consensus regarding application/software development needs. Elicitation is the foundation of any project because it is responsible for bringing project requirements to the table. Elicitation errors, according to scientists and engineers, are one of the most common reasons of project failures and abandonment, which have a negative influence on the bottom line. Simply expressed, the purpose of requirement elicitation is to discover all assumptions, risks, and needs associated with any project.

The literature was analysed to get insight into the most prevalent problems that arise throughout the request elicitation process, and it was discovered that the problems are connected. Problems with inaccurate identification of relevant stakeholders or a lack of engagement with stakeholders, in particular, can result in ambiguous or incomplete requirements. Similarly, if

the proper request elicitation approach is not used, it is more difficult to find the user's actual requests, which leads to frequent changes in the user's requests. By reviewing the findings, it is clear that the most prevalent issues originate with stakeholders, requirements, and elicitation approaches. However, in order to solve the difficulties, each of these three major factors must be solved.

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