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A SYSTEMATIC LITERATURE REVIEW ABOUT SOFTWARE REQUIREMENTS ELICITATION

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Abstract

Requirements Elicitation is recognized as one of the most important activity in software development process as it has direct impact on its success. Although there are many proposals for improving this task, still there are issues which have to be solved. This paper aims to identify the current status of the latest researches related to software requirements elicitation through general framework for literature review, in order to answer the following research questions: Q1) What aspects have been covered by different proposal of requirements elicitation? Q2) What activities of the requirements elicitation process have been covered? And Q3) What factors influence on requirements elicitation and how? A cross-analysis of the outcome was performed. One of the results showed that requirements elicitation process needs improvements.

Keywords: Requirements elicitation, Requirements identification, Requirements engineering, Factors, Framework.

1. Introduction

According to the Software Engineering Body of Knowledge (SWEBOK) [1] the software development process consists of several phases as follows: Requirements gathering, analysis, design, architecture, implementation and maintenance. Requirements gathering are the first and the most important phase [2], since requirements are the descriptors of what the system should do, the services it offers and the restrictions on its operation, they reflect the needs of the users [3]. The broad spectrum of tasks and techniques performed to understand the requirements is known as Requirements Engineering [4]. It involves finding out what are the goals, needs as well as the expectations of stakeholders and communicate them to the developers [5]. Several activities for software development were proposed.

SWEBOK [1] activities consist of: Elicitation, Analysis, Specification, Verification and Management. Pohl's model consists of: Elicitation, Negotiation, Specification, Documentation and Validation/Verification [6]. Sommerville's model [3], composed of: Acquisition, Specification, Validation and Documentation. Wiegers's model [7], breaks down into two sub RE activities: Development and Requirements Management, whereby the development activity is broken down into Elicitation, Analysis, Specification and Verification. Our research focuses on the task of software Requirements Elicitation.

Loucopoulos et al. [8] defines the Requirements Elicitation as the process of acquiring all relevant knowledge to produce a requirements model of a problem of a specific domain. According to Borland [9], the Elicitation is the ability to work collaboratively with stakeholders to discover the current product needs and agree upon the vision and goals of the proposed project. According to the SWEBOK [1] this task is broken down into two activities: Requirements sources and Elicitation techniques. On the other hand, Pohl [6] defines the requirements elicitation as a core activity of the requirements engineering, which consists of: (1) Identify sources of the relevant requirements, (2) Identify the requirements of these sources and (3) Develop new requirements. Mulla et al. [2] defines the process of requirements elicitation as follows: (1) Identify requirements sources, (2) Collect the wish list for each corresponding part, (3) Document and Refine the wish list, (4) Integrate the wish lists with the various stakeholders and (5) determine the non-functional requirements.

In this study, the definition of requirements elicitation will be used considering the activities proposed by Loucopoulos et al. [8], Pohl [6] and Mulla et al. [2] as follows: (1) Acquire knowledge of domino, (2) Determine the Sources of requirements, (3) Define the appropriate elicitation technique, (4) Identify the requirements of these sources (5) Document and (6) Refining the requirements.

Bohem [10] argues that the requirements elicitation is the first and most critical step in the requirements engineering process doing it wrongly will lead to poor quality products, late delivery dates and high costs [10]. According to the Standish Group Report in 2013 [11], the number of failed projects in 2006, 2008 and 2010 have increased. This report defines a list of factors that cause failures in projects. Moreover, incomplete requirement is one of the major factors with the highest percentage (13.1%). The report also defines the three main reasons for project success which are: user involvement, executive management support and clear statement of requirements [11].

Previous studies showed several problems related to requirements elicitation. According to Laporti et al. [12], this one is a complex process and requires as much information as available, including some experience with previous systems. In the study conducted by Zhang et al. [13] stated that, two of the causes for the failure of projects were lack of clear and adequate requirements elicitation besides inappropriate project scope. Mulla et al. [2] argues that the requirements elicitation is a difficult task especially in large software projects with information overload and many Stakeholders with different points of view. However, the existing methods are not suitable for large projects. Atladottir et al. [14] argue that by considering users as a primary source of information leads to a positive end product. Whereby, Meth et al. [15] argue that "Automation" is at the top of the wish list of most software developers, and that "Identify user needs" is not performed efficiently.

In this way, given the importance of the impact of the requirements elicitation in the success of software projects several literature review works has been carried out, such as the work of Pacheco et al. [16], who reviewed methods to Stakeholder identify, Carrillo et al. [17] and Meth et al. [15], who reviewed tools supports the requirements elicitation process.

Meanwhile, there are some important aspects in the requirements elicitation that deserve to be studied, for example: Framework, Models, Elicitation process activities and factors. Moreover, it is important to know the relationships between some aspects, for example: Which factors influence on the elicitation process activities? So, the propose of this research is to review the different aspects developed in the requirements elicitation in order to know the relationship between them and to have a global view of the development of this domain.

This paper is organized as follows: Section 2 describes the research methodology used; Section 3 discusses literature review based on the proposed framework. Section 4 presents the analysis results by applying the proposed framework to the selected literature and finally Section 5 conclusion.

2. Research Methodology

A systematic literature review was conducted considering the guidelines used by Kitchenham et al. [18], which has been adapted, determined 3 phases as follows:

- Planning the review: In this phase, the research questions are elaborated and the review protocol is defined.
- Development the review: In this phase, the primary studies are selected according to the selection and exclusion criteria
- Results the review: In this phase, the statistics and the analysis realized to the studies which were selected before are presented, the analysis details are explained on sections 3 and 4.

2.1. Planning the review

To achieve this purpose of the investigation, these following research questions are proposed:

- Q1: What aspects have been covered by different proposal of requirements elicitation?
- Q2: What activities of the requirements elicitation process have been covered by the different proposals? and
- Q3: What factors influence on requirements elicitation and how?

The following databases were used mainly in order to define the search protocol: SCIENCE DIRECT, IEEE Xplore Digital Library and ACM Digital Library. The research covers the period from January 2009 to December 2014.

It was used the following stream search TITLE-ABS-KEY ("Requirements Elicitation") OR TITLE-ABS-KEY("Requirements Identification") OR TITLE-ABS-KEY("requirements engineering"), which have been applied on the title, abstract and keywords. After that, the selection and exclusion criteria showed in Table 1 were applied.

Table 1. Selection and exclusion criteria.

Selection Criteria	Exclusion criteria
Studies related to the state of art and motivation.	Sources of studies that is different than Journals and Proceeding.
Having different types of proposals: Frameworks, models, techniques, tools, etc.	The study language is other than English
Propose factors that influence elicitation.	Elicitation mentioning but which are not oriented software engineering.
Ensure that it is related to any activity elicitation process.	

2.2. Development the review

The primary studies identified in the search process were submitted to a selection process according to the criteria established on Table 1. For that, it was necessary to do a previous review about the content in order to determine its relevance and finally, the majority of these studies were discarded because they were about other areas like Engineering, Business or Energy. The review process development is in Fig. 1.

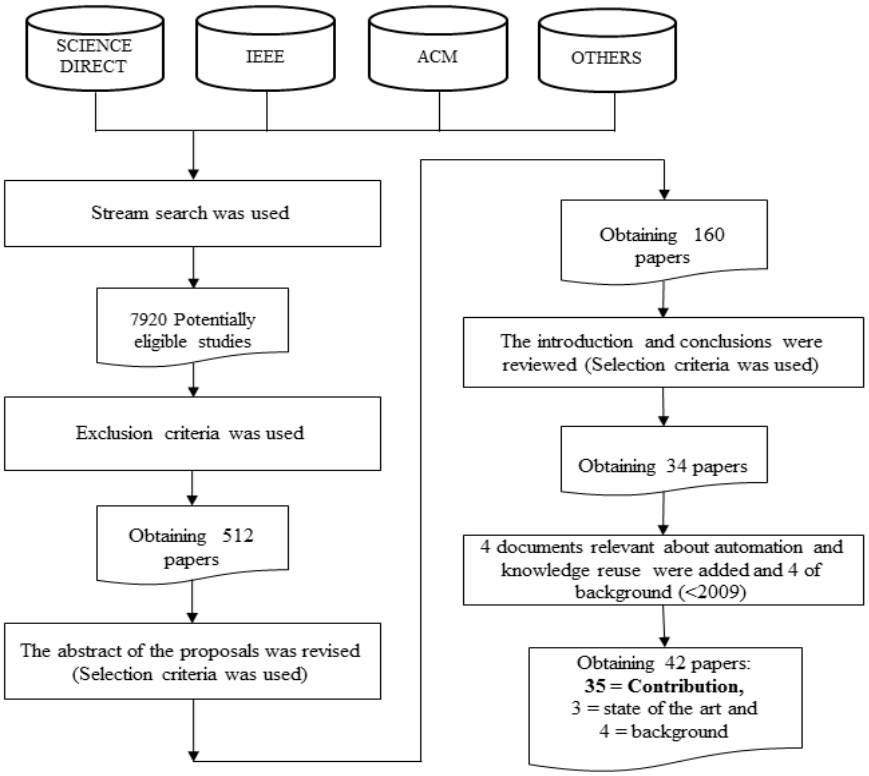

Fig. 1. Systematic literature review process.

Since there has been found few papers about automation and the reuse of knowledge in elicitation requirements, we added 4 papers [27, 28, 40, 57] that do not belong to the period established (<2009). Also, we added 4 papers [5, 9, 20, 55] about background.

2.3. Results of the review

2.3.1. Tendencies about publications

The result of systematic review process gave 7920 studies, from which, 42 ones where selected according to the selection and exclusion criteria. In this case, 3 studies were about literature review, 4 ones about background and 35 were about different proposals. Those 35 studies about of proposals were analysed to answer the research questions. In Table 2, it is possible to see the amount of studies selected by each type of source.

Table 2. Potentially eligible studies y selected studies.

Source	Potentially eligible studies	Selected studies
Science Direct	1297	12
IEEE	5885	10
ACM	154	5
Others	584	8
TOTAL	**7920**	**35**

Furthermore, in Fig. 2 it is presented the number of studies related to requirement elicitation on the years (2009 - 2014) and the 4 studies considered out of the period (<2009). These 35 studies correspond to different aspects on Elicitation and factors that influence requirements elicitation.

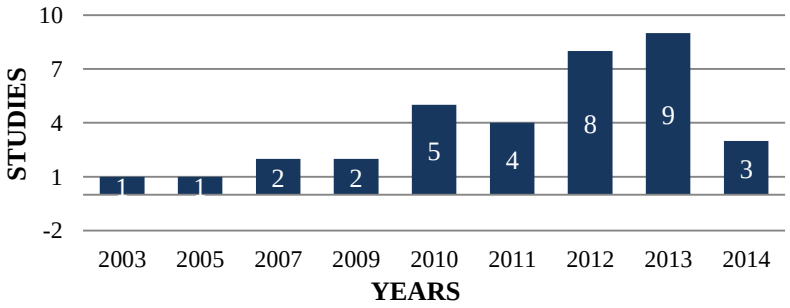

Fig. 2. Evolution studios on requirements elicitation.

On the other hand, using the stream search in SCOPUS [19] we got the tendencies of publications presented in Fig. 3. Besides, the first paper about requirements elicitation was proposed by Alford in 1985 [20], who discussed the evolution of software requirements elicitation methodology.

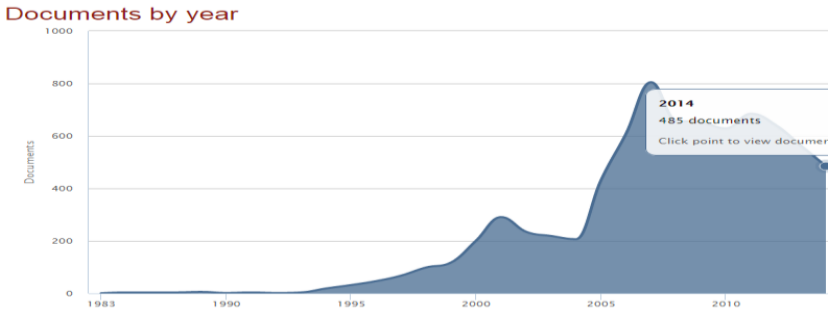

Fig. 3. Trends publications about requirements elicitation in SCOPUS.

2.3.2. Data source

Table 3 shows the publications made about requirements elicitation by type of source (Journal and Proceeding) from the different databases. It is possible to see that the majority of studies in Journals are from Science Direct and studies in Proceedings are from IEEE. Also, we can see that the majority of studies have been published in Journals (51%) while the studies published in proceeding represent the 49%. It important to notice that "Others" classification corresponds to studies founded in SCOPUS, EBSCO and ProQuest [2, 14, 29, 31, 38, 73, 78, 82].

Table 3. Publications on requirements elicitation by source type.

	Science Direct	IEEE	ACM	Others	Total	Percentage
Journal	12	0	1	5	18	51%
Proceeding	0	10	4	3	17	49%
TOTAL	12	10	5	8	**35**	**100%**

3. Analysis of the Studies

This section the literature review presents according to the proposed General Framework, shown in Fig. 4. This framework is confirmed by 3 categories: "Covered aspects", "Activities" and "Influencing factors". Each of these parts relates to the following research questions posed.

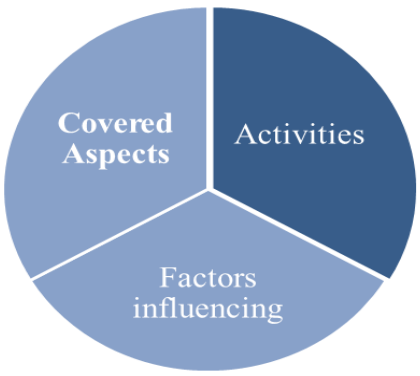

Fig. 4. Proposed general framework for the literature review.

The classification "Covered Aspects" will let us know until now, what aspects are considered in the requirements elicitation and in what magnitude. "Activities" will let us know about the elicitation process activities that have been covered by different studies. Finally, "Influence factors", will let us know what factors are considered by different studies as positive or negative influence in the elicitation.

Table 4 shows the studies found in the systematic review of literature according to the classification of the proposed framework and the databases used.

Table 4. Classification of studies founded in the systematic review of literature about requirements elicitation.

Classification	Science Direct	IEEE	ACM	OTHERS	TOTAL
Covered aspects	[12, 13, 21, 24, 54, 56]	[27,28, 32, 23, 22, 53, 26, 25, 30]	[39, 40, 52, 57]	[2, 29, 31, 38]	23
Activities	[12, 13, 24, 21, 56, 54]	[27, 28, 32, 23, 22, 53, 26, 25, 30]	[39, 40, 52, 57]	[2, 29, 31, 38]	23
Influencing factors	[12, 13, 24, 21, 54, 72, 74, 75, 77, 79, 81]	[27, 28, 32, 23, 26, 25, 30, 76]	[57, 80]	[2, 14, 29, 31, 38, 73, 78, 82]	29

3.1. Covered aspects

This classification will tell us what issues the various proposals in the requirements elicitation have covered and it is also related to the first research question (Q1). This requires taxonomy based on the types of contributions that are in the literature, such as type of contribution, level of automation, knowledge reuse, human factor importance, collaborative approach, and project type (Fig. 5).

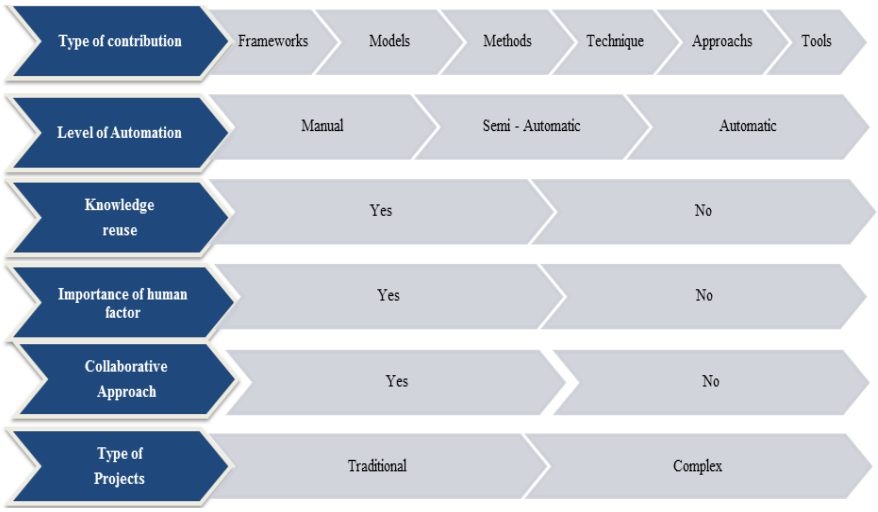

Fig. 5. Taxonomy for the "covered aspects" in the requirements elicitation.

Table 5 shows the six sub questions of the research Q1. The components of the taxonomy will be explained next.

Table 5. Research questions related to "covered aspects" in the requirements elicitation.

Classification	Research questions
Type of contribution	Q1.1: What types of contributions exist for software requirements elicitation?
Level of Automation	Q1.2: What contributions are oriented towards software requirements elicitation automation?
Knowledge Reuse	Q1.3: What contributions reuse knowledge on software requirements elicitation?
Importance of Human Factor	Q1.4: What contributions consider human factor as important regarding requirements elicitation?
Collaborative Approach	Q1.5: What contributions consider a collaborative approach for software requirements elicitation?
Types of projects	Q1.6: What contributions are oriented towards requirements elicitation for complex software projects?

3.1.1. Type of contribution

Table 6 presents classification of the related work regarding to frameworks, models, methods, techniques, approaches and tools used in requirements elicitation as follows:

Table 6. Types of contributions in the requirements elicitation.

Types of Contributions	References	Total
Frameworks	[27, 28, 29, 30, 31, 32, 56]	7
Models	[12, 38, 39, 40]	4
Methods	[21, 22, 57]	3
Techniques	[23, 24, 25, 26]	4
Approaches	[2, 13, 52]	3
Tools	[53, 54]	2
		23

a. Frameworks used for requirements elicitation

The Framework is used to select the techniques to obtain better requirements based on empirical, theoretical studies, and expert judgment [56]. Some of the related frameworks are as follows:

- Ankori framework aims to automatically retrieve functional requirements by applying machine learning and agile processes [27].
- Li et al. framework improves requirements elicitation by reusing requirements, applying ontologies and the KADS Model [28].
- Fuentes et al. framework improves the requirements elicitation in regards of human context by applying the theory of activity [29].

- Tiwari framework which helps select requirements elicitation techniques of software project based on the alignment of project related information and gathering techniques [30].
- Aranda and Sabahat frameworks improve communication in requirements elicitation of Global Software Development (GSD) [31, 32].

Some frameworks that have been analysed by these authors are: [33, 34, 35, 36, 37, 70, 83].

b. Models used for requirements elicitation

- Laporti et al. model for negotiating users views using a collaborative approach [12].
- Liao's model, where applies the Value Chain Analysis (VCA) for the elicitation of requirements [38].
- Kamalrudin et al. model where applies Essential Use Cases (UEC) [39].
- Jain et al. model for requirements identification in Component-Based Software Development applying the information processing theory (IPT) in Component Based Software Development (CBSD) [40].

Some models that have been analysed by these authors are: [41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 71].

c. Methods used for requirements elicitation

- Azadegan et al. method using a collaborative approach [21].
- Dragicevics et al. method for Elicitation, Documentation and Validation of Software User Requirements (MEDoV) [22].
- Shibaoka et al. method applying ontologies and led by objectives [57].

Some methods that have been analysed by these authors are: [51, 58, 59, 60].

d. Techniques used for requirements elicitation

- Vlas et al. technique for the elicitation and automated classification of natural language requirements for open source projects based on rules and ontologies [23].
- Using Human Computer Interaction (HCI) [24].
- Yin et al. technique to help capture the non-functional requirements by using the Problem Frame Focus (PF) systematically [25].
- De Oliveira et al. technique to help identifying functional and non-functional requirements based on the Business Process Models (BPM) [26].

Some techniques that have been analysed by these authors are: [61, 62, 63].

e. Approaches used for requirements elicitation

- Predicting requirements with similar users' needs by using an algorithm (kNN) and Collaborative Filtering [2].
- Zhang et al. approach for multiple users with conflicts [13].
- Durdik et al. approach by using an objective-driven and architecture centered approach [52].

Some approaches that have been analysed by these authors are: [64, 65, 66].

f. Tools used for requirements elicitation

- Soltanian et al. tool by using scenarios and prototypes [53].
- Fernandes et al. tool by using a collaborative and game-driven (Game-Based) approach [54].

Some tools that have been analysed by these authors are: [67, 68].

3.1.2. Level of automation

Meth et al. [15] argues that the "automation" is at the top of the wish list of most software developers. In a survey conducted on the contribution to the practices of requirements elicitation, 69% of respondents identified automation as the most valuable contribution to the improvement of the practices of requirements elicitation [69]. Ankori's Framework [27] and the tool of Soltanian et al. [53] use automation in requirements elicitation. Other proposals employing semi-automation are the Model of Laporti et al. [12] and the Framework of Fuentes et al. [29], while the rest perform requirements elicitation manually (See Table 9).

3.1.3. Knowledge reuse

Pisan [55] argues that when software companies finish building a project, have their requirements developed, and artifact for which they have dedicated time. When developing new projects, they start from scratch to get new requirements. If they applied a technique to capture the experience and skills of engineers to reuse or adapt previous requirements, it would streamline the work of the requirements engineers. [12, 28, 57, 23, 31, 53, 54, 40] are among the proposals that reuse the knowledge for requirements elicitation. The other proposals do not reuse the knowledge (See *Appendix A*).

3.1.4. Importance of human factor

Human factor should be considered in the requirements. And adequate elicitation should not only capture customer requirements, but all aspects of the context that may affect the system or its use in any way [29]. Furthermore, one of the problems in requirements elicitation is found in the different stakeholders points of view [29]. Every stakeholder describes his needs differently [3]. Among the proposals which consider the human factor as important in the requirements elicitation are [12, 13, 22, 24, 29, 31, 52, 53, 54, 56] (See *Appendix A*).

3.1.5. Collaborative approach

According to Azadegan et al. [21], the requirements elicitation is highly collaborative and involves many actors, in which each actor has different needs, expectations, along with his own experience, prejudices and points of view which must be met by the introduction and delivery of the future system. Among the proposals that use a collaborative approach in requirements elicitation are [2, 12, 21, 24, 31, 53, 56, 54]. The other proposals do not use collaborative approaches (*See Appendix A*).

3.1.6. Types of projects

Mulla et al. [2] argue that the requirements elicitation is a difficult task especially in large software projects with information overload and many Stakeholders with different points of view. In addition, existing methods for requirements elicitation are not well suited to large projects. Among the proposals aimed at requirements elicitation for Complex Software projects are [30, 31, 32, 54]. Other proposals aim for traditional projects (See *Appendix A*).

3.2. Activities

This classification will tell us which contributions cover the various activities in the requirements elicitation process, and it is also related to the second research question (Q2). For such, the Framework is shown in Fig. 6, in which this framework has been made based upon the definitions of the requirements elicitation process authors: Pohl [6], Loucopoulos et al. [8] and Mulla et al. [2].

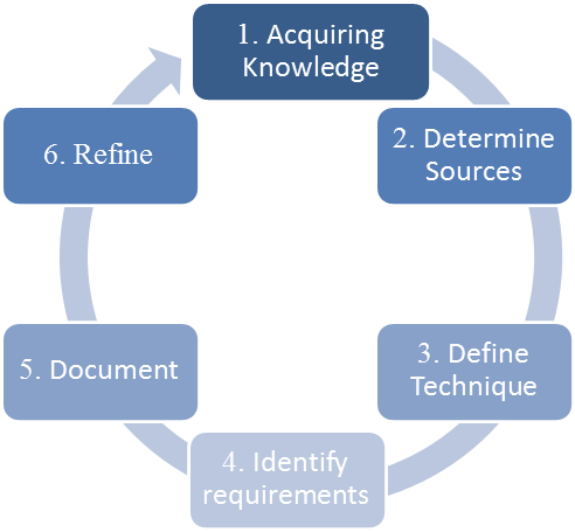

Fig. 6. Framework for identifying contributions in the process of requirements elicitation.

The engineer of requirements needs to know "Acquiring Knowledge" about the type of application to be developed. This activity will allow him to infer tacit knowledge that the stakeholders do not articulate, assess the advantages and disadvantages that will be needed between sometimes conflicting requirements and act as a "user" champion sometimes [1]. "Determine Sources" requirements refers to identifying all types of potential sources, that is because the requirements can come from different sources, such as users, systems, documents, etc. [8]. Once requirements sources have been identified, the engineer can begin to elicit the user needs. "Define Technique", this activity is focused on choosing the proper requirements elicitation technique for expressing user needs [8]. "Identify requirements" refers to eliciting the requirements from identified sources and with

the adequate requirements elicitation technique [6]. "Document" means defining how to document the obtained information from the requirements elicitation [2]. And "Refine" refers to defining the process of validation and correction of the obtained requirements [2].The studies that relate to each of the activities in the requirements elicitation process are shown in Table 7.

Table 7. Studies that relate to the requirements elicitation process.

Activities	References
Acquiring knowledge	[12, 23, 30, 57]
Determine Sources	[53]
Define Technique	[30, 56]
Identify Requirements	[2, 12, 13, 21, 22, 23, 24, 25, 26, 27, 28, 29, 31, 32, 38, 39, 40, 52, 53 ,54, 57]
Document	[22, 31]
Refine	[54]

3.3. Influencing factors

This classification will allow us to know which factors influence the requirements elicitation either positively or negatively and it is related to the third research question (Q3). To this end it has been classified as shown in Table 8, where the studies were divided into 2 groups: studies relating to factors influencing the elicitation of requirements (1) Positively and (2) Negatively. These factors were identified according to the 29 studies (see Table 4).

Table 8. Studies that relate to factors that impact the requirements elicitation.

Factors	Impact	References
Automation	+	[12, 27, 29, 78]
Knowledge	+	[12, 23, 25, 30, 57, 77, 81]
Collaboration	+	[2, 12, 21, 24, 29, 54]
Reutilization	+	[23, 28, 57]
Communication	+	[31]
Stakeholders	+	[2, 13, 14, 72, 73, 76, 80]
Business Objectives	+	[26, 38]
Different Stakeholders views	-	[13, 74, 82]
Complexity of the project	-	[32, 75, 79]

4. Analysis of the Result

This section describes in detail the results of applying the General Framework proposed as shown in Fig. 4, and thus we can answer the research questions raised in this article (See section 2.1). The percentages presented in this section are obtained on total references with no redundancy in the study analysed.

4.1. Covered aspects (Q1)

First, to identify the "covered aspects", the proposed Taxonomy in Fig. 5 was applied, which explains in detail the analysis of the classification: Type of contribution, level of automation and type of project. Other classifications will be shown in the summary of the analysis in Figs. 7 and 8, shows the results when

applying the taxonomy (Fig. 5) related to the classification "Type of contribution", where one can observe that, out of the 23 selected studies, 30.43% correspond to Frameworks, 17.39% to Models, 13.04% to Methods, 17.39% to Techniques, 13.04% to Approaches and 8.7% to Tools. So, most of the contributions are focused on Frameworks (30.43%). With this analysis we can answer the first research question.

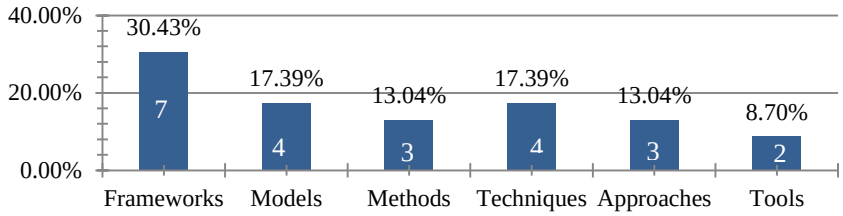

Fig. 7. Rates of types of contribution in the requirement elicitation.

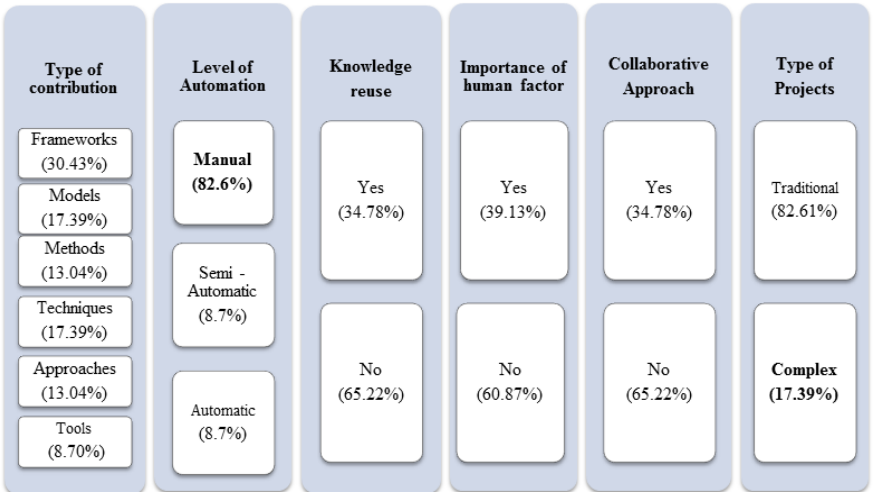

Fig. 8. Summary of results according to the "covered aspects".

Table 9 shows the results of the Level of automation classification, according to the type of contribution. 82.6% of contributions allow making the requirements elicitation manually, 8.7% in a semiautomatic way and 8.7% automatically. In addition, with this analysis we can answer the research question Q1.2.

Thus, a detailed analysis was made of each of the other classifications and is summarized in Fig. 8, as we can see, the percentage of studies are grouped in: Types of contributions, level of automation, reuse of knowledge, Importance of Human Factor, Collaborative Approach and Type of Project.

With this summary we can answer research questions Q1.2 to Q1.6. In summary, regarding the requirements elicitation, the following is observed: Most of the contributions for it are Frameworks (30.43%). Few studies have focused on its automation (8.7%). Most studies do not reuse the existing knowledge (65.22%). Most of these studies do not consider the Stakeholder as an important piece in the requirements elicitation (60.87%). Most studies do not use a

collaborative approach (65.22%). And few studies are focused on complex software projects requirements elicitation (17.39%).

Table 9. Level of automation by type of contribution.

Type of contribution	Manual	Semiautomatic	Automatic	Total
Frameworks	[28], [56], [30], [31], [32]	[29]	[27]	7 (30.43%)
Models	[38],[39],[40]	[12]		4 (17.39%)
Methods	[57],[21],[22]			3 (13.04%)
Techniques	[23],[24],[25],[26]			4 (17.39%)
Approaches	[2],[13],[52]			3 (13.04%)
Tools	[54]		[53]	2 (8.70%)
Total	**19 (82.6%)**	**2 (8.7%)**	**2 (8.7%)**	**23 (100%)**

4.2. Activities (Q2)

Second, to identify "Activities", a correspondence matrix took place between the requirements elicitation process activities and the different proposals based on the proposed Framework in Fig. 6. The results are shown in Table 7, which shows the different contributions that are related to each of the activities of the requirements elicitation process. We can see that most of the contributions are focused on the "Identify Requirements" activity (91%) and other activities are poorly covered: "Acquire knowledge" (17%),"Identify sources" (4%), "Defining technique" (9%), "Document" (9%) and "Refine requirements" (4%). It should be noted that some papers are aimed at more than one activity, for example: the proposal of Laporti et al. [12].

4.3. Influencing factors (Q3)

Third, to identify the "Factors", a table of correlations between the factors influencing the requirements elicitation positively (+) or negatively (-) and the different proposals was developed (Table 8). We can see that, the factors that influence positively are: automation (14%), knowledge (24%), collaboration (21%), reuse (10%), communication (3%), stakeholders (24%) and business objectives (7%). And the factors that influence negatively are: different stakeholders views (10%), and the complexity of software projects (10%). Furthermore, few proposals are related to the following factors: Communication, business Objectives, different stakeholders views and complexity of the project.

We can also see that there are contributions that identify more than one factor, such as the contribution of Vlas et al. [23], which identifies two factors that influence positively: automation and knowledge. Also, we can see that few proposals focus on the factors that influence negatively (See Table 8).

4.4. Cross-tab analyses

After the results of the analysis of the proposed Framework, we performed two cross-tab analyses with the obtained results: “Covered Aspects” Vs “Activities” and “Factors” Vs “Activities”.

For this kind of analysis between the related contributions to the “Covered Aspects” Vs “Activities”, we performed a matrix of correlation, which shows in Appendix A. As we can see, most proposals are related with "Requirements Identification”, considering the aspects: "Reuse of Knowledge", "Human factor importance" and "Collaborative Approach". Moreover, there are no proposals about: "Automation" to support activities: "Define Technique", "Document" and "Refine". There are also no proposals about "Reuse of Knowledge" to support "Define technique" activity. There are no proposals considering "Human factor importance" for Requirements Refine. And there are any proposals about "Determine Sources" of requirements considering complex projects software.

For the cross-tab analysis between the contributions related to “Factors” Vs “Activities”, we came up with a matrix of correlation shown in *Appendix B*. It is possible to see that most proposals about factors correspond to “Requirements Identification” activity. Furthermore, some proposals about factors like “Automation”, “Knowledge”, “Collaboration” and “Reutilization” correspond to “Knowledge Acquiring” activity, and there are no proposals about factors correspond to "Determine Sources" and "Define Technique" activities.

5. Conclusions

This paper presented a Systematic Literature Review of 7920 articles related to software requirements elicitation, in which the abstract of 512 studies were reviewed, studies that helped obtain 35 articles relevant to this study. The articles were analysed based on the general framework proposed in Fig. 4, whereby the conclusions of this work were related to the three research questions presented in the General Framework, also to the cross-tab analysis. Figure 8 presents various aspects that have been covered by previous studies for requirements elicitation. Most of the proposals focused on the "Identification Requirements", while some focused on "Acquiring domain knowledge", "Technique Identify", "Identifying Sources", "Document" and "Refine Requirements". Few proposals focus on the factors that influence the requirements elicitation in a negative way. According to the results obtained in the cross-tab analysis between the contributions related to "covered aspects" and "activities" of the process of the requirements elicitation, there are no proposals about: "Automation" to support activities: "Define Technique", "Document" and "Refine". Moreover, according to the results obtained between the contributions related to "factors" and "activities", there are no proposals about factors correspond to "Determine Sources" and "Define Technique" activities. Therefore, it is recommended to make proposal covering the missing points to improve in the requirements elicitation process, such as covering the activities (“Acquire domain knowledge”, “Define an adequate technique”, “Determine the source of the requirements”, “Document” and “Refine requirements”), considering all the factors especially the ones affecting negatively and analyse other factors that may influence in the requirements elicitation.

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Appendix A

Correlation matrix between the "Covered Aspects" and the "Activities" of the requirements elicitation process

Activities / Covered look	Acquiring knowledge	Determine Sources	Define Technique	Identify Requirements	Document	Refine	Total
Automation	[12]	[53]		[12, 27, 29, 53]			**4**
Knowledge Reuse	[12, 23, 57]	[53]		[12, 23, 28, 31, 40, 53, 54, 57]	[31]	[54]	**8**
Importance of Human Factor	[12]	[53]	[56]	[12, 13, 22, 24, 29, 31, 52, 54, 53]	[22, 31]		**10**
Collaborative approach	[12]	[53]	[56]	[2, 12, 21, 24, 31, 53, 54]	[31]	[54]	**8**
Complex Project	[30]		[30]	[31,32, 54]	[31]	[54]	**4**
Total	**4**	**1**	**2**	**17**	**2**	**1**	

Appendix B

Correlation matrix between the "Factors" and "Activities" of the requirements elicitation process

Activities / Factors	Acquiring knowledge	Determine Sources	Define Technique	Identify Requirements	Document	Refine	Total
Automation (+)	[12]			[12, 27, 29]			**3**
Knowledge (+)	[12, 23, 30, 57]			[12, 23, 25, 57]			**5**
Collaboration (+)	[12]			[2, 12, 21, 24, 29, 54]		[54]	**6**
Reutilization (+)	[23, 57]			[23, 28, 57]			**3**
Communication (+)				[31]	[31]		**1**
Stakeholders (+)				[2, 13]			**2**
Business Objectives (+)				[26, 38]			**2**
Different stakeholders views (-)				[13]			**1**
Complexity of the project (-)				[32]			**1**
Total	**4**	**0**	**0**	**16**	**1**	**1**	