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Software Requirements Elicitation Practices Among Software Developers in Riyadh

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Abstract*: The main goal of any organization planning to launch a new system is work successfully, but that does not mean the system optimality and efficiently. The nominal goal is covering all the requirements of the institution, which is why the software requirement elicitation is the most important step on requirement engineering process. That is lead us on this paper to study the result of survey about how the software requirement elicitation among software developing process on the capital of Saudi Arabia, Riyadh. As initial work, we distributed a survey through WhatsApp application and email to employees in information technology department. The number of complete responses are 36 from approximately 60 recipients. The survey showed the most popular techniques and the reason of merge more than one technique. The future work we will cover the most cites on Saudi Arabia.*

Keywords—Requirement Elicitation, Techniques, Survey, Riyadh & Software Engineering

1. INTRODUCTION (*Heading 1*)

Software requirement engineering is a combination of operations that working together to achieve a final product as user required. The life cycle of requirement engineering divided into four stages in the following sequence: Elicitation, Analysis, Specification, Validation, each one of them plays an important role in system structure (figure 1). When all system requirements compile from the user it is requirement elicitation. After the elicitation, we need to analyze requirement to make sure of complacency. Requirement specification it describes system-to-be. The validation is ensured from specification if it achieved stakeholders needed and built the system requirement document.

Requirements elicitation is recognized as the first stage in many requirements engineering process. It is one of the important factors in developing any new application and play a big impact in software quality. Most of systems fail just because of wrong elicitation practice. The developer can get a clear view of requirements for developing the system by implementing the right elicitation techniques to know the needs of stakeholder. A substantial part of requirements elicitation is dedicated to extracting and surfacing the wants of the potential stakeholders. Robertson [1] refer to this process as "trawling for requirements" to highlight the fact that through this process you are likely to get more requirements than expected. More recently the concepts of inventing and creating requirements have been used to highlight the role of creativity and to emphasize what really goes on during requirements elicitation [2].

The elicitation techniques are divided in two types direct and indirect. Direct type classifies the methods by whom we interact with the domain expert. The purpose is to enhance the understanding of the problems of system that is currently in used. Most common techniques used are interviews, case study, and prototype. Indirect type classifies them by what type of information is obtained. It's used in order to obtain information that cannot be easily access directly, such as questioners and documents analyses [3]. The selection of technique to be engaged is depend on the purpose of the system and the kind of organization, that's why we start to create a survey on capital of Kingdome Saudi Arabia, Riyadh to study the practices of collecting software requirements.

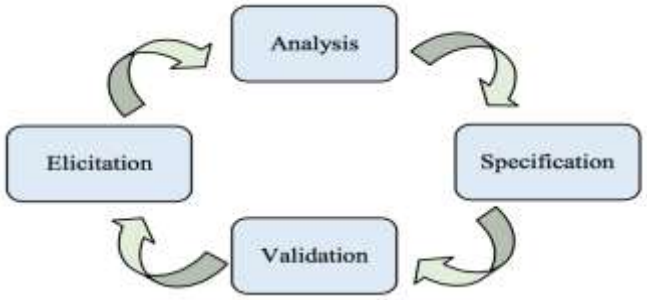

Figure 1: Requirement Engineering Process

2. REQUIREMENTS ELICITATION TECHNIQUES

Obtaining elicitation of requirements is a complex process. It's more likely than expected to get more requirements, however it's better than getting less. It comes after the initiation of the project and before the design of the system. It has numerous techniques such as interview, questionnaire, workshop and prototype. It can occur with direct approach such as interview or indirect questionnaire [4].

A. Traditional Techniques

The most used techniques for requirements elicitation are [5]:

- Interview: is a way of identifying system stakeholders ' facts and opinions face-to-face conversation. There are closed interview where a set of predefined questions provided by requirement engineer and open interview where the engineer and stakeholders of requirements discuss openly.

- Questionnaire: is a technique that requires lower cost and time from a large number of people. It is useful to find answers about specific questions either close ended questions or open ended questions.

- Survey: is a technique used by a large number of people to obtain requirements. To collect a huge set of requirements, it covers the whole region. It is generally used for general purpose software requirement collection.

B. Collaborative Techniques

This include techniques that involve group of stakeholders [5]:

- Prototyping: A system prototype is an initial system buildup that has regularly been utilized to approve and validate system requirements. There are Throw-away prototypes help with comprehensive requirements and evolutionary prototypes provide the customer with a working system and are regularly part of the last and final system.

- Focus Group: is a technique in which a gathering group of four to nine clients from various backgrounds discuss in a free way with various skills.

- Brainstorming: provides an open discussion environment where users are free to provide their system requirement.
  Card sorting: The method of card sorting is used to generate association information and group specific data items. Participants in a card type are asked to organize individual items in groups that are unsorted.

- Card sorting: can be executed as a series of individual activities, as a simultaneous activity of a small gathering group, or as a cross hybrid approach where group discussion of individual differences is followed by individual activity.

3. RELATED WORK

Alnuem (2012) proposed a qualitative research approach, he said interview technique was adopted to conduct surveys in KSA's Global Software Development software companies. He used two interviewing techniques: structured and semi-structured, to conduct interviews, and designed a closed-ended questionnaire as well as an open-ended one. In addition, he used grounded theory approach for data analysis as it provides researchers with the opportunity to carry out data analysis in parallel with data collection [6]. After interviewing process completed, data collection took place in two phases, first initiated by a questionnaire feedback then followed by face-to-face interviews to provide a guide to the grounded approach to theory. He said that the approach helped a lot because the opportunity was given to all interviewees during the first phase to get the main idea of the project. Furthermore, this helped during the second phase because the interviewees had already collected basic information and interviewees gave tremendous feedback during the second phase as well. So that phase one acts as an input to phase two. Therefore, the author basically pointed out and identified that culture and communication loss are the most challenging issues faced in understanding requirements and is a serious challenge for KSA software companies involved in the development of Global Software. And the solution would be to use modern technologies such as audio and video conferencing during communication and requirements analysis, motivation, rewards, rotations of jobs, visits and trust.

Moreover, (T. Alsanoosy, M. Spichkova and J. Harland, 2018) mentioned that culture impacts extraordinarily how people and businesses operate and how they adopt techniques, techniques and practices to achieve their objectives and goals. Also, culture shapes the way individuals think, choose what matters, communicate and understand [7]. Therefore, they present a conceptual model takes advantage from Hofstede's Cultural Theory which described the six dimensions of a national culture: Individualism versus collectivism (IDV) the degree to which people work together within a society. Power Distance Index (PDI): degree accepted by the lesser individual authority. Uncertainty Avoidance Index (UAI): degree to which individuals of society feel awkward and uncomfortable or comfortable in chaotic or confused situations. Indulgence versus Impulses (IND): how much individuals have some fun and enjoy life within a society without restrictions and regulations. Masculinity versus Femininity (MAS): the level of the distinction between social gender roles. Long-vs. Short-term Orientation (LTO): how much individuals within a society are associated to their own past while tending the difficulties and challenges of the present and the future. The influence of Saudi culture on requirements engineering activities represented in Table 1.

Table 1.Influence of Saudi Culture on Requirements Engineering Activities

RE Activity	Cultural Dimensions				
	PDI	IDV	MAS	UAI	Specific
Elicitation	✓	✓		✓	✓
Analysis	✓		✓	✓	
Specification		✓			✓
Validation	✓		✓		
Management	✓	✓			

4. METHODOLOGY

In this research we used a survey to gather the requirements elicitation practices among the software developers in Riyadh which has a vibrant software industry that works hard to achieve the vision of digital transformation. The survey was designed using Google Forms. It includes eight questions on how software developers in Riyadh collecting software requirements, which requirements elicitation techniques they used and why. It was distributed for employees who are working in information technology department in various organization in Riyadh. Since it is dedicated for IT employees we face a problem for reaching to them and get answers from them. We used the statistical analysis approach to process and read the collecting data include planning, designing and drawing meaningful interpretation to represent the data findings as shows in the next section.

5. RESULTS AND DISCUSSION

The This section describes the findings of the survey which was distributed through WhatsApp application and email to approximately 60 recipients and analyzed the collected responses from 36 respondents. The first question of the survey is about collecting the organization type of the respondents by asking them to identify the type of their organization which are government, semi government, or private. The result shows that most of the respondents are working in the government with (44.4%), semi government with (36.1%), and private sectorwith (19.4%) as shown in Figure 2.

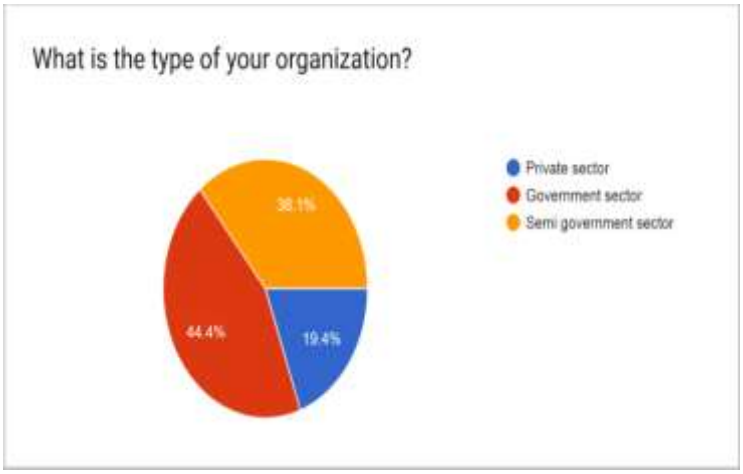

Figure 2. Organization Types

The second question of the survey is explaining the role of each respondent during requirements gathering. The majority of the respondents are working as analyst with (33.3%), whereas the least role is data scientist with (2.8%) as shown below in Figure 3.

Figure 3. Respondents Role

The third question shows that most of the respondents use more than one of requirements gathering technique with (83.3%). The majority of them from government sector with (38.8%), the other from semi government with (27.7%), and private with (16.6%) as shown in Figure 4. Thus, we can suggest that combining technique will be more effective for requirements gathering.

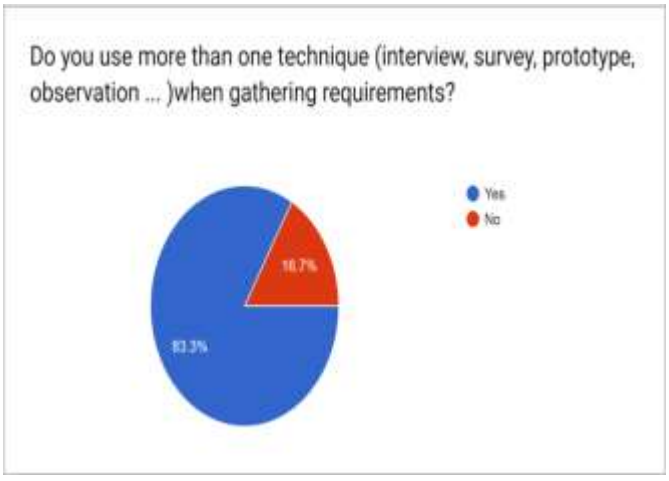

Figure 4. Ability to Use More Than One Technique

In this survey, we are interested to understand the most techniques used to gather system requirements and the returned benefits of using this technique. We asked the respondents to identify the used techniques during requirements gathering and why choosing this technique. The

result has shown that respondents are always used brainstorming technique with (86.1%) because it's easy to manage, and less use is focus group technique with (33.3%) as shown in Table 2. Thus, we can suggest that the most used technique in different sector is brainstorming as shown in Table 3.

Table 2. Responses Rate for Used Technique and Reasons

Answer Choices	Easy to manage	Inputs from different perspective	Suitable with time	High focus on a specific area	Help to collect many requirements	Understand the real needs of the end user	Comfortable to all who are involved
Brainstorming	36.1%	25%	11.1%	8.3%	25%	19.4%	19.4%
Interview	30.5%	27.7%	11.1%	11.1%	13.8%	25%	19.4%
Document Analysis	30.5%	5.5%	13.8%	25%	5.5%	16.6%	13.8%
Prototyping	19.4%	8.3%	11.1%	8.3%	8.3%	25%	30.5%
Observation	8.3%	8.3%	0%	11.1%	25%	22.2%	5.5%
Scenarios	13.8%	13.8%	11.1%	8.3%	13.8%	11.1%	11.1%
Workshop	11.1%	19.4%	2.7%	11.1%	22.2%	13.8%	19.4%
Questionnaires	16.6%	11.1%	13.8%	5.5%	5.5%	16.6%	5.5%
Focus group	13.8%	11.1%	5.5%	8.3%	11.1%	11.1%	5.5%

Table 3. Responses Rate for Used Technique in Different Sector

Answer Choices	Government sector	Semi government sector	Private sector	Total Percentage	Total Response
Brainstorming	41.6%	25%	19.4%	86%	31
Interview	36.1%	25%	13.8%	75%	27
Document Analysis	36.1%	25%	13.8%	75%	27
Prototyping	33.3%	22.2%	11.1%	66.6%	24
Observation	25%	16.6%	13.8%	55.4%	20
Scenarios	27.7%	11.1%	13.8%	52.6%	19
Workshop	27.7%	11.1%	11.1%	50%	18
Questionnaires	27.7%	11.1%	8.3%	47.1%	17
Focus group	16.6%	13.8%	2.7%	33.1%	12

The fifth question illustrates the used languages while gathering requirement, mixed languages (Arabic and English) are the most languages used when gathering requirements (72.2%) which include all respondents from private sector, 10 respondents from government sector, and 4 respondents from semi-government sector. Whereas the percentage for English and Arabic users is convergent (16.7%) and (11.1%) respectively, it includes a combination between government and semi-government sector, shows that who use English mostly from semi-government sector 4 respondents , conversely for Arabic mostly from government sector by 3 respondents.

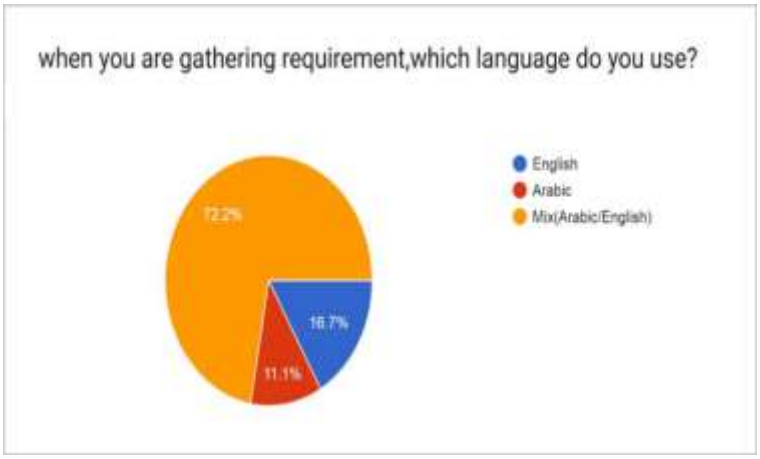

Figure 5. Used Language

The sixth question is about level of techniques impact during requirements elicitation, all respondents agreed that techniques have a significant impact on requirements gathering. However, they differed in the agreement level as follow (55.6%) they see that the impact of elicitation techniques on requirement is Always, (30.6%) saw that the effect is Usually, while slightly (13.9 %) saw that the effect is sometimes.

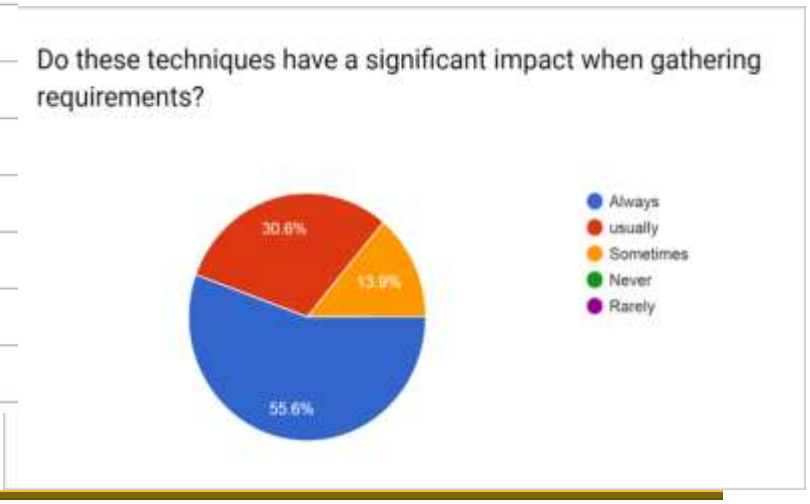

Figure 6. Importance of Techniques

In this question, the majority of respondents use reuse requirements technique by 34 respondents, and level of use varies between (Sometimes, Usually, Always). Equal result for Rarely and Never by a single respondent for each.

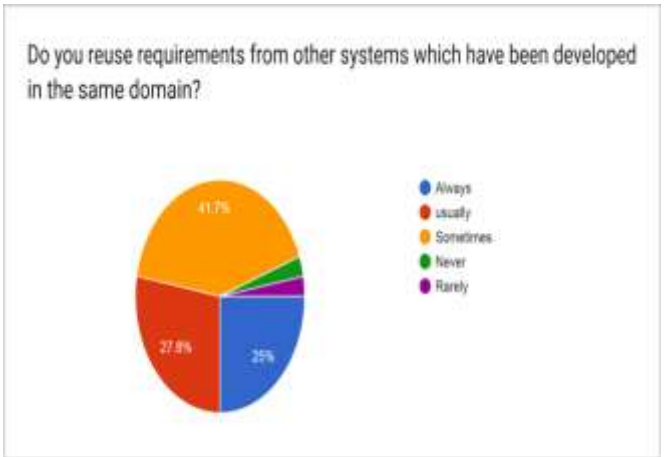

Figure 7. Reuse Requirements From Other System

For the open ended question, there are 18 respondents face difficulties during requirements elicitation process which are summarized as follow:

1. The most difficulty they face is stakeholders they don't know what they need.
2. Requirements conflict.
3. For interview technique some users they don't know exactly what they want, so it will be waste of time.
4. For interview technique they need to choose time suitable for all parties, and this take time
5. Not include all responsible parties in requirement gathering process which lead to missing some requirements and cases.
6. Hidden information especially for security reasons.
7. Change requirements
8. Change opinion either while process or after development, its time consuming.
9. Integrity of data. End user usually fill the forms with any data to end up.
10. When the requirement needs third party integration to be implemented.

The proposed solutions to overcome the mentioned difficulties from respondents are:

1. Ask questions in order to gain more information from stakeholders.
2. Use scenario technique to make clear image for stakeholders.
3. Requirements prioritization to resolve conflict.
4. The best way to overcome the change of requirements is to become adaptable and accept the changes. however, it must be prioritized and estimated with new time and budget allocations, and confirmed it from stakeholders.
5. Identify the right interviewee sample for effective interview.
6. Be prepared and collect many documents about the system (Background study).
7. Improve your communication skills.
8. Combining between more than one technique to gathering the requirements.

Requirement elicitation is the most important stage to building a new software. There are different techniques to the elicitation step. In this paper, we focused on analyzing most used requirement elicitation techniques in Riyadh city by distributed a survey to employees working in information technology department. They have different roles such as analyst, developer, and engineering. Generally, the result of this survey impressive, the highest technique useful is brainstorming with 86.1%, this is because it is easy to manage. Also, the effectiveness of combining many techniques to gathering the requirements. The only obstacle that we encountered was difficulty of access to IT employees and take answers from them. For future work, we will distribute our study to cover most of Saudi Arabia cities to try to discover which technique is more useful for Saudi Arabia companies, how much technique used together, and why using this approach speedily.

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