Requirements Engineering: An Industrial Survey In The Gulf Cooperation Council Countries

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Abstract

Studies on requirements engineering (RE) explicitly focusing on the countries of the Gulf Cooperation Council (GCC) have been scarce despite significant global attention. GCC-specific RE research studies are needed because of the unique cultural characteristics and common work ethics prevalent in GCC countries, as these countries get integrated with the globalization of software development. This study compares the state of RE practices within the six countries of the GCC, namely, the Kingdom of Saudi Arabia (KSA), the United Arab Emirates (UAE), Qatar, Kuwait, Bahrain, and Oman, using six RE factors in order to assess whether: (1) the requirements were gathered by a particular method; (2) they were complete and accurate at the start of the project; (3) they were completed adequately; (4) the scope of the project was clearly defined; (5) the size of the project negatively affects requirements elicitation and (6) the customers and users made adequate time available for requirement gathering. Among the 163 software practitioners in the GCC countries surveyed, the results show that the RE practices are relatively similar among the six countries with only subtle differences. Initiating software-related projects with unclear requirements and undefined project scopes are the two major limitations of the RE practices among the survey participants. The results of this study contribute toward providing project managers and system analysts who are working globally and within the GCC countries with valuable decision-making tools to help them consider the identified RE techniques, methods, challenges, and their related risks, early in their software development projects.

Keywords: Requirements Engineering, Gulf Cooperation Council, Requirements Engineering Practices, Project Success, Software Projects.

1. INTRODUCTION

As the term itself explicitly suggests, Requirements Engineering (RE) is the process of articulating the requirements of a system [1]. Encapsulating several activities such as finding the needs of stakeholders, understanding the context of requirements, modeling, negotiating, validating, documenting, and managing such requirements [2]. RE is an indispensable part of systems and software engineering as 70 percent of the project failures (according to Project Management Institute) [3] are due to various issues faced at the requirement engineering stage. According to BABOK ® guide requirements can be classified into various types, like business requirements, solution requirements (functional-nonfunctional), stakeholders' requirements, transition requirements [4].

Requirement engineering begin by clearly and precisely identifying the scope of the project with an adequate analysis of the business needs and goals of the project; by defining the role of the different stakeholders involved in the determination, documentation and management of the requirements; by defining and documenting the requirements for the collection of tools and techniques; by choosing the required software languages and tools that best fit the project's objective and managing the project successfully throughout its lifecycle [5].

Many organizations involved in project development and their implementation have defined a structured process and some uniform techniques of requirement engineering as the Globally Distributed Software (GDS) projects are being rapidly implemented across various regions, to reduce production costs and compete with the industry by leveraging globally available tools and resources [6]. However, the adaptability of requirement engineering practices varies widely across regions, countries, organizations and the types of project undertaken, due to the customization requirements of projects as well as the social and cultural aspects of the environment in which such projects are going to function or operate [7]. Recent trends also show that new locations are evolving as developmental sites and the GCC countries are an example of such locations in the Middle East. Moreover, the Information and Communication Technologies (ICTs) market and digital transformation growth trend report of Measuring the Information Society (MIS) [8] shows that the Middle East which includes the 6 GCC countries that are the focus of this research, is the fastest growing region in the world with an estimated Compound Annual Growth Rate (CAGR) of 42 percent during 2016-2021, as compared to a global average CAGR of 25 percent[1]. Although several studies have been done on software developers' challenges regarding RE practices and seeking possible solutions, little quantitative research has centered on the software companies in the GCC countries.

There are several studies available on requirement engineering practices and issues in various countries. Some of these studies found that there are no strong differences between organizations in different countries and regions in terms of RE practices [9]. Some other studies have reported on the customized RE practices in developing countries like Pakistan [7]. In addition, others studies highlighted that cultural aspects need to be considered when choosing the requirements elicitation techniques in countries like Kuwait, Sudan, Thailand and China [10], while some others highlighted the methodology, tools and techniques as a big challenge to RE practices [11], [12], [7], [13], [14], [15], [16]. Interestingly, in the execution of large GDS projects with teams located in various countries, additional major impediments related to communication, coordination, domain knowledge, task allocation, following accepted design, etc. were found to impact the successful implementation of projects [17].

Studies covering the GCC countries are few and far between. At country level, some studies [18], [19] indicated that in the Arab countries the selection of requirement engineering techniques is influenced by their culture, with some of the cultural traits being very specific to a particular country. In fact, Switching the organizational culture to be consistent with agile standards can creat obstacles that generate a need for change management practices through the implementation of agile growth methodology [20] and hence due attention should be provided to social and cultural aspects during the entire project execution life cycle.

Owing to cultural diversity, language issues, level of education and understanding of digital skills[2], work ethics and unfamiliarity with western culture and practices, the GCC countries have some striking similarities as well as differences in the way they conduct their requirement engineering process, which can be linked to project success and failure. Since there are no studies available so far, which cover comparison of requirement engineering practices, the issues faced during such process and their resultant impact on the success and failure of a project across all the 6

[1] *Measuring the Information Society Report 2018, Vol. 1*

[2] *The Hays Global Skills Index (Hays, 2017) reports annual increases in "talent" mismatches with an undersupply of individuals with digital skills in relation to the need companies say they have. However, in 2017, for the first time, this was the case only for Europe and the Middle East, but not in Asia and the Americas. Nevertheless, it remains a problem even in those regions where there was no increase. Hays attributes this mismatch mostly to vacancies in positions for which higher education is required and in tech-related sectors.*

GCC countries, this study will bring in novelty in terms of segregating (i) cross-country similarities, wherein the project implementation team can apply an unified approach, from (ii) cross-country differences, wherein they need to follow country-specific practices. As such, this study will assist project managers and system analysts in identifying RE practices that are common in these countries and RE issues that are different, thus enabling them to adopt a proactive approach in solving the requirement problems at an early stage, leading to better project success. The author believes that this study will add to existing literature on cross-country diversity in requirement engineering practices, while providing insightful views on causes and their effect on success and failure of projects in the GCC.

In a previous study [21], the author used a survey questionnaire which shows that essential success factors for projects include (i) that requirements must be completed adequately, (ii) using an appropriate requirement methodology and (iii) that stakeholders must be involved throughout different project phases.

This study is conducted through a survey of local software companies involved in the requirement project engineering process and project implementation, with a clear objective of understanding cross-country similarities or differences faced by a project management team during the requirement engineering process, leading to project success or failures. Oman was excluded from this study owing to the unavailability of the adequate number of respondents. We followed a methodology adopted by Verner and Evanco [22], [23] in our survey, as they are one of the major contributors in the field of requirement engineering practices and their impact on failure or success of a project [13] . We surveyed 200 software companies with 163 complete responses across the 6 GCC countries using a 4-point Likert scale questionnaire and the survey data were analyzed using Chi-square, One-way ANOVA and Scheffe Test in order to determine the similarities and difference in cross-country practices.

The layout of this study is as follows: a background and a literature review are described in the following section. Section 3 explains the methodology, Section 4 explains the results, Section 5 explains the discussions; Section 6 compares the results with other research studies; Section 7 describes the limitation and results validity, and the final section presents the conclusion and future scope for research.

2. BACKGROUND AND LITERATURE REVIEW

The RE process depends on the use of suitable techniques through which system analysts determine the opportunities, problems, and requirements of customers [24], [25]. The integration between a software and its environment, and the increasing globalization of software development makes RE a relatively challenging process [17]. Since RE is a complex issue, several scholars have suggested different guidelines for utilizing different techniques and methods to assist system analysts during the RE practices. These RE techniques and tools include questionnaires, introspection, observations, prototyping, Joint Application Development, card sorting, document analysis, interviews, user scenario and laddering [26], [27].

Kiotins et al., [28] identified RE practices as critical factors determining the success of a project. Many software engineering researchers have confirmed that RE practices are difficult to implement owing to their lengthy and cumbersome feedback cycles and high diversity [29], [30], [31], [32]. These difficulties make the selection of the apt RE practices difficult, especially when practitioners are unaware of the challenges they face, their importance, and their sources. Therefore, they tend to focus on traditional, or arbitrary methods based on their own experiences [33].

The RE process acts as a lynchpin for the success of almost every software development project [34]. Fernández et, al., [35] reported that Most of the software system fails due to problems with the requirements. In fact, fixing the requirements errors that were discovered late in a development cycle causes high cost of rework [36]. The Standish Group's [37] report on the Comprehensive Human Appraisal for Originating Software (CHAOS) states that 44% of the

reasons for the failure of projects are owing to insufficient RE. Whenever analysts are unaware of choosing the most suitable RE techniques, as one technique might be appropriate but not suitable to other situations and attributes for enhanced involvement of stakeholders, requirement-related practices are bound to fail and proved ineffective [38]. This failure may result in late delivery and unreliability of the system, which may cost more than the original estimate and lead to a failure to meet user expectations [5].

Verner and Cerpa [39] stated that good requirements, high level of involvement of customers and their effective management, have the most significant correlations with the success of projects. Many researchers have conducted surveys in the area of RE and software engineering practices. For example, In 2017, Fernández et al. [35] through their project NaPiRE across many countries and different geographical regions, found out that the ten most common factors for project failures are (i) weak access to customer needs/ business information (ii) inconsistent requirements (iii) insufficient support by customer (iv) stakeholders with difficulties in separating requirements from known solution designs (v) flawed communication among the project team (vi) time boxing, or not enough time in general (vii) underspecified requirements that are too abstract (viii) moving targets (changing goals, business processes and/or requirements (ix) communication flaws between project team and customer and (x) incomplete and/or hidden requirements. NaPiRE project in its further studies [35], [40] conducted some country-specific difference or similarities between Australia and the US as well as Germany and Brazil. They found out that there are differences as well as similarities among these countries in their requirement engineering process and their problems leading to project success or failure.

There are several studies available on requirement engineering practices and issues in various countries. In a study [9] conducted in 10 countries (Austria, Germany, Ireland, Canada, USA, Estonia, Finland, Norway, Sweden and Brazil) across different sizes of businesses and domains, ranging from embedded software systems, to consulting and projects related to cloud computing and web applications, custom software development, enterprise resource planning products, IT consulting services, etc. compiled and published in 2019, among the 5 elicitation techniques provided in SWEBOK [41], interviews, facilitated meeting and prototyping were used by more than half of the respondents, whereas scenarios and observations were less often used; while documenting requirements, most of them used free form textual format, though for use cases and data models, semi-formal approaches are used. A study in Pakistan [7] focused on local, offshore projects and the problems related to foreign projects such as languages, culture differences and time zone which may cause many problems for RE practices. They found that many software houses are using their own customized models to cope with these problems. In addition, some software companies have changed RE practices in compliance with their needs and business procedures, and most organisations adopt various guidelines and models to elicit, analyze and manage their requirements [7]. In a research study conducted in 10 different parts of the world including the Arab world, India, China, Africa and South America, it was concluded that culture affects the RE process. These include, respect for leader in Thailand; decision tree technique a favorite in the Arab world (Kuwait) as they like visuals more than descriptive documents [11]. In a developing country like Sudan, the agile method requires extensive communication, whereas an unplanned or mixed method ends up having to alter requirements several times during the project due to lack of proper guidance on the project, risks, deliverables, objectives, assumptions, opportunities, challenges, stakeholders, functional and non-functional requirements [11]. Additionally, in China, providing sufficient time for RE elicitation as well as preference for prototype, document analysis and questionnaire were considered very important [34]. Some other studies highlighted the differences in the methodology, tools and techniques. For example, in Brazil, lack of knowledge in the requirement team, communication issues- as preference for agile techniques require extensive communication- were found to be impediments, while in Germany companies individualize their RE, often follow more often rigid processes with stronger contracting components and formal change management [42]. In Austria and Brazil, while investigating into causes of incomplete and / or hidden requirements, inadequate qualifications of RE team members, lack of experience, missing domain knowledge, unclear business needs leading to poorly defined requirements, were found to be common problems in RE [12].

In a study involving small and medium-sized software development companies in Pakistan [7], a variety of new factors were found during the qualitative review of this study. These factors were mainly linked to the involvement of the stakeholders and the supplier during the life cycle of the project. An additional new factors were added to the available lists such as the change request introduced by the client, customer lack of expertise, lack of experience of the vendor, personal, low stakeholder participation and technological restriction [7].

Another study covering companies involved in in-house software development in the U.S. and Australia, it was observed that the most important correlations for project success are to get good requirements such as high level of customer/user involvement, high-level sponsorship throughout, to scope the project effectively and to manage those requirements effectively [13]. In Turkey, a study conducted across various sectors identified that inadequately defined requirements and demands are the most critical process problem for all sectors, though in regulated sectors such as telecom, finance and energy sector which demand higher than average education and experience, these issues were managed more effectively [14]. The paper in [15] have examined the various techniques such as tools and frameworks being used by requirements engineers during the requirements engineering process and any limitations of those techniques based on the context and the domain of the project. They observed that the size of the project, the type of the project, the funds allocated to the project and the difficulty of the technique are four factors to be addressed when choosing the right technique. They also indicated that requirements engineering techniques should include support for a competitive environment and that some techniques are unable to identify the key stakeholders during the requirements elicitation process. Furthermore, stakeholders do not realize what they actually want from the outset of the project and therefore they try to adjust the agreed requirements which can have a negative impact on the cost of the project and the completion timeline. They also asserted that, many of the methods used in requirements engineering are too complex to make them inapplicable to a real-world project.

In another study covering Argentina, Brazil, Chile, Colombia, Costa Rica, Ecuador, Mexico and Peru, it was noted that interviews and use cases were the most frequently used techniques for requirements elicitation and analysis, while there was a low adoption rate of formal documentation techniques, tools and methodologies. The study also revealed that communication with the various stakeholders in the elicitation phase was the major problem area [16]. Interestingly, in the execution of large GDS projects with teams located in various countries (analysts in Argentina, developers and testers in India, configuration suppliers from Poland and core applications suppliers from Denmark; users based in Venezuela and Brazil) the following issues: inadequate communication; language and cultural barriers; geographical distance and time differences; knowledge management problems; lack of confidence and engagement; lack of knowledge about the problem domain; ambiguity, contradictions and lack of clarity in the specifications; individual goals; rotation of the team members; etc. were found to be major impediments in the successful implementation of projects [43].

As far as the GCC countries are concerned, they are among the 22 countries of the Arab world, sharing similar beliefs, culture, history, language, and geographic location. Most of the previous research literature concentrates on RE in the developed world (i.e., influence of the western culture), with the exclusion of the few studies that were conducted in developing countries [19], [20]. The countries of the GCC are among those that are considered developing countries and limited information is available about how RE is practiced in this region, and most research focuses on issues related to the satisfaction and acceptance of the IT system [44]. Some studies show that several software projects are likely to be vulnerable to high rates of failure due to problems related to RE in the GCC region. For instance, several hospitals and healthcare software systems have been listed as failed projects in the KSA [45]. Another study in the KSA examined the successes and failures of IT projects and identified that the causes for their failures include unclear and incomplete requirements and poor planning [46]. Rouibah and Al-Rafee [47] observed that many IT projects failed in Kuwait owing to incomplete or misunderstood information system requirements. As far the GCC countries are concerned, a few studies have pointed out

that cultural issues weigh high in influencing the selection of RE techniques. They further stated that the Arab countries are different from other parts of the world in terms of RE methods used for software development [47] [48]. In fact, choosing the adequate and most suitable RE technique often creates uncertainties in the decision-making process. Therefore, the expectation of the perceived value of the RE techniques may vary between nations that belong to diverse cultures [47]. RE research conducted in other countries may not necessarily be applicable to the countries of the GCC. Most of the RE techniques were imbibed from the western culture and have standardized tools and techniques which may create differences in applications in the Arab world when compared with western cultures [49]. For instance, Alsanoosy, Spichkova, and Harland [48] investigated the impact of the Kingdom of Saudi Arabia's (KSA's) national culture on RE practices. They found that there were ten cultural factors that impacted the RE practices and five of them were specific to the Saudi culture. These resonate well with Chiyangwa et, al., [20] found that certain agile practices can be useful in different cultures and some practices required major cultural adaptation. Moreover, the selection of RE techniques typically depends on personal preferences or existing business practices rather than on the project characteristics at hand [50]. Therefore, the evaluation of the social practice of software development is an important aspect of modern information technology (IT) systems. Denhere, Höme, and Van der Poll [51] investigated the management of development projects of GDS in Dubai, Abu Dhabi, and Oman along with India and Pakistan. Their study was predominantly aimed at outlining the factors that project managers consider important, including cultural and regional effects on the operation of virtual teams in the GDS environment in the Middle East. The results confirmed that cultural understanding, use of a common language, use of technology, and use of project management techniques, have a positive impact on virtual team operations.

3. METHODOLOGY

This is a survey-based empirical study covering software development companies involved in project delivery in the 6 GCC countries. The study is designed to assess the responses from critical stakeholders such as project managers, system analysts, users, information system managers, application developers, and programmers, on a convenient sampling basis from successful, unsuccessful, and challenged projects. The questionnaire is in line with a similar survey conducted by [13] and [21]. This study is considered as exploratory in nature and is based on the aims of the RQs. It follows an inductive approach on qualitative aspects of responses, which has a deductive orientation using one-way ANOVA and statistical tests in order to determine the similarities and differences among the type of responses from each country.

The following sections describe the questionnaire design, administration of the questionnaire, selection of the respondents, collection of the data, and data analysis.

3.1. Questionnaire Design

The research questionnaire highlighted several software engineering problems related to the customers or users, project management, software development process, requirements, and development team. The author used questionnaires related to RE practices only to be congruent with the objectives of this study. Further, this study follows a survey-based empirical approach. The author used three techniques for data collection: questionnaires, telephone calls, and face-to-face interviews. Most of the questionnaires were sent to the participants those live in a country other than Kuwait by Email to save cost and time. It is also easy to collect data from a large population and provide data that are relatively easy to communicate [52]. However, during the survey, the results could only be generalized to the sample population [53]. This study is considered as exploratory in nature and is based on the aims of the RQs.

3.2 Questionnaire Administration, Selection of Respondents, and Data Collection

The author sent the survey to 200 software development companies in the countries of the GCC and received 163 completed questionnaires (37 from Bahrain, 36 from the KSA, 12 from Kuwait, six from Oman, 36 from the UAE, and 36 from Qatar), each reported on different projects on the basis of the survey questionnaire. The participants included 37 project managers, 25 system analysts, 28 users, 17 information system managers, 31 application developers, and 25

programmers. All of these respondents were actively involved in the softwares used in their own organizations, including banks, educational institutions, and government institutions, in the GCC countries.

The author treated the missing data values by taking the average of the total dimensions for scale items (e.g., if the participant answered four questions out of six, the author used the average to represent the dimension and then the average for the comparison). However, the author excluded all the cases with any cross-missing information and then calculated the chi-square test after excluding the missing values from that table.

The response rate was 82%. The author believed that a sample of 163 participants was acceptable to conduct an empirical study on the software engineering practitioners as the response rate was within the range of similar studies (see, e.g., [39]). The software engineers striving to develop the in-house softwares to be used by their organizations were the core targets of this study, assuming that they were interested in the results. The author made it a point to categorically inform the participants of the stipulated time in which the survey would be completed and declared that the delay would be subsequently followed by a total of three reminders. This data collection process may be the reason why this survey had a high response rate. The results were consistent with the observations of the authors in [54], [55]. Although the results cannot be expected to apply to all the organizations, the author believes that they are fairly representative of the organizations that create in-house softwares. Surveys are usually driven by personal data, showing what people say has happened, not what they have done or experienced [48]. As the author interrogated the software developers, the study results were limited to their awareness and perspectives on the projects and to the point of view of the project managers with whom they were associated. Participants considered 150 successful projects, eight unsuccessful and five unfinished or challenged projects. Unsuccessful projects included four from Qatar and four from the KSA. Approximately, 77% of the respondents worked in the development projects, and 23% worked in the maintenance and enhancement projects (the participants classified 15% maintenance and enhancement projects as successful). They considered all the projects in Bahrain as successful. The analysis suggested that either these organizations had a high rate of successful projects or a tendency to report only successful projects.

As the author observed in the sample, the software practitioners were not randomly selected. Instead, the author used a convenience sample that comprised software engineers and practitioners who could be easily contacted. The convenience sample can be biased, and the inferences are not as valid as those drawn from a random sample. Therefore, convenience sampling can be considered less reliable than random sampling. Nevertheless, Saunders et al. [53] suggest that such bias sample is less relevant because of a low degree of variability; all the respondents were involved in the development of softwares across a variety of sectors, sizes, and internal projects.

Based on the prior studies [13], [21], [22], [56], we expected that the projects that were considered successful would (1) start with complete and accurate requirements and (2) were gathered using a particular methodology with a well-defined scope, and the customers and users were given adequate time for gathering requirements. With these factors in mind, the questionnaire covered RE factors, and the participants from the six countries were asked to answer the following six questions:

1) Were the requirements gathered by a particular method?
2) Were the requirements complete and accurate at the start of the project?
3) Were the requirements completed adequately in all the GCC countries?
4) Was the scope of the project clearly defined in all the GCC countries?
5) Did the size of the project negatively affect requirements elicitation in all the GCC countries?
6) Did the customers and users make adequate time available for requirement gathering?

3.3 Data Analysis

In this questionnaire, the author used a 4-point Likert-type scale (i.e., yes, only partially, not sure, or not at all) for most of the questions. Using a 4-point scale is the best option for recording opinions on the services or products has the user has experienced. The major advantage of using a Likert scale is that it dissuades the participants from giving a neutral answer and thus, functions unequivocally [57]. Given that the questionnaire had four possible answers, two positive answers, and two negative answers, the author sometimes consolidated the 4-point Likert scale to just 2 (success/failure) for analysis and reporting purposes.

The author used the following statistical methods to identify the similarities and differences in software requirement practices in the region of the GCC:

Chi-square: The chi-square made it possible to examine the best-fit model for each hypothesis. It also allowed the analysis of individual responses based on the success of the project. A significance level of greater than 0.05 is considered sufficient for determining model fitness.

One-way ANOVA: The ANOVA test determined the similarities and significant differences among the means of the groups (i.e., compare and contrast responses from each country).

Scheffe Test or Post-hoc Test: This test compares the possible simple and complex pairs of means due to a narrow confidence interval. The author used this test only if the null hypothesis was rejected in the ANOVA test, indicating different country means. Exploring the differences between country means is crucial for providing specific details on which the country differs significantly from the rest.

4. RESULTS

In this section, the author presents the outcome of the chi-square, one-way ANOVA, and post-hoc Scheffe tests for all the six questions.

4.1. Were the Requirements Gathered by a Particular Method?

Country	Requirements Gathered by a particular Method			Total	% Not Using a particular Method
	No	Partially	Yes		
UAE	30	0	6	36	83.3%
Saudi Arabia (KSA)	30	1	5	36	83.3%
Kuwait	7	1	4	12	58.3%
Qatar	19	0	17	36	52.8%
Bahrain	36	0	1	37	97.3%
Oman	2	0	4	6	33.3%
Total	124	2	37	163	76.07%

TABLE 1**:** "Were the requirements gathered by a particular method?" by country.

	Project Success/Using No Method	**Project Success/Using Method**	**Project Failure/Using No Method**	**Project Failure/Using Method**		
UAE					**Chi-square**	**1.345**
	30	6	0	**0**	**df**	**2**
					Sig.	**0.510[b,c]**
KSA					**Chi-square**	**2.945**
	26	6	4	**0**	**df**	**3**
					Sig.	**0.400[c,d]**
Kuwait					**Chi-square**	**0.343**

	7	5	0	**0**	**df**	**2**
					Sig.	**0.842[c,d]**
Qatar					**Chi-square**	**3.567**
	16	17	3	**0**	**df**	**2**
					Sig.	**0.168[b]**
Bahrain					**Chi-square**	**17.986**
	36	0	0	**1**	**df**	**2**
					Sig.	**0.000[b,c,*]**
Oman					**Chi-square**	**3.000**
	2	4	0	**0**	**df**	**2**
					Sig	**.223[b,c]**

** The chi-square statistic is significant at 0.05.*

TABLE 2: Significance value for requirements gathered by a particular method with project success and failure.

The methods the six countries used for requirement gathering were as follows:

- Meetings (nine respondents)
- Interviews (six respondents)
- Workshops (two respondents)
- Brainstorming meetings (two respondents)
- Analysis of previous systems (one respondent)
- Emails, online requirement gathering, and telephone calls (four respondents)
- An agile method (two respondents)
- ASAP (two respondents)
- Questionnaire (one respondent)

Table 1 shows how RE practices are conducted in a requirement gathering process. Only six projects (out of 36) in the UAE used a particular method for the requirement gathering. Most respondents (83.3% in the UAE) did not use a particular method for the requirement gathering. Table 2 shows that the significance value for the UAE was 0.510, suggesting that no significant correlation exists between this factor and the success of the project. A total of six out of 36 projects resorted to a specific method in the KSA. Most respondents (83.3%) in the KSA did not use a particular method for the requirement gathering. The significance value (0.400) in Table 2 suggests that this factor has no significant correlation with the success of the project. Kuwait shows that only five of the 12 projects were used a particular method for requirement gathering, and 58.3% of the respondents in Kuwait did not use a particular method for requirement gathering. The significance value (0.842) shows that no significant correlation exists between this factor and the success of the project. Most respondents in Qatar (47.2% or 17 out of the 36 projects) used a particular method for requirement gathering, and 52.8% of them did not use a particular method. The significance value (0.168) shows that no significant correlation emerges between this factor and the success of the project. In Bahrain, 97.3% of the respondents did not use a particular method for requirement gathering. However, the significant value (0.000) shows that there is a significant correlation with project success. It is noteworthy that all their projects were considered successful as depicted in Table 2. The author failed to examine the relationship between this factor and the success of the project owing to the minimum number of respondents in Oman.

		Sum of Square	df	Mean Square	F	Sig.
Requirements gathered by a particular method?	Between groups	5.919	5	1.184	8.003	0.000
	Within groups	23.222	157	0.148		
	Total	29.141	162			

TABLE 3: ANOVA table for requirement gathering by particular methods.

The ANOVA test in Table 3 shows that the significant value of the countries that used a particular method for requirement gathering is highly significant (sig. value of 0.000 is less than the alpha level 0.05). The results from the one-way ANOVA test prove that differences arise among the six countries, but do not indicate which of these countries are different from one another when using a particular method for requirement gathering. Therefore, the hypothesis of RQ1 is rejected, and the alternative hypothesis is accepted. The author continued the analysis with the post-hoc test. A statistically significant difference emerged at the $p < 0.000$ level in using a particular method for collecting requirements for the six countries $F (5, 157) = 8.003$, $p < 0.000$. The post-hoc test indicates that Qatar ($M = 0.47$, $SD = 0.506$) is significantly using more methods for requirements gathering than the other countries. However, the UAE and KSA ($M = 0.17$, $SD = 0.378$) have the same results, and no statistically significant difference appears in the mean between them. This indicates that both the countries use almost the same methods for requirements gathering. Bahrain has not used a particular method for requirements gathering with a mean score ($M = 0.000$, $SD = 0.000$). Moreover, Qatar is significantly different from Kuwait ($M = 0.42$, $SD = 0.515$) and Oman ($M = 0.67$, $SD = 0.516$). Therefore, if Kuwait and Oman are excluded from the assessment because of the availability of fewer respondents, then Qatar turns out to be the sole country that took recourse to the requirement gathering factor as opposed to the remaining five countries. Then, the KSA and UAE came together, and Bahrain exhibited the least number of methods used, which did not use an appropriate method for the requirements gathering.

4.2. Were the Requirements Complete and Accurate at the Start of the Project?

Country	Requirements Complete and Accurate			Total	% of Complete and (Partially Completed) Accurate Requirements
	No	Partially	Yes		
UAE	8	2	26	36	77.7%
Saudi Arabia (KSA)	3	15	18	36	91.6%
Kuwait	2	5	5	12	83.3%
Qatar	2	11	23	36	94.4%
Bahrain	4	5	28	37	89.1%
Oman	0	3	3	6	100%
Total	19	41	103	163	88.3%

TABLE 4: "Were the requirements complete and accurate at the start of the project?" by country.

	Project Success/ Requirements (Not) Complete	Project Success/ Requirements Complete	Project Failure/ Requirements (Not) Complete	Project Failure/ Requirements Complete		
UAE					Chi-square	3.956
	8	28	0	0	df	2
					Sig.	0.138[b,c]
KSA					Chi-square	2.559
	3	29	0	4	df	3
					Sig.	0.465[c,d]

Kuwait					Chi-square	3.000
	2	10	0	0	df	2
					Sig.	0.223[b,c]
Qatar					Chi-square	5.029
	2	30	0	4	df	2
					Sig.	0.081[b,c]
Bahrain					Chi-square	0.701
	4	33	0	0	df	2
					Sig.	0.704[b,c*]
Oman					Chi-square	0
	0	6	0	0	df	0
					Sig.	0

** The chi-square statistic is significant at 0.05.*

TABLE 5: Significance value for the requirements, complete and accurate, at the start of the project with project success and failure.

Table 4 shows that 77.7%, (28 out of 37) of the UAE respondents completed their requirements accurately and considered their projects successful. The significant value of 0.138 in Table 5 shows a minimal deviation between this factor and the success of the project. In the KSA, as high as 91.6% of the participants considered that their requirements were complete and accurate. This was the reason why they showed predilections toward considering their projects successful. The significant value (0.465) in Table 5 shows a large deviation between this factor and the success of the project. In Kuwait, 83.3% of the respondents made their requirements complete and accurate, and they considered their project a success. The significant value (0.223) also reveals a minimal deviation between this factor and the success of the project. In Qatar, 94.4% of the respondents made their requirements complete and accurate, and they considered their projects successful. The significant value (0.081) also reveals a minimal deviation between this factor and the success of the project. In Bahrain, 89.1% of the respondents completed their requirements accurately and they considered their projects successful. The significant value (0.704) exhibits a large deviation between this factor and the success of the project. In Oman, almost 100% of the respondents had complete and accurate requirements.

		Sum of Square	df	Mean Square	F	Sig.
Requirements complete and accurate?	Between groups	1.021	5	0.204	2.256	0.051
	Within groups	14.206	157	0.090		
	Total	15.227	162			

TABLE 6: ANOVA table for requirement, complete and accurate.

Table 6 shows the one-way ANOVA test conducted to compare the factor for complete and accurate requirements within the six countries. The significant value of 0.051 indicates no statistical significance among the countries for completing an accurate requirement and shows no differences between them when using this factor, thereby depicting a striking similarity among all the countries completing accurate requirements. Therefore, the author accepts the hypothesis (RQ1).

4.3. Were the Requirements Complete and Adequate in All the Countries of the GCC?

Country	Requirements Complete and Adequate			Total	% of Not Completed Requirements
	No	Partially	Yes		
UAE	31	1	4	36	86.1%
Saudi Arabia (KSA)	20	13	3	36	55.5%
Kuwait	5	3	4	12	41.6%
Qatar	28	6	2	36	77.7%

Bahrain	29	2	6	37	78.3%
Oman	1	4	1	6	16.6%
Total	114	29	20	163	69.9%

TABLE 7: "Were the requirements completed adequately in all the GCC countries?" by country.

Table 7 shows that, in the UAE, 86.1% of the respondents did not complete their requirements adequately. However, they considered their projects successful. Table 8 shows that the significance value is equal to 0.016, which indicates no deviation toward the success of the project in the UAE's performance. In the KSA, 55.5% of the respondents did not complete their requirements adequately and considered their projects successful. The significant value (0.000) in Table 8 shows that this factor is significantly correlated with successful projects. In Kuwait, 41.6% of the respondents did not complete the requirements adequately and considered their projects successful. The significant value (0.424) shows that this factor does not significantly correlate with successful projects. In Qatar, 77.7% of the respondents claimed that they did not complete their requirements adequately and considered their projects successful. The significance value (0.020) is less than 0.05, showing that this factor is significantly correlated with successful projects. In Bahrain, 78.3% of the respondents did not complete their requirements adequately as well. The significance value (0.411) does not significantly correlate with project success. The author did not consider Oman in this analysis owing to the low number of respondents.

	Project Success/ Requirements (Not) Complete	Project Success/ Requirements Complete	Project Failure/ Requirements (Not) Complete	Project Failure/ Requirements Complete		
UAE					Chi-square	8.236
	31	5	0	0	df	2
					Sig.	0.016[b,c*]
KSA					Chi-square	17.885
	20	12	0	4	df	3
					Sig.	0.000[c*]
Kuwait					Chi-square	1.714
	5	7	0	0	df	2
					Sig.	0.424[b,c]
Qatar					Chi-square	7.795
	27	5	1	3	df	2
					Sig.	0.020[b,c*]
Bahrain					Chi-square	1.779
	29	8	0	0	df	2
					Sig.	0.411[b,c]
Oman					Chi-square	2.400
	1	5	0	0	df	2
					Sig.	0.301[b,c]

** The chi-square statistics at 0.05% level of significance.*

TABLE 8: Significance value for requirements, complete and adequate in all the GCC countries with project success and failure.

		Sum of Square	df	Mean Square	F	Sig.
Requirements completed adequately?	Between groups	4.833	5	0.967	5.155	0.000
	Within groups	29.437	157	0.187		
	Total	34.270	162			

TABLE 9: ANOVA table for requirements completed adequately.

The ANOVA test in (Table 9) shows high significance among the countries for completing adequate requirements, owing to the significance value of 0.000, which is less than the alpha value 0.05. The results from the one-way ANOVA test prove that differences arise among the six

countries, but do not indicate which of these countries are different from one another when using this factor. Thus, the author continued the analysis with the post-hoc test. The post-hoc test for the comparison of all the countries indicates that the UAE and Oman had a significant difference in completing their requirements adequately. No significant differences emerged among the other countries. However, no major disparity has occurred in the case of the KSA, Kuwait, Bahrain, and Qatar, owing to the broad essential principles of certain countries. All the GCC countries, in this case except Oman, are identical because none of them completed their requirements adequately. Therefore, if Oman is excluded owing to the low number of participants, then the author accepts the hypothesis question (RQ1), which states that all the six countries are similar in not completing their requirements adequately.

	Project Success/ Scope (Not) Defined	Project Success/ Scope Defined	Project Failure/ Scope (Not) Defined	Project Failure/ Scope Defined		
UAE					Chi-square	2.380
	32	4	0	0	df	2
					Sig.	0.304[b,c]
KSA					Chi-square	1.154
	20	11	4	1	df	3
					Sig.	0.764[c,d]
Kuwait					Chi-square	2.222
	9	3	0	0	df	2
					Sig.	0.329[b,c]
Qatar					Chi-square	12.900
	29	3	1	3	df	2
					Sig.	0.002[b,c*]
Bahrain					Chi-square	8.233
	29	8	0	0	df	2
					Sig.	0.016[b,c*]
Oman					Chi-square	1.333
	3	3	0	0	df	2
					Sig.	0.513[b,c]

** The chi-square statistic is significant at 0.05.*

TABLE 10: Significance value for project scope clearly defined in all the GCC countries with project success and failure.

4.4. Was the Project Scope Clearly Defined in All the Countries of the GCC?

Country	Project Scope Clearly Defined			Total	% of Not Defined Project Scope
	No	Partially	Yes		
UAE	32	1	3	36	88.8%
Saudi Arabia (KSA)	24	4	8	36	66.6%
Kuwait	9	0	3	12	75%
Qatar	30	0	6	36	83.3%
Bahrain	29	2	6	37	78.3%
Oman	3	1	2	6	50%
Total	127	8	28	163	77.9%

TABLE 11: "Was the project scope clearly defined in all the GCC countries?" per country.

In Table 11, 88.8% of the respondents in the UAE did not define the project scope and considered their project successful (2.7% partially defined their project scope and only 8.3% defined their project scope completely). The significance value (0.304) in Table 10 shows no significant correlation with the success of the project. In the KSA, 66.6% of the respondents

claimed that the scope of their project was not defined. Only 33.3% of their project scope was defined. The significance value (0.764) is more than 0.05, showing no significant correlation with the success of the project. Besides, 75% of the respondents in Kuwait claimed an undefined project scope. The others (25%) claimed that their project scope was defined. The significance value (0.329) shows no significant correlation with project success. In Qatar, 83.3% of the respondents claimed that their project scope was not defined. However, they considered their project a success. The significance value (0.002) indicates a contradictory result as most respondents considered their projects to be a success. In Bahrain, 78.3% of the respondents had a poorly defined project scope. The significance value (0.016) shows a contradictory result because most respondents consider their project a success. In Oman, 50% of the respondents did not have a well-defined project. The significance value (0.513) exhibits that this factor has no significant correlation with the success of the project.

		Sum of Square	df	Mean Square	F	Sig.
The scope of the project is well defined?	Between groups	0.920	5	0.184	1.165	0.329
	Within groups	24.798	157	0.158		
	Total	25.718	162			

Table 12: ANOVA table for project scope clearly defined.

The one-way ANOVA test in Table 12 is conducted to compare the six countries in defining their scope of the projects; the significance value is 0.329 (greater than the alpha value 0.05). Therefore, the UAE, Kuwait, Bahrain, Oman, the KSA, and Qatar had no significant differences in practicing a well-defined scope in their projects. Thus, the author accepts the hypothesis RQ1.

4.5. Did the Size of the Project Negatively Affect Requirements Elicitation in All the GCC Countries?

According to Table 14, in the UAE, only 25% of the project size has affected the requirements elicitation process and 75% of the projects did not. The significance value (0.744) in Table 13 is not significantly associated with the success of the project. In the KSA, 75% of the respondents claimed that their project size did not affect the elicitation process, and only 25% project size affected the requirement process. The significance value (0.043) in Table 13 is significantly associated with project success. In Kuwait, only 58% of the participants claimed that their project size did affect the elicitation process. The significance value (0.710) is not significantly associated with the success of the project. In Qatar, 33.3% of the respondents claimed that their project size did not affect the elicitation process. The significance value (0.375) is not significantly associated with the success of the project. In Bahrain, 29.7% of the respondents claimed that their project size affected the requirements elicitation process and 70.3% projects did not. The significance value (0.428) shows that this factor is not significantly correlated with the success of the project. The author did not consider Oman in the analysis because of less number of participants.

	Project Success/ Size of Project (Not) Affected	Project Success/ Size of Project Affected	Project Failure/Size of Project (Not) Affected	Project Failure/ Size of Project Affected		
UAE					Chi-square	0.591
	27	9	0	0	df	2
					Sig.	0.744[b,c]
KSA					Chi-square	8.170
	25	7	4	1	df	3
					Sig.	0.043[c,d*]
Kuwait					Chi-square	0.686
	5	7	0	0	df	2
					Sig.	0.710[b,c]
Qatar					Chi-square	2.250
	22	8	2	2	df	2
					Sig.	0.370[b]

Bahrain					Chi-square	1.698
	26	11	0	0	df	2
					Sig.	0.428[b,c]
Oman					Chi-square	3.333
	3	3	0	0	df	2
					Sig.	0.189[b,c]

** The chi-square statistic is significant at 0.05.*

TABLE 13: Significance value for the size of the project negatively affects requirements elicitation in all the GCC countries with project success and failure.

Country	Size of the Project Negatively Affect Requirements Elicitation			Total	% of the Project Size Effect on Requirements Elicitation
	No	Partially	Yes		
UAE	27	1	8	36	25%
Saudi Arabia (KSA)	27	2	7	36	25%
Kuwait	5	1	6	12	58.3%
Qatar	24	0	12	36	33.3%
Bahrain	26	1	10	37	29.7%
Oman	3	1	2	6	50%
Total	112	6	45	163	31.2%

TABLE 14: "Did the size of the project negatively affect requirements elicitation?" per country.

		Sum of Square	df	Mean Square	F	Sig.
Was the scope changed during the project?	Between groups	1.397	5	0.279	1.303	0.265
	Within groups	33.646	157	0.214		
	Total	35.043	162			

TABLE 15: ANOVA table for the size of the project negatively affect requirements elicitation.

The one-way ANOVA test in Table 15 is conducted to compare the six countries on the effect of the project size on the requirements elicitation process. The significance value is 0.265 (greater than the alpha value 0.05). Therefore, the UAE, Kuwait, Bahrain, Oman, the KSA, and Qatar had no significant differences and there was no negative effect of the project size on the requirements elicitation process in all the six countries. Thus, the author did not further analyze the results of this section using the post-hoc tests and considered that all the countries are similar in this aspect. Hence, the first hypothesis question (RQ1) was accepted.

4.6. Did the Customers or Users Make Adequate Time Available for Requirement Gathering?

4.6. Country	Customers/Users Make Adequate Time Available for Requirement Gathering?			Total	% of Allowing Adequate Time (Partially and Completely)
	No	Partially	Yes		
UAE	15	3	18	36	58.3%
Saudi Arabia (KSA)	2	9	25	36	94.4%
Kuwait	3	0	9	12	75%
Qatar	2	11	23	36	94.4%
Bahrain	10	7	20	37	72.9%
Oman	1	2	3	6	83.3%
Total	33	32	98	163	79.7%

* The chi-square statistic is significant at 0.05.

TABLE 16: "Did customers or users make adequate time available for requirement gathering?" per country.

According to Table 16, in the UAE, 58.3% respondents allowed adequate time for gathering requirements, and 42% respondents did not allow adequate time for the requirement gathering. The significance value (0.307) in Table 17 is not significantly associated with the success of the project. In the KSA, 95% respondents claimed that customers/users allowed adequate time for requirement gathering completely and partially. The significance value (0.718) in Table 17 is not significantly associated with the success of the project. In Kuwait, only 75% participants claimed that the customers and users had enough time to gather requirements completely and partially. The significance value (0.324) does not demonstrate any clear connection to the project's performance. In Qatar, 95% of the respondents claimed that customers/users allowed adequate time for requirement gathering completely and partially. The significant value (0.081) shows no significant correlation with the success of the project. In Bahrain, 73% respondents claimed that customers and users allowed adequate time for requirement gathering completely and partially, and only 27% did not. The significance value (0.343) shows that this factor is not significantly correlated with the project success. The author did not consider Oman in the analysis because of less number of participants.

	Project Success/ with No Adequate Time for Requirements	Project Success/ with Adequate Time for Requirements	Project Failure/ with No Adequate Time for Requirements	Project Failure/ with Adequate Time for Requirements		
UAE					Chi-square	2.362
	15	21	0	0	df	2
					Sig.	0.307[b]
KSA					Chi-square	1.348
	2	30	0	4	df	3
					Sig.	0.718[c,d]
Kuwait					Chi-square	2.222
	3	9	0	0	df	2
					Sig.	0.329[b,c]
Qatar					Chi-square	5.029
	1	31	1	3	df	2
					Sig.	0.081[b,c]
Bahrain					Chi-square	2.141
	10	27	0	0	df	2
					Sig.	0.343[b,c]
Oman					Chi-square	2.400
	1	5	0	0	df	2
					Sig.	0.301[b,c]

** The chi-square statistic is significant at 0.05.*

TABLE 17: Significance value for customers/users make adequate time available for requirement gathering with project success.

	Sum of Square		df	Mean Square	F	Sig.
Customers/users make adequate time available for requirement gathering?	Between groups	3.411	5	0.682	4.675	0.001
	Within groups	22.908	157	0.146		
	Total	26.319	162			

TABLE 18: ANOVA table for customers/users make adequate time for requirements.

The results from the one-way ANOVA test in Table 18 prove that differences emerge among the six countries on this factor, and the significance value is $p = 0.001$. Still, it does not indicate which of the six countries are different from one another. Therefore, The RQ1 hypothesis is rejected, and the alternative hypothesis (RQ2) is accepted. Hence, the author continued the analysis with the Scheffe post-hoc test. A statistically significant difference emerged at $p < 0.001$ level with customers and users making an adequate time available for requirement gathering in the six countries, $F (5, 157) = 4.675$, $p < 0.001$. The post-hoc comparison test indicates that the mean

score for Qatar and the KSA (M = 0.94, SD = 0.232) both have the same results; no statistically significant difference appears in the mean between them. This also indicates that both of them allow their customers and users more adequate time for requirements gathering than the other GCC countries. Bahrain (M = 0.73, SD = 0.450), Kuwait (M = 0.75, SD = 0.452), and Oman (M = 0.83, SD = 0.408) have no significant difference among them. The UAE appears to be significantly different from Qatar. The KSA has a mean value of M = 0.58 and SD = 0.500; thus, it is considered to be the country that allows the lowest time for gathering requirements from customers and users. Most of the countries are less dedicated to this factor; however, they do not substantially vary in evaluating the position of consumers and users in giving adequate time to complete their requirements.

5. DISCUSSION

The results from analyzing the first RE factor indicates that the GCC countries are different when utilizing a particular method for a requirements gathering process. Although the percentage of the projects that used a particular method in all the six countries was 23.9%, Qatar tended to be the frontrunner to use a method for gathering requirements preceded by the KSA and UAE, and Bahrain, which is the least that used an appropriate method for requirements gathering. Other than Bahrain, the chi-square test finding for the GCC countries (in Table 2) shows that there is no evidence of finding a significance associated between this factor and the success of the project as per the respondents. The author related this result to the low number of projects using an appropriate requirements method. The results would not preclude the use of a requirement method from contributing to project success if more projects were included in the study using suitable requirement methods. The author also suggests that software engineers either used their own requirement methods or preferred not to use any method, for example, in Bahrain.

Although, the second RE factor shows that the GCC countries were similar in having their requirements complete and accurate, Bahrain, Qatar, and the UAE tend to have more accurate requirement completion. However, there is not enough evidence to draw a correlation between this factor and project success in most of the GCC countries because the significant value is higher than 0.05; however, this does not mean that they are weakly correlated. The dataset analysis shows that a completed and accurate requirements practice was done when the project managers met the stakeholders, held interviews, and communicated either using Emails or telephonic conversations. These project managers also allowed adequate amount of time for requirement gathering.

The UAE, KSA, and Qatar were more significant in completing their requirements adequately to the end of the project, compared with the other GCC countries. They had a significance value of less than 0.05, showing that they were significantly correlated with successful projects.

Our dataset shows that the respondents in the GCC countries considered the majority of their projects as successful, even though the requirements were not completed or only partially completed, and the significance values in Tables 2, 5, 8, 10, 13, and 17 show that most of the GCC countries do not have enough evidence to show significant correlations with project successes. The author related this issue with the fact that project stakeholders have different definitions of project success, as wide variety of people exist with different preciptions and experiences. Several researchers [58], [23] corroborated that project success and major success factors are interpreted differently between different sectors, cultures, and countries based on stakeholders viewpoints of success factors which pay more attention on soft factors, in particular on the skills of the individuals who actually carry out the project and on the relationships between them. Therefore, it is possible that software engineers in the GCC countries defined their project success based on their task completion and job satisfaction. For instance, the participants in Bahrain did not complete their requirements adequately and did not use a particular method for requirement gathering. However, they considered all their projects successful. Thus, if their projects were delivered within the required budget and time frames, they might consider their projects successful.

A defined scope means that the team understood what must be achieved and what work must be done to deliver a project on time [59]. Unfortunately, most of the GCC countries did not define their projects' scope from the start and endusers were not involved in the project scope from the begining. The UAE and Qatar did not define their project scope very clearly.

The size of the project did not affect the requirements elicitation process negatively in all the GCC countries. Based on the dataset, the author relates this issue to the fact that in the total number of projects that were complete, accurate requirements were relatively small; therefore, the requirements were easy to elicit and collect before development and were not affected by the size of the project.

In the GCC countries, 79.7% of the respondents either completely or partially accepted the fact that the customers or users allowed adequate amount of time for requirement gathering. The significant value shows no significant correlation with the success of the project because it is more than 0.05. The KSA's and Qatar's customers and users were allowed more adequate time for requirement gathering than the other countries. Bahrain and the UAE had their projects with fewer customers or users those allowed adequate time for requirement gathering.

The study results might not be applicable to Omani companies as the number of participants from this country could be an outlier.

As GDS is gaining more acceptance in the software industry, RE practices are becoming much more complex and demanding when applied in the GDS model [60]**.** This study helps to identify risks otherwise overlooked by project managers and provides project leaders with a comprehensive overview of the RE status of the different GCC countries that can help project managers control their software projects in the early stages, thereby facilitating the completion of projects on the agreed schedule and budget.

To identify what can be learned from the results of the analyzed RE factors based on their differences and similarities when implemented in the GCC countries, the author illustrated the followings:

- Qatar appeared to be using more methods for the requirement gathering factor compared with the other five countries, then the KSA and UAE together, and finally, Bahrain.
- The GCC countries were similar in having complete and accurate requirements. Bahrain, Qatar, and the UAE had more accurate requirement completions.
- The UAE, KSA, and Qatar were more statistically significant in completing their requirements adequately, compared with the other GCC countries.
- The GCC countries were similar in not defining the scope of their projects at the beginning of the projects.
- The GCC countries were similar in not having the size of the project effect on requirements elicitation process negatively.
- The KSA and Qatar customers and users were allowed more time for requirement gathering than the users of the other GCC countries. Bahrain and the UAE had their projects with fewer customers and users who were allowed adequate time for requirement gathering.

The data observation provides evidence that all the software companies in the GCC are currently facing almost the same RE challenges. Project managers should take into account that the GCC countries share the same problems when implementing the RE practices. Therefore, when working in the GCC, project managers need to encourage a balance between formal western methods and social aspects within this region.

6. FINDING IN THE GLOBAL CONTEXT: A COMPARISON REVIEW

This section covers whether the findings on the requirements gathered by a specific method among software developing companies in the 6 GCC countries are consistent with some of the findings by other researchers. For example, The research results is similar to [13] in developed countries such as Australia and the U.S., it was found that almost close to 50% of the project respondents did not know what requirements gathering methodology was used and gathering requirements with a specific methodology was not significantly correlated with project success [13].

Similarly, our findings on whether the requirements were complete and accurate at the start of the project among the sample practitioners and their significant positive relationship with project success compares well with other studies (Schmidt et al.[61], Keil et al.[62], Durmic [63], Woźniak [64], Standish Group [37], Ieiarte and Sussy [65], Naguib [66], Oz and Sosik [67], Glass [68], and Procaccino, et al. [69].

Our findings on whether the requirements were complete and adequate from the practitioners in all the GCC countries, show that the majority of the responses were highly skewed toward non-completion, though their projects were successful. It was observed by other researchers that larger projects witnessed frequent change of requirements; however, such changes when effectively managed through a central repository are positively correlated with project success [13]. This results are similar to Perkins [70], Fernández, et al [35], Humphrey [71], Kalinowski et al. [12].

As regards to whether the scope of the project was clearly defined in all the GCC countries, contrary to our findings, Glaser [72], Komal et, al.,[57], Akbar et, al., [6], Purba et al.[73] show that a well-defined project scope has very high correlation to its success. Standing et al. [74] found that complete and accurate requirements at the start of the project leads to a well-defined project scope, resulting in successful software deliverables.

Our findings that size does not matter much in a project's success are similar to the finding of a number of previous studies such as Pimchangthong and Boonjing [75], Özturan [76] Bezdrob [77]. Important takeaways in this respect are that, size of the project and the number of organizations involved in such a project, do increase the complexity of the project, resulting in unclear, incomplete, and potentially unstable requirements leading to frequent changes; however, our results prove that it is not the large numbers of customers and users that significantly impact project failure, but rather, its functionality.

While the majority of our respondents from all the GCC countries to a varying degree provided a positive reply with regard to customers and users making adequate time available for requirements gathering, surprisingly there was no clear evidence that the participation from customers and users had any significant relation to a project's success. This is contrary to some of the findings in Jia and Capretz [78], Thakurta [79], Kwon [80], that user and client involvement, skilled and sufficient staff as well as effective communication and feedback were key to a project's success and involvement of customers/users should occur in all phases of software development.

While most of the cited studies covered various factors related people, process, and technological aspects in our results show clear requirements and specifications; clearly defined objective, goal, and scope; realistic schedule; adoption of effective project management skills and development methodologies; client involvement including knowledge and skills of client-side staff as well as effective communication and feedback; good leadership and support from top management were some of the key factors that can lead to successful delivery of projects in this region. These results are in line with the findings by Fricker et al. [81], covering both developed and developing countries. It is also important that cultural aspects also need to be considered while involving all the stakeholders during the entire RE and development process, as according to Geethalakshmi and Sanmugham [82], the non-technical side of a project's success and failure is mostly under-

researched as teamwork is highly correlated to a project success, whether it is in a developed or a developing country as noted by Pereira et al. [83].

7. LIMITATION AND VALIDITY OF THE RESULTS

This study has limitations that might affect the validity of its results. The author constructed this study through an in-depth review of the literature. Owing to the small amount of literature regarding the RE practices in the GCC region, the author used some old literature as evidence. Moreover, the author checked some of the participants' software documentation, which they had obtained during the interview as a second source of evidence. The survey provided only the software engineers' perceptions. However, when conducting a survey, the author relied on the information the respondents provided. There is a high possibility that the software engineers' perceptions might change after the project is finished. It is also possible that the respondents liked to choose only successful projects. Because software engineers were the only participants surveyed by the author, the findings were limited to their views and opinions about the projects and teams in which they worked. The findings of this study are derived from the data collected by the software engineers working in various roles and directly participating in the projects; the opinions of the software engineers were investigated without the author's influence. The questionnaire used by the author had been used effectively in other studies [13], [23], [81], [82], [83].

7.1. Internal Validity

The author used exploratory research to explore the subject of the RE practices from the viewpoint of the software engineers within the GCC region. They included project managers, users and customers, and programmers and developers, who had different perceptions on project success.

7.2. Construct Validity

The questionnaire that the author used in this study was successfully used many times with other software developers from different countries [13], [23]. Therefore, as it had been validated many times, the author could use the questionnaire as a valid instrument for exploring the RE practices for software engineering in the GCC countries.

7.3. External Validity

As this study sample is convenient and not a random sample, the author cannot consider the results to be as reliable as a random survey. This is because a convenient sample might be biased and involve inference. However, the respondents participated in the software development processes in different types of projects. As this study took place in the GCC countries, which is a small part of the world, the findings cannot be generalized. The study is limited to the sample population size at the time they conducted the survey.

7.4. Conclusion Validity

In this study, the author used ordinal data and nonparametric statistics for their analysis. The author believes that the analysis is reliable since he obtained the variables from the experienced software engineers those have a good knowledge of different software development projects. Key limitations of this study are the small number of projects in Kuwait and Oman, and the low number of failed projects in all the countries.

8. CONCLUSIONS

This study has examined the current state of RE practices within the GCC countries based on the six RE factors. It has focused on identifying the commonalities and differences of the six RE factors within the six countries. The author collected and analyzed the data using a questionnaire-based survey from software professionals working in software organizations in the GCC countries.

The results show that more similarities rather than differences emerged among these countries.

Many project managers started their projects with inappropriate requirements methods and undefined project scopes, and used their own requirement tools and techniques. Besides, the most common RE gathering methods that were used within the GCC region were traditional methods, such as meetings and interviews. Many advanced RE methods and techniques used in western countries are not used in this region, which could be attributed either to the lack of familiarity among the project managers and system analysts, or the uncertainty of choosing the right methods and tools for RE practices.

In a GDS paradigm, the research results provide a useful insight to project managers and system analysts regarding how RE practices are performed within the cultures of the GCC region, as the perceived value of RE techniques may vary between countries belonging to cultures that are distinct from the western culture. Therefore, this study could be the first move toward understanding how RE practices are perceived in the GCC countries, which may play a significant role in the progress of GDS initiatives. Project managers should provide a project environment that supports cultural differences in a GDS so that the delivered system can be sustainable and applicable.

The contributions of this study will be vital for project managers and system analysts in identifying the challenges of RE practices in the GCC countries. The study demonstrates that using the standard RE practice and appropriate methods and tools will help software companies define the RE stage correctly, which accordingly will improve the success rates of their projects.

Future research should propose guidelines or frameworks based on the highlighted problems for software firms in the GCC countries. These guidelines will facilitate the system analysts in choosing suitable tools and methods when applying RE practices in the GCC region.

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