

REQUIREMENTS PRIORITIZATION IN AGILE PROJECTS: FROM EXPERTS' PERSPECTIVES

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ABSTRACT

Software becomes an essential part of our lives because of the required automation in every field. A software requirement plays an important role in its development. In Requirement Engineering (RE), requirement prioritization (RP) is the crucial activity to successfully deliver the software system. Recently, Agile Software Development (ASD) methods have become a widespread approach used by the software industry. ASD stresses the importance of providing the customer with a product of a maximized business value. To achieve that, RP is used. The aim of this study is to investigate the current practice related to RP process, including its timing, participants, criteria used and prioritization techniques applied. An online questionnaire (based on literature review) has been designed and a survey has been conducted with the focus group which mainly involving some practitioners or experts from industry (domain experts) together with academicians (knowledge experts) in few parts of Malaysia. The researchers received 20 valid responses indicating RP practices in agile projects. The researchers found out that despite the fact that business value is the most common criterion used to prioritize requirements; other criteria like important, complexity and cost are considered as well. Other findings indicate that consideration of such multiple criteria requires different viewpoints, thus making RP a process that has to involve many participants of different roles in prioritizing the requirements. While the most popular technique used by the practitioners in this study is MoSCoW technique. Besides, the survey study also asking on any special attention given to the non-functional requirements (NFRs) or user stories in prioritization process in agile projects, since commonly known, due to the nature of the agile environment itself, the NFRs are nearly always neglected during the RP process. The results shown that over 85% of respondents giving attention to NFRs during prioritization in agile projects and less than 15% stated that there are a few reasons why their team did not pay much attention on NFRs during the prioritization process.

Keywords: *Requirement Prioritization, Agile Software Development, Functional Requirements, non-Functional Requirements, Requirement Engineering*

1. INTRODUCTION

Software Engineering (SE) is a practically oriented field of computer science, focusing on methods of software-intensive Information Technology (IT) systems development in an industrial context. This context generally includes the customer-supplier relationship, in which a customer is willing to pay for the software due to its perceived value. IT systems in business applications are considered a tool for optimizing business processes and act as a source of competitive advantage. The delivery of actual value to the customer is not a simple and straightforward task. In particular, new

approaches that support this idea, namely Agile, have gained recognition and been adopted by the mainstream software industry. The Agile approach stresses the importance of providing the customer with a product of a maximized business value [1]. In addition, one of basic elements of the emerging concept of "Agile mindset" is the attitude towards customer satisfaction and needs [2]. One way to conform to such principles is distinguishing requirements with respect to their business value and using a prioritized list of requirements to guide development process. This is a practice adopted by particular development methods like Scrum [3] or Extreme Programming [4]. According to an SLR

done by [5], the most frequently used Agile methodologies were Scrum and Extreme Programming (XP). The Scrum method was used in 13 studies, and XP method was used in 13 studies.

Requirements prioritization, or RP, is conducted in each iteration and driven by business value. It was one of the first practices reported as most commonly adopted in Agile projects [6]. The results of adopting this practice can be observed quickly, as software developers claim that Agile demonstrates a positive influence on managing changes in requirements priorities (even in case of less experienced teams) [7]. RP has been reported as a way of modifying known challenges in requirements engineering (RE), such as: continuous management of requirements that may change over the course of the project [8] or rare customer involvement and requirements validation [9]. It is also considered a good way to increase customer value [10]. Given that, it is not surprising that RP is an important topic, both to researchers and practitioners. Requirement negotiation and analysis (including prioritization as an essential part) has been reported by recent systematic mapping study [11] as a commonly explored Agile requirements engineering (ARE) research subject. In addition, practitioners consider RP with customer involvement as one of most important ARE practices [12].

Despite its importance and potential benefits, RP in ASD is also reported as problematic task [13], affected by several challenges [14]. Business value is usually used as a criterion for assigning priorities. Further works have provided additional perspectives and/or refine perspectives into more detailed criteria to be considered during prioritization (e.g. [16-20]). In particular, developers' perspectives and related criteria such as cost [19][22], risk [20] and interdependencies between requirements [20][24] are considered. It also means that in addition to the customer or Product Owner (PO), there are others involved in RP decision-making process [20][23]. The inclusion of additional criteria and decision makers may sequentially influence the timing of (re)prioritization activities. Another issue is the selection of the most suitable prioritization technique to be used in a given project from the large number of available ones [23][25].

RQ1: When does requirements prioritization take place?

RQ2: What aspects and techniques are applied during prioritization?

RQ3: Who participates in prioritization tasks?

RQ4: Is there any special attention given to the non-functional requirements or user stories prioritization in Agile projects?

The remainder of this paper is structured as follows. Section 2 provides an overview of related work. In Section 3, the researchers describe the setting design and execution of the survey study. Study's results are presented in Section 4, followed by their discussion in Section 5. The paper is concluded in Section 6.

2. RELATED WORK

An extensive review of the literature was carried out to find related studies and works that could help to tackle the identified problem. The results obtained have been successively explained. Numerous researchers developed many techniques, and several studies investigating the topic of RP can be found in the literature. The most directly related work are empirical studies on RP, Cao and Ramesh [6] identified RP as one of the cores, commonly used practices in the early phase of Agile methods adoption by the industry. Hoff et al. [16] conducted a field survey to determine decision factors that are considered by practitioners during RP. Racheva et al. [17] opposed Agile RP "best practices" from the literature and industrial practice through an exploratory study of eight companies. Other studies involving the same main authors can also be found.

In [18] they developed a conceptual model systematizing the aspects considered during RP by practitioners. Svensson et al. [19], who limited the scope of their interest to quality requirements only, conducted interviews with practitioners from 11 companies to identify prioritization techniques and criteria used by them in RP. Martakis and Daneva [24] investigated dependencies between requirements and their influence on software project activities, including RP. A study focused on large-scale outsourced Agile projects by Daneva et al. [20]. Additionally, N. H. Borhan et al. [21] conducted a Systematic Literature Review (SLR) focusing on ASD. Based on the findings gathered in the SLR, the researchers found out that one of the limitations of existing techniques developed by other researchers is a lack of technique or approach which concurrently considers the non-functional requirements while prioritizing the requirements or user stories in Agile projects. Aleksander et al. [28] conducted a survey involving practitioners from Polish IT industry only and the findings indicated that consideration of such multiple criteria requires different viewpoints, thus making RP a process that has to involve many participants of different roles. Sylwia et al. [29] conducted a survey focusing on the importance of non-functional requirements (NFRs) in ASD projects. From the survey, they concluded that over 77% of respondents perceive having NFRs

defined in ASD project as at least important; for 30%, it is critical.

3. RESEARCH SETTING

3.1 Survey Instrument

An online questionnaire was designed using Google Forms service. The questionnaire includes generic questions about demographic information to characterize respondents' backgrounds and working environments (without identifying any respondent nor his/her employer, as the survey was anonymous). The most important questions however focused on respondent's experience concerns on the practices used in RP.

To formulate the survey questions on RP and the predefined answers the respondents could choose from, we reviewed the existing scientific literature and used concepts and practices from several papers (mostly dedicated to RP in Agile). The result is not simply a super-set of all criteria, techniques and other items extracted from the literature. The researchers opposed information from different sources. For example, there is a large set of RP techniques available [23][25], but testimonials of practitioners indicate that they do not prefer to use advanced, complex techniques [19]. For this reason, the researchers decided to select a short list of RP techniques most frequently cited and discount the rest, especially the more advanced methods that involved multi-criteria decision-making algorithms [23].

Some of the questions are presented in Table I, together with research questions and with literature sources that contributed to them. All of the questions Q1-Q6 were multiple-choice questions. Each was provided with a number of possible answers, but also a text field, which allowed entering other answer as well.

Table 1: Survey questions

Research Question	Survey Question	Sources
RQ1	Q8: When does RP take place?	[17][26][27]
RQ2	Q9: Which aspects of requirements are considered during prioritization? Q10: Which prioritization technique is used?	[16-20][23][25][26]
RQ3	Q7: What criteria are used to select people to participate in RP? Q11: Who participates in requirements prioritization?	[16][17][20][23]

	Q12: Who makes the final decision about requirements priorities?	
RQ4	Q13: Special attention was given to the non-functional requirements or user stories prioritization in agile projects	[28][29][30]

A complete interview questions can be found through this link:

https://docs.google.com/forms/d/e/1FAIpQLSeDTXSunlaRcRmxDDqG6c5hi2eo_wSg2JgTDZzIFUlwXEjWCg/viewform?vc=0&c=0&w=1&flr=0

3.2 Survey Study

A survey study was planned based on the designed questionnaire on RP practices. It was conducted as part of a wider survey on RE practices used in ASD projects. In this study, it will focus on RP practices only. The researchers invited the industry practitioners together with the knowledge experts with experience in Agile software projects to participate in the survey. No restrictions with respect to application domain nor organization type were set.

3.3 Population

The target population can be defined as ASD project respondents. The researchers did not limit their focus to any specific type of application or domain. However, they assumed that an individual belonging to the population needs to have at least one-year experience in ASD. As the researchers were not able to find any means to gather a representative sample of the investigated target population in a systematic way, they applied a non-systematic method, namely convenience sampling. The researchers used social networks such as LinkedIn, Research Gate and Facebook to invite members of Agile groups. Secondly, the researchers sent direct invitations to people that they knew to have experience in Agile using the communication tools available on their website, and to people who published their curricula vitae on the internet indicating that they have experience in ASD.

3.3.1 Subject Q3

The two categories of subjects for this exploratory study are experts from industry and academicians. The industry experts were obtained through contacts on social media (Facebook, LinkedIn and Research Gate) and by contacting friends working in the software industry in Malaysia

to get many of respondents in Agile area. These experts were selected based on the criteria that they are i) Agile practitioners and ii) have experience in Agile Software Development and quality assurance for more than 3 years. This is as adapted from Mohamed [35] and Tran et al. [36]. Academicians were contacted through emails based on the following criteria, as suggested by Hallowell and Gambatese [37], Rogers and Lopez [38], Mohamed [35], and Rajaram et al. [39]: i) currently lecturing in the field of the study, ii) holds an advanced degree such as PhD in Software Engineering, iii) faculty members at an accredited university, iv) have authored book/academics materials related to the software testing, and v) have at least 5 years of experience in Agile Software Development. The selected responded from academicians category were introduced by senior faculty advisors and friends based on their excellent reputation in the Software Development focusing on Agile.

The experts were asked to indicate their willingness to participate in the survey after they were informed about the purpose of the study. The thankful notification was sent to the experts who apologized for their inability to participate in the exercise.

3.4 Data Collection

The survey questionnaire were sent to many experts or practitioners, but only 30 were returned. Data collection took 2 months more in contrast to a planned 1-month schedule for the respondents to answer the survey. Reminders were sent to the respondents who failed to return the survey at the expiration of the given time. The researchers had to reject 10 of them because the respondents could not complete the survey given to them. Therefore, the valid responses of the survey were 20 (3 academicians and 17 practitioners). These 20 valid responses were complete without blank answers (no missing data). The professional experience of the respondents varies from 1 year to more than 10 years. There is limitation found in this study concerns the size of the sample used. The total number of valid responses is 20, and therefore its representativeness is limited. Their responses thus cannot be generalized in order to formulate definitive, general conclusions. However, the findings gained from this study is very useful in order to help the other researchers in the related area to be aware on the current RP practices used in ASD projects since to the best of our knowledge, there is still lack of survey study on the current RP practices among the practitioners especially in Malaysia.

Therefore, additional research is needed to compare the findings with those resulting from larger or different samples.

3.5 Data Analysis

The collected data were analyzed using descriptive statistics to describe the opinion of respondents about the RP practices in ASD projects and Cronbach Alpha was conducted to identify the internal consistency in the components of the questionnaire. Cronbach's Alpha defines the internal consistency or average correlation of items in the survey questions.

Therefore, for Q13, it was focusing on the special attention given to the non-functional requirements in ASD. Commonly, due to the nature of ASD that emphasizes user involvement, the focus of the agile development team is often more on functional requirements, while non-functional requirements are often neglected. For this question, their ratings are converted to a 5-Likert score, which is mapped as strongly agree, agree, neutral, disagree, and strongly disagree to 5 to 1, respectively. Frequency, mean, and cross-tabulation were used for analysis by the SPSS tool version 26. Descriptive analysis was used to compute the mean of each item. By the mean value, it can be known which item is more important among the respondents. The respondents' comments and suggestions were also sorted, which the authors summarized and discussed in the following section.

3.6 Validity Procedure

The survey was conducted in an unspecified manner in order to minimize the threat related to respondents' honesty, but the researchers still included several demographics questions to establish the context of respondents' work. The researchers defined the minimal criteria to include a response in further analyses. To minimize concerns related to the participation of people without sufficient knowledge, the researchers determined that only respondents with actual experience in ASD would be included. Moreover, the researchers decided that only complete responses with all questions answered would be taken into further consideration.

The researchers made an effort to define survey questions and answers based on literature analysis, but remained aware that some respondents might not find any of predefined answers to be applicable. To address this, in each of Q2-Q6, the researchers included "Other" option with opportunity to manually enter the answer by the respondents. The questionnaire was reviewed, edited several times and

was validated by performing a pilot test to improve its understandability and assure compliance with the guidelines [31]. More importantly, the pilot test assists in avoiding the ambiguities, obstacles or mistakes that might arise when answering the questionnaire. A pilot study involving 3 practitioners (fitting respondent's profile) was conducted as a final test before distributing it to the respondents.

4. RESULTS AND ANALYSIS

The survey was conducted within the period of December 2021-February 2022. The researchers received 30 responses, but after checking them against the pre-defined criteria, including completeness and actual experience with ASD, the researchers had to reject 10 of them. As a result, 20 responses were included in the results as a valid response. Table 2 shows the response rate of the survey.

Table 2: Response Rate of the Survey

Description	No of Practitioners	Rate (%)
Sent	50	60
Lost/No response	20	40
Valid/Complete survey	20	66.7
Invalid/Rejected survey	10	33.3

Based on these criteria, 50 invitations were sent to experts or practitioners via email and social media. Many of them did not reply, and as such only 30 responses were gathered from the survey. However, after checking them against the pre-defined criteria (completeness) the researchers had to reject 10 of them. As result, 20 responses were included in the results, for a completion rate of 67%.

The most essential information on respondents' background is shown in Table 3. 10% of them had limited experience (less than 2 years); roughly 55% declared experience between 5 to 10 years; and around 35% claimed more than 10 years' experience in Agile projects. No respondents reported that they had between 2 to 5 years of experience in Agile development. The most popular ASD method turned out to be Scrum, used either exclusively or together with Kanban, XP or Lean. As for job position or project role, about 35% declared that they work as Product Owners (POs), followed by Scrum Master. This seems to confirm testimonials from the industry that, despite lack of explicit identification of analyst's role in Agile methods such as Scrum, in practice it is not uncommon to apply ASD with an explicit activity of requirements engineering and/or business analysis, and to designate a development

team member(s) responsible for this activity [32][33]. Most of the respondents in the study survey are Pos. A possible reason for this is that POs were the ones most interested in the survey on ARE. Most of the respondents were involved in software development, while the remainder were academicians (knowledge experts). From the study, 55% of the respondents having less than 10 Agile team members and 9 respondents stated that they are working with 10-20 Agile team members. No respondent claimed that they had more than 20 Agile team members in their organization. The demographic information about the respondents is presented in Table 3.

Table 3: Demographic information about respondents

Answer	No. of Responses	% of Responses
Experience in agile software development:		
Less than 2 years	2	10%
2 – 5 years	0	0%
5 – 10 years	11	55%
More than 10 years	7	35%
Agile method used:		
Scrum	9	45%
Scrum & XP	1	5%
Scrum and Kanban	8	40%
Scrum, Kanban and XP	1	5%
Lean, Kanban and Scrum	1	5%
Job position/project role:		
Developer	2	10%
Product Owner	7	35%
Scrum Master	7	35%
Engineering Manager	1	5%
Academician	3	15%
Sector of organization:		
Software Development	17	85%
Education	3	15%
Mobile Application Development	0	0%
Agile team member numbers:		
Less than 10	11	55%
10-20 members	9	45%
20-50 members	0	0%
More than 50	0	0%

RQ1 - When does requirement prioritization take place?

RQ1 was addressed by Q8. Figure 1.1 shows the answers for Q8 (When does requirement prioritization take place?). 90% of the respondents claim that RP is done at sprint/iteration planning meetings. However, in one case, RP took place during sprint or iteration. 5% of respondents' experience with RP occurred at the beginning of the software project

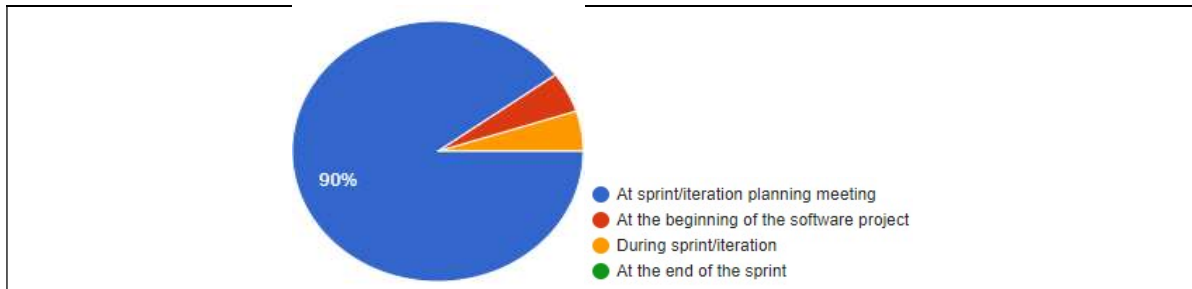


Figure 1.1: Distributions of answers for Q8

RQ2 - What aspects and techniques are applied during prioritization?

Figure 1.2 shows answers to Q9 regarding the aspects of requirements that are considered during prioritization. The majority of respondents declared that the business value for the customer is a criterion considered in RP (19). The next aspect is important which about 90% of respondents (18). Another aspect, which is cost, is about 40% of the respondents and complexity of implementation was declared by 6 respondents.

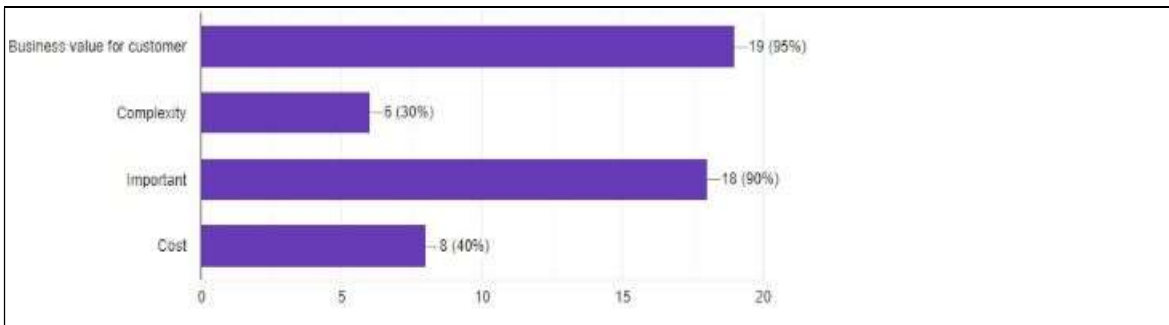


Figure 1.2: Distributions of answers for Q9

The researchers asked about prioritization techniques in Q10. The results are depicted in Figure 1.3. The most popular technique used by the practitioners or experts in Malaysia is the MoSCoW technique, with 16 respondents. 14 respondents reported cost-value ranking, followed by the cumulative voting (20%). The Kano model, which is suggested for Agile projects by BABOK Guide [34] is seldom used – (1 answer only).

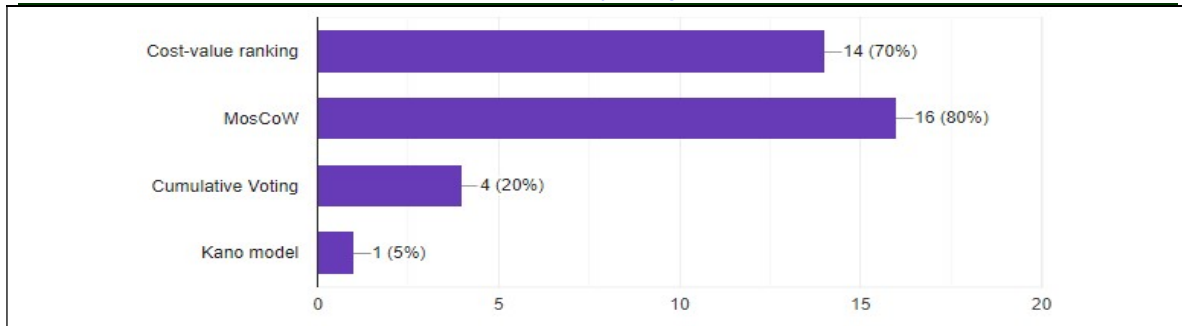


Figure 1.3: Distributions of answers for Q10

RQ3 - Who participates in requirements prioritization?

As shown in Figure 1.4, the most frequent answer was Product Owner (20 respondents). Scrum Master was reported by 5 respondents. Other team members that can also participate in RP include the customer representative (80%) and technical lead (1 respondent). Quite often, in some cases it is not a single representative, but all relevant stakeholders including the Agile team itself, as reported by 8 respondents. Teams usually share their opinions with the PO. In addition, no respondent stated that a Project Manager was involved as a decision maker during the prioritization process in Agile projects.

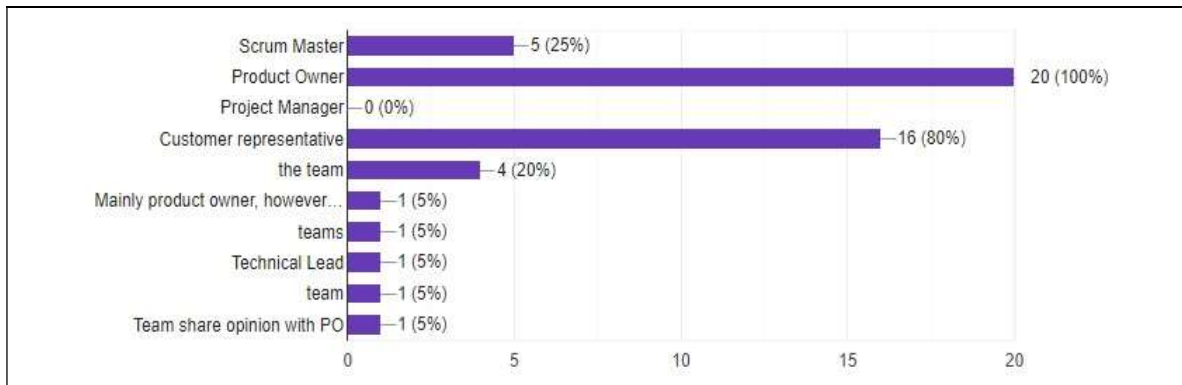


Figure 1.4: Distributions of answers for Q11

Figure 1.5 presents answers to Q7, the purpose of which to determine the criteria used to select participants of RP tasks. The most common answer was the knowledge about business goals, at about 70% of respondents, but also other criteria gained significant numbers of responses, namely experience in Agile development at 20% of respondents. One respondent stated that there were no criteria for selecting people to participate in RP. Besides, there is one respondent mentioned that, if possible, all the criteria such as knowledge about business goals, knowledge about user stories, technical expertise and experience in Agile development should be considered while prioritizing user stories, as otherwise the team has prioritized them sequentially.

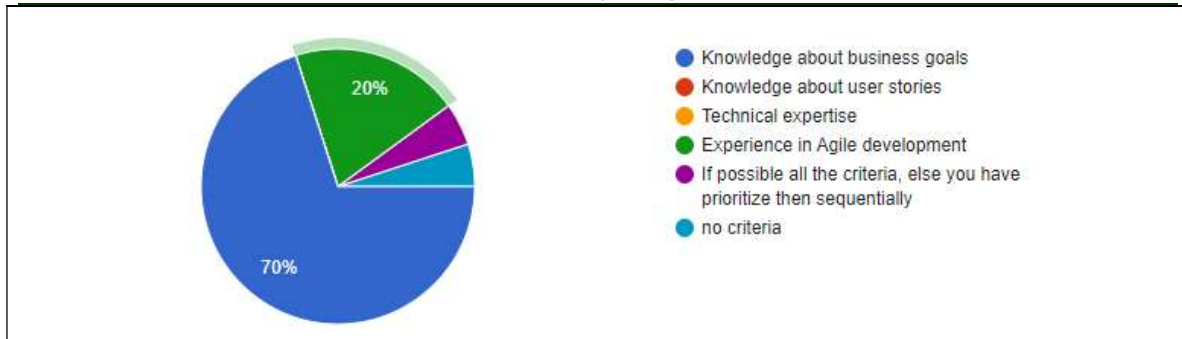


Figure 1.5: Distributions of answers for Q7

Q12 asked about the person who makes the final decisions about priorities. As shown in Figure 1.6, most of respondents assigned this authority to Product Owner (95%), which is in line with Scrum guidelines. Scrum Master and Developers do not make final decisions about priorities in any cases here. As for “other”, the team would share knowledge with the PO to make the final decisions about priorities.

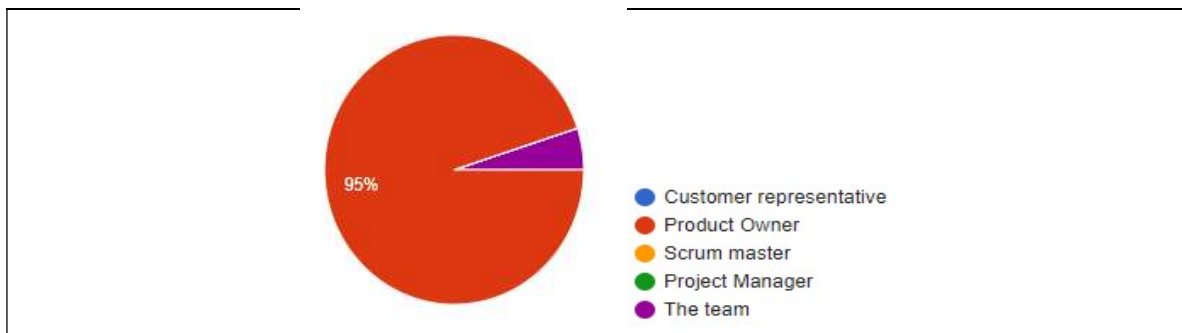


Figure 1.6: Distributions of answers for Q12

RQ4 – Is there any special attention given to the non-functional requirements or user stories prioritization in agile projects?

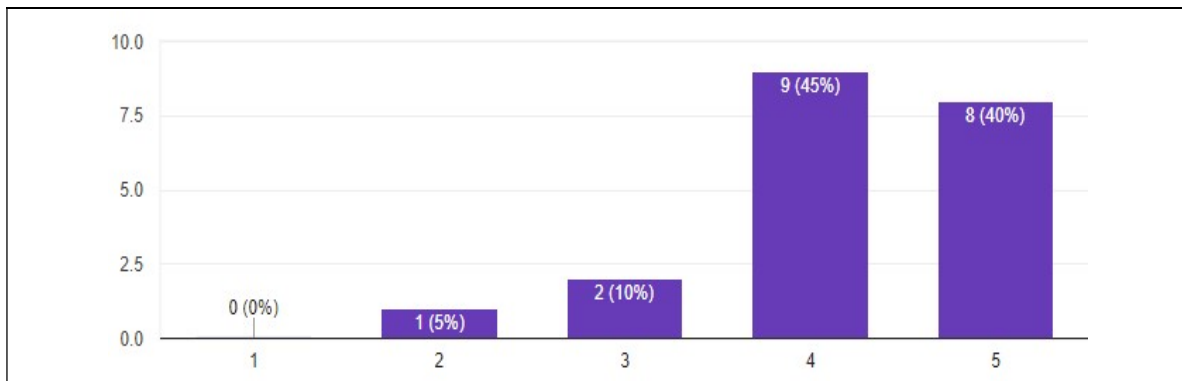


Figure 1.7: Distributions of answers for Q13

Figure 1.7 presents the answers to Q13, which aimed to determine whether any special attention was given to the NFRs or user stories prioritization in Agile projects. Most of the respondents stated that there is special attention given to the NFRs or user stories in prioritization process (85%). However, a few respondents (3 respondents) also claimed that they did not really put much attention on the NFRs or user stories. The respondents mentioned that it comes by default especially when the team members are having good experience in software development.

Additionally, one respondent also stated that the analysis team focusing on the end user and the final shape of the feature causes several problems, mainly because of lack of quality of delivered user stories due to the ignorance of NFRs itself. One of the respondents stated that it is important to give priority for NFRs as well during the prioritization process in Agile projects, in order to produce a high-quality software in ASD. From the responses, one of the reasons why NFRs or user stories are always being neglected is due to incomplete requirements or user

stories provided by the customer (which is lack of awareness on NFRs).

A reliability test was conducted to identify the internal consistency and specified measurement's usability. Cronbach's Alpha defines the internal consistency. Cronbach's alpha, reliability coefficient ranging from 0.70 to 0.95 is considered acceptable reliability in SPSS [42] [43]. Table 4 shows the results obtained for the NFRs attributes involved in ASD (Q15-Q21). For Q15, the survey question concerned (Security), followed by Q16 (Scalability), Q17 (Maintainability), Q18 (Availability), Q19 (Usability), Q20 (Reliability) and Q21 (Accessibility). The results from these seven questions (referring to N items) on the NFRs, have been analyzed and the Cronbach's Alpha value is 0.951, where it is acceptable and reliable [35]. What constitutes a good level of internal consistency differs depending the sourced reference, although all recommended values are 0.7 or higher.

Based on the findings, most of the respondents were claimed either very frequent or frequently put attention on the NFRs attributes stated in the survey questions.

Table 4: Reliability statistics

Cronbach's Alpha Based on Standardized Items	N of Items
.951	7

Table 5: Statistics of each items

		Q15	Q16	Q17	Q18	Q19	Q20	Q21
N	Valid	20	20	20	20	20	20	20
	Missing	0	0	0	0	0	0	0
Minimum		2.00	2.00	2.00	2.00	2.00	2.00	2.00
Maximum		5.00	5.00	5.00	5.00	5.00	5.00	5.00

Table 5 shows the statistical analysis of each item on NFRs. In the study, there were 20 cases included in the analysis, and no cases were excluded

due to missing values. The minimum value given by the respondents for each item was 2.00, while the maximum value given by the respondents was 5.00.

Table 6: Scale Statistics

Mean	Variance	Std. Deviation	N of Items
30.6500	18.345	4.28308	7

Table 6 shows the mean and standard deviation of the difference which is mean = 30.6500, while the standard deviation = 4.28308.

Table 7: Item Statistics

	Mean	Std. Deviation	N
Q15	4.0500	.60481	20
Q16	4.0000	.64889	20
Q17	4.4000	.75394	20
Q18	4.6500	.74516	20
Q19	4.8000	.69585	20
Q20	4.0500	.68633	20
Q21	4.7000	.73270	20

Table 7 shows the results of the respondents agreed that the NFRs also given attention during the prioritization in Agile projects. Q19 (Usability) has the highest mean values (mean=4.8000). The mean for Q16 (Scalability) has the lowest mean value (mean=4.0000).

5. DISCUSSION

This section discusses the most important results and considers possible threats to the validity of the study. The answers to Q8 were subjected to a more detailed analysis. As shown in Figure 1.1, the most common answer was that RP is first implemented at the sprint/iteration planning meeting. This was the sole answer to this question, as 18 respondents reported using RP at the sprint/iteration planning meeting. The respondents also stated that RP is used at the beginning of the software project and during sprint/iteration as well. As for RP at the beginning of the project, this is typically considered an initial attempt, and is later reinforced by RP conducted before or during iterations.

As for prioritization aspect, business value was reported as most important, but other aspects (important, complexity, and cost) are considered as well by many organizations. With respect to RP techniques, the respondents seem to rely on simple techniques like MoSCoW or cost-value ranking. Cumulative voting also one of the techniques used by the organizations. The more sophisticated Kano Model is seldom used in respondents' teams. It seems to confirm the earlier observations by [19].

For Q11, the results indicate that RP often involves PO, Scrum master and customer representative. In Q7, the criteria used to select people to RP tasks, it was found that the knowledge about business goals is the criteria most commonly selected while prioritizing the requirements or user stories, followed by experience in Agile development. The survey study also revealed that other Agile team members also influence the prioritization process. The final decision, however, mostly belongs to the PO.

Some results were quite surprising with the respect to the principles and guidelines of Agile methods, in particular Scrum, which turned out to be the most commonly used method by survey respondents. For example, Scrum Master was reported, as RP respondents not even half of respondents, despite the fact that Scrum Guide [4] assigns several responsibilities to this role, including finding techniques for effective Product Backlog management and helping Product Owner to arrange the Product Backlog to maximize value.

The most important contribution in this study is the researchers intended to recognize the importance of NFRs in ASD projects, as well as to identify the up-to-date practices and techniques used in this area especially in Malaysia. The additional comments and knowledge sharing given by the respondents who were participating in this survey study also can strengthen the obtained findings in this study.

Additionally, based on the literature review and based on the researches done by few researchers [12] [41] [44] they agreed that NFRs have been ignored in ASD and NFRs have become an important research area, mainly due to the abundance of project failures caused by neglecting quality attributes related to the user values. They also claimed that NFRs are nearly always neglected and postponed to the later stage during the prioritization process. However, based on the findings gained in this study, most of the respondents stated that they were giving attention to the NFRs at the early stage of the RP to avoid any circumstances at the later stage of the software development. In addition, from the results of this survey study, even though the practitioners have also given special attention to NFRs during the RP process, however, not all the NFRs attributes

giving much attention due to the time restriction in developing the Agile projects. A few respondents also claimed that this occurs by default, especially when the team members have strong experience in software development. One respondent also stated that when the analysis team focuses on the end user and the final shape of the features, this causes several problems, mainly because of lack of quality of delivered user stories or requirements by the customers due to ignorance of NFRs itself.

5.1 Threats to validity

Despite following validity procedures described in Section 3.5, several limitations and threats to validity should be noted.

Internal validity: The researchers used a non-random selection of survey respondents (via social media interest groups and direct contact), which could introduce additional unknown variables. In particular, expert sampling is a form of non-random selection technique that does not rely on a particular theory indicating the number of respondents [40]. Therefore, the subjective and nonprobability nature of their selection impose the limitation to perform inductive generalization of the obtained results. However, considering the variety of inclusion criteria to be simultaneously met by the respondents, covering areas such as position and years of professional experience, this technique is claimed to deliver relevant information if the questions precisely correspond to the respondents' expertise [41]. Distribution through social media groups is a channel that prevents us from determining how many people received the invitations. This also incorporates an element of self-selection – the researchers were not in any way able to force them to fill the survey questions, thus it relied on individual decision to participate.

External validity: The most relevant threats from this category are the number of respondents and their heterogeneity. The relatively small number and certain observations regarding respondents' demographics suggest that in spite of efforts to reach people from various company types and application domains, it is difficult to ensure that a sample is representative for the whole population in Malaysia. Moreover, even if it is representative for Malaysia IT industry, there can be differences between different states in Malaysia. The limited experience of significant part of respondents can also be considered a threat; however, the survey questions mostly concerned facts related to their work and did not require significant expertise.

Construct validity: This survey study is associated with mono-method bias, as the only source of data are the answers of survey respondents. By making anonymous survey, the researchers tried to minimize threats of guessing answers and providing false, “better-looking” answers, but the researchers cannot totally exclude such possibilities. In addition, the survey questions were based of literature sources, but the design itself included decisions that were at least partially subjective (e.g., final selection of pre-defined answers).

6. CONCLUSION

RP is an important task, having impact on subsequent software development activities. This study provides an update on how RP is done in practice based on survey responses gathered from 20 IT industry practitioners including few academicians (knowledge experts) in few parts of Malaysia. As RP is an activity directly contributing to business value delivery, it is important to identify its current state of practice, based on industrial evidence. The findings of this study can be used by practitioners to make decisions about RP activities for IT projects they participate in, and by researchers to plan more focused studies investigating the causes and contextual factors behind the practices declared by the respondents. Regarding RQ1, the results show that RP is mostly done at sprint/iteration planning meetings. As for RQ2, the results confirm the primary importance of business value associated with particular requirements, but at the same time show significant importance of aspects essential from customer's point of view like the important of the requirements, complexity and cost of the software. Simple RP techniques, not requiring advanced competencies like MoSCoW and cost-value ranking, are the most commonly used by the respondents in this study. Regarding RQ3, the results show that in addition to the customer's point of view and focusing on business value, the participation of customer's representatives is mutual. Such representatives are selected due to their particular roles in the development team and/or competencies like knowledge about requirements. Besides, for RQ4, it is relating to NFRs in Agile projects. Due to the time restrictions in producing software in Agile projects, the NFRs or user stories are often ignored for this and other reasons. However, it is important for the practitioners to pay much more attention to NFRs during the prioritization process in order to produce high-quality software. This would also help to reduce the possibility of rework on the tasks in

ASD, which would increase the cost and time consequently. Therefore, possible future work includes a more in-depth analysis of rationales behind RP practices used and their consequences; using other research methods like the case studies; and attracting more respondents from other countries to increase the accuracy of the results. In particular, reported practices that potentially conflict with the guidelines of Agile methods appear to be an interesting direction for future investigation and study.

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