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Examining Usability Activities in Scrum Projects – A Survey Study

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Abstract

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Over the past decades, usability techniques have been introduced into software development practices. At the same time many development organizations have started to use the agile development process – Scrum – to plan and organize their software projects. Little is known about how usability activities are used in Scrum projects and therefore a survey was distributed worldwide to explore this topic. The results from the study shed new light on how IT professionals rate the usability techniques used in Scrum and if the usage of one technique is correlated with other techniques. The results indicate that the most commonly used usability technique in Scrum is workshops, followed by user stories, lo-fi prototyping, interviews and meetings with users, all used by more than half of the participants. A highly ranked usability technique by the IT professionals is formal usability evaluation with users, which is interesting since that technique is not commonly used.

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1. Introduction

Scrum, as one of the agile software development processes, has been a topic of much discussion in the software community over the last few years (Paulk et al., 2009). The focal aspects of Scrum are simplicity and speed (Abrahansson et al., 2003). Scrum, which has been used to develop complex software systems since the early 1990s, is not only a process or a technique for building software systems; rather, it is a framework within which you can employ various processes and techniques (Schwaber & Sutherland, 2011). Now, more and more companies and organizations have shown a great interest in Scrum and invested considerable time and money in promoting the framework in practical applications.

Meanwhile, usability had been emerged during the mid 1980s, and was accepted broadly in the 1990s by the software industry. This was partly as a response to the new challenges that web-based software - to be used by a large number of diverse users - put on developers. The body of knowledge of usability is large and includes various perspectives, from usability engineering to more context-oriented approaches (Bygstad et al., 2008).

Researches have been trying to integrate the concept of usability into industry for the past decade. Venturi & Troost (2004) introduce how User-Centered Design (UCD), one of the main approaches in usability field, is integrated into industry. Others, such as Begstad et al. (2008), investigate the relationship between usability and several software development methodologies, such as rational unified process XP/Agile methods and Microsoft solutions framework.

However, there is less research on usability activities in Scrum process. This study is aim at investigating, through an online survey among IT companies and organizations, the integration of usability activities into Scrum development process in current industry practice. Four research questions are list below:

RQ1: How is Scrum practiced in industry?

RQ2: Are there any hindrances when integrating usability activities into Scrum framework?

RQ3: What usability activities are used in Scrum process?

RQ4: If and how are users involved in Scrum process?

2. Background and related work

2.1. Agile

In February 2001, 17 software developers met at the Snowbird, Utah resort, to discuss lightweight development processes. They published the Manifesto for Agile Software Development to define the approach now known as agile software development.

Well-known agile software development processes include:

- Agile Unified Process (AUP)
- Extreme Programming (XP)
- Dynamic Systems Development Method (DSDM)
- Scrum

Most of these agile methods promote development, teamwork, collaboration, and process adaptability throughout the life cycle of the project.

Agile methods break tasks into small increments with minimal planning, and do not directly involve long-term planning. Iterations are short time frames (called timeboxes) that typically last from one to four weeks. Each iteration involves a team working through a full software development cycle including planning, requirements analysis, design, coding, unit testing, and acceptance testing when a working product is demonstrated to stakeholders. This minimizes overall risk and allows the project to adapt to changes quickly. Stakeholders produce documentation as required. Iteration may not add enough functionality to warrant a market release, but the goal is to have an available release with minimal bugs at the end of each iteration. (Beck, 1999)

2.2. Scrum

2.2.1. What is Scrum

Scrum is not a process or a technique for building products; rather, it is a framework within which you can employ various processes and techniques. The role of Scrum is to surface the relative efficacy of your development practices so that you can improve upon them while providing a framework within which complex products can be developed. (Schwaber & Sutherland, 2011)

2.2.2. Scrum Theory

Scrum, which is grounded in empirical process control theory, employs an iterative, incremental approach to optimize predictability and control risk. Three pillars uphold every implementation of empirical process control. (Schwaber & Sutherland, 2011)

Scrum Framework:

Roles:

- Product owner
- ScrumMaster
- Team

Ceremonies:

- Sprint planning
- Sprint review
- Sprint retrospective
- Daily scrum meeting

Artifacts:

- Product backlog
- Sprint backlog
- Burndown charts(Schwaber & Sutherland, 2011)

The Product Backlog lists the requirements for the product being developed. It is the master list of all functionality desired in the product, and each item in the Product Backlog has a description, a priority and an estimate of the effort needed to complete it.

The Release Plan describes the goal of the release, the highest priority items in the Product Backlog, the major risks, and the overall features and functionality that the release will contain. It establishes a probable delivery date and cost, assuming that nothing changes.

A Sprint is one iteration of a month or less that is of consistent length throughout a development effort. Only the Product Owner has the authority to cancel the Sprint. It suggests that Sprints may be 2-6 weeks long. (Sutherland and Vodde, 2008)

The Sprint Planning Meeting is when the iteration is planned. It is time boxed to eight hours (for a one month Sprint) and has two parts: determining what will be done in the Sprint and determining how the Team is going to build the product increment during the Sprint.

The Sprint Backlog is an output of the Sprint Planning Meeting. It consists of the tasks for the Sprint derived from the Product Backlog. “Done” defines what the Team means when they commit to “doing” a Product Backlog item in a Sprint. A completely “done” increment includes all of the analysis, design, refactoring, programming, documentation and testing for the increment and all Product Backlog items in the increment.

The Sprint Backlog Burndown is a graph of the amount of Sprint Backlog work remaining in a Sprint across time in the Sprint. The Release Burndown graph records the sum of remaining Product Backlog estimated effort across time.

The Sprint Review meeting is a four-hour time-boxed meeting (for one-month Sprints) that is held at the end of a Sprint where the Team presents the functionality done in the iteration to the Product Owner and other stakeholders. The Team demonstrates and discusses the work done in the Sprint.

The Sprint Retrospective meeting is a three-hour time-boxed meeting (for one-month Sprints) held after the Sprint Review and prior to the next Sprint Planning meeting

where the Team discusses what went well in the last Sprint and what can be improved for the next Sprint.

The Daily Scrum is a time-boxed, 15-minute meeting used to inspect progress toward the Sprint goal and to make adaptations that optimize the value of the next workday. During the meeting, each Team member explains:

- What he or she has done since the last Daily Scrum?
- What he or she is going to do before the next Daily Scrum?
- What obstacles are in his or her way?

The ScrumMaster is the specific individual responsible for ensuring that Scrum values, practices and rules are enacted and enforced.

Some would characterize the ScrumMaster as the project manager who leads by coaching, teaching and supporting the Team rather than directing and controlling.

The Product Owner is the specific individual responsible for managing and controlling the Product Backlog. The Product Owner sets the priority for each item in the Product Backlog. The Product Owner may represent multiple customer constituencies but has the responsibility and authority to reconcile conflicting requirements and determine the business value associated with each item in the Product Backlog.

The Development Team is typically seven people, plus or minus two. Teams should have all the skills needed to create an increment. (Paulk et al., 2009)

2.3. User-Centered Design (UCD)

ISO 13407 Human centred design process for interactive systems states that User-Centered Design “is an approach to interactive system development that focuses specifically on making systems usable. It is a multidisciplinary activity” (iso 13407, 1999).

There are 12 principles for successful user-centred system design, which was presented in a paper by Gulliksen et al., (2003).

1. “User focus
2. Active user involvement
3. Evolutionary systems development—the systems development should be both iterative and incremental
4. Simple design representations
5. Prototyping
6. Evaluate use in context
7. Explicit and conscious design activities
8. A professional attitude
9. Usability champion—usability experts should be involved early and continuously throughout the development lifecycle
10. Holistic design—all aspects that influence the future use situation should be developed in parallel
11. Processes customization—the UCSD process must be specified, adapted and/or implemented locally in each organization.

12. A user-centred attitude should always be established.” (Gulliksen et al. 2003)

2.4. Related Work

Some software development theorists believe that usability activities are easily integrated into the formal frameworks. The iterative and incremental structure of software development methodologies ensures continuous communicational and validation by users (Jacobson et al., 1999; Stapleton, 2003).

Venturi, Troost and Jokela (2006) investigated UCD adoption. During the research, they designed and carried out a web survey on 83 UCD practitioners during a time frame of 40 days. The results of the research showed that, the top five UCD methods were user interviews, expert/heuristic evaluation, qualitative usability test, hi-fi prototyping, and lo-fi prototyping. Overall, the most frequently used evaluation methods are qualitative, allowing rapid feedback to the design activities. The results also pointed out that UCD activities are typically carried out during the early phases of the product life cycle.

Another survey of the usability professionals was conducted in Sweden by Gulliksen (Gulliksen et al. 2004). The results showed that the methods that received the highest rating were those involving users. Methods such as expert-based evaluations, benchmarking and questionnaires, that do not involve users, received the lowest rankings. It also indicated that the supports from every stage of the chain, such as the program manager, the team and the management, are essential for including usability considerations in projects.

Bygstad, Ghinea, and Brevik (2008) surveyed 78 general or IT managers to investigate the relationship between software development methodologies and usability activities. In their findings, there is a gap between intention and reality: the companies express interest and concern of usability aspect of their products, but they are less willing to use resources on it in industrial projects with strong time and cost pressures. The results of their survey also revealed that companies perceived usability activities and software development methods to be integrated, which the authors believed is a positive development.

3. Research Methods

3.1. Overview

The main research method in this study was a survey. To develop the survey, two informal interviews were conducted. Furthermore two pilot studies were implemented after the release of the first version of the survey. Based on the feedback of the pilot studies, the survey was revised before it was distributed. The target group of the respondents of this survey is IT professionals who have the experience on Scrum process and usability.

3.2. Informal interview

In order to achieve deeper understanding of the practical use of Scrum method in software development process, informal interviews are scheduled with two experienced experts of Scrum method. These two interviews contribute the development of the survey.

3.3. Survey content

The survey is constructed in QuestionPro, which is an online survey tool (<http://www.questionpro.com/>). It includes 41 multiple-choice questions and 5 open questions.

The questionnaire (see Appendix 2) is grouped into the following four sections:

- (1) Information of the company/organization and experience of the participant
- (2) Scrum process in one project
- (3) Information of usability activities that have been used in the Scrum project
- (4) Open questions on usability activities using in Scrum process.

The aim of the first section was to gather background information of the respondents and their work environment. The second section was planned to collect the data about how Scrum process was working in real industrial. The third section is designed to get information from the respondents' experience with usability techniques, if and when they involve users and how the users are selected. In the final section comments on the integration of usability activities into the Scrum process were gathered.

3.4. Pilot study

After the first version (Appendix X) of the survey has been released, two pilot studies were done. The participants of the pilot test used to be PhD students of HCI group in Uppsala University and have the experience of using Scrum recently.

To estimate the approximate time of taking the survey, the first pilot test is timed without any interruption. An interview is conducted after the test. Think aloud method is used in the pilot test 2 to detect more problems of the survey questions.

Significant problem was founded by conducting this pilot study. Questions on the usability activities in the first version of the survey were listed as a matrix. (See Figure 3.4) In the pilot study, participants felt that too much mental workload was needed during this usability activities' part. So all the techniques' questions were asked one by one in the final version. (Appendix 2)

	Not at all	Once a year or less	2-6 times a year	7-12 times a year	2-3 times a month	Once a week or more
Usability goals	<input type="checkbox"/>					
Scenarios	<input type="checkbox"/>					
Use case modeling	<input type="checkbox"/>					
Personas	<input type="checkbox"/>					
Requirement analysis	<input type="checkbox"/>					
Think-aloud w users	<input type="checkbox"/>					
Evaluation in usability lab	<input type="checkbox"/>					
Heuristic evaluations	<input type="checkbox"/>					
Digital Prototyping	<input type="checkbox"/>					
Lo-fi prototyping	<input type="checkbox"/>					
Analyzing user group	<input type="checkbox"/>					
User stories	<input type="checkbox"/>					
Storyboards	<input type="checkbox"/>					
Interviews	<input type="checkbox"/>					
Questionnaires	<input type="checkbox"/>					
Focus group	<input type="checkbox"/>					
Work shop	<input type="checkbox"/>					
Meeting with users	<input type="checkbox"/>					
Field studies	<input type="checkbox"/>					

Figure 3.4: Matrix Version of Questions about Usability Techniques

3.5. Survey distribution

3.5.1. The first distribution

The initial idea was to send the survey to all the software development companies in Uppsala area. The Uppsala Tax Office provided the information of all 699 companies, but only with 108 of them had email addresses. All the rest 591 companies' email addresses had been searched on Google. Only 215 out of them had been found.

There were 323 emails were sent out one by one in case they were prohibited as spam on 25th April 2011. But 47 of them were reported back as undelivered mails. The rest of 306 emails were resent on 2nd May 2011. During these two weeks, which from 25th April to 6th May, there were totally 49 companies that replied. Only 8 of them responded the survey and 41 of them replied by email to say that they do not use Scrum in their software development process. See Figure 3.5.1 explains this process.

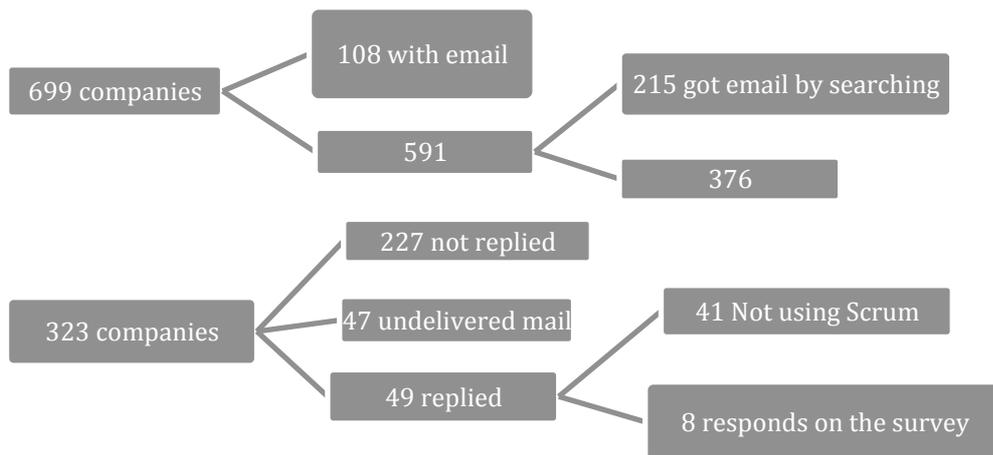


Figure 3.5.1 The First Distribution of Survey. Figure describes the first distribution of the survey.

3.5.2. The second distribution

Since there were only 8 respondents had responded on 5th of May, the “Uppsala area” idea apparently does not fit the study. Instead, three ways were used to send the survey link on the second distribution.

First, an email list of 68 valid email addresses of software development companies in Stockholm was provided by Lokaldelen, which is a website offers the information of companies in Sweden (<http://www.lokaldelen.se/>).

The second way of sending the survey was through contact persons. The examiner of this thesis project did send the survey link to the interviewees of one of her studies, which is related to Scrum. The two participants of the pilot studies also help to send the survey link to their contact persons.

In order to get more responds, the survey link was posted on an online discussion group, Scrum Alliance, which is a forum for Scrum professional. (<http://groups.google.com/group/scrumalliance>) The post content is in Appendix X.

When the first and the second distributions were combined, the period was 40 days, from 25th April 2011 to 4th June 2011, totally 49 respondents responded to the survey and 35 of them completed all questions in it.

4. Results

This chapter presents the results of the survey and consists of five parts:

- Respondents' profile
- Organization profile
- Scrum practice
- Usability activities
- Scrum and UCD integration

4.1. Respondents' Profile

There were totally 49 respondents that finished the first section - Information of the company/organization and experience of the participant - in the survey.

About 71% of the respondents were male (N=49, 35 men and 14 women) and 72% of them had a M.Sc. or B.Sc. degree. Out of 49 respondents, 14 of them were certified ScrumMaster.

The respondents were asked about their main job task, the result is shown in Figure 4.1. It shows that 29% of respondents had programming as their main task and 20% responded that the usability engineering is their main role. Around 18% of respondents played the management role in projects. None of them did the software testing or evaluation work as their main job task (shown in Figure 4.1).

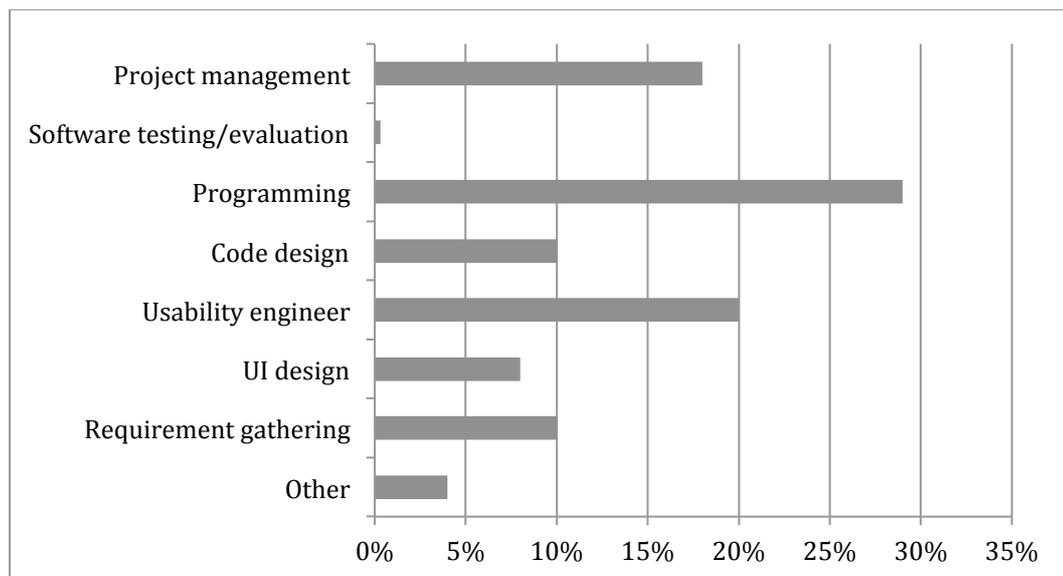


Figure 4.1: Main Job Task of Respondents (N=49). Figure shows the main job tasks of the respondents.

4.2. Organizations' profiles

In order to get more information of Scrum's using environment in real industries, respondents were asked about the size and type of the business that the company/organization was running.

4.2.1. Size of Companies/Organizations

There were only 10% of respondents worked in the companies that had less than 10 employees. About 2/3 of respondents' companies had employed more than 50 employees (Figure 4.2.1).

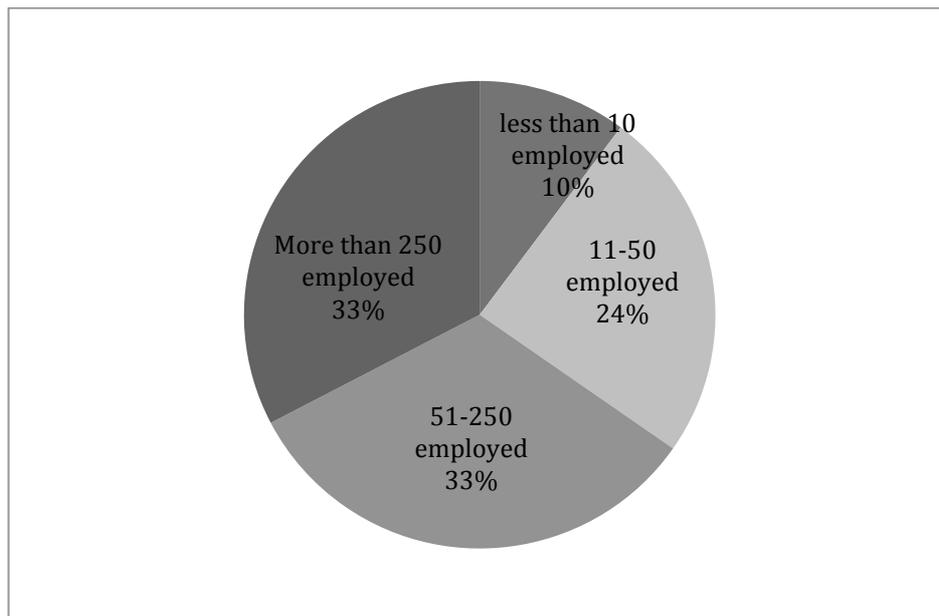


Figure 4.2.1: *Size of Companies/Organizations (N=49).* Figure shows the size of the companies/organization that the respondents were employed.

4.2.2. Type of Business

Totally 48 respondents answered the question about the type of business and 1 did not reply. Over 40% of these companies/organizations worked with e-commerce area (see Table 4.2.2). Respondents also reported some "Other" business types that were not listed in the question, which included betting and product manufacturer.

Table 4.2.2: *Type of Business of Companies.*

Type of business	Percentage
Internet, e-commerce	44%
Computer industry	10%
Other	10%
Telecommunication	8%
Health and medicine sector	6%
IT Consultancy	6%
Financial sector	6%
Game	4%
Usability, HCI	2%

Authority	2%
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4.3. Scrum Practice

4.3.1. Other Development Processes Used in Parallel to Scrum

Eleven respondents reported that Scrum was the only software development process that was used in their companies/organizations. Around 33 out of 49 respondents confirmed that they used other software development processes in parallel to Scrum (See Table 4.3.1). Nearly half of them used their own model, which was developed by the company. One respondent mentioned that his company constantly adapted its own process. It was closely based on Scrum, but had elements of Kanban in some circumstances, and had several other elements from XP (esp. pair programming).

Table 4.3.1 Other Development Process Used in Parallel to Scrum

Other development process in parallel to Scrum	Percent (N=33)
Own model (developed within the company)	46%
Waterfall model	33%
XP (Extreme programming)	30%
Kanban	18%
RUP (Rational Unified Process)	15%

4.3.2. Background of one Representative Scrum Project

With the purpose of getting validity result on how usability activities are integrated in the Scrum process, the respondents were asked to select one Scrum project that they were involved in and finished recently in section 2 of the survey.

Totally 47 respondents finished this part of the survey. Seventy percent of them had simultaneously been working on multiple projects for the last 3 months.

When asked about the type of the projects that they had selected, about 40% responded that the projects were web related, 26% of the projects were software products of sale and 17% were software systems for clients. Furthermore, 15% were internal software systems and 2% responded working on other types of systems, including embedded software systems and hardware systems. (See Figure 4.3.2).

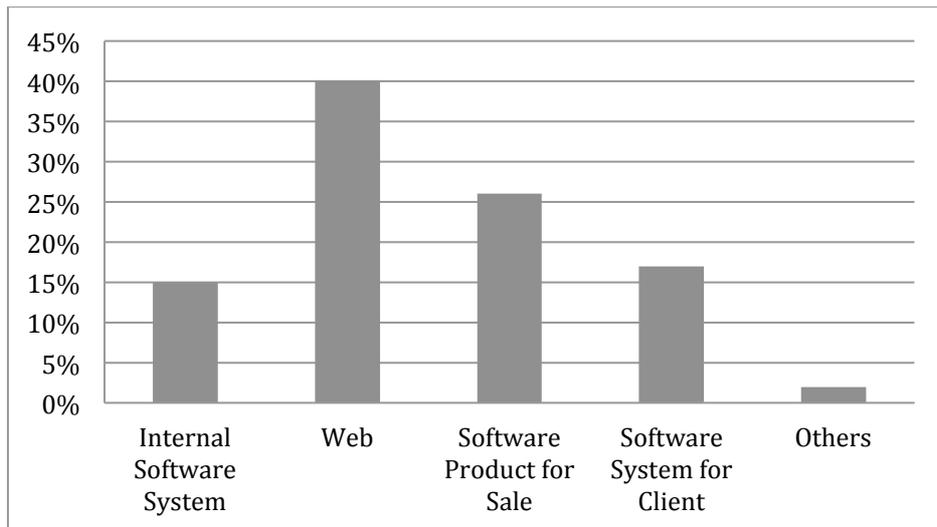


Figure 4.3.2: *Type of System (N=47).* The figure shows the types of project that the respondents had selected.

4.3.3. Scum practice

In order to measure whether the Scrum process is used by the basic rules of Scrum or not in these projects, some standard questions on Scrum were listed, such as: what is the size of the team, how long did each sprint usually last and some basic Scrum activities whether be practiced or not.

Around 83% of respondents replied that each sprint in these projects usually last between 2 weeks to 4 weeks, which is a proper duration based on the Official Scrum Guide. (Schwaber & Sutherland, 2011) About 57% respondents replied that there were 5 to 9 people in a project team, which is an appropriate size for Scrum project.

Table 4.3.3 shows the results on fundamental activities of the Scrum development process. 8 out of those 10 activities were practiced up to 80% or more. The activities that had been least used was burn-down charts, which should be used to measure remaining Sprint Backlog items across the time of a sprint. There were only 55% of the respondents mentioned that this is practiced.

Table4.3.3: Fundamental activities of the Scrum process that had been involved in the projects.

Scrum Activities	Percent (N=47)
The role of Product Owner is used	83%
The role of ScrumMaster is used	79%
The role of Team is used	89%
The Sprint planning is used	96%
The Sprint review is held	77%
The Sprint retrospective is performed after every sprint	72%
Daily scrum meeting is held	85%
Product backlog (PB) is used	81%
Sprint backlog is used	81%
Burn-down Charts are used	55%

According to the opinion of the respondents themselves, on Question 23 (do you think you use Scrum by the book?), only 38% thought they use a formal Scrum. And the rest 62% of respondents gave many comments on why they don't use Scrum by the book or the difference between their "Scrum" and the formal Scrum. Some comments from the respondents are listed below:

"Our company have worked with Scrum for many years and we have developed our way for product process."

"We don't have a by the book product owner, but a pm that acts as a product owner"

"Long sprints, a fair amount of upfront planning and specifications, not much focus on working software, and a fairly absent product side (did go a long time without a Product Owner)"

4.3.4. Software Quality Criteria

Respondents were asked to rate the importance of software quality criteria of the projects they had selected. According to ISO 9126 standard (ISO 9126, 2001), software quality is classified by a set of six characteristics, which are referred as Reliability, Portability, Usability, Efficiency, Maintainability and Functionality. Table 4 presents the explanations of these six characteristics.

Table 4.3.4.1: Software Quality Criteria, ISO 9126 (ISO, 2001)

Characteristics	Explanations
Reliability	The efficiency of software to manage its level of performance under certain conditions.
Portability	The competency of software to be transferred between environments.
Usability	The efficiency of software to be usable by an individual estimate.
Efficiency	The level of performance of software plus the resources used under certain conditions.
Maintainability	The efficiency of software to make specified modifications.
Functionality	The efficiency of software to endure a set of functions under certain conditions.

The purpose on this question is to get increased comprehension of the projects. All these six criteria effect the adoption of usability activities in Scrum project.

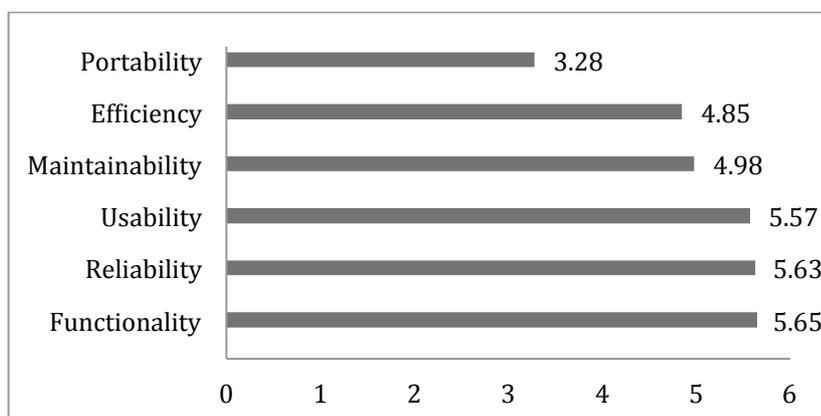
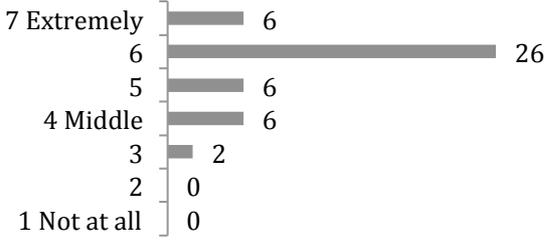
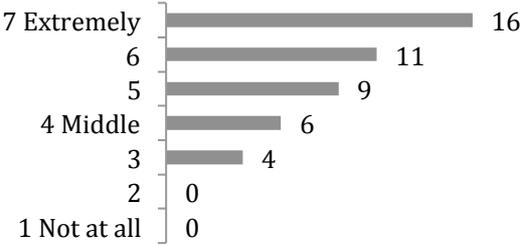
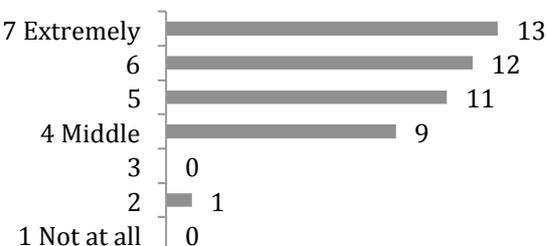
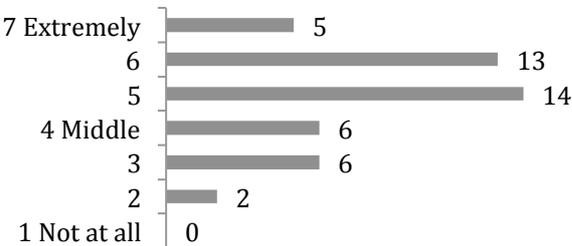
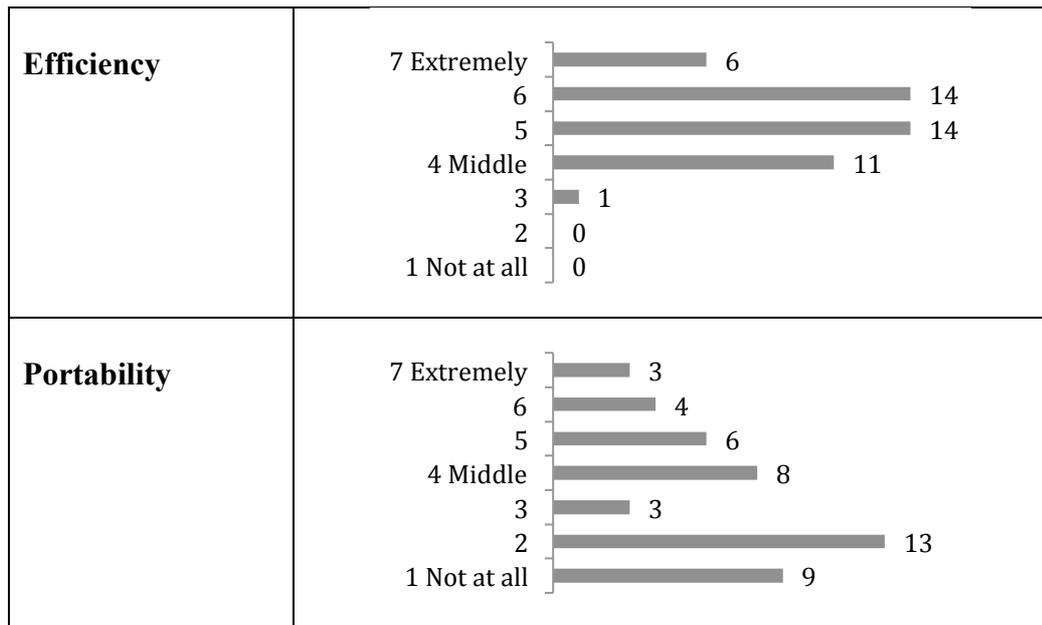


Figure 4.3.4: The Mean Value of the Importance of Software Quality Criteria

There were 46 respondents that rated the importance of these quality criteria (1=Not important at all, 2, 3, 4=Middle, 5, 6, 7= Extremely important). The mean value of these six criteria is shown in Table 4.3.4.2. The most important quality criteria of the project is functionality; the following are reliability and usability. Figure 4.3.4 indicates the detail rating data of each quality criteria by bar chart.

Table 4.3.4.2: Rating for each software quality criteria.
(The number on the bar refers to the number of respondents)

Quality Criteria	Importance of Software Quality Criteria														
Functionality	 <table border="1" data-bbox="715 622 1262 869"> <tr><td>7 Extremely</td><td>6</td></tr> <tr><td>6</td><td>26</td></tr> <tr><td>5</td><td>6</td></tr> <tr><td>4 Middle</td><td>6</td></tr> <tr><td>3</td><td>2</td></tr> <tr><td>2</td><td>0</td></tr> <tr><td>1 Not at all</td><td>0</td></tr> </table>	7 Extremely	6	6	26	5	6	4 Middle	6	3	2	2	0	1 Not at all	0
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6	26														
5	6														
4 Middle	6														
3	2														
2	0														
1 Not at all	0														
Reliability	 <table border="1" data-bbox="715 925 1235 1171"> <tr><td>7 Extremely</td><td>16</td></tr> <tr><td>6</td><td>11</td></tr> <tr><td>5</td><td>9</td></tr> <tr><td>4 Middle</td><td>6</td></tr> <tr><td>3</td><td>4</td></tr> <tr><td>2</td><td>0</td></tr> <tr><td>1 Not at all</td><td>0</td></tr> </table>	7 Extremely	16	6	11	5	9	4 Middle	6	3	4	2	0	1 Not at all	0
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Usability	 <table border="1" data-bbox="715 1227 1262 1473"> <tr><td>7 Extremely</td><td>13</td></tr> <tr><td>6</td><td>12</td></tr> <tr><td>5</td><td>11</td></tr> <tr><td>4 Middle</td><td>9</td></tr> <tr><td>3</td><td>0</td></tr> <tr><td>2</td><td>1</td></tr> <tr><td>1 Not at all</td><td>0</td></tr> </table>	7 Extremely	13	6	12	5	11	4 Middle	9	3	0	2	1	1 Not at all	0
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Maintainability	 <table border="1" data-bbox="715 1541 1287 1787"> <tr><td>7 Extremely</td><td>5</td></tr> <tr><td>6</td><td>13</td></tr> <tr><td>5</td><td>14</td></tr> <tr><td>4 Middle</td><td>6</td></tr> <tr><td>3</td><td>6</td></tr> <tr><td>2</td><td>2</td></tr> <tr><td>1 Not at all</td><td>0</td></tr> </table>	7 Extremely	5	6	13	5	14	4 Middle	6	3	6	2	2	1 Not at all	0
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6	13														
5	14														
4 Middle	6														
3	6														
2	2														
1 Not at all	0														



4.4. Usability Activities

4.4.1. Rating of Usability Activities in Software Development Process with Scrum Process

Participants were asked about which usability technique they had used in the Scrum project and how these techniques were worked. There were totally 13 popular usability techniques listed in the survey. The description of each technique that the respondents get in the survey is shown in Appendix 1.

Totally 41 respondents answered this part of survey. Around 35 of them completed all the questions. There were five detail questions on one specific usability technique when respondents replied that he/she had used this technique in his/her project.

4.4.1.1. Which Usability Techniques Are Used in the Scrum Project

Every technique was listed to asking the respondents if they had used it in their Scrum project or not. The result in Table 4.4.1.1 shows that the workshop is the most common usability technique. Fairly common are user stories, lo-fi prototyping, interviews and meetings with users.

Table 4.4.1.1 Percentage of Usage of Usability Techniques

Methods	Used	Total	Percentage
Workshop	30	41	73%
User stories	23	36	64%
Lo-fi prototyping	20	36	56%
Interview	25	46	54%
Meeting with users	21	40	53%
Scenarios	17	36	47%
Digital Prototyping	17	36	47%

Personas	15	35	43%
Field study	17	40	46%
Usability goals	15	38	40%
Formal usability evaluation with users	11	36	31%
Informal usability evaluation with users	8	35	23%
Questionnaire	9	42	21%
Heuristic Evaluations	4	35	11%

4.4.1.2. Rating on How Useful of Each Usability Techniques

The respondents were asked to rate those usability techniques that they had used in the projects.

Table 4.4.1.2 The Rating of the Usability Activities by the Respondents
 In Figure 4.4.1.2 results on how useful the respondents find these techniques are listed. N, which represents the number of respondents who had used the technique in their projects, is labeled for each technique in the table. The result reveals that 73% of the respondents thought that formal usability evaluation with users was useful, 59% of them saying that field study and digital prototyping were useful. Around half of the respondents said usability goals, lo-fi prototyping worked very well. And the respondents also replied fairly well on interviews (60%), workshops (62%), Meetings with users (57%), scenarios (59%), personas (40%) and user stories (52%). None of these techniques were rated as very bad.

Techniques	Very good	Fairly good	Neither good or bad	Fairly bad	Very bad	N
Interview	28%	60%	8%	4%	0	25
Questionnaire	0	33%	56%	11%	0	9
Workshop	38%	62%	0	0	0	30
Meeting with users	38%	57%	5%	0	0	21
Field study	59%	29%	12%	0	0	17
Usability goals	53%	20%	27%	0	0	15
Scenarios	35%	59%	0	6%	0	17
Personas	40%	40%	13%	7%	0	15
User stories	26%	52%	13%	9%	0	23
Digital Prototyping	59%	30%	12%	0	0	17
Lo-fi prototyping	50%	25%	20%	5%	0	20
Formal usability evaluation with users	73%	18%	9%	0	0	11
Informal usability evaluation with users	25%	75%	0	0	0	8
Heuristic Evaluations	25%	50%	0	25%	0	4

4.4.1.3. Frequency of Using Usability Techniques

Figure 4.4.1.3 analyzes the frequency of using these techniques during one Scrum project. The highest score in rating and is used the most often, once a week or more, is user stories (74%). And the second place is lo-fi prototyping (40%). About 75% of respondents who had used questionnaire technique said it is used for only once a year or less, and Personas was also used once a year or less in 38% of the cases. The rest of other techniques were used mostly 2 to 6 times a year.

Table 4.4.1.3 Frequency of Using Usability Techniques

Technique	Once a week or more	2-3 times a month	7-12 times a year	2-6 times a year	Once a year or less
Interview	9%	13%	22%	44%	13%
Questionnaire	0	0	0	25%	75%
Workshop	7%	7%	25%	50%	11%
Meeting with users	15%	10%	30%	35%	15%
Field study	0	0	7%	53%	40%
Usability goals	21%	7%	29%	29%	14%
Scenarios	24%	24%	18%	24%	12%
Personas	6%	19%	13%	25%	38%
User stories	74%	13%	9%	4%	0
Digital Prototyping	24%	12%	6%	35%	24%
Lo-fi prototyping	40%	20%	15%	20%	5%
Formal usability evaluation with users	0	0	18%	82%	0
Informal usability evaluation with users	0	25%	13%	50%	13%
Heuristic Evaluations	0	25%	0	50%	25%

4.4.1.4. Frequency of Involving Users in Usability Techniques

Respondents were asked about the frequency of involving users in each usability technique that they had used in the project. “Not applicable option” was added in the question options because that “Heuristic evaluations” is supposed to be not involving any users. For several techniques, such as meeting with users, formal usability evaluation with users and informal usability evaluation with users, users should be involved every time. But the result in Table 4.4.1.4 shows that only 70% respondents said that their projects involving user every time for “meeting with users”, 64% for Formal usability evaluation with users and 63% for Informal usability evaluation with users. User stories, which is the most frequent used technique in respondents’ projects (see Table 4.1.4.3), has the highest score (48%) of never involving user.

Table 4.4.1.4 Frequency of Involving Users in Usability Techniques

Technique	Every time	More than half of the case	In half of the case	Less than half of the case	Never	N/A
Interview	52%	22%	0	18%	4%	4%
Questionnaire	50%	13%	0	13%	25%	0
Workshop	18%	21%	11%	29%	21%	0
Meeting with users	70%	0	5%	20%	0	5%
Field study	67%	0	13%	13%	0	7%
Usability goals	7%	7%	14%	29%	36%	7%
Scenarios	23%	18%	0	23%	18%	18%
Personas	31%	0	19%	6%	31%	13%
User stories	17%	4%	4%	22%	48%	5%
Digital Prototyping	12%	12%	12%	24%	40%	0
Lo-fi prototyping	25%	10%	0	40%	25%	0
Formal usability evaluation with users	64%	0	9%	18%	9%	0
Informal usability evaluation with users	63%	0	38%	0	0	0
Heuristic Evaluations	0	0	0	0	0	100%

4.4.1.5. Which Group the Users Come From in Using Usability Techniques

Another question was to ask the respondents to describe which group the users usually came from when they were involved in using these UCD techniques. Figure 4.4.1.5 shows the details. There were 4 techniques got their highest score on “Own employees” and 8 on “Customers’ employees”. Only two techniques, personas and field study, had their highest score in using representative sample of users.

Table 4.4.1.5 Which group the users come from

Technique	Arbitrary sample of users	Representative sample of users	Own employees	Customers’ employees	Not Sure	Other
Interview	8%	38%	25%	46%	0	21%
Questionnaire	23%	8%	31%	23%	0	8%
Workshop	10%	15%	23%	26%	5%	8%
Meeting with users	12%	24%	8%	36%	8%	8%

Field study	9%	35%	13%	30%	0	9%
Usability goals	4%	16%	24%	32%	0	4%
Scenarios	0	10%	29%	24%	10%	5%
Personas	5%	40%	10%	20%	0	0
User stories	0	18%	21%	25%	0	0
Digital Prototyping	8%	21%	13%	25%	4%	0
Lo-fi prototyping	3%	24%	31%	21%	0	3%
Formal usability evaluation with users	0	18%	29%	29%	6%	6%
Informal usability evaluation with users	9%	18%	18%	36%	18%	0

4.4.2. Users Are Involved in Which Part of the Scrum Process

To gather more information about how user involvement has been done in a Scrum process, the respondents were asked to indicate which part of the Scrum process they had involved users. The result is shown in Figure 4.4.2. Nearly 40% of respondents reported that they involved user in the process of creating the Product Backlog. There were also more than 30% respondents that answered that their project involved users at the end of Scrum process. Only about 5% respondents said that users were involved in the process of creating Sprint Backlog and Sprint Retrospective.

In the other part of this question, six respondents had reported their opinion:

- “ (1) Before the development work started
- (2) In planning between sprints
- (3) In events separate from the sprints.
- (4) UX team had it's own tasks in parallel to the product development team, although the UX team was a part of that team also.
- (5) We deploy early and often UX and myself are in different teams. UX comes with input to our scrum planning/work.
- (6) They were not at all involved in the scrum process. ”

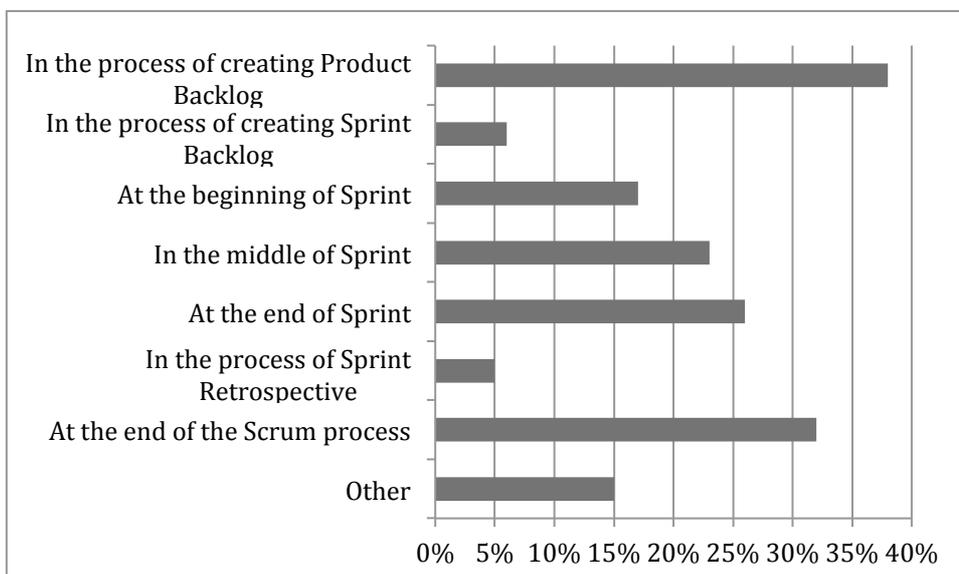


Figure 4.4.2 Rating on Which Part of the Scrum Process Involving User

4.5. Integration of Scrum process and UCD

Totally 35 respondents replied on this part of the survey. They were asked to describe the interest of the team in related to usability. These interests of usability activities are stated as four steps: skepticism, curiosity, acceptance and partnership. The explanation of these four steps is in Table 4.5.

Table 4.5 Descriptions of Four Steps of Interests of UCD Activities

Steps	Description
1. Skepticism	The team has never involved usability activities and the team is not interested in including usability activities.
2. Curiosity	The team starts to become curious about what usability activities can offer and would like to know more.
3. Acceptance	Usability activities are well understood and appreciated as an important part of the systems development when needed.
4 Partnership	Usability activities are a natural part of the process and undertaken by the team.

There were 11 out of 35 respondents believed that their teams were curiosity in usability and 10 respondents got the opinions on that usability is accepted by the teams, which is level three – Acceptance. (See Figure 4.5.1)

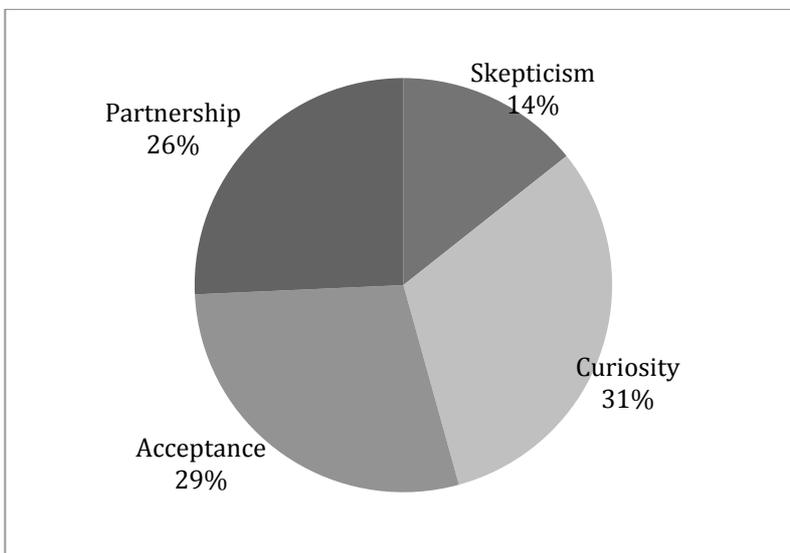


Figure 4.5.1 Interest of the Team in Relation to Usability

The last multiple-choice question was to ask the respondents to rate the degree on integration of UCD activities and Scrum process. The result is illustrated in Figure 4.5.2.

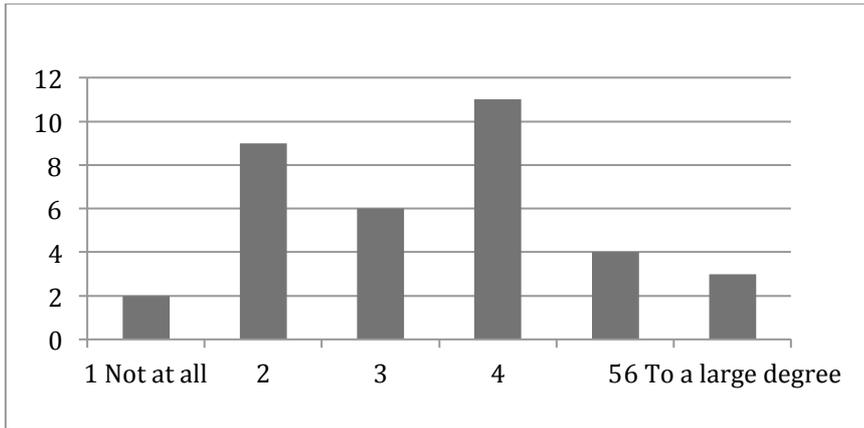


Figure 4.5.2 Rating on the degree of UCD activities are integrated with Scrum

4.6. Cross results

4.6.1. The difference of usability activities between partnership and skepticism

By walking through all the results of the survey, one interesting point is to see what usability techniques had been used by the team in the partnership step, which usability activities are a natural part of the process, and the skepticism step, which the team had never involved usability activities and the team is not interested in including usability activities. Furthermore, the difference between them is also valuable.

From the result in Figure 4.6.1, it is obvious to see that User stories got the highest score in both partnership and skepticism team. For usability evaluation, only one respondent in skepticism team said that his/her project did Informal usability evaluation with users, but there were 3 respondents in partnership team reported that their projects had conducted Formal usability evaluation with users. Besides the difference on usability evaluation with users, 4 respondents from partnership team mentioned that they had used Usability goals techniques but only 1 from skepticism team said that.

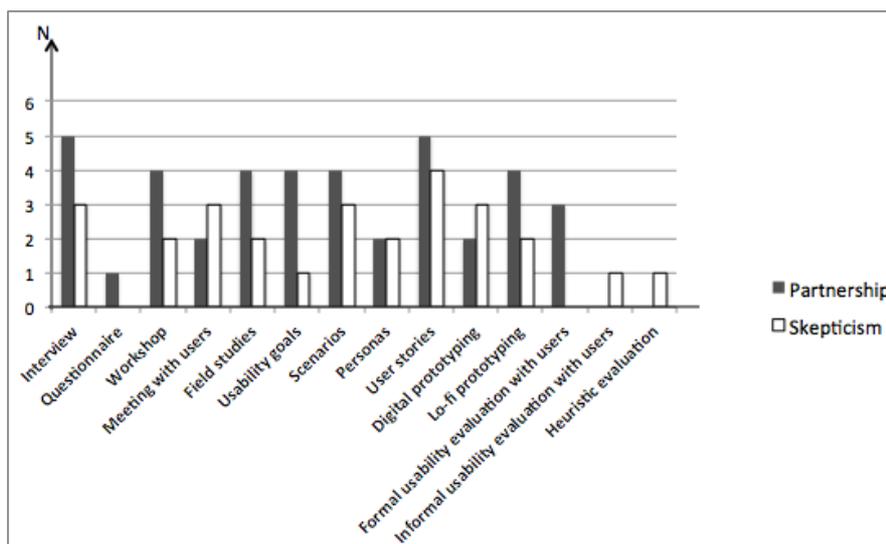


Figure 4.6.1 the difference of usability activities between partnership and skepticism

4.6.2. Integration Degree V.S. Application Type

Respondents were asked to select one Scrum project that they were involved recently and then answered the following questions about Scrum practices and usability activities of this project. Data had been collected from Question15 and Question43 to see that which degree of integration of usability activities and Scrum framework the respondents reported on which application type they were working with. The results in the table blow shows that “Website” and “Software system for a client” got a higher degree (3.6) than the other two application types, but they are not a high score since they only got 0.1 higher than the average score 3.5 (the total score is 7).

Table 4.6.2 Number of respondents that selected on Integration Degree and Application Type

Integrate degree	Internal software system	Website	Software product for sale	Software system for a client
Degree1	0	1	1	0
Degree2	2	1	4	1
Degree3	1	2	1	2
Degree4	1	6	2	1
Degree5	1	2	1	0
Degree6	0	0	1	1
Total Number	5	12	10	5
Average Degree	3.2	3.6	3.1	3.6

Does the application type affect the usability techniques selection? Respondents were asked about the application type on the Scrum project and the usability techniques they had used in the Scrum project. From the results of Chi-square tests on application type and all 14 usability techniques, there is no significant result shows that the application type affects the selection of any usability techniques. This implies that the usability techniques are found equally interesting regardless of area of application.

4.7. Correlation Among Usability Techniques

Some significant and interesting correlations were found among the usage of usability techniques in software development process with Scrum process. Results in Table 6 shows that there were totally 6 usability techniques, which had significant correlations with field studies, they are interviews ($r = .63, p < .01$), workshops ($r = .36, p < .05$), meetings with users ($r = .40, p < .05$), personas ($r = .36, p < .05$), lo-fi prototyping ($r = .36, p < .05$) and heuristic evaluation ($r = .52, p < .01$).

Interviews are significant correlated with meetings with users ($r = .41, p < .05$). Questionnaire is significant correlated with digital prototyping ($r = .37, p < .05$), formal usability evaluation with users ($r = .50, p < .01$) and informal usability evaluation with users ($r = .39, p < .05$). Workshops are significant correlated with personas ($r = .47, p < .01$). Usability goals are significant correlated with scenarios ($r = .43, p < .05$). Digital prototyping is significant correlated with heuristic evaluation ($r = .37, p < .05$). Lo-fi prototyping is significant correlated with personas ($r = .43, p < .05$) and formal usability evaluation with users ($r = .40, p < .05$).

User stories are the only usability technique that not significant correlated with any other usability techniques.

Table 4.7 Correlation among usability techniques

	Interviews	Questionnaire	Workshops	Meetings with User	Field Study	Usability Goals	Scenarios	Personas	User Stories	Digital Prototyping	Lo-fi Prototyping	Formal usability evaluation with users	Informal usability evaluation with users	Heuristic Evaluation
Interviews				*	**									
Questionnaire										*		**	*	
Workshops					*			**						
Meetings with User	*				*									
Field Study	**		*	*				*			*			**
Usability Goals							*							
Scenarios														
Personas			**		*						*			
User Stories														
Digital Prototyping		*												*
Lo-fi Prototyping					*			*				*		
Formal usability evaluation with users		**									*			
Informal usability evaluation with users		*												
Heuristic Evaluation					**					*				

* Represents that the correlation is significant at the 0.05 level

** Represents that the correlation is significant at the 0.01 level

5. Discussion

5.1 Scrum Process Practiced in Industry

The survey results demonstrate what kinds of practitioners were using Scrum in the industry. The number of male respondents (71%) is overwhelmingly more than female (29%). The reason for this imbalanced gender distribution might be that there were more male than female in software engineering industry. As for the educational background of the Scrum practitioners, 57% of them hold M.Sc. or upper degree. It illustrates that the Scrum practitioners do received higher level education.

For the organizations that were using Scrum in their software development lifecycle, the result shows that Scrum is more acceptable for big companies/organizations (more than 50 employees) than the smaller ones. This can be explained by the nature of Scrum framework, such as each Scrum team usually needs 5 to 9 people and each sprint usually lasts between 2 to 4 weeks. So there were too much time and human resources consuming for small companies/organizations.

Unexpectedly, Scrum is often not used in a standard way. Only 38% respondents reported that they strictly follow the formal rules of the Scrum framework. Although from the results, there were 80% of the 10 fundamental activities of Scrum framework were used in the projects, it is still doubtful since only 29% of the respondents had ScrumMaster certification and only 16% of respondents said their team members got trained of how to use Scrum. These results indicate that although people who were using Scrum usually have higher level educational background, they may still lack of clearly understanding and professional training of the Scrum framework.

5.2 Usability Activities in Scrum Process

The survey asked the respondents to rate both the usefulness and how often they use the 14 most well-known usability techniques. Surprisingly, we found that the usefulness and the frequency-of-use of these techniques are not consistent. 73% of the respondents consider the technique “Formal usability evaluation with user” very good, but only 31% used it in their projects. The technique “Digital prototyping” and “Field study” were also rated high but not frequently used. One possible explanation for this inconsistency is that the most important characteristic of Scrum is quickness. The duration of one Scrum sprint usually last 2-4 week, but some usability techniques need longer time. Formal usability testing usually takes practitioners a long time to prepare the testing instruments, recruit participants, and conduct the tests. However, the practitioners usually have to work on tight deadlines. They cannot afford spending one month just doing the evaluation. Compare to the “Digital prototyping”, the technique “Lo-fi prototyping” got high scores both in percentage of usage and rating of useful. A main advantage of “Lo-fi prototyping” is fast and it is accessible to any team member in the development process. The finding reveals that the usability techniques that people feel very helpful and useful may not fit the Scrum process very well. The selection of which usability technique is used in the Scrum process should be considered with the characters of Scrum.

5.3 Validity and Limitations of the Study

Internal Validity

Several strategies were used to maximize internal validity. First, all questions about usability activities involving in Scrum process were based on one specific Scrum project that the respondents selected instead of basing on the previous experience of using usability techniques that may come from other non-Scrum project. Second, respondents were asked to pick the Scrum project that they did most recently. This guarantees that the respondents answered the survey questions based on their freshest experiences, rather than tracing back to the projects that they work on many years ago. Third, the readability of the survey had been improved before sending it out. For example, by changing from four-14x6 matrix questions to 3 sub-questions for each 14 techniques (See Appendix 2), respondents' mental workload were decreased which reported by the pilot study.

External Validity

The external validity of this study is limited in two ways. First, although 49 respondents responded this survey from 35 different IP address, it is still hard to confirm that they came from 35 different organizations or 35 different Scrum projects. Still, respondents who have the same IP address also could be in different Scrum projects. Second, the imbalance of the sample distribution also affects the external validity. Respondents came from 7 countries around the world, 78% of the respondents came from Sweden, the rest of them came from China (8%), US (6%), France (2%), Greece (2%), Lithuania (2%), South Africa (2%).

6. Conclusions and Future Work

This study investigates the adoption of the Scrum process in industry and how usability activities are integrated in the Scrum process. The four research questions are reviewed as below:

- How is Scrum practiced in real industrial?
- Can usability be integrated with Scrum process?
- What usability techniques are used in Scrum process?
- If and how users are involved in Scrum process?

In response to the first research question, the finding shows that Scrum is not practiced “by the book” by the respondents in the real software development industrials. The practitioners of Scrum still lack of professional training of how to use Scrum.

Regarding the second research question, the results of the survey reveals that usability activities can be integrated with Scrum framework. But the degree of the integration is influenced by the application type. Website got a higher degree of integration of usability activities and Scrum framework comparing to other application types, such as internal software system and software product for sale.

For the third research question, based on the results of the survey, workshop is the most frequently used usability technique used in Scrum process. And followed by: user stories, lo-fi prototyping, interview and meeting with users.

Lastly, according to the data, users are mostly involved in the process of creating Product Backlog and at the end of the Scrum process. It is noticeable that the selection of user shows the preference of using customers’ employees and companies’ own employees.

The original idea of Scrum method is developed without considering usability aspect. However, the result of this study shows that the acceptance of usability, in current software development industry, was significantly increased. UCD activities can be integrated well with the Scrum framework in certain type of application by applying certain usability techniques.

A novel contribution of this study is that there were significant correlations of the usage among different usability techniques in Scrum projects. An example of the interpretation of the correlation of the usage of various usability techniques is that if an IT professional uses workshops he is more likely to use personas. Furthermore it is noticeable that the technique user stories are not correlated with any other usability techniques, which could indicate that these techniques are not used to define the user stories or these techniques are not used to describe the user requirements through user stories.

7. Acknowledgement

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9. Appendix

Appendix 1 Description of each usability technique in the survey

Usability technique	Description
Interview	is a conversation between two people (the interviewer and the interviewee) where questions are asked by the interviewer to obtain information from the interviewee. The interview technique is used to collect detail information on users' profiles, needs, desires and expectations.
Questionnaire	is a instrument consisting of a series of questions and other prompts for the purpose of gathering information from respondents to collect feedback from a large number of current or future users.
Workshop	is a type of meeting emphasizing interaction and exchange of information usually among a small number of participants. Typically the duration is half a day.
Meeting with users	Two or more people come together to discuss one or more topics, often in a formal setting. The goal of meeting the users is often to get some feedback on the system.
Field studies	are observations of how a product or service is used in real settings. During field studies users are observed solving their tasks in their work environment.
Usability goals	describe the usability requirements, that is they state how easy to use the system should be.
Scenario	is an informal narrative description of an event or series of actions and events. It is like a story of how a particular user uses the system for a particular task.
Personas	are detailed profiles of specific user types that are created to represent behavioral aspects of your different user types. A small number of personas are used to gain understanding of the user types.
User stories:	A user story is a short, simple description of a feature told from the perspective of the person who desires the new capability, usually a user or customer of the system. They typically follow a simple template: As a (type of user), I want (some goal) so that (some reason).
Digital Prototyping:	Incomplete version of the user interface design done in a software tool. It provides the ability to virtual explore the use interface design.
Lo-fi prototyping	Low fidelity prototypes are sketches of the user interface describing what

(Paper prototyping):	should be in each window/web page and where it should be. These could be drawn on paper with pencil or drawn in a sketching tool. There are no colors used, styles, etc..
Formal usability evaluation with users (eg. think aloud evaluation).	A user solves predefined tasks and an evaluator observes how easy it is for the user to use the system. Usually the evaluator only observes the users, but does not communicate much with the user during the evaluation. In think aloud evaluation the user is asked to say what he/she is thinking while solving the tasks.
Informal usability evaluation with users:	An evaluator meets the users and observes how he/she would use a system or a prototype. The evaluator often discusses the use of the system or prototype with the user during the evaluation and they co-operate on redesigning the system/prototype.
Heuristic evaluation:	A team of evaluators systematically applies a set of user-centered heuristics (guidelines) in order to evaluate if the system is easy to use.

Appendix 2 The online survey questions with answers to the multiple-choice questions

Background of the respondents and companies/organization

1. Please select the total number of employees in your company/organization:
 - 1-10
 - 11-50
 - 51-250
 - 250+
 - Not sure
2. How many employees in your company/organization are working on software development:
 - 1-4
 - 5-9
 - 10-19
 - 20-49
 - 50-99
 - 100-250
 - 250+
3. What is your company/organization's main industrial section?
 - Authority
 - Internet, e-commerce
 - Computer industry
 - Usability, HCI
 - Health and medicine sector
 - IT Consultancy
 - Financial sector
 - Telecommunication
 - Game
 - Other
4. For how long has Scrum been used in your company/organization?
 - 0-1 year
 - 1-3 years
 - 3-5 years
 - 5-10 years
 - More than 10 years
 - Not sure
5. What percentage the employees working in software development are using Scrum?
 - 0-20%
 - 21-40%
 - 41-60%
 - 61-80%
 - 81-100%
 - Not sure
6. If you are using any software development process in parallel to Scrum in your company please specify what process you are using
 - XP (Extreme programming)
 - Waterfall model
 - RUP (Rational Unified Process)
 - Own model (developed within the company)

- Kanban
 - Not sure
7. If you could choose only one, what would you say is your main job task?
 - Requirement gathering
 - UI design
 - Usability engineer
 - Code design
 - Programming
 - Software testing and/or evaluation
 - Project management
 - Other
 8. For how many years have you been working with the software development?
 - 0-3 years
 - 4-6 years
 - 7-9 years
 - 10-14 years
 - More than 15 years
 9. For how long have you personally used the Scrum process?
 - 0 – 1 year
 - 1 – 3 years
 - 3 – 5 years
 - 5 – 10 years
 - More than 10 years
 10. Are you a certified ScrumMaster?
 - Yes
 - No
 11. What is the level of your education?
 - Ph.D.
 - M.Sc.
 - B.Sc.
 - University diploma(1-2 year study)
 - Self-educated
 - Other
 12. What is your age?
 - Below 19
 - 20-24
 - 25-29
 - 30-34
 - 35-39
 - 40-44
 - 45-49
 - 50+
 13. What is your gender?
 - Male
 - Female

Scrum process in one project

14. For the last 3 months, have you been simultaneously working on multiple projects or one single project at a time?

- 1 project
- 2-4 projects
- 5 projects or more

Please select one Scrum project that you were involved in and finished recently and answer the following questions according to that project. If you haven't finished any project recently, pick one project that you have been working on recently.

15. Please choose the type of system
 - Internal software system
 - Website
 - Software product for sale
 - Software system for a client
 - Other
16. Who are the customers or the people who pay for this project?
17. Who are the end users?
18. Do users of your system have a possibility to solve their tasks by using other applications?
 - Yes
 - No
 - Not sure
19. What was your primary role in this project?
 - ScrumMaster
 - Product Owner
 - Team
 - Other
20. How many people were in a project team in this project (not including the Product Owner and the ScrumMaster)?
 - Less than 5
 - 5 – 9
 - More than 9
21. How long did each sprint usually last in this project?
 - 1 week
 - 2 weeks
 - 3 weeks
 - 4 weeks
 - More than 4 weeks
 - Other
22. Which of the following items applies to the Scrum development process practice in this project?
 - The role of Product Owner is used
 - The role of ScrumMaster is used
 - The role of Team is used
 - The Sprint planning is used
 - The Sprint review is held
 - The Sprint retrospective is performed after every sprint
 - Daily scrum meeting is held
 - Product backlog (PB) is used
 - Sprint backlog is used
 - Burn-down Charts are used

23. Do you think you use Scrum by the book?
 Yes
 No, please describe the difference
24. Have the team members got trained in using Scrum?
 Yes, all of them
 Some of them have been trained
 None of them have been trained
 Not sure
25. Could you please rate the importance of these quality criteria in this project in your opinion?

Answer	Reliabilit	Portabilit	Usabilit	Efficienc	Maintainabilit	Functionalit
	y	y	y	y	y	y
1 Not at all						
2						
3						
4 Middle						
5						
6						
7						
Extremel						
y						

There are several usability techniques you may have used in this project.

<<All descriptions of 14 usability techniques had been listed in the survey and the Question a, b and c had been shown after respondents reported they had used certain technique>>

<< Here a description of the usability techniques was given. It is described in Appendix 1 and will therefore not be listed again>>

26 – 39 Please indicate if you have used the XXX technique in this project, and how useful you find this technique?

Not used it

Very bad

Fairly bad

Neither good nor bad

Fairly good

Very good

a. Approximately, how often have you used this XXX technique in this project? Please pick the alternative which best describes the frequency.

Once a year or less

2 - 6 times a year

7 - 12 times a year

2 - 3 times a month

Once a week or more

b. How often have you involved users in this XXX technique in this project?

Never

Less than half of the case

In half of the case

More than half of the case

Every time

Not applicable option

- c. How did you select the users that were involved while using this XXX technique in this project? Please choose all that apply.
- Arbitrary sample of users
 - Representative sample of users
 - Own employees
 - Customers' employees
 - Not Sure
 - Not applicable option
40. If you used other usability techniques or methods in this project, please specify
41. In what part of the Scrum process did you involve users in this project?
- In the process of creating Product Backlog(user)
 - In the process of creating Sprint Backlog
 - At the beginning of Sprint
 - In the middle of Sprint
 - At the end of Sprint
 - In the process of Sprint Retrospective
 - At the end of the Scrum process
 - Other
42. How would you describe the interest of the team in relation to usability?
- Skepticism
 - Curiosity
 - Acceptance
 - Partnership
43. To which degree do you think that usability activities are integrated with Scrum in this project?
- 6 To a large degree
 - 5
 - 4
 - 3
 - 2
 - 1 Not at all

Open Questions

44. In your opinion, who is responsible for the usability aspects in this project? Please describe his/her/their responsibilities.
45. Please share your positive experiences about involving usability activities with Scrum.
46. Please share your negative experiences about involving usability activities with Scrum.