The Onboarding Process in Agile Software Development Teams: An Empirical Study

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Master of Computer and Information Sciences

2017

Abstract

In most modern software development environments, the development work is done in teams, often using an Agile development approach. It is not uncommon for new members to join an existing team, for example to replace a team member who has left or to add extra resources to the team. Initially this team member may be unproductive compared to existing team members as they develop an understanding of the team norms and the way of working, as well as learning new tools and technical skills. Ideally this new team member will get integrated into the team and be productive quickly. The process of getting up to speed and becoming a productive team member is known as "onboarding". If the onboarding of the newcomer takes a long time, this can negatively affect the productivity of the team. In practice, there is a wide diversity of approaches to the onboarding process with a range of possible onboarding practices adopted in Agile software development teams. It would be useful for practitioners to have some guidance on which onboarding activities should be undertaken to effectively achieve the desired onboarding goals in an Agile software development context. This thesis investigates this question by firstly developing a conceptual framework of the goals of onboarding and the characteristics of an onboarded team member, and then identifying which onboarding activities are common in Agile software development teams. A mapping of the activities' contributions to each onboarding goal is then proposed. This can be used by teams to support the decision of which onboarding practices to adopt, given their desired onboarding goals.

The approach taken to develop the onboarding activity mapping to goals is based on a structured interview approach, using Repertory Grids as instruments to elicit the mapping. The onboarding goals (the repertory grid constructs) were identified from a synthesis of related literature, and the onboarding activities (the repertory grid elements) were elicited from an analysis of semi-structured interviews of 13 participants from 8 organizations. These same 13 members of Agile teams then participated in the repertory grid where they indicated the level of influence they perceived each onboarding activity to have on each onboarding goal. The grids were then aggregated and the patterns in relationships identified.

The results show that there are some practices, for example the assigning of a proactive mentor to a new team member, that achieves a broad range of onboarding goals. It also

provides guidance for the design of an onboarding process in Agile software development teams, for a given set of goal priorities.

This thesis contributes a structured conceptualization of onboarding goals, providing language and concepts to describe and explain the purpose of onboarding in detail. The thesis also provides a list of common onboarding practices that could form the basis of a taxonomy of such activities. In addition, the results of the aggregation of the Repertory Grids provides a guideline for designing an onboarding process, based on empirical data.

Table of Contents

1 Introduction 4

1.1 Motivation and the Research Problem 4

1.2 Research Approach and Design 6

1.2.1 Literature Review 7

1.2.2 Semi-structured Interview 7

1.2.3 Repertory Grids 8

1.3 Main Contributions 8

1.4 Structure of the Thesis 8

2 Literature Review 10

2.1 Introduction 10

2.2 Meaning and Importance of the Onboarding Process 10

2.3 Onboarding in the Context of Agile Teams 12

2.4 The Model of the Onboarding Process in Previous Studies 14

2.4.1 New employee characteristics 15

2.4.2 New employee behavior 17

2.4.3 Organizational efforts 18

2.4.4 New employee adjustment 20

2.4.5 Socialization outcomes 21

2.5 The Model of Onboarding Process in This Research 21

2.6 Expected Outcomes of Onboarding in Agile Software Development Teams 23

2.6.1 Culture context of the organization 27

2.6.2 Job responsibility 29

2.6.3 Standard of work 30

2.6.4 Agile process 31

2.6.5 Project knowledge 33

3 Research Design and Methodology 34

3.1 Research Aim and Questions 34

3.2 Research Process 35

3.3 Unit of Analysis 38

3.4 Literature Review of Research on Onboarding Process 38

3.4.1 Implementation of literature review 40

3.5 Semi-Structured Interviews 40

3.5.1 The interview participants 46

3.5.2 Implementation of interview 46

3.6 Repertory Grid Technique 48
3.6 Ethical Consideration 54
4 Findings and Discussion 55
4.1 Company Context of interview 55
4.2 Context of newcomers 57
4.3 The result of interview 58
4.3.1 The Activities that Used in Current the Industry 58
4.3.2 The Duration of Onboarding 62
4.3.3 Discussion of interview result 64
4.4 Contribution of activities to each outcome 64
4.4.1 Understanding team norms (E1) 66
4.4.2 Understanding of company culture (E2) 68
4.4.3 Knowing the responsibilities, expertise and authority of other team members (E3) 69
4.4.4 Understand other's expectations of your own role's responsibilities (E4) 70
4.4.5 Understand what work to do and when/ how to choose tasks (E5) 71
4.4.6 Understand the project structure and aims and the implications (E6) 72
4.4.7 Understand how to code and test to the team's expectations (E7) 73
4.4.8 Understand and meet the team's standards of work quality (E8) 74
4.4.9 Understanding and showing the Agile mindset (E9) 75
4.4.10 Knowing how to use Agile artefacts and techniques that are part of the team's software development process (E10) 75
4.4.11 Understanding the project domain knowledge and terminology (E11) 76
4.4.12 Discussion 76
4.5 Influence of activities in achieving the outcomes 77
4.5.1 Discussion of Help from the team leader, project manager and other team members 90
4.5.2 Discussion of Orientation and Induction 91
4.5.3 Discussion about the activities 91
4.6 Comparison of Aggregated Outcomes 92
4.7 Comparison of Employee-Initiated Activities, Employer-Initiated Activities, and BAU (Business as Usual) Activities 94
4.8 The Implications of the Findings 101
5 Conclusion 103
5.1 Threats of Validity 104
5.2 Further research 105
Bibliography 106
Appendix: 112

Appendix 1: Questionnaire of semi-structured interview. 112
Appendix 2: Consent form 113
Appendix 3: Participant Information Sheet 114
Appendix 4: Interview Response Capture Form 117
Appendix 5: Raw data of repertory grids 123
Appendix 6: Influenced Levels of Activities towards Outcomes 133
Appendix 7: Influenced Levels of Activities towards Outcomes (Colored) 135
Appendix 8: Influenced level of activities against five categorized desired outcomes 137
Appendix 9: The Influence Levels of Three Group of Activities 142

1 Introduction

This chapter introduces this thesis and describes the motivation for the research, the research questions, background to the questions, research approach, and research design of this study. The main contribution is also indicated at the end of this chapter.

1.1 Motivation and the Research Problem

In most modern software development environments, the development work is done in teams, often using an Agile development approach (Jeremiah, 2015). Ideally these teams are long-lived, in the sense that the membership of the team is stable over several projects. It is not uncommon, however, for new members to join a team for example to replace a team member who has left or to add extra resources to the team. Ideally this new team member will get integrated into the team and be productive quickly. If the integration of the newcomer takes a long time, this can affect the productivity of the team. The process of getting up to speed and becoming a productive team member is known as "onboarding" and this thesis investigates both the changes in the new team member towards being onboarded, and the activities that might speed up the onboarding process. The aim of this study is to understand which onboarding activities influence which desired changes, with a view to designing more effective and efficient onboarding activities for desired onboarded outcomes. For example, if the desired outcome for the new team member is understanding the team culture and norms, is it more effective onboarding practice to explicitly discuss the team culture and norms with the newcomer, or to have the newcomer learn these indirectly through working with the team over time?

The importance of effective onboarding is amplified if team turnover is high, since onboarding will be more frequent in this circumstance. Team turnover may be a consequence of general staff turnover in an organization (i.e. staff leaving the organization) and this section argues that high staff turnover is common generally and in software companies in particular, therefore good onboarding is a significant and contemporary challenge, worth researching.

The phenomenon of high staff turnover rate is an enduring issue, reported as far back as 1989, when it reached over 30 percent (Abdel-Hamid, 1989), and still at 15% around 25 years later, (Pike, 2014). The same phenomenon of high turnover rate is also found among

software development firms (Kwak & Stoddard, 2004). Furthermore, they confirm that high turnover significantly influences the productivity of the development team. Boehm (1991) argues that personnel shortfalls caused by employment turnover can be one of the riskiest items during the process of a software development project, followed by unrealistic schedules and budgets and developing the wrong functions and properties, etc. The negative consequences of the dynamics of human resources in software development companies pose a threat to the coherence of the organization, the enthusiasm of employees, the performance of teams and the quality of project outcomes.

Another reason related to the changing of team members happens when senior team members leave their positions and juniors replace them. This situation may be caused by job promotion and team restructure. However, during the change of staff, there are many knowledge gaps and work tasks that have to be transferred.

In summary, the phenomenon of team member turnover is common, therefore the onboarding process for new people during turnover is crucial.

The importance of onboarding is further emphasized if the impact of poor onboarding is considered. New members need to acquaint themselves with other team members, integrate into the mechanics of the project and acquire the necessary technical skills after the staff assimilation period (Abdel-Hamid, 1989). Within the turnover period, the performance and capacity of the team can drop to a certain degree because of the shortage of valid output from new team member. Limited financial and talent resource cause this phenomenon to be more serious in small scale teams than larger teams. According to the research of Landon and Laudon (2015), it takes one and a half years on average for new software employees to reach maximum productivity. However, the duration of this process can vary, depending on the ability of the new person and the efficiency of the onboarding process. Effective onboarding can reduce the time taken to contribute and gain competence, strengthen the bonds between team members, enhance job satisfaction, and increase the productivity of the team (Snell, 2006).

In order to increase the effectiveness of the onboarding process, researchers have identified different methods used by software development teams. According to Ashforth and Saks (1996), and Bauer, Bodner, Erdogan , Truxillo, and Tucker (2007), techniques

such as orientation, mentoring, proactive interventions and support from team members can help reduce the anxiety of the new person and enhance job satisfaction thereby boosting person-organization fit. The research by Begel and Simon (2008) focused on the use of particular instructional pedagogies for new college graduates who had no concrete understanding of what software developers do all day. The research showed that pair programing, legitimate peripheral participation and mentoring may contribute most to speed up the assimilation of new graduates into teams as developers.

While previous studies have noted that the onboarding process holds the key for the integration of newcomers to a team and they provide some examples of the effective activities that may influence the outcome of onboarding, they do not identify the connections between the onboarding activities that can be followed by organizations or employees to achieve the desired outcomes. Further, there are very few descriptions of effective activities on how to integrate newcomers. To fill the gaps in this area, this study aims to capture the commonly used activities and techniques that influence the onboarding process, and show the relationship between the activities and desired onboarding outcomes.

In the context of a new team member joining an Agile software development team, the research questions are:

RQ1 What are the desired outcomes for the onboarding process?

RQ2 What activities are currently used in practice in the onboarding process?

RQ3 What level of contribution do each onboarding activity make to each of the desired outcomes?

RQ3a What onboarding activities are perceived as having the most contribution to the desired outcomes overall (i.e. give the best onboarding value)

RQ4 What is the perceived duration of the onboarding process?

1.2 Research Approach and Design

The research aim is to identify the perceived relationships between onboarding activities and different onboarding goals or outcomes. The main research method used to achieve this involves the use of a partially-fixed Repertory Grid instrument to undertake structured interviews. In order to design the Repertory Grid, the onboarding activities

(grid elements) and the desired onboarding goals (grid constructs) need to be identified. The grid constructs (outcomes) were fixed for each grid in order to aggregate the grids, and were identified from an synthesis of relevant literature. The grid elements (activities) were elicited from each participant in a semi-structured interview prior to conducting the Repertory Grid with the participant.

This section describes these methodologies in detail and how they were deployed in this study.

1.2.1 Literature Review

To start the research, a literature review of previous theories in the area of onboarding newcomers was conducted. The main aim of this step was to reveal the importance and meaning of the onboarding process, as well as the current states of this procedure in the Agile software development industry. From the reviews, the factors that influence the quality of the onboarding process were captured to give an in-depth description of onboarding in practice. Due to the use of the repertory grid technique, another purpose of the literature review was to obtain the expectations of newcomers after being onboarded as the elements of the grid.

1.2.2 Semi-structured Interview

To collect data, semi-structure interviews were used to answer the question of what effective activities are being utilized during the onboarding process in current Agile software development teams. According to Sliverman (2013), interviews are a widely-used approach in qualitative research, and this method has been stated to discover a deeper understanding of social phenomena than other techniques. The purpose of this thesis was to discover onboarding in the real word, and the interview method was a suitable approach to investigate the perspectives of the lived experience. Gill, Stewart, Treasure, and Chadwick (2008) pointed out that semi-structured interviews not only include key questions to define the exploration of the research, but also enable interviewees to pursue more ideas and responses in detail. In this case, open-ended questions allowed the participants to expound their conceptions, describing details of the actual circumstances of the onboarding process. This contributed to enrich the content of the conversations, helping the researcher to focus on the in-depth investigation of the process and enhance

the accuracy of the raw data for the following steps.

1.2.3 Repertory Grids

Repertory Grid is the second methodology employed to collect data in this thesis, to obtain the perception to onboarding process, participants are regarded as "scientists", using their work experience to build up a personal construct system to provide evidence for goal of this thesis. According to Latta and Swigger (1992), the repertory grid technique elicits both conceptual and content, and modeling into an individual's mental pattern and the relationships which exist among their concepts. Since the aim of this study is to discover how the practical onboarding activities influence onboarding outcomes, the opinions of practitioners need to be captured and the repertory grid helps to collect their perceptions towards onboarding, and allow researcher to discover the pattern of relationships between activities and outcomes.

1.3 Main Contributions

This study contributes to the body of empirically-based knowledge related to the onboarding process in Agile software development teams. This thesis gives an in-depth understanding of practical activities that are used in Agile teams, and provides empirical grounding of effective onboarding. On addition, the study in this thesis contributes a clear and consistent the meaning of "onboarding" and factors and enablers of this process. The study also maps the relationship between practical activities and onboarding outcomes, and a structured set of guideline for practitioner to follow. Practitioners will benefit from a deeper understanding and awareness of what activities are suitable for which desired outcomes. This knowledge should encourage the deployment to onboarding activities. With the highly influencing activities and expected outcomes of onboarding, the durations of newcomers' integration may be shortened, thereby boosting the performance of the whole team.

1.4 Structure of the Thesis

After the introduction of chapter one, chapter two elaborates the research context of this research, based on a survey of current literature in the area of onboarding process in software development. A reviewing of literatures provides a model of the onboarding

process and the expected onboarding outcomes in current Agile software development team. The chapter three presents the research approach applied in this study along with the approach of the data collection and analysis methods. The main contribution of the thesis is presented in Chapter Four, where the findings of both the Repertory Grid analysis and interview data analysis are elaborated and discussed. The final chapter of the thesis, Chapter Five, summarizes the main results, answering the research questions explicitly, notes some limitations of the research, and suggests some avenues of future related research.

2 Literature Review

2.1 Introduction

To minimize the negative consequences of turnover in terms of productivity in organizations, the onboarding process is introduced as a mechanism to help newcomers adapt to new work environments in the software development industry. At the same time, it contributes to help newcomers to acquire professional knowledge and skills quickly and smoothly in their new organization or role. The study by Begel and Hemphill (2011) stated the problems that face newcomers if an onboarding process is not deployed. Previous studies have presented the importance of onboarding, and given some of the effective activities that may influence the outcome of onboarding. However, in those studies there is no mapping showing the connections between the onboarding activities and challenges that can be followed by organizations or employees. To fill the gap in this area, this study aims to capture the activities and techniques that influence the onboarding process, and give the relationships between the activities and the expected outcomes of organizational socialization.

2.2 Meaning and Importance of the Onboarding Process

Over the years, a high turnover rate has been widely found in the worldwide workforce. In the software industry, this figure has been 15 percent since 2010 (Pike, 2014). This phenomenon can be costly for organizations because of numbers of expense in different aspects. Once an employee leaves an organization, the decrease in customer satisfaction and the delay in project releases caused by low productivity during the replacement period are the most significant factors leading to financial loss in software development companies. To minimize the negative consequence of turnover in terms of productivity, the onboarding process, also known as organizational socialization, is introduced as a mechanism to help newcomers adapt to their new work environments throughout the software development industry.

Onboarding is defined as a procedure whereby new employees move from being organizational outsiders to becoming organizational insiders (Bauer & Erdogan, 2011). It contributes to helping newcomers acquire professional knowledge and skills quickly and

smoothly in their new organization. The onboarding process is designed to speed up the integration of newcomers into their new team; to decrease the various shock situations caused by new hires; and to help the newcomers gain self-confidence and the acceptance of their teams. Pike (2014) pointed out that organizational socialization also contributes to retaining top performing talent and eliminating those who are not suitable for the organization, as new employees normally either integrate into the culture and values of the new team or leave (Pike, 2014). Kumar, Wallace, and Young (2016) stated the importance of onboarding in the evolutionary process of newcomer integration in their research. Onboarding provides the means for newcomers to learn within their new workplace and helps to establish them as capable, confident participants.

Johnson and Senges (2010) studied the onboarding process of new software engineers employed in Google and how to train them to become productive. By analyzing the data gathered from semi-structured interviews, the outcomes revealed that Google offered a state-of-the-art onboarding program and benchmark qualities to reduce isolation and enhance collegiality among new hires. In the research of Begel and Simon (2008), eight developers who had just graduated from university newly hired by Microsoft were selected as subjects to help identify the behaviors of newcomers in a software development team. The results showed that new college graduates have many problems, typically caused by poor communication skills and social naïveté. Begel and Simon indicated that the usage of particular onboarding processes, such as pair programing, legitimate peripheral participation and mentoring, are able to solve those problems.

On the other hand, Begel and Hemphill's (2011) study explored the problems that newcomers face if an onboarding process is not deployed. Their research aimed to discover the challenges experienced in newly virtual teams. Unlike the onboarding in normal physical teams, newcomers in virtual teams found the opportunities for interaction with their colleagues reduced in a dramatic way. It was difficult for them to have a series of either formal or informal onboarding training. Begel and Hemphill found that this phenomenon leads to poor coordination, reduced trust, and conflict between team members.

The previous studies present the importance of onboarding, and give some of the effective activities that may influence the outcome of onboarding. These provide ideas for the

onboarding process in the contents of Agile teams, which is the aim of this study. However, in those studies, there is no mapping showing the connections of between onboarding activities and the desired outcomes that can be followed by organizations or employees. To address the gap of this area, this study aims to capture the activities and techniques that influence the onboarding process, and give the relationships of activities, as well as the challenges that are encountered in conducting onboarding.

2.3 Onboarding in the Context of Agile Teams

In this research, the focus was to discover the onboarding process using the background of Agile development team. The Agile software development method is a series of principles for software development under which requirements and solutions evolve through the collaborative effort of self-organizing, cross-functional teams (Collier, 2011). Teamwork, collaboration and process adaptability during the life cycle of projects are crucial and highly promoted in Agile software development teams. Setting aside technical skills, members in the teams must integrate into their groups and have high levels of social accountability, thereby achieving the cohesion of the teams. Compared with other development methodologies, not only do regulations regarding the structure of development in Agile need to be followed, but the corporate mindset among the teams must also support the deployment (Papadopoulos, 2015). In addition, artefacts such as stand-up meetings, burn-down charts, product backlogs, etc. are introduced in Agile development to maintain projects staying on track in every iteration. Coding standards, test-driven development or behavior-driven development and daily builds are also the features of this methodology (Vukicevic & Draskovic, 2012). As the result of the strict standards in the Agile development method, this method is complex and difficult to adopt. Many previous researches have studied how to deploy the Agile development method in organizations. Papadopoulos (2015) studied a global communications software and services company, aiming to discover the transaction process from traditional software development to Agile software development. The results show that adopting the Agile framework is not straightforward, especially in large companies with a long history of using traditional methodology. Such companies need to carefully deploy the changes to avoid common issues, such as misunderstand of Agile mindset, happening when trying to adopt this methodology. On the other hand, Papadopoulos also mentions that it requires time to build the Agile culture and embrace the practices which activate the desire to be

closely monitored to avoid additional project-specific problems.

Nearly all researches regarding the deployment of the Agile software development method stand are from the point of view of an organization or a company. The problems they focus on are based on the macroscopic view, trying to find solutions to fit Agile to a whole team and an organization. However, it is also important to give guidelines to fit Agile to a person.

There are few studies that refine the details of the onboarding process towards the unit of a person or a new employee. The difficulties encountered during this procedure, the causes of these difficulties, and an efficient approach to tackle them, is an interesting topic, which has not been the emphasis of academic study. This thesis is to answer the questions in this area, aiming to discover the situations of new hires, giving advice to them and their companies about how to deal with the problems met throughout the procedure of onboarding. According to the studies from Papadopoulos (2015), the onboarding of Agile methodology in software development teams is difficult. The onboarding for new employees in Agile teams is challenging as well, as the goals of both these two kinds of onboarding are the same, focusing on fitting into a specific type of development framework. In order to integrate Agile into software development teams, newcomers have to learn how to communicate with other team members; how to manipulate the artefacts and tools used in Agile; and how to become a trusted part of the team. To fulfill these requirements, the efforts from individuals who are new faces in teams are not the only component required, but support from the organization as well. If there is no onboarding for newcomers in Agile teams, it will take a long time for them to catch up with the pace of others or they may even fail to achieve the assimilation. The high level of difficulty of onboarding in Agile underlines the urgency of this study, and the wide usage of Agile methodology in the software development industry reinforces the high applicability of this study.

Agile is the most popular development method these days. The results of a survey from HP Inc conducted in 2015 about development and IT professionals proposed that the Agile software development method has been defined as the norm in the development industry (Jeremiah, 2015). The study showed that more than 90 percent of the surveyed organizations were using Agile, and of this figure one-fifth of the organizations were

adopting “pure Agile”. Only nine percent of the companies surveyed leaned towards Waterfalls development methodology. According to Jeremiah (2015), although the appearance of the Agile development method can be tracked back to more than a decade ago, the uptrend of Agile adoption in the software development domain only started in the last seven years, from 17 percent in 2009, to 90 percent in 2015, still maintaining growth. These figures indicate that most of the workforce in the software development industry are applying the Agile method, and because of the high rate of turnover, a massive number of newcomers are facing the assimilation of this method when they step into the workplace. Therefore, the onboarding of new employees in Agile software development organizations is crucial and urgent.

In summary, the proliferation of Agile methodology and the difficulty of deploying Agile in software development teams determines the importance of discovery in this area. The conducting of this research not only helps fill the gap in this academic field, but also offers a guideline for newbies in the Agile teams on how to integrate into their organizations.

2.4 The Model of the Onboarding Process in Previous Studies

In the study by Bauer and Erdogan (2011), a model of the onboarding process is presented, describing the factors, adjustment and outcomes of the procedure.

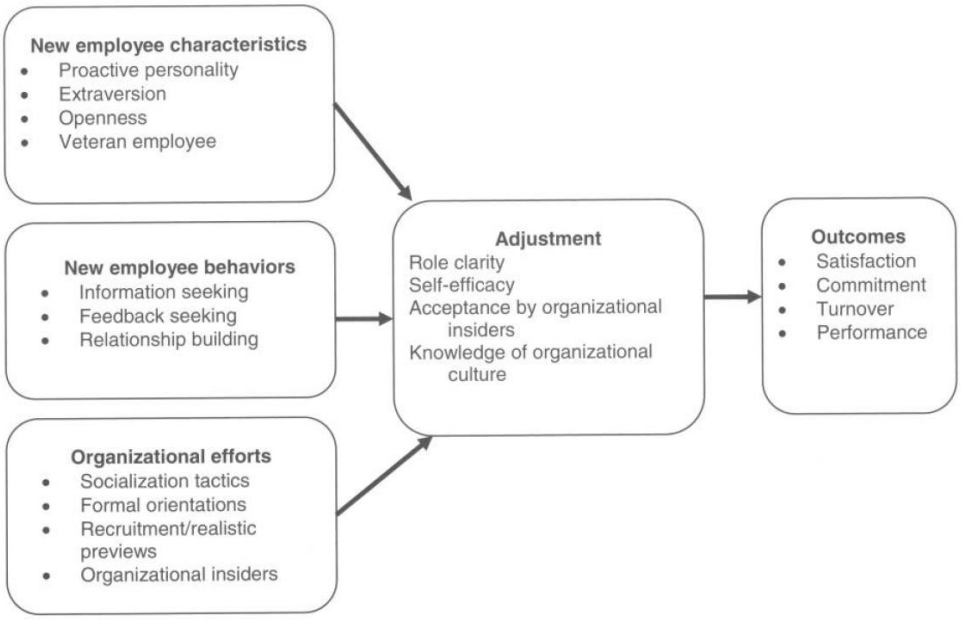

Figure 2-1 Model summarizing the socialization process (Bauer & Erdogan, 2011) *Page 52*

As seen in Figure 2-1, the process of socialization has been divided into three main parts: enablers, adjustment and outcomes. According to Bauer and Erdogan (2011), there are many factors holding the key to the successful organizational socialization of new hires. They have categorized the factors into three classes: (1) new employee characteristics, (2) new employee behaviors, and (3) organizational efforts. They examined new employee characteristics, also called individual differences, among the new staff regarding their working backgrounds and personality traits, which play an important role in onboarding. As participants, a newcomers' behavior, such as seeking knowledge energetically and being eager to get feedback, always speeds up the integration. Lastly, efforts from the organizations themselves contribute to the socialization through the process of acclimating new staff using a series of activities. Adjustment is included in the model to indicate how well a newcomer will be accepted as a trusted member in their new organization. Based on the studies of Fisher (1986), Feldman (1981), and Bauer, Morrison and Callister (1998), role clarity, self-efficacy, social acceptance and knowledge of the organizational culture are frequently used as indicators of adjustment. Lastly, the expected outcomes of onboarding are considered using the indicators of satisfaction, commitment, turnover and performance in Bauer and Erdogan's study.

2.4.1 New employee characteristics

The characteristics of the newcomers determine their performance when they enter organizations. This concept includes having a proactive personality, the Big Five personality traits, and the prior experience of the new employees (Bauer & Erdogan, 2011). Saks and Ashforth (1996) stated that certain personality traits among new employees are conducive to integration. For instance, individuals with a proactive personality are willing to engage in proactive behaviors, enhancing socialization. They tend to be motivated to learn, and their motivation may translate into behaviors which contribute to their effective socialization (Major, Turner, & Fletcher, 2006). A perfect example is that they may ask a lot of clarifying questions to help them understand the company and their work. Thompson (2005) also found that they are good at developing social networks, helping them have a better understanding of the organizational culture.

The second factor stated in Bauer and Erdogan' s research in terms of newcomer

characteristics is the Big Five factor model. Kammeyer-Mueller and Wanberg (2003) found newcomers who are open to new experiences show higher levels of adjustment to their new jobs and greater training proficiency. They tend to seek information and feedback, which helps them positively in framing their new jobs and building relationships with co-workers.

Finally, new employees who are already experienced with their jobs may go through a slightly different onboarding process, because experienced employees are capable of using their insights from previous workplaces to assist them in the new companies (Bauer & Erdogan, 2011).The extensive prior knowledge of experts can influence what they notice, and their way of organizing, representing, and interpreting information in their environment, thereby affecting their problem-solving ability (National Research Council, 2000). They also ask questions at the right time and in the proper way, and use their prior experience to deal with problems (National Research Council, 2000). It is easier for them to communicate with their teammates, as they can master the protocol in offices.

Many studies have demonstrated that the characteristics of newcomers influence the effectiveness of onboarding (Bauer & Erdogan, 2011; Kammeyer-Mueller & Wanberg, 2003; Thompson, 2005; Bauer, Morrison, & Callister, Organizational socialization: A review and directions for future research, 1998). In my view, this concept is widely known and has already been confirmed many times in different researches. Therefore, the contribution of this study would be limited if it focused on discovering the relationship between new employees' characteristics and the onboarding process. Moreover, there is no evidence showing that personality traits can be influenced by a specific onboarding process. Therefore, the characteristics of new employees are not considered as a research objective in this thesis.

However, employers might need to consider the characteristics of newcomers as a factor in designing and setting up the onboarding process since, as discussed earlier in this section, it is an important factor that can affect the outcome of onboarding . The concept of a personalized onboarding process is also stated in the recommendation section of this study, in order to give more ideas for further research.

2.4.2 New employee behavior

According to Bauer and Erdogan (2011), newcomers are active participants in the onboarding process. They state that employees' adjustment can be quickened by adopting the behaviors that help them understand the expectations of their organizations, by learning the values and norms of the company, and by being commitment to their teams.

The first new employee behavior given in Figure 2-1 is information seeking. Based on the theory of Bauer and Erdogan, information seeking is a key behavior for new employees during their onboarding. They can ask questions about different aspects of their jobs, covering the structure of the organization and their job responsibilities. There are various ways of information seeking in the study of Stein and Christiansen (2010), such as viewing company documents, reading instructions for new employees, and communicating with colleagues. Further, another study from Bauer et al. (2007) states that the frequency of active information seeking is related to the adjustment of employees and their work attitudes. The frequency changes over time as their knowledge increases. For example, initially they tend to ask more questions about work expectations and how they will be evaluated. (Chan & Neal, 2000).

Feedback seeking is also an employee behavior given in the Figure 2-1 as a factor influencing a newcomer's socialization. Because of a lack of understanding of the unique context of the new organization, newcomers may not know, for example, whether they meet the standards of working quality, or whether it is appropriate to raise a mistake with the supervisor (Bauer & Erdogan, 2011). Actively seeking feedback helps new employees learn more quickly about what they should do to meet the expectations of the organization. Similar to information seeking and feedback seeking can also benefit new employees in the absence of institutionalized socialization on the part of the organization (Gruman, Saks, & Zweig, 2006).

Lastly, Bauer and Erdogan (2011) note that relationship building plays an important role in newcomers' integration. This behavior is found to be crucial to the success of newcomers' onboarding and achievement of outcomes such as performance and job satisfaction (Kammeyer-Mueller & Wanberg, 2003; Chan & Neal, 2000). The approach provided by Bauer and Erdogan for relationship building can be such things as seeking

opportunities to converse with co-workers; participating in voluntary company functions; and arranging time to talk with team mates.

The benefits of information seeking, feedback seeking and relationship building have been elaborated on. Other activities that can also be used are introduced in previous studies; however, the descriptions of effective behaviors and activities for onboarding are limited in quantity. Besides, there is a gap in the studies regarding what and how the activities and behaviors of newcomers affect the outcomes of onboarding. Bauer and Erdogan (Bauer & Erdogan, 2011) also indicated in their research that more studies are needed to discover what behaviors contribute to enhancing the outcomes of the socialization process, such as how newcomers acquire new resources, how they negotiate their roles, and the way such behaviors affect employee adjustment and onboarding outcomes. Therefore, the main aim of this study is to discover effective activities in the onboarding process, and how they influence the outcomes.

2.4.3 Organizational efforts

Apart from the efforts of new employees themselves in onboarding, efforts from the organization also influence the outcomes of onboarding, Organizational effort in terms of onboarding newcomers is mainly presented by the deployment of organizational socialization programs. According to Bauer and Erdogan (2011), the ways of training and orienting newcomers vary in organizations. The differences include socialization tactics, orientation programs, job previews for new staff, and whether organizational insiders help or hinder the process?

Socialization tactics are enacted according to the values, culture and policies of an organization. Six different dimensions of socialization tactics were defined by Maanen and Schein (1979): a) collective versus individual socialization; b) formal versus informal socialization; c) sequential versus random socialization; d) fixed versus variable socialization; e) serial versus disjunctive socialization; and (f) investiture versus divestiture socialization. Based on their study, Jones (1986) reduced the six dimensions into two categories: institutionalized and individualized. Examples of using institutionalized tactics include the military and universities, in which new recruits and students undergo socialization activities through a participative cohort. In contrast, the newcomers in organizations where individualized onboarding tactics are applied start

work directly after they join in. Individuals in those companies need to collect information about company culture, norms and values during their work, thus they have to be more proactive in their information seeking.

As seen in Figure 2-1, Bauer and Erdogan proposed an orientation program to help newcomers understand the company culture, and also introduce them to their new job and colleagues. They stated that an orientation program can last from a few hours to several months, with shorter orientations normally being applied in small companies. Some companies adopt computer-based orientations for newcomers who are distributed in different cities; however, this form of orientation may be less effective in delivering information than face-to-face communication (Wesson & Gogus, 2005). Bauer advocated that an effective onboarding program should be formally documented, have the high involvement of all newcomers, be consistently applied, and be tracked over time.

Another activity provided in Figure regarding organizational effort is giving a realistic job preview. Bauer and Erdogan (2011) stated there are two main advantages in giving new employees as much accurate information as possible before they start work. First of all, newcomers will have a clear view of their job and the company, which may reduce the possibility of unmet expectations. Secondly, activity preview can also help employers weed out potential employees who will not fit their companies, thereby preventing the situation of having to replace them shortly after hiring. An example of providing a realistic job preview is to hire newcomers on internships, allowing them to accurately evaluate their future in the company.

Based on Figure 2-1 and many other studies, organizational insiders are regarded as an important factor influencing the outcomes of newcomers' onboarding (Kammeyer-Mueller & Wanberg, 2003; Chan & Neal, 2000; Singh, 2012). For example, the mentoring progress is a widely-used approach in onboarding, and research shows that this process helps newcomers in many ways, such as providing job instruction, teaching knowledge about projects and offering social support (Kumar, Wallace, & Young, 2016).

Organizational effort is stated as being the third enabler in the onboarding process. As described in previous studies, organizational efforts contribute to the integration of newcomers in a certain way, but like employee behaviors, the onboarding activities

initiated by employees are not clear, and the relationships between onboarding outcomes and onboarding activities are lacking. Therefore, in this thesis, the aim is to fill in this area, identifying effective activities used in current practice, as well as connecting these activities to onboarding outcomes.

2.4.4 New employee adjustment

In Bauer and Erdogan's (2011) model, employee adjustment is included to indicate how well a newcomer is going to be accepted as a trusted member in their new organization. The most frequently used indicators of new employee adjustment are role clarity, self-efficacy, acceptance by organizational insiders, and knowledge of organizational culture.

Role clarity helps newcomers to estimate how they feel about the new job itself. The higher the role clarity, the deeper the understanding of the role (Kammeyer-Mueller & Wanberg, 2003). According to the study by Adkins (1995), role clarity is defined as one of the most consistent predictors of socialization outcomes such as job satisfaction and organizational commitment.

Self-efficacy as the second adjustment indicator for new employees relates to the level of confidence newcomers feel towards their new jobs. Research shows that self-efficacy is highly related to the outcomes of onboarding in terms of organizational commitment, satisfaction and turnover (Bauer, Bodner, Erdogan, Truxillo, & Tucker, Newcomer Adjustment During Organizational Socialization: A Meta-Analytic Review of Antecedents, Outcomes, and Methods, 2007).

As described in the previous section, organizational insiders affect the learning process of new employees. It is important for newcomers to be accepted within organizations. Acceptance by peers and co-workers has always been used as an indicator for adjustment in the onboarding process (Bauer & Erdogan, 2011).

Knowledge of the organizational culture has been suggested as key in newcomers' onboarding. According to Klein and Weaver (2000), understanding organizational politics, goals and values is an important indicator of a newcomer's adjustment, and also influences final outcomes.

These four adjustments help measure how well newcomers integrate into their new companies, but each concept remains shallow and abstract. There is no clear guidelines for what the goals of onboarding are and when they need to be achieved. This study helps identify the adjustments required, and gives the expected outcomes of onboarding.

2.4.5 Socialization outcomes

Bauer and Erdogan (2011) proposed four outcomes as the final goals of onboarding: (1) high satisfaction, (2) great organizational commitment, (3) low turnover, and (4) better performance. The idea is supported by a large number of studies (Adkins, 1995; Gruman, Saks, & Zweig, 2006; Kammeyer-Mueller & Wanberg, 2003; Chan & Neal, 2000). As described in the previous sections, the expected results of a successful and effective onboarding process are to enhance work engagement and the productivity of employees, thereby achieving financial success for the company. Bauer et al. (2007) proposed that job satisfaction and organizational commitment are closely associated with organizational socialization tactics.

2.5 The Model of Onboarding Process in This Research

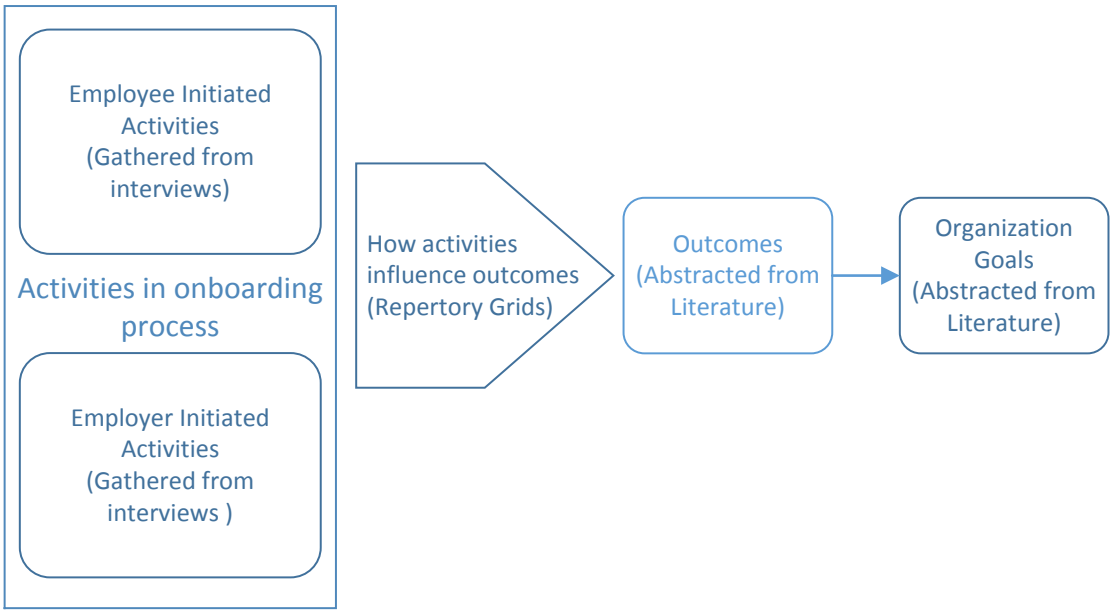

Figure 2-2 The model of onboarding process in this study

Figure 2-2 conceptualizes the onboarding process investigated in this study. The emphasis is on understanding the specific onboarding *activities* used in practice, as well identifying the expected *outcomes* of the onboarding process. As shown in Figure. 2-2, it is the link between which activities contribute to which expected outcomes that is the focus of this

study. The onboarding activities have been categorized into employer initiated ones and employee initiated ones to reflect my hypothesis that these two types of activities may have different levels of influence on achieving the outcomes desired by the employer. Although Figure 2.2 shows the organizational goals linked to the desired onboarding outcomes, this is included in the model for the sake of completeness, but is outside the scope of this thesis.

When comparing Figure 2-1 with Bauer & Erdogan's model of onboarding (2011) in Figure 2-2, some similarities and differences can be seen, which reflect the scope and emphasis of this thesis. The general, abstract ideas of "New employee behaviors" and "Organizational efforts" in Figure 2-1, correspond to the more specific and concrete "employee initiated activities" and "employer initiated activities". In Figure 2-2. "New employee characteristics" is outside the scope of this thesis. Partly this is because the characteristics of newcomers that influence the outcomes of onboarding in a significant way has been well studies. This relationship has already been widely confirmed in different research, and so is of less interest. On the other hand, there is no evidence showing that personality traits can be influenced by a specific onboarding process. Thus, the influence of employee characteristics on onboarding is not an aim in this research. In contrast, the emphasis of this study is to discover what behaviors and activities can be used to hasten integration when onboarding, and how these activities influence onboarding outcomes.

According to the study by Bauer and Erdogan (2011), the behaviors and efforts during the onboarding process can be initiated by both the new employees and the organizations, but there is no comparison of the contribution to socialization from these two factors. The patterns of influence on onboarding that are activated by the different roles are various and interesting. Therefore, the research in this study will give a comparison between employee initiated activities and employer initiated activities in terms of their effectiveness in the onboarding process. The activities which might affect newcomers' socialization are captured from the interviews in this study. In the previous study, the effective activities provided are limited, and not specific, which is different to discovering the relationship between the activities and outcomes of onboarding.

As noted in sections 2.2 and 2.3, there are only a few studies that focus on how the

behaviors and activities influence the outcomes of onboarding, which leaves a gap in this area. In this study, the activities were identified through interviews, and the repertory grid technique was used to find the patterns of the relationship between the activities and outcomes of onboarding. The methods deployed in this thesis and the reasons of using each method are elaborated on in Chapter 3.

The third part in Figure 2-2 is onboarding outcomes. Outcomes from the literature tend to be presented in a general rather than specific way, such as high satisfaction, high organizational commitment, low turnover, and high performance (Adkins, 1995; Gruman, Saks, & Zweig, 2006; Kammeyer-Mueller & Wanberg, 2003; Chan & Neal, 2000). They do not show what skills or knowledge need to be enhanced for newcomers. Thus, these outcomes are defined as 'organization goals' in this study, which is the last part of the model. The expected outcomes of the onboarding process in the research are obtained based on the weaknesses of newcomers that have been indicated in the literature. The expected outcomes of onboarding are categorized and given in the following section 2.6.

Overall, the model of the onboarding process in this thesis differs from the model normally used in previous studies. The reason for this is the difference in study emphasis and aims. Previous researchers have concentrated on defining influencing factors, enablers and strategies for effective onboarding (Bauer, Bodner, Erdogan, Truxillo, & Tucker, Newcomer Adjustment During Organizational Socialization: A Meta-Analytic Review of Antecedents, Outcomes, and Methods, 2007; Thompson, 2005; Adkins, 1995; Chan & Neal, 2000), while this thesis focuses on finding specific activities and outcomes and their relationship to onboarding.

2.6 Expected Outcomes of Onboarding in Agile Software Development Teams

The main aim of this section is to present the expected outcomes of the onboarding process in Agile software development teams, in order to develop the onboarding model depicted in Figure 2-2. All the outcomes were obtained based on the weaknesses of newcomers and the challenges they faced during onboarding.

As newcomers in organizations, a lack of knowledge and information about their jobs and

the company can cause a lower level of productivity and performance (Begel & Simon, 2008). In the software development industry, new employees may encounter problems with technical skills, project knowledge and socializing with colleagues (see Table 2-1 for references to evidence). Therefore, as the result of onboarding, they are expected to have ability to communicate and work with other team member; meet the standers of work quality; and master the framework of Agile software development method, thereby being capable of completing tasks by themselves.

The repertory grid technique is used in this study, described in the following chapter. As the partial grid is deployed, the expected outcomes which gathered from literature are also regarded as elements in grid.

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Category	Element	Explanation	Source References
Culture Context	Understand company culture	It is essential for newcomers to understand the underlying culture and values of their company, since this can provide them with a concept of the broader goals of their organization thereby allowing them to fit into the team as a whole.	(Stein & Christiansen, 2010) (Pike, 2014) (Singh, 2012) (Jensen, King, & Kuechler, 2011) (Steinmacher, Wiese, & Gerosa, 2012) (Steinmacher, Wiese, & Gerosa, 2012)
	Understand the team norms	The correct contact network and team power structure provides newcomers with a resource to interact with their team members.	(Symon & Cassell, 2012) (Seibert, Kraimer, & Liden, 2001)
Job Responsibility	Understand others' expectations of one's own role's responsibilities	Newcomers always find it difficult to navigate their work direction, and a pair of reports shows erroneous understanding of job responsibility leads to reduced productivity.	(Steinmacher, Sliva, & Gerosa, 2014) (Bauer & Erdogan 2011)
	Know the responsibilities, expertise and authority of other team members	Newcomers, especially graduates, do not ask questions soon enough, and find it is difficult to find the right person who can answer their questions.	(Begel & Simon, 2008) (Steinmacher I. , Wiese, Conte, Gerosa, & Redmiles, 2014) (Stein & Christiansen, 2010) (Seibert, Kraimer, & Liden, 2001)
	Understand what work to do and when	New team members are encouraged to find their own tasks to work on instead of simply accepting tasks distributed by others.	(Krogh, Spaeth, & Lakhani, 2003) (Park & Jensen, 2009)
Standard of Work	Understand how to code and test to the team's expectations	The phenomenon of coding unproductively and testing robustly is common among newcomers of software development, which caused by the lack of knowledge about operation of the tools that are used in their company.	(Begel & Simon, 2008) (Cubranic, Murphy, & Booth, 2005)
	Understand and meet the team's standards of work quality	Knowledge of the standards of work outputs broader than code and tests. For example, the level of quality of documentation, the quality and level of involvement.	Based on own experience.
Agile Methodology	Adopt the mindset of Agile	A healthy mindset among team members contributes to the solidarity and performance of a team. Newcomers need to fit into the thought style of an Agile team.	(Hoek, Harrison , & Christopher, 2001) (Shore & Warden, 2010)
	Know how to use Agile artefacts and techniques that are part of the team's software development process	To enhance performance of newcomers, they need to understand all the artefacts and techniques which are utilized in the projects, and master those techniques.	(Rüping, 2003) (Shore & Warden, 2010)

Project Knowledge	Understand the project structure, aims and implications	If newcomers lack knowledge on the overall structure of the system this leads to the misunderstanding of the project goal, which is closely related to their performance.	(Steinmacher, Wiese, & Gerosa, 2012)
	Understand the project domain knowledge and terminology	Newcomers' unfamiliarity with the domain knowledge hinders their performance	(Oliveira, Rocha, Travassos, & Menezes, 1999) (Steinmacher, Sliva, & Gerosa, 2014)

Table 2-1 Summary of the expected outcomes from synthesis of literature

2.6.1 Culture context of the organization

There are many studies showing that newcomers find it difficult to have a good understanding of an organization's culture and values (Stein & Christiansen, 2010). However, the cultural context of a company is regarded as an influence on the performance of employees. This session describes the expected outcomes of the onboarding process for newcomers in terms of culture context, covering understanding of company culture and team norms.

- **Understanding company culture**

According to Stein and Christiansen (2010), understanding company culture and knowing how the organization operates holds the key to employee socialization, since this can provide newcomers with a concept of the broader goals of their organization thereby allowing them to fit into the team as a whole. Klein and Weaver (2000) state that understanding the values and goals allows newcomers to gain a sense of satisfaction and commitment within the organization. Workers tend to enjoy their jobs when their aims and values meet and fit into the environment of the workplace, enabling them to develop better relationships with colleagues, and improving their productivity.

Company culture can involve different aspects. For example, management strategy. In today's companies, less traditional management strategies such as hierarchical leadership are used. Instead, fostering creativity, collective problem-solving and greater employee freedom have been regarded as the key to management, which is proven by successful top companies such as Google, Apple Inc., and Netflix Inc (Corporate Culture, 2016). Such values encourage employees to be creative, willing to share ideas, think positively, and have a sense of responsibility.

The power structure of an organization is another form of company culture. A clear concept of power structure allows newcomers to distinguish the power or authority that is distributed between people within the organization (Domhoff & Dye, 1986).

For newcomers, adopting company culture is like adopting a way of thinking and doing things, rather than just simply learning knowledge. " … behavioral criterions are the unwritten rules emphasizing such matters as employees' appearance and cooperation with

one another" (Chen, Zhu, & Xie, 2006)There is no clear rule for newcomers to follow; they need to take the time to understand and fit in to the culture.

- **Understanding team norms**

Team norms are basically sets of relationship guidelines, covering many aspects of business routines, such as communication, decision-making and dealing with conflict. Team norms vary based on the culture of the company. For instance, if a company embeds a team-based culture focusing on the participation of staff at all the levels, the team norms of this company must be designed based on team accountability, autonomy and shared leadership. The team norms, including peripheral, relevant and pivotal norms, are compiled by members of a group, who enforce the expected behaviors (Pike, 2014). Newcomers have to know and follow these norms in order to obtain acceptance and support from their community.

Team norms can be reflected in the pattern of information exchange throughout the whole team. For example, high quality content is important when sending messages to team members for support. Based on the study of Singh (2012), a newcomer who has ability to send a comprehensible message may have a higher chance of receiving replies from others. It is especially important when a person needs to ask for help from their team – an inarticulate message may be misunderstood by the community. Therefore, to become one of the team, a high quality of language interaction is needed to fit into the team norms.

Another example of a team norm is the response time for other messages, emails and requests. There are several researches indicating that it is essential for newcomers to know the tolerance for delayed responses in a team. Jensen, King, and Kuechler (2011) argue that receiving a timely response has a positive impact on newcomers' future participation. Singh (2012) also points out that nearly all newcomers who do not respond to their community's messages will face the problem of not receiving a reply or receiving a condescending reply from others. Both the studies by Steinmacher, Wiese, Chaves, and Gerosa (2013) and Steinmacher, Wiese, and Gerosa (2012) argue that a proper response can influence the integration of newcomers as well.

A good understanding of team norms helps newcomers be accepted, which also has a positive impact on both performance and self-confidence.

2.6.2 Job responsibility

Lack of confidence leads to the inefficiency of newcomers, which is embodied in weakness of work direction, confusion about their task selections, and disorganization about their future development (Steinmacher & Gerosa, 2014). These situations may significantly influence the productivity of newcomers. Therefore, they are expected to have an explicit concept of their job responsibilities, and understand what to contribute to.

- **Understanding others' expectations of one's own role's responsibilities**

According to Steinmacher, Sliva, and Gerosa (2014), newcomers always find it difficult to navigate their work direction, and some studies show that an erroneous understanding of job responsibility leads to reduced productivity. On the other hand, Bauer and Erdogan (2011) also point out that a high level of role clarity helps newcomers to adjust to their new roles and contributes to more positive onboarding outcomes, such as higher job satisfaction and organizational commitment.

However, the different roles in Agile teams makes it more difficult for newcomers to understand the responsibility of each role. There are at least five different roles in an Agile software development team: Manager, Product Owner, Analyst, Developer, and Tester, and all of these roles have distinct responsibilities. For example, a developer in an Agile team is responsible for estimating the size of the user story; implementing of backlog items; and writing and verifying code (Shore & Warden, 2010). A product owner has the responsibility for keeping a clear vision of the product, writing user stories and prioritizing user stories with other team members. The responsibility of each character might be changed slightly in practice to fit the environment of each organization, but the main structure of staff distribution should follow the Agile rules.

- **Knowing the responsibilities, expertise and authority of other team members**

In an Agile development team, collaborations between team members are encouraged. To become a trusted person in the team, newcomers should be helpful and know when and how to ask for help when needed. However, according to Begel and Simon (2008), newcomers, especially graduates, do not ask questions soon enough, and find it difficult to ask the right person their questions. Therefore, it is important for them to know the responsibility, expertise and authority of the other team members.

Steinmacher, Wiese, Conte, Gerosa, and Redmiles (2014) also point out that new graduates struggle about how and who they should ask for help. The correct contact network and power structure in the team provides newcomers with a resource to interact with their team members. They need to know the people they will be working with to support themselves in getting accepted by others. At the same time, with helping from team members, they can understand the values and norms of their team, and the tasks they should finish in their daily work. Moreover, the contact network offers new members a resource to help them with difficulties and issues that they encounter during their work and their careers (Stein & Christiansen, 2010). Based on the study by Seibert, Kraimer, & Liden (2001), new employees who have access to upper or high-level organizational contacts (i.e., core developers, scrum masters) are more able to gain useful information, social support and sponsorship, having varying stocks of resources.

- **Understanding what work to do and when/how to do it**

New team members are encouraged to find their own tasks to work on instead of simply accepting tasks distributed by others, and, after onboarding process, they should have the ability to arrange the most appropriate task for themselves, as this can maximize the contribution of their specialized knowledge to projects (Krogh, Spaeth, & Lakhani, 2003). However, according to the figures in that study, only a small part of newcomers had adequate experience or were confident enough to choose a task for themselves. Park and Jensen (2009) also reported that there was a need for newcomers to figure out how to get involved and become active, and what to contribute to.

2.6.3 Standard of work

It is well-known that the technical skills of team members play a crucial role in software development organizations. However, it has been found that newcomers tend to have difficulties adapting to the new technical environment, which is caused by uncertainty about what skills and knowledge are specifically required. To contribute to the team, newcomers are expected to have high competence and expertise in the languages, tools, and project architecture of the team.

- **Understanding how to code and test to the team's expectations**

Based on the theory of Begel and Simon (2008), the phenomenon of coding unproductively and testing robustly is common among newcomers in software development, which is caused by a lack of knowledge about the operation of tools that are used in their companies. However, these two skills are crucial as a member of a software development team. Thus, the ability to code and test is one of the focuses of the onboarding process.

Once the newcomer has an appropriate task to work on, the chosen of artefact can affect the contribution of the person. According to Cubranic, Murphy, and Booth (Cubranic, Murphy, & Booth, 2005), a suitable tool helps to enhance the performance of software development. An example in their study was new employees could use the data presented by Hipikat to generate results that were comparable in quality and correctness with those of senior members in the team.

From the aspect of technical skills, Begel and Simon (2008) indicate that graduates are capable of coping with complex problems in programming. They are excellent at coding and debugging, but testing robustly is one of the issues for them. Besides that, graduates also have difficulty manipulating tools that support large-scale development.

Understanding and meeting the team's standards of work quality

Broader than understanding the standard of testing and coding expected by the team, this outcome relates to the expected standards of other artifacts and ways of working. This includes the standard of quality expected in documentation and other artifacts produced as part of the software development process. This could also include understanding the expected time taken for tasks, how quality is measured, and expected levels of involvement and participation in different software development activities.

My supervisor shared that it is his experience that newcomers may have expectations about the quality of these things based on their own values and experience, and that it may not align with the team's expectations of work quality. It is reasonable that part of the outcome of onboarding is a better alignment of the team's expectations and the newcomer's expectations about standards of work quality.

2.6.4 Agile process

The features of Agile software development teams, such as self-directed and cross-

functional working, pose a barrier for newcomers to adapt to the environment, especially for those who do not have previous experience in the Agile method. To integrate into the team and make a contribution to the community, it is necessary for newcomers to get used to the workstyle and procedure of their project. Since this research focuses on the onboarding process in Agile development teams, knowledge of the process and workflow of the Agile method is also considered to be important.

- **Adopting the mindset of Agile**

Based on the theory of Hoek, Harrison ,and Christopher (2001), a healthy mindset among team members contributes to the solidarity and the performance of a team. Different to traditional development methodology, Agile emphasizes the collaborative effort among the whole team. Every team member should have a sense of responsibility for the project. This development method also advocates adaptive planning, evolutionary development, early delivery and continuous improvement (Shore & Warden, 2010). A series of mindset is adopted to match the aims of Agile to cultivate high performance teams.

Newcomers need to fit in with the thought style of an Agile team, having the ability to offer help, being willing to take on roles, and being grateful for each other's work. Other mindsets that should be embedded include always being respectful towards others, intending to learn and acquire knowledge, and focusing on delivering value (Hoek, Harrison , & Christopher, 2001).

- **Knowing how to use Agile artefacts and techniques that are part of the team's software development process**

Unlike traditional ways of development, much less project documentation is used to describe the development process in Agile (Rüping, 2003). Instead, artefacts and techniques are deployed to recode the process of the project, such as user requirements, product architecture, and product iterations. The key feature in Agile is Sprints, also called iterations. Sprints are fixed-length periods of time during which a list of tasks (user stories) should be accomplished. A user-story, which is translated from the requirements of customers, is another signature technique that is used in Agile to describe a feature that need to be delivered as a function in the product (Shore & Warden, 2010). There are many other artefacts deployed in Agile, such product backlogs, story points, and burndown charts. Different meetings are also designed to keep the development procedure

transparent, and maintain the high level of involvement of every shareholder. To enhance their performance, newcomers need to understand all the artefacts and techniques which are utilized in the projects, and master those techniques.

2.6.5 Project knowledge

There are two main aspects in project knowledge: (1) project structure, aims, and implications; and (2) domain knowledge and terminology. Unlike technical skills and knowledge of Agile methodologies, project-specific knowledge may differ from project to project.

- **Understanding the project structure, aims and implications**

According to a study by Steinmacher, Sliva, and Gerosa (2014), the project structure is difficult for newcomers to understand, and would take too much time to learn. This phenomenon is either caused by the size of project or the lack of knowledge of newcomers in terms of developing skills. A lack of knowledge about the overall structure of the system leads to misunderstanding the project goal, which is closely related to their performance. Thus, during the onboarding process, the project structure is considered a key point to be learned by newcomers, as well as the purpose and implications of the project.

- **Understanding the project domain knowledge and terminology**

According to Steinmacher, Sliva, and Gerosa (1999), project domain knowledge during software development influences productivity, as it relates to the identification and description of what must be accomplished. For newcomers, unfamiliarity with the domain knowledge hinders their performance (Steinmacher, Sliva, & Gerosa, 2014). Based on Steinmacher et al., new staff who have previous experience in domain knowledge tend to undergo a shorter onboarding process than others, and are more easily received by the community.

3 Research Design and Method

This chapter describes the research approach deployed in this study. The unit of analysis, the methods of data collection, data analysis techniques, are all included.

3.1 Research Aim and Questions

The main purpose of this research is to understand the onboarding process in practice for new team members in the context of Agile software development teams, with a view to uncovering possible improvements to onboarding. In this investigation, the onboarding process is conceptualized as a set of activities that move new team members towards desired outcomes related to speed up their productivity and integrate into the new working environment. is to understand the relationships between onboarding activities and the desired outcomes of the onboarding process. provide guidelines for Agile software development teams and newcomers to speed up their productivity and integrate into the new working environment. In the context of a new team member joining an Agile software development team the research questions are:

Research questions
RQ1 What are the desired outcomes for the onboarding process?
RQ2 What activities are currently used in practice in the onboarding process?
RQ3 What level of contribution do each onboarding activity make to each of the desired outcomes?
RQ3a What onboarding activities are perceived as having the most contribution to the desired outcomes overall (i.e. give the best onboarding value)
RQ4 What is the perceived duration of the onboarding process?

The first two research questions provide some insights into the nature of the main concepts in the onboarding process and are used to design the repertory grid used to answer RQ3. For each desired outcome, the answer to RQ3 gives practitioners an idea of which onboarding activities will have the most contribution to that outcome. The answer to RQ3 may also help to identify any outcomes which have no or few activities that influence them. This suggests possible gaps or shortcomings in the onboarding process that need to be addressed.

RQ3a relates to the same data gathered for RQ3, but the analysis identifies any activities that contribute a lot to many outcomes. These are useful to practitioners as good candidates to optimize the onboarding process.

The onboarding process is a journey with an unclear endpoint. RQ4 provides some understanding of how long practitioner's think it takes for someone to be onboarded sufficiently that they can now be considered part of the team. The notion is that further improvements the new team member's productivity and integration would be part of "normal" team development. Having an idea of the duration of onboarding can help practitioners plan and manage their expectations.

3.2 Research Process

Figure 3-1 shows the research process used in this thesis to answer each research question and shows the step of how data was collected and analyzed.
RQ3 by RG meant that some mechanism for obtaining the elements and constructs was needed, which are based on the answers from RQ1 and RQ2. Since a partial RG was selected (see section 3.6), the elements (outcomes) were fixed for each participant and derived from literature. The constructs were not fixed and so were got from each participant in an interview prior to doing the repertory grid, as is usual for repertory grid research.

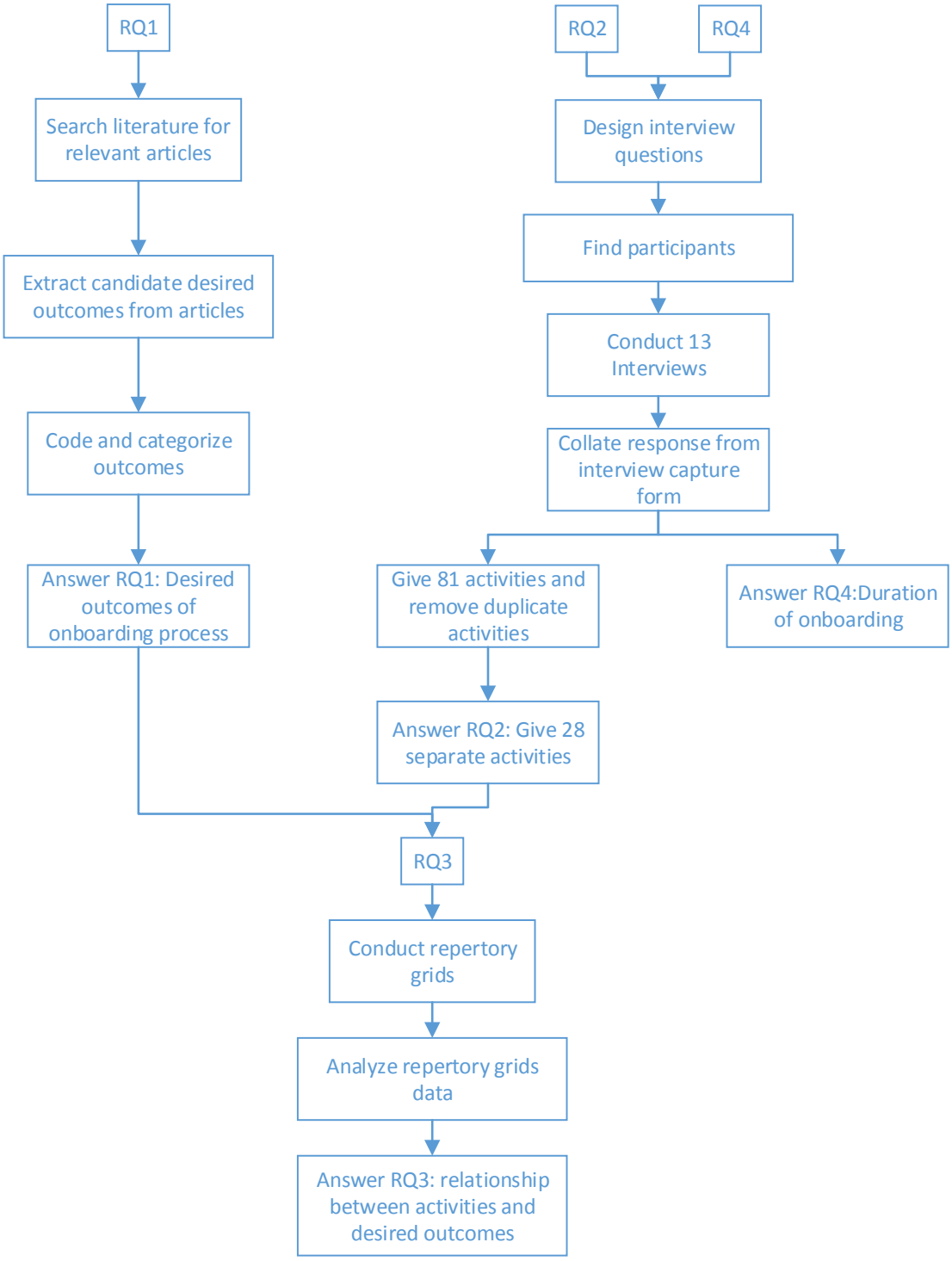

Figure 3-1 Research Process

Research Process for answering Research Question 1

The first step in identifying the desired outcome of onboarding is to identify relevant research articles. The following online research databases were searched: Google scholar, IEEE Xplore, ScienceDirect, and ACM Digital Library. The initial search string used to search the entire content of articles was (onboarding) AND (Agile Software development). This returned no relevant articles. The search was changed to exclude the "agile" keyword

and still too few articles (10) were returned. So the search string was then changed to broaden the search into onboarding in domains other than just software development. The search string used was:
((onboarding) OR (newcomer) OR (new employee) OR (new staff) OR (new team members)) AND (software). This returned around 200 papers.

The papers found from this were filtered by firstly reading the title and sometimes the abstract to see if they were relevant to the onboarding process and that they were empirical research. The empirical research included systematic literature reviews of empirical research. This reduced the number of papers included to around 20. These were then skim read and if they mentioned onboarding outcomes, they were included in the literature to answer RQ1. As seen in Table 2-1, 17 research papers were used to extract the desired onboarding outcomes.

The outcomes were extracted from each article into a written list. This list was filtered by removing duplicate outcomes as well any outcomes where the evidence was not convincing. Sometimes several similar outcomes in the list were coded into one outcome. For example, understanding several specific team norms were mentioned as desired outcomes, and these were coded as the desired outcome “understand the team norms”. This resulted in the 11 outcomes shown in Table 2-1.

The 11 outcomes were categorized into themes as shown in the first column of Table 2-1. These categories are a useful way of structuring the desired outcomes as a model of the outcomes and a language to talk about the types of outcomes.

Research Process for answering Research Question 2 and 4

Since the aim of this thesis was to study the practical circumstances of the new team member onboarding process in depth, the interview methodology was adopted along with qualitative data collection strategies and cognitive modelling based on George Kelly’s Personal Construct Psychology (Edwards, McDonald, & Young, 2009). The combination of these two research methodologies can provide rich and powerful data and contribute to capturing the perceptions of practitioners.

Semi-structured interviews were designed to capture practical activities that were used in

the onboarding process, which was designed to answer RQ2 and to obtain the data for the repertory grids. Further, the advice from practitioners about the duration of the onboarding process were noted to answer RQ4. Since this thesis includes exploratory studies, the strategy of qualitative interviews, which is normally deployed to research a phenomenon using participants' interpretation of their environment, was used. The interview response capture form (Appendix 4) were used to note the responses that were given by interviewees. At the same time, audio recording were made of each interview to provide a backup to the completed interview forms. For example, if the noted response was not captured clearly in the form then the researcher used the recording as a resource to check on what was said for that response. By collating the responses from the interviews, 81 activities were gathered and after removing duplicate activities, 28 separate onboarding activities were identified (see Table 4-3 in the Chapter 4). The design of the interview is justified and described in more detail in Chapter 3.5.

With the expected outcomes collected from the literature, and practical onboarding activities gathered from interviews, the repertory grid technique was conducted for the purpose of giving the answer for RQ3. A further description of the deployment of this technique is presented in Chapter 3.6.

3.3 Unit of Analysis

As the study aims to find out the relationship between practical onboarding activities and desired onboarding outcomes, the unit of analysis is chosen to be the "activity". Based on the practical activities collected from the interviews, and the data from the repertory grids, the level of influence and contribution of each activity against each desired outcome are inferred. And for the deeper understanding of connection of activities and outcomes of onboarding, an analysis of how aggregated activities influenced expected outcomes is also given.

3.4 Literature Review of Research on Onboarding Process

The first step of this thesis was the literature review, which included reading, noting, and analyzing articles and theories related to the onboarding process of newcomers and the Agile software development method. The focus of this stage was to define the meaning and importance of the onboarding process for new employees; to obtain the current

situation of the onboarding process of new employees in the Agile software development industry; and to define the factors influencing the onboarding process. Based on prior studies, the onboarding process has been stated as being an important element that impacts on the performance of both newcomers and their teams (Bauer & Erdogan, 2011; Pike, 2014; Bradt & Vonnegut, 2009). It hastens the integration period of new employees into new environment; enhances productivity of the whole team; and increases job satisfaction and organizational commitment. The main purpose of the literature review was to provide theoretical evidence for this study and help build the structure of the research, achieving an in-depth understanding of onboarding in Agile software development teams. The findings of the review were the foundational resource for setting up the semi-structured interview questions and the elements of the repertory grid, which were the main approaches in this study to collecting data to answer the research question.

The previous studies in the area of the onboarding process in the software development industry bring forth the significance of this procedure, and the techniques and strategies that are currently incorporated within the onboarding process. Based on the thesis of Bradt and Vonnegut (2009) and Begel and Simon (2008), an appropriate onboarding process holds the key to the enhancement of productivity of new employees in a relatively short period. Bauer and Erdogan (2011) argued that proactive behaviors of new employees such as information seeking, and organizational efforts such as a mentoring program, can be the appropriate way to speed up the integration of new employees.

However, some prior studies focus on the onboarding of newcomers in more traditional software development, like Waterfall and open source methodology, rather than Agile. For example, Steinmacher and Gerosa (2014) used a systematic literature review method to aggerated the barriers faced by newcomers in open source projects. Twenty-one studies were analyzed to support the results of their study. Based on their research, the barriers during newcomers' onboarding were categorized into five classes: finding a way to start, social interactions, code issues, documentation problems and newcomers' knowledge. However, they did not give an effective way of how to tackle these challenges.

Begel and Simon (2008) conducted an in-situ qualitative case study of new software developers at a company. They found many of the barriers for graduates when they first started software development jobs were caused by poor communication and social skills.

They also revealed that the adoption of particular instructional pedagogies such as pair programming, legitimate peripheral participations and mentoring might be more effective in preparing college graduates to become qualified developers in the industry. The background of development methodology was not included in their study, and a clear connection between effective pedagogies and onboarding outcomes was not given either. Further, due to the specificity of Agile and its strict regulation, the onboarding process in such a development environment can be more complex and tougher than in other development methods. Therefore, the contribution of the current research is obvious, as it reveals the effective activities required during the onboarding process of new employees in Agile software development teams, and describes how these activities influence the outcomes of the onboarding process.

3.4.1 Implementation of literature review

The underlying definition and meaning of onboarding process was obtained from the literature review conducting in the prior of this research. These theories give an overview of the meaning and importance of onboarding process for both individuals and organizations (Abdel-Hamild,1989; Ashforth & Saks, 1996; Bauer & Erdogan,2011; Bauer, Bodner, Erdogan, Truxillo,& Tucker, 2007). Furthermore, with the result from researchers conducted previous (Bauer & Erdogan,2011; Begel & Simon, 2008; Begel & Erdogan, 2011; Steinmacher &Gerose, 2014), the current situation of onboarding newcomers in software development industry is revealed, providing evidences for this study. The challenges for newcomers, the efforts from individuals and organizations and the expectations of companies to newcomers are obtained from literature to support the following steps which are the implementation of semi-structured interview and repertory grid.

3.5 Semi-Structured Interviews

The main purpose of the literature review was to define the onboarding process and acquire evidence for the research that followed, while the use of semi-structured interviews was to obtain information about the activities that were used in the process of onboarding newcomers in Agile software development teams for the purposes of data

collection.

Table 3-1 indicates how the interview questions related to the research questions, and how the interview questions answering the research questions.

	Research Questions	**Interview Questions**
Context of Interview		The questions in the interview based on the background to the project where a new person joins the team of participants. 1. Please describe the main aim of the software project. 2. What was your role? 3. Please describe the agile software development process for this project
Characteristics of the new team member		4. Was the new team member new to the organisation? 5. Was he/she a graduate? 6. What was the team role of the new person? 7. Was the new team member new to the role? 8. Did they have any knowledge of the project domain. Expert or novice? 9. Did they have any knowledge of agile software development practices and tools, expert or novice?
Expectations of Onboarding	What are the desired outcomes for the onboarding process? What is the perceived duration of the onboarding process?	10. What aspects of the new team member's behaviour, attitudes, knowledge and capability did you think would change through the onboarding? 11. How long did you think the whole onboarding process would take? 12. How did you judge when the new team member was part of with the team and didn't need any more onboarding help?
Onboarding Activity	What activities are currently used in practice in the onboarding process?	13. What planned activities did you get the new team member to do to help a them with onboarding to the team? 14. Who was involved in the onboarding activities? 15. How long do you estimate that the onboarding of this team member took?

Issues and Challenges	What are challenges for onboarding new team members?	16. What do you think the main challenges or issues are with on boarding new team members to agile development teams? 17. What was done to address these challenges in your team?

Table 3-1How the interview questions related to the research questions

Since the research question of this thesis was to gain a deep understanding of new employee onboarding in the real world, and the variety of factors that lead to this being a complex phenomenon, it was crucial to discover the perspectives and standpoints of the lived experience from those who experience it in daily life, which is the first step in phenomenological research (Englander, 2012). According to Sliverman (2013), the interview method is widely used in qualitative research, and this method has been stated to help discover a deeper understanding of social phenomena than other techniques.

According to Brinkmann (2015), interviews are an appropriate approach for data collection when researchers need to analyze information from participants' experiences. This type of research approach is suitable for the study of onboarding, since the experiences are naturally generated during the integration of newcomers and their practical experience of it. Therefore, the aim of the interviews was to find answers for the research questions by discovering the experience of participants, and espousing the study object under investigation. Along with the information extracted from the conversations between interviewer and interviewees, the challenges of current onboarding processes in the Agile software industry and helpful techniques used in practice were discovered.

In the area of empirical software engineering research, the interview method is a commonly used approach for qualitative data collection. In this research, to capture the data of the practical onboarding process, which involves human behaviors, face-to-face interviews are more appropriate than written or recorded documents of practitioners' experience. Further, this method allows participants to expound their conceptions, describing details of actual circumstance in the onboarding process. This enriches the content of conversations, helping the researcher to focus on the in-depth investigation of the process and enhances the accuracy of the raw data for the steps that follow. This method of data collection is particularly valuable for case study researches of Agile development, since the opinions, notions and perceptions can be obtained during the interviews (Fitzgerald, Hartnett, & Conboy, 2006).

In an Agile software development team, there should be at least five different roles: Manager, Product Owner, Analyst, Developer, and Tester, and the responsibility of roles are different. The focus of this research is on the investigation of onboarding of

developers and tester, since the number of these two roles account the most part a development team. Newcomers are the most important element in this study, they were invited into the interviews as the essential resource for information, and their perceptions were regarded as the main reference for data analysis. To ensure the accuracy of the data collected and information captured from these different roles, the interview questions had to be open-ended thereby allowing participants to provide their views. Gill, Stewart, Treasure, and Chadwick (2008) point out that semi-structured interviews not only include key questions to define the exploration of the research, but also enable interviewees to pursue more ideas and response in detail from the interviewers. They also argue that compared to structured interviews, semi-structured interviews embed a high level of flexibility, which contributes to understanding and elaborating of information. This interview format is more probing, so it promoted depth of discovery and more qualitative contributions to enrich the data gathered from the practitioners in Agile software development teams.

The practice environments in this process and the various cognitive constructs that surround it are also captured to provide context of participants and their organizations. Although this thesis does not investigate how project conditions influence the onboarding process, the project descriptions, which involve onboarding of newcomers, still may provide guidelines for readers to track the similarities between this thesis and their own situations. In Agile software development projects, high human resource turnover can have a negative effect on new staff onboarding. For example, Begel and Simon (2008) state that when a new employee comes into the development team, the duration of the projects may affect the performance of the new person.

During the semi-structured interviews, participants were asked to describe a situation in their software development project where a new person joined their team by answering open-ended questions. They also needed to describe their expectations of the onboarding process, the techniques they currently used, and the difficulties they met. Due to the distinct responsibilities of roles, their descriptions would be diverse, which would help to explore the different aspects of the onboarding process in the context of the same project using the different roles in a team.

Initially, ten potential organizations were the candidates for the interviews. All of these

organizations had adopted the Agile method to manage their development procedures and had at least one newcomer during the last six months. An invitation for the interviews along with a participant information sheet was sent to each of the potential candidates. Eight organizations expressed their interest in the study and confirmed their participation in the interviews.

After obtaining the consent of the participants, the interviews were scheduled to match the availability of the interviewees and researcher. Each participant was interviewed in an hour-long interview. During the conversations, interviewees were encouraged to speak freely about their experience of onboarding newcomers in their Agile software development team. As the result of the semi-structured interviews, the interview questions were designed as open-ended questions to map the research questions.

3.5.1 The interview participants

Because the research aim was to discover the onboarding process of newcomers in the context of Agile, all the interview participants came from a software development team that deployed Agile methodology. At the same time, each team had newcomers who had joined in the last six months, to ensure all the activities provided from the interviews still related to the onboarding process.

After selecting the potential participants based on an existing contact network, an interview invitation (Appendix 2) along with a participant information sheet (Appendix 3) was sent to each candidate.

3.5.2 Implementation of interview

To get an in-depth finding, the semi-structured interview along with repertory grid techniques is conducted after the literature review. Software development companies in Auckland which are the practitioners of Agile method and have at least one newcomer in last six months, are selected as the potential candidates of the interviews. An invitation of the interviews and a participant information sheet are sent to each candidate. There are ten originations expressed their interest to this study, however, due to the time constrains, eight of them have confirmed the participation of the interview. The schedule with each

participant is arranged after many times of time coordination.

It took 5 weeks to complete the conduction of interviews with every participant. All the conversations during the interviews have been electronically recorded. And capture form is used for the noting purpose in the interview, which has been attached as Appendix 4. All the interviews were carried out by face to face communications and only one participant presented in each interview. The average duration of each interview was 50 minutes.

Before the start of interview, the consent form was provided to in accordance with the AUT Ethical Committee's guidelines for ethical research practice, the interviewees were noticed the data from interviews could not be used in other purpose, other than this study. Their names and other identifying details would not be used in any form of reports including this study. They also have been informed of their right to withdraw from the research at any point, as well as their right to withdraw their consent to allow researcher to use their data. After the second confirmation of participation, the background and aim of the interview was presented to help interviewees reviewing the information of this study. As the begin of interviews, participants were asked to give the answers to all the structure questions prepared in advance. And then, they filled up the repertory grids.

Semi-structured questionnaires are used at the beginning of interviews and precede the repertory grid technique. The questionnaire applied in the interview has been attached as the Appendix 1 available at the end of the thesis. In accordance with the research questions of this study, the questionnaires consist of five parts. The first section aims to obtain context of case study which allows the participants to describe the main aims and Agile process of the software projects involved with newcomers in the teams. The design of this part is to collect the background of each projects, providing readers with approach to match their own situations with the study cases. The second part of the questionnaire aims to understand the nature of the new team members. Participants need to present the characteristics and behaviors of newcomers, and their previous experience in the area of software development, Agile methodology, and product domain. To obtain the issues and challenges for newcomers in practice during onboarding process, the third part of conversations enable participants to describe the actual scenarios when newcomers encountered with problems. Then, participants need to describe what are the expected

outcomes of Agile team members to onboarding process. This contributes to confirm the main goal of the entire team to onboarding process which gathered from literature review. The last part, which is also the focus of interviews is designed to acquire the practical activities of onboarding in Agile development teams, and the duration of onboarding process.

3.6 Repertory Grid Technique

Repertory Grid is the second methodology employed to collect data in this thesis. This technique was first published in 1995 by George Kelly, used to describe the way of how people thinking about a phenomenon in their world by mapping their cognition (Tan & Hunter, The Repertory Grid Technique: A Method for the Study of Cognition in Information Systems, 2002). In this part of research, to obtain the perception to onboarding process, participants are regarded as "scientists", using their work experience to build up a personal construct system to provide evidence for goal of this thesis. According to Latta and Swigger (1992), the repertory gird technique elicits both conceptual and content, and modeling into an individual's mental pattern and the relationships which exist among their concepts. They also argued that comparing with other form of knowledge representation, repertory grid helps to carry out the relative ease with which subjective models can be derived.

The three basic components of a repertory grid are elements, constructs, and links (Smith, 1980). The elements are research objects of the domain of investigation, identifying the administration of study, which are normally are the volume in the grids. The constructs are the ideas that participants or interviewees hold about the elements, normally are the rows in grids. The third component which is link that indicate the interpretation of participants to the relationship between each element and each construct. The repertory grid is classified into three types, which named full, partial and fixed grid (Edwards, McDonald, & Young, 2009). For the full repertory grid, the participant need to provide all the elements and constructs during the interview. As for the partial repertory grid, only the constructs need to be identified by the participant and the elements are supplied by interviewer. While the fixed repertory grid does not require the participant to provide both elements and constructs, all details of the repertory gird are supplied by interviewer. In this research, the partial repertory gird is used, due to the complexity of the situations of

onboarding process. The elements are the expectation by community to newcomers after the onboarding practical process, which obtained from literatures. The constructs, which is the techniques and approach that teams used to achieve these expectations (elements), can be distinguish, because of the various environment in different team.

Unlike interviews that gathering in-depth answers from interviewee, participants are asking to give a score to elements against constructs. This rating method is the frequently used way on links to show the connection of elements and constructs (Hunter & Beck, 2000). This approach enables participants to sort the elements freely, and minimizing the nonexistent discriminations. Rating scales of five, seven, nine and 11 points have been deployed in previous research. (Björklund, 2008) used nine levels scales to investigate the often-tacit criteria teacher used to judge creative work. Based on study of (Latta & Swigger, Validation of the Repertory Grid for Use in modeling Knowledeg, 1992), the rating point for research participants should not exceed the number of elements, but (Bell, 1990) argued that to obtain an accurate result the minimum point of scale should be five. On the other hand, (Tan & Hunter, The Repertory Grid Technique: A Method for the Study of Cognition in Information Systems, 2002) pointed out that a seven-point Likert scale was almost the limitation of human discrimination, and technique it is very difficult for participants to use any scale above a five-point. Based on the research object and numbers of elements in the repertory grid, a seven scale is employed in the links. A scale of 1-7 not only ensure the validity of study data, but also minimizes time-consuming. In this scale, 1 represented very low effectiveness (or importance of each construct towards each element) and 7 represented very high effectiveness (or importance). 4 was the midpoint on the scale.

The partial Repertory Grid is chosen with supplied elements and elicited constructs. In the study of Young, Edwards, McDonald ,and Thompson (2005), they successfully explore those personality characteristics that were seen to be positive in individuals fulfilling the range of roles found in systems development teams by using partial repertory grid. The supplied elements enable participants to pay more attention on eliciting only the constructs during the interview (Edwards, McDonald, & Young, 2009). In the case of this study, the measurements of Agile software development organizations to estimate whether new employees are onboarded which are obtained from literature review, are regarded as the supplied elements in the Repertory Grid. The reason for using supplied

elements instead of elicited elements is that the difference of expectations to onboarding process based on the previous researches related to the onboarding of software development are not distinguish, falling into five classes: culture context, job responsibility, work standards, Agile process and project knowledge. Moreover, with the supplied elements, participants can focus on eliciting constructs, which is the primary aim of the Repertory Grids. In partial grids, the design of elicited constructs contributes to ensure the richness of data base, and are more meaningful generating extreme ratings (Edwards, McDonald, & Young, 2009). During the interviews, the participants provides the activities that embedded in the process of newcomers' onboarding, and these activities may vary according to the environment and situations of development procedure in different teams.

3.6.1 Implementation of Repertory Grids

After the questionnaire, the activities that contribute to the integration of newcomers in each organization are collected. The interviewer will fill up all the activities into the repertory grids as the constructs. Participants are asked to completed the repertory grid and score a grade to level the feasibility of each activities towards different expectations and outcome of onboarding. The elements are settled in columns across the table, while constructs are arranged in rows. The relation between the elements columns and constructs rows composes the grid, indicating where each figure falls on a 7-point scale anchored by each construct against each element. Interviewees need to fill up the matrix of columns and rows by rating that enables a wide range of raw data.

The elements are categorized into five classes which are social interactions, job responsibility, technical skill, project domain, and Agile process.

The elements of repertory grid are listed in Table 3-2.

E1	Understanding team norms
E2	Understanding company culture
E3	Knowing the responsibilities, expertise and authority of other team members
E4	Understand other's expectations of your own role's responsibilities
E5	Understand what work to do and when
E6	Understand and meet the team's standards of work quality
E7	Understand how to code and test to the team's expectations
E8	Understand and show the agile mind set
E9	Know how to use Agile artefacts and techniques that are part of the team's software development process
E10	Understand the project domain knowledge and terminology
E11	Understand the project structure and aims and the implications

Table 3-2 Elements of repertory grids

3.6.2 Analysis of Repertory Grids

In order to see the patterns in contributions of activities to each of the fixed desired outcomes, the scores of the repertory grid cells need to be aggregated for all participants. Frequency Distribution technique is used to aggregate and quantify the contribution of each construct against each element. This involves using the frequency that each Likert value appears in each cell of the repertory grid. Valiela (2001) stated that frequency distribution was estimated as a very convenient approach to analyze multiple ratings and group data into categories allowing researcher to discover frequency of each category. This method was successfully deployed in the study of Moynihan (1996) that used Repertory Grid to identify prevalent risks in software development projects which are undertaken for third parties. He states that the frequency counting is suitable for the researches which focus on the exploration in nature, contributing to achieve free of

researcher bias. Since the partial repertory grid technique was adopted in the interview, the amount of construct that collected from interview is 28 as the end of result.

As a 7-point Likert scale is used, for the purposes of aggregating, the Likert scale is treated as an interval scale rather than an ordinal scale. The level of influence of each activity towards onboarding outcomes is computed according to frequency of responses and value in the grid which on the Likert Scale of 1 to 7.

To indicate how frequent a particular score was given to an activity, a histogram depicting is used to represent the value for each intersection of elements and constructs.
Firstly, to have a clear pattern for analysis, the 7- point Likert scale 1-7 with 4 as a neutral point has been converted into a 7-point scale from -1 to 1 with zero as the neutral point by subtracting 4 which is mean of scale from each Likert score and dividing by 3. The equation of this sept is shown in the Equation A.

$$Score = \frac{i-4}{3}$$

Equation A

And then, to aggregate the equation that used to calculate the Frequency of each activity towards each expected outcome is shown Equation B.

$$F = \frac{\sum_{i=1}^{7} f_i\,(i-4)}{3\sum_{i=1}^{7} f_i}$$

Equation B

The weighted average of the scores based on the frequency distribution of scores are calculated based on the equation.

We then assume a normal distribution of the averages and classify the aggregated score one standard deviation around the neutral point (0) as the mean, to give 5 categories of scores we label VL (more than one standard deviation below 0); L (between 0 and 1 standard deviation below 0) Neutral (0); H (from 0 to 1 standard deviation above zero); VH (More than one standard deviation above 0). For our scale one standard deviation is 0.68, rounded to 0.7.

If $F < -0.7$, then aggregated value for corresponding intersection is Very Low (VL)

If $-0.7 < F < 0$, then aggregated value for corresponding intersection is Low (L)

If $0 < F < 0.7$, then aggregated value for corresponding intersection is High (H)

If $F > 0.7$, then aggregated value for corresponding intersection is Very High (VH)

If F = 0, then aggregated value for corresponding intersection is Neutral (N)

To find pattern of preferences from the raw data of repertory grids, the numbers on the 7-point scale are leveled into three clusters, allocated with different colors. The shades of blue represent low effectiveness or contribution ranging from -1 to 0, while the shakes of green represent high effectiveness or contribution ranging from 0 to 1. This technique helps to enhance the operability of initial data from grids, marking noticeable preferences of activities towards onboarding process of each participant.

The following example shows the steps of how to calculate the Frequency of C1 (Mentoring) towards E1 (Understanding company culture). The data of other activities have been attached as Appendix 5.

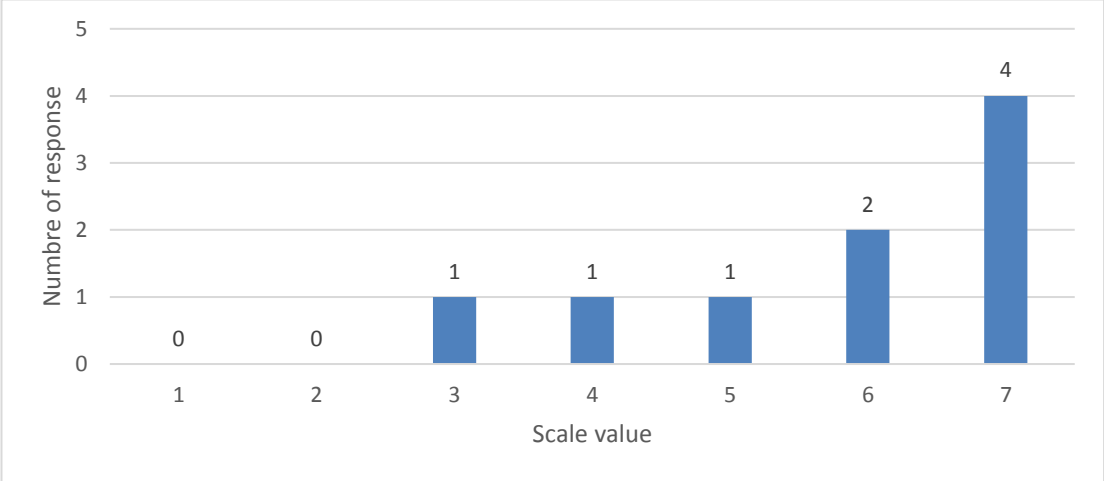

Figure 3-1 The number of response of Mentoring

As shown in Figure 3-1, there were 9 participants chosen Mentoring as a practical onboarding activity in their teams. Four of them scored the influence level of this activity against Understanding of company culture as a point 7, two scored 6, one scored 5, one scored 4, and one scored 3.

Scale	Number of responses (n)	Deviation(d)
1	0	-3
2	0	-2
3	1	-1
4	1	0
5	1	1
6	2	2
7	4	3
		F=0.6
		Level=H

Table 3-3 Aggregation for all participant ratings for Construct 1 Element 1

According to Figure 3-1, the number of responses had been collected into Table 3-3. And based on the Equation B, the average score was calculated and the value of influence level of C1 to E1 is 0.6, which falls into the range of High.

3.6 Ethical Consideration

Ethics approval was obtained from the Auckland University of Technology Ethics Committee on 11/8/2016 AUTEC Reference number 16/277. All participants were provided with a participant information form (Participant information form attached – Appendix 3) and invited to email the researcher with any questions prior to the research. Consent forms were signed by each interviewee, permitting the use of the information elicited during the interviews for this research. The interviewees were assured that they may withdraw from the research at any time prior to completion of data collection, without being disadvantaged in any way. Two copies of the consent form were signed by each interviewee, of which one was to be retained by the interviewee. The results of other activities influence level are shown Chapter 4.

4 Findings and Discussion

4.1 Company Context of interview

There were eight companies that were involved in the interviews. Table 4-1 shows the information of each organization in terms of industry sector, size of software development department, software development methodology, type of project and interview participants roles. Besides, the roles thirteen participants from eight organizations are presented.

Organization	Industry Sector	Size of Software Development Dept.	Software development methodology	Type of Project	Interview Participants Roles
A	Bespoke Healthcare Software	<10	Scrum	External client	Developer x 3 Scrum Master
B	Bespoke Software	20	Scrum	External client	Developer x 2
C	Financial Services	>100	Scrum	Internal client	Developer x 2
D	Financial Services Product	>100	Scrum	Internal and external client	Tester
E	Fleet Management Product	15-20	Scrum	External client	Developer
F	Bespoke software	40-50	Scrum	External client	Tester
G	Insurance Service	30-40	Scrum	Internal client	Tester
H	Telco	20-25	Scrum	Internal client	Developer

Table 4-1 Details of organizations in the interviews

According to Table 4-1, in the eight organizations, three of them are bespoke software companies, three are service companies, and two are product companies. All of the organizations deploying Scrum software development method. Two out of eight organizations have more than 100 employees in their software development departments. Three companies are the size of medium between 20 to 50 employees in development teams. Other three companies are small size with less than 20 employees in development apartments. Besides, three companies provide service for internal clients and four companies provide service for external clients. In terms of participant's roles, there are 9 out of 13 are developers, 3 are testers and 1 is Scrum Master.

4.2 Context of newcomers

To have an in-depth understanding of onboarding, the participants were asked to give the information of new team members in their organizations. Table 4-2 shows the details of each newcomers.

Newcomer	Role	New to Organization	New to Role	New to project Domain	New to Agile process
1	Developer	Yes	No	Yes	Yes
2	Developer	Yes	Yes	Yes	Yes
3	Developer	Yes	No	Yes	No
4	Developer	Yes	No	Yes	Yes
5	Developer	Yes	Yes	Yes	Yes
6	Developer	Yes	Yes	Yes	Yes
7	Tester	Yes	No	Yes	Yes
8	Developer	Yes	No	Yes	Yes
9	Tester	Yes	No	Yes	Yes
10	Tester	Yes	Yes	Yes	Yes
11	Developer	yes	No	Yes	No

Table 4-2 Details of newcomers in organizations

Based on the interviews, the details of eleven newcomers are gathered.

All of the new members are new to the organizations. Four of them have previous experience to their roles by the time they joined the teams. Other seven newcomers are

new to the roles. None of the new members have knowledge to project domain, and only two have knowledge of Agile process.

4.3 The result of interview

4.3.1 The Activities that Used in Current the Industry

From the interview, participants were asking to provide activities that contribute to onboarding process. 28 separate activities are obtained. The following Table 4-2 shows the activities and the meaning of each activities.

The meanings of activities are abstracted based on the answers of interviews.

No.	Activity	Frequency	Meaning / Definition
C1	Mentoring	9	In the mentoring process, new employees are assigned with experienced person for purpose of obtaining information, and advice as they advance.
C15	Online resource	8	The resource online is diversity and enormous. Some of the information from internet are useful for the onboarding.
C7	Ask team member for help (except Team leader and Project manager)	7	Asking team member for help (except Team leader and Project manager) is an employee initiated activity, which cannot be forced by employer.
C14	Team socializing	7	Team socializing can be achieved in many different ways.
C4	Training session	6	Training session is the activities or resource that company used to guide newcomers toward a specific learning objective. Normally presenting by the form of course.
C13	Code Repository	6	A code repository is a file archive or web hosting facility where storing a large amount of source code.
C10	Internal documentation	6	Internal documentations are the file and data that only available for internal staff, which may describe the data structures, algorithms, and control flow of the project.
C17	Pair programming	4	Pair programming is an Agile software development technique that involves two developers at a time to work with one work station.
C16	Stand up meeting	4	Stand up meeting is daily meeting that only take few minutes. In Agile team, every team member needs to present their present work states.
C18	Assigned with simple tasks	3	Simple tasks are assigned to newcomers in order to lower the difficulty.
C3	Induction	2	Induction is an event that hold for newcomers once they join the company. It is normally adopted in medium to large size companies. During the program, newcomers is told of the firm's history, beliefs, values, long term goals, and company structure. The regulations of safety, security and health are also included.
C24	Self-learning (Books)	2	Interviewees point out that they spend time on learning the technique by themselves.
C9	Ask Project Manager for help	1	Helps from Project Manager
C8	Ask Team Leader for help	1	Helps from Team Leader
C6	Agile Course	1	Agile Course is a kind of Training that instruct the knowledge of Agile Methodology.
C5	MSDM	1	MSDM also known as Microsoft Developer Network, is the portion of Microsoft responsible for managing the firm's relationship with developers and testers.

C28	Discussion group	1	The discussion group is a form of meeting that applied every two month in the participant' team, which allowing people to have a free talk about the challenge encountered in past several months.
C27	Knowledge database	1	A knowledge database is designed to store complex structured and unstructured information.
C26	Project plan	1	A Project plan is a formal document that displays project activities along with a time line. It is used to guide the control and execution of a project.
C25	Working conference	1	A formal meeting which aims to showcase a product or knowledge, designated for a specific group of audience.
C23	Set expectation	1	Setting the goals or expectations to newcomer before they start the onboarding process.
C22	Electronic communication	1	Electronic communication represents the message exchange between staffs through email, text massages, and social media massaging.
C21	Video of product function	1	The video provided by the organization for newcomers that shows each function and feature of their project/ product.
C20	Education stipend	1	An education stipend in industry is a predetermined amount of investment provided by organization for employee to attend course or get a certification.
C2	Orientation	1	Orientation is intended to show newcomers about their job responsibility, and how to fit into their role. This process may set for a period of a time (normally longer than a week), and a set of activities is planned.
C19	Meeting with other teams	1	The meetings are not limited inside the team.
C12	Floor map	1	The idea of Floor map is given by an interviewee. As his desecration, the Floor map is a diagram showing the distribution of every staff in the floor. The information of staff such as authority, expertise and department is also attached in the Floor map.
C11	Checklists	1	Checklists is a form of table that used to note the tasks that need to be completed within a specific period of time.

Table 4-3 the activities from interview

Since the partial repertory grid was deployed in the interview, the construct (activity) of grid was not provided, interviewees were asked to give the activities, of which influenced the outcome of onboarding, and deployed in their companies.

The activities are various, therefore, occurrence of each activities in repertory grids are different, ranging for 9 to 1. There are 12 activities that more than one interviewees regard them as effective activities in onboarding process.

There are 9 out of 13 practitioners stated Mentoring as an effective onboarding activity, which ranks the top of 28 activities, following by Online resource with 8 times given in the interviews. 7 practitioners argue that Asking team member for help (except Team leader and Project Manager) and Team socializing help the onboarding of newcomers. Training session, Code repository, and Internal documentation appear six times in the repertory grids. 4 interviewees state Pair Programming and Stand up Meeting can influence outcomes of newcomers' onboarding. 3 interviewees believe Assigned with simple tasks also helps the integration of newcomers. Induction program and Self-learning (from Books) rank the button in the range of activities which occurrence are two and above.

The activities in the second half of Table 4-2 which scoring 1 in the volume of frequency has only been provided from one interviewee of each activity, which are Asking help from Project Manager, Asking help from Team Leader, Agile course, MSDM, Discussion group, Knowledge database, Project plan, Working conference, Set expectation, Electronic communication, Video of product function, Education stipend, Orientation program, Meeting with other teams, Floor map and Checklist.

The various frequency of 28 activities represents the difference of practical activities during onboarding process in the current companies. The higher occurrence in grids is, the wider usage of particular activity is. For example, mentoring program rank the top among 28 activities, which means this type of pedagogies has the highest level of adoption among the organizations in the interview. In construct, the activities which only appear once are used not as frequently as the activities have higher occurrence, such as Check lists and Floor map.

4.3.2 The Duration of Onboarding

According to previous study, it takes one and a half year in average for new software employees to reach the maximally productivity (Landon & Laudon, 2015). Other study also appeal that the duration of onboarding process can be various, depends on the ability of the new person and efficiency of onboarding techniques (Bauer & Erdogan, 2011). However, the answers from interview towards the duration of onboarding process differ from literatures.

> *I started to feel confident with my work after the first month I had worked here, and an extra month to have a fully control of what I am doing. (Developer)*

The quote is from a developer in organization E, who had three years of software development experience before his new job. According to his states, it was taken two months in total for him to full understand his new jobs and new environment.

The duration of onboarding for person who have no previous working experience is longer than experienced person, but the different is not significant.

> *It was hard for me the learn the languages and techniques at the very beginning and it took me three weeks to learn. After the training session, I was able to do some easy tasks, and another three weeks for doing easy tasks. So after around one and a half month, I was capable of finishing regular tasks, but still needed some helps from others. (Developer)*

> *I am now can finish my work by myself, but I not think I am already being a part of the team. I still get confused with some process during development and still cannot acquaint everyone in my team (Developer)*

Compared with the experienced person, the developer from organization C had no experience before the current job struggled with technical skills and more time was spent on learning. The developer from organization H mentioned that he had not full integrate into the new team, after working two months. It is clear that the onboarding of newcomer who are fresh to working place is more than two months.

The duration of onboarding differs from person to person.

4.3.3 Discussion of interview result

The activities that used in onboarding process are various, and based on Table 4-1 28 different activities has been mentioned that influence outcomes of onboarding. The number of activities is bigger than expected, which can be leaded by the shortage of description of effective activities in previous studies. Mentoring, Training session, Induction are the frequently recommend activities for newcomers' onboarding (Qureshi & Fang, 2010; Steinmacher I. , Wiese, Conte, Gerosa, & Redmiles, 2014; Begel & Simon, 2008), however, the approaches such as Online resources, Team socializing and Code repository has not been presented, which are also highly used in practice.

On the other hand, the duration of onboarding process which abstracted from interviews are much shorter than the statement from literature. The main reason might be related to the adoption of onboarding process, reduced the time of socialization. Besides, the measurement of where onboarding process end might be different.

4.4 Contribution of activities to each outcome

As the result of interviews and the literature review, 28 practical onboarding activities and 11 desired outcomes are captured. With the deployment of repertory grids, the influence level of each activity towards outcomes are gathered. The original grids filled up by participants are in Appendix 5.

According to the Equation B in Chapter 3, the aggregated values of influence levels of activities were calculated and the figures are showing in Appendix 6. After this the values were categorized into five levels, and colored in the shades of blue, green, and yellow, which has been stated in Chapter 3.6.2. The table of showing the levels of each cells is in Appendix 7.

The Appendix 7 has been summarized into Table 4-4.

Expectation / Activities*	Very High Influence	High Influence	Neutral	Low	Very Low
E1	C7; C8	C1; C2; C3; C4; C9; C11; C14; C16; C17; C18; C19; C22; C23; C26	C6; C21; C25	C10; C13; C24	C5; C12; C15; C20; C27; C28
E2	C2; C3	C1; C4; C7; C14; C17; C22; C23; C26	C6; C8; C11; C17;	C9; C10; C18; C19; C24	C5; C12; C13; C20; C21; C27; C28
E3	C6; C8; C26	C1; C4; C7; C14; C16; C19; C22	C3; C9; C10; C11	C2; C12; C18; C23; C24	C5; C13; C15; C21; C25; C27; C28
E4	C6; C8; C26	C1; C4; C7; C10; C11; C17; C22	C9; C16; C20	C3; C13; C14; C18; C19; C23; C24	C2; C5; C12; C15; C21; C25; C27; C28
E5	C6; C8; C11; C19; C26	C1; C7; C16; C17; C23	C2; C10; C22; C25	C3; C4; C9; C15; C18; C24	C5; C12; C13; C14; C20; C21; C27; C28
E6	C8; C21; C26	C1; C4; C7; C9; C10; C16; C17; C23	C6; C11; C13; C19; C22	C3; C14; C18; C25	C2; C5; C12; C15; C20; C23; C24
E7	C1; C4; C8; C13; C18;	C5; C7; C10; C15; C17; C22; C24; C25	C20; C27	C9; C11; C16; C19; C21; C23; C26; C28	C2; C3; C6; C12; C14
E8	C6	C1; C2; C10; C16; C17; C19	C22; C27	C4; C7; C9; C13; C15; C18; C22; C24; C26; C27; C28	C3; C5; C8; C11; C12; C14; C20; C21; C25
E9	C6; C8	C1; C4; C7; C10; C13; C18; C22; C25	C2	C9; C11; C14; C15; C16; C17; C23; C24; C26; C27; C28	C3; C5; C12; C19; C20; C21
E10	C6; C19; C27	C1; C2; C4; C7; C10; C15; C22	C28	C9; C13; C16; C17; C18; C23; C24; C26	C3; C5; C8; C11; C12; C20; C21; C25
E11	C21; C25;	C1; C4; C7;	C28	C2; C13; C14; C15;	C3; C5; C6; C8;

	C27	C9; C10; C17; C18; C19; C22		C16; C23; C24; C26	C11; C12; C20

Table 4-4 the level of influence of activities on outcomes

ELEMENT	MEANING
E1	Understanding team norms
E2	Understanding company culture
E3	Knowing the responsibilities, expertise and authority of other team members
E4	Understand other's expectations of your own role's responsibilities
E5	Understand what work to do and when
E6	Understand the project structure and aims and the implications
E7	Understand how to code and test to the team's expectations
E8	Understand and meet the team's standards of work quality
E9	Understand and show the agile mind set
E10	Know how to use Agile artefacts and techniques that are part of the team's software development process
E11	Understand the project domain knowledge and terminology

4.4.1 Understanding team norms (E1)

According to Table 4-4, there are 16 out of 28 activities, including mentoring, team socializing and etc., that have a considerable (High or Very High) positive influence to the E1 which is understanding of team norms. According to the chapter 3, team norms are sets of basically relationship guidelines, covering many aspects of business routine, such as communication, decision-making, and dealing with conflict. Therefore, the involvement of team norms in onboarding activities is fairly higher than other expectations, which means newcomers can extract useful information that related to team norms from different types of process. Orientation (C2), Induction (C3), for example, may influence newcomers' understanding of team norms in a macroscopically way. The basic rules and behavior regulations; and the power network of organization providing by C2 and C3 enable new employees to have a conception of what should do and who is the one make the final decision for the whole company. Another form of formal activities that contribute E1 in a High level is Training session (C4). Compared with C2 and C3 which lasting half of a day or up to two days, C4 is relatively longer terms of onboarding activity,

taking approximately several weeks. The information about team norms from C4 are more concentrated on detail aspects likes meeting schedule instead of general information likes company structure. In terms of time scale, C2, C3 and C4 contribute to form the first impression of team norms, since these activities normally are held once new staffs starting their new jobs.

As team norm is a set of business habits which takes time for newcomers to understand and adopt, ongoing practical activities throughout their working is necessary. From the data, the best approaches for the continually and deeper understanding are Asking help from members inside the team (C7) and Team lead (C8). Both of the activities that fall into the Very High level in terms of the contribution to the understanding of team norms.

> *Team Lead is the person I will ask or discuss about team norms with. The ways of working, sometimes, are different from team to team. For example, when I came here, I had no idea about the meeting schedule and who should attend to the different meetings. Nobody but the person who in your team knows team norms, so the best way is to ask your team lead, or your colleagues. (Developer)*

According to the quote, the adoption of norms is throughout the business routine. Coworkers from the same team, as the unclear members, can provides newcomers with the working routine in detail, resulting the highest contribution of C7 and C8 on E1. Since team norms cover decision-making, meetings arrangement, project management, conflict and interpersonal relationship, newcomers may need to find the answers for when is it acceptable to miss a meeting; is the team open debate acceptable; how do people tackle with problem; and any other questions which may come up at any time during the working. There is no class or person especially designed to answer the questions, thus, they have to either observing others behaviors or ask their team mates directly.

The communications between colleagues that happened during the activities such as Pair Programming (C17) and stand up meeting (C16) and Team socializing (C14), help newcomers knowing coding habits, what and how they express their working status, and common interests by observation, making notes, and informal discussion.
Compared with C2, C3 and C4, the influence of C7, C8, C17 and (C14) can be continually, since the interactions between newcomers and senior staffs are happening everyday

throughout the working time, not like Induction and Orientation which are held once or twice a year.

4.4.2 Understanding of company culture (E2)

Based on the second line of Table 4-4, the patterns of effective activities against E1 and E2 are similar, more than 50% the activities have the same level of contribution on both two expectations. The similarity of the result towards the understanding of company culture and team norms might attribute to the overlapping of information of these two concepts. Company culture, also can be defined as the personality of a company, including work environment, company value, ethics, and goals, which influence team norms in a certain way. For instants, if a company embeds a team-based culture focusing on the participation of staffs on all the levels, the team norms of this company must be designed based on team accountability, autonomy, and shared leadership. In contrary, a traditionally hierarchical organization is more likely to have a set of directive team norms to match their company culture. Therefore, the mindsets of company culture and team norms are synchronous, allowing newcomers to understand by the same information resource, such as mentor, orientation, and their team members.

However, there are still difference between the effective activities of E1 and E2. Firstly, the quantity of the activities that rank in the High and Very High on E2 is less than which of E2. Stand up meeting, project manager and team lead are not High level contribution resource of company culture, but score High and above in teams of team norms. This means, the involvement of company culture is not as high as the team norms during the daily work. Newcomers will find it is difficult to capture the information of company culture during the interaction with the member inside their team. While, the events held up by organization are the best way for them to know the culture. The constructs of Orientation (C2) and Induction (C3) fall into the range of Very High dedication of understanding of company culture (E2).

> *We have an induction session for new staffs to get familiar with company structure, health and safety. We also have an orientation talking about the same things as the induction every year that called basic class which is for all employees of both new and old.* (Developer)

Orientation and Induction normally contain the introduction of firm' s history, company structure, and matters needing attention, allowing newcomers to know the values and culture of their company and the goals of their organization.

Other activities which are Mentoring (C1), Training session (C4), Asking help from team members (C7), team socializing (C14), Pair programming (C17), communication software (C22), Set expectation (C23) and project plan (C26) contribute to the understanding of company culture for newcomers in a High level.

4.4.3 Knowing the responsibilities, expertise and authority of other team members (E3)

According to Table 4-4, the third element in the repertory grid is Understanding the responsibilities, expertise and authority of other team members. Three activities captured from the interviews have been estimated as the most effective approaches to achieve this expectation. Agile Course (C6), Team Lead (C8) and Project Plan (C26) are the top three accesses ranking in the highest level in terms of positive influence for newcomer to achieve this outcome. Since the study objects of this research are the development teams who conducting Agile method, the team structure and responsibilities of roles in teams participated in the interviews are following the standards of Agile. In an agile team, the must has roles are Team Lead (Scrum Master), Team Member (Developer and Tester), and Product Owner. Other roles, such as Architect and QA, can be added depending on the size of the project. Agile course (C6) can provide newcomer with definitions of each roles of the team, therefore, they can distinguish the responsibilities of team members, based on their roles in the team.

> *The knowledge of Agile can really help newcomers to understand the responsibilities of their team members. Agile course can definitely provide these knowledges for the person who does not familiar with Agile. (Developer)*

C6 gives newcomers the outline of roles' responsibilities in a regular Agile team, however, the setting of roles can be different in practical environment. Team Lead (C8), as the person who knows well about the expertise and authority of every member in the team,

always is the one for new member to obtain the information of their coworkers. Project plan (C26) is form of documentation that used to show how and when project's objectives should be achieved, by stating the major products, milestones, and assignment of responsibility of staffs.

Other activities that have High contribute to the understand of responsibilities, expertise and authority of other team members, are Mentoring (C1), Training session (C4), Asking helps from team members (C7), Team socializing (C14), Stand up meeting (C16), and Communication software (C22). All the activities that help newcomer knowing the responsibilities of their team members require communications between junior and senior staff, and the person who can offer the information must be a member inside of the team.

In contrast, Code repository (C13), Online resource (C15), and other 5 activities have very slightly impact on E3.

4.4.4 Understand other's expectations of your own role's responsibilities (E4)

The activities that have Very High contribution to the Understanding of own role's responsibilities are Agile course (C6), Team lead (C9), and Project Plan (C26), which are exactly the same with the Very High level activities of understanding of responsibility and expertise of other team members. This phenomenon might be caused by the similarity of these two expected outcomes. Both two focus on the responsibility of roles in team, only the objects are different, one aiming for others', another aiming for newcomer themselves'. Agile course can provide the knowledge of every role's obligation which is very useful for both E3 and E4. Again, Team Lead who is responsible for the management of data of each team members, including newcomers', can also be a prefect resource for new staffs to get information from.

There are seven activities that evaluated have High contribution on E4, which are Mentoring (C1), Training session (C4), Asking helps from other team members (C7), internal documentation (C10), Checklists (C11), Pair programming (C17) and Communication software (C22). The thing that should be mentioned is Stand up meeting (C16) which scores High in E3, only get a Neutral degree towards E4. In daily Standup

meeting, everyone needs to elaborate what they did, what they will do and what difficulty they encountered. By the description of other, newcomer acquire information about responsibility of their team member, while, hard to know the responsibility of their own.

Eight activities are scored as None or Very Low contribution on E4, including Orientation (C2), Online recourse (C15) and Internal Knowledge database (C27).

4.4.5 Understand what work to do and when/ how to choose tasks (E5)

The patterns of influenced activities towards understanding of what work to do and understanding of job responsibility are similar. Agile course (C6), helps from Team Lead (C8) and Project plan (C26) are the Very High influenced activities to both two outcomes. The difference is that Checklists (C11) and Meeting with other teams (C19) can also influence understanding of what work to do and how to choose tasks in a Very High degree.

There is quote supporting the helps from team leader contribute to achieve this onboarding outcomes.

> *Team Lead is the person I ask when I don't know what should I do and when should I do. He knows the capability of every people (in the team), if you cannot decide which task you should work with, better to find your lead. (Developer)*

In an Agile development team, team lead is also called as scrum master, who is responsible for facilitating the team, and guide team members to follow the track during every sprint. As the guidance, team lead knows the capability and expertise of every member, thereby providing advice for them in terms of working direction.

The Very High activities in relation to E3 and E4 are the same. The activities that fall into the High range for these two expectations are also similar. Agile course (C6), Team lead (C8) and Project plan (C26) provide the most helpful access for newcomers to become familiar with the responsibilities and authority of their team mates, as well as their own

job.

4.4.6 Understand the project structure and aims and the implications (E6)

To understand the project structure and purpose, three activities have been estimated as the most effective approaches for newcomers, which are Asking help for team lead (C8); Video of product function (C21), and Project plan (C26).

> *The project we are working is really complex and huge, so for me, a new one in the team, always struggle to understand many different parts of the project. I have to keep asking my team lead what is this and what is that. And same reason, at the moment I came, some functions have been done by others, so I need to confirm that with my team lead to avoid futile effort. (Developer)*

Most of the companies do not have a formal introduction of project structure and aims particularly designed for newcomers, thus, the way to understanding project structure has to be found during the practical of their work. Team lead is an appropriate person to seek advice from, as well as other team members (C7), which is also a High contribution construct of this expectation (E6). However, according to the description of interviewees, there always are several different projects running at the same time in a team. Newcomers need to choose the person who is working the same project with them to get information about the project.

Mentoring (C1) is another High effective construct of E6. This approach is a common method using in the development organizations for guiding newcomers.

> *In this company, we don't have a formal induction for new employees, and I was in a quite big project. I had no idea what this project was at the beginning, but I was fortunate that I had one lady who took me under her wing, and teach me about the project, how we finish our jobs. (tester)*

Other activities ranking in the High level against Understanding of project structure and aims and the implications are Training session (C4), Internal Documentation (C10), Stand up meeting (C16), Pair programming (C17), Internal knowledge database (C27), and

Discussion group (C28).

4.4.7 Understand how to code and test to the team's expectations (E7)

There are five activities that can influence the understanding of how to code and test to the team's expectations in a Very High level, which are Mentoring (C1), Training session (C4), Team lead(C8), Code repository (C13), and Assigned with simple tasks (C18).

At the early stage of onboarding, newcomers especially who have limited previous experience on the language and tools that using in their new team, assignment of simple tasks can help them to learn quicker than having a complex task.

Online resource (C15) and MSDN (C5) also contribute to E7, in a High level.

> *I was a newbie as a developer when I came to my company, I had a lot of to learn and have lots of problem, and nobody going to help me all the time. I always try to find solutions online first, and if I still cannot find the answer I will ask my mentor or my team members. (Developer)*

This developer is not the only interviewee that indicated that the importance of online resource in the aspect of technique knowledge. In many situations, team members including mentor, team lead are too busy to provide help for newcomer, therefore, they should have a way to acquire knowledge to support themselves, which online resource is one of the approach, and other resource obtained from interviews are books and videos (C24).

> *I have one PDF, UniVerse BASIC, which is pretty much the bible for me to utilized. (Developer)*

Other activities, Training session (C4) and Pair programming (C17), also help newcomers to understand how to code and test.

The influence of Orientation (C2), Induction (C3), Agile course (C6), and Team socializing (C14) on this expectation are slight.

4.4.8 Understand and meet the team's standards of work quality (E8)

In all 28 of the constructs, the only activity that fall into Very High range in terms of contribution on understanding of how to meet team's standards of work quality is Agile course (C6), along with other six High level contributed constructs. Compared with other elements, especially E1 and E1, the amount of high effective activities that help to the understanding of team's standards of work quality are small, only account for 25% of all the activities. This figure shows that organizations in current software development industry have not attached importance to the initiation of standards of work quality to new employees.

Newcomers may find it is difficult to have an access to achieve the standardize work at the beginning, if there is no Agile course provided by their organization, and in many cases, Agile course is not a popular choice for employer as a program for newcomers. Therefore, the lack of resource of working standards may leads to the unbalance of productivity and quality among the newcomers' part of the jobs. However, the information of the standards of work quality can also be obtained from the daily working. Since the definition of work quality is highly subjective, to embody this concept, completeness, bug detection rate, and feedback for users can be used to redefine it. Mentor (C1) can give advices about the time frame of functions implemented, allowing newcomers to manage their own working schedule to fulfill the scrum cycle of development. The bug detection rate can be found in internal documentations (C10), or newcomers can also find the answer from their team members (C7). To meet the need and expectations of customers, meetings (C19) with product owner and team lead is an appropriate approach for newcomers.

For newcomers, after understanding what are the work quality standards, they need time and practice to adopt the standards. From the interviews, it normally takes 4 weeks to 3 months for them to qualify their completeness within the time, to lower their bug rate under the required range, to meet the expectations of customer. The duration of period depends on the experience level of the newcomer. The plentiful experience on the same position as the new job will definitely ensure the relatively quick adoption of the standards,

while the margin between newbies and expertise needs to be full by time and effort.

4.4.9 Understanding and showing the Agile mindset (E9)

According to the row of E9 in Table 4-4, Agile course (C6) and Help from Team Lead (C8) have a Very High influence on newcomers in understanding the Agile mindset. It is not surprising that an Agile course can provide knowledge for newcomers about the Agile mindset, since the Agile mindset is one of the most important part that need to be delivered in Agile courses.

There are six activities influence the understanding of Agile mindset in a High degree, and the activities are Mentoring (C1), Orientation (C2), Internal documentation (C10), Stand Up Meeting (C16), Pair Programing (C17), and Meetings with Other Teams (C19).

4.4.10 Knowing how to use Agile artefacts and techniques that are part of the team's software development process (E10)

Similar to understanding the Agile mind set, E10 is the expected outcome regarding Agile application. Based on the row of E10 in Table 4-4, An Agile course (C6) contributes at a Very High level to newcomers knowing and mastering Agile artefacts and techniques. From the course, they can understand what a user story is, Product backlog, Release plan, Sprint backlog, etc., and how those artefacts work and how to use them. They can also learn the meaning of different meetings, such as the Daily Scrum Meeting and Sprint Review Meeting.

> *We have several different meetings in a sprint. We have daily stand up meeting, sprint planning meeting, and retrospective meeting. I had Agile lessons before, I known what these meetings are, and how they work, but it still took three weeks for me to understand what should I do in every meeting, since all they have different purposes. I normally need to prepare a note before Daily meeting, and listen others really carefully at the beginning, to know what should I talk to describe my own opinion. (Developer)*

The other two Very High influenced activities of this outcomes Meeting with Other Teams

(C19) and Knowledge Database (C27).

Five activities have High level influence on this expected outcome, which are Mentoring (C1), Orientation (C2), Training Session (C4), Asking Other Team Member for Helps (C7), Internal Documentation (C15), and Electronic Communication (C22)

4.4.11 Understanding the project domain knowledge and terminology (E11)

According to the line of E11 in Table 4-4, three activities, which are Video of Product Function (C21), Working Conference (C25), and Knowledge database (C27), impact the understanding of the project domain knowledge and terminology in a Very High degree.

There are nine activities impact this expected outcome in a High level, including Mentoring (C1), Training session (C4), Internal Documentation (C10). Since the knowledge of project domain normally includes the information about business policies,

4.4.12 Discussion

Overall, every expected outcome of onboarding can be effected by certain activities, which means all the outcomes can be achieved with the deployment of the specific activity. The Very High influenced activities of outcomes are recommended the most, and the High influenced activities are also appropriated approaches for newcomers to meet their onboarding goals. There is not an obvious gap showing a specifically expected outcome cannot be achieved by the deployment of practical onboarding activities.

Based on the quantity of Very High and High level influential activities of different outcomes, the E8, Understand and meet the team's standards of work quality is the hardest one to achieve in the eleven expected outcomes, since the quantity of the activities that make a Very High and High contribution are lowest among all the elements. Only the Agile course (C6) is estimated as Very High, and six activities fall into High level.

In contrast, understanding team norms is a relatively easy outcome as it can be achieved in different ways. Since the number of activities can contribute to understand team norms, with two Very High and fourteen High level influenced activities.

4.5 Influence of activities in achieving the outcomes

To give a clear view of the influence of each activity against every desired outcome, the Appendix 7 was organized into Table 4-5. The activities gathered from the interviews were categorized into two parts. The first part includes the activities that were chosen by more than one participant as being effective activities in the onboarding process, which are elaborated in the Table 4-5.

Activity	**Very High**	**High**	**Neutral**	**Low**	**Very Low**
Mentoring (C1) 9	E7	E1; E2; E3; E4; E5; E6; E8; E9; E10; E11			
Online resources (C15) 8		E7; E10		E5; E8; E9; E11	E1; E2; E3; E4; E6
Ask team member for help (except Team leader and Project manager) (C7) 7	E1	E2; E3; E4; E5; E6; E7; E9; E10; E11		E8	
Team socializing (C14) 7		E1; E2; E3		E4; E6; E9; E11	E5; E7; E8; E10
Training session (C4) 6	E7	E1; E2; E3; E4; E6; E9; E10; E11		E5; E8	
Internal documentation (C10) 6		E4; E6; E7; E8; E9; E10; E11	E3; E5	E1; E2	
Code Repository (C13) 6	E7	E9	E6	E1; E4; E8; E10; E11	E2; E3; E5
Stand up meetings (C16) 4		E1; E3; E5; E6; E8	E2; E4	E7; E9; E10; E11	
Pair programming (C17) 4		E1; E2; E4; E5; E6; E7; E8; E11	E3	E9; E10	
Assigned with simple tasks (C18) 3	E7	E1; E9; E11		E2; E3; E4; E5; E6; E8; E10	

Induction (C3) 2	E2	E1	E3	E4; E5; E6	E7; E8; E9; E10; E11
Self-learning (Books) (C24) 2		E7		E1; E2; E3; E4; E5; E8; E9; E10; E11	E6

Table 4-5 Influence of Activities on Achieving the Outcomes

ELEMENT	MEANING
E1	Understanding team norms
E2	Understanding company culture
E3	Knowing the responsibilities, expertise and authority of other team members
E4	Understand other's expectations of your own role's responsibilities
E5	Understand what work to do and when
E6	Understand the project structure and aims and the implications
E7	Understand how to code and test to the team's expectations
E8	Understand and meet the team's standards of work quality
E9	Understand and show the agile mind set
E10	Know how to use Agile artefacts and techniques that are part of the team's software development process
E11	Understand the project domain knowledge and terminology

C1 Mentoring

The influence of Mentoring on all expectations was estimated as High or above. This means the contribution of this activity is comprehensive and significant, covering all the aspects of expected onboarding outcomes, from E1 to E11. Based on the data, the enhancement of understanding how to code and test to the team's expectations (E7) is most obvious through the deployment of Mentoring.

> *In my opinion, mentoring is the most important way to help newcomers. For me, before my mentor came to me, I had no clue of nearly everything. I didn't know how to set up the working environment, who would I ask, and even where to start with. (Developer)*

Newcomers point out that the Mentoring is the most useful onboarding activity as it helps them in the many different respects. Unlike Orientation (C2), Induction (C3) and other activities, Mentoring happens throughout the work life of newcomers until they are qualified to be a productive member. The guidance from mentors does not only focus on one aspect, but the whole process of development.

C15 Online Resources

The influence of Online Resources for newcomers in understanding how to code and test (E7) and knowing how to use Agile artefacts and techniques (E10) is High.

> *If I have trouble with a command or a function, I will do some research (Online) trying to find out the answer, before I have to ask somebody. People are so busy with their own work, most of time, even my mentor, I can't ask others every time I have problem. (Developer)*

Newcomers expressed that Online Resources are a way that they can achieve by themselves without requiring the guidance of their team members.

However, Online Resources are unable to enhance knowledge regarding job responsibility, project structure and company structure.

C7 Asking team members (except Team Lead and Project manager) for help

Help from team members (except Team Lead and Project Manager) contributes to nearly all of the expected outcomes of the organization. Only the standards of work quality (E8) cannot really be acquired from this activity, falling into the Low effectiveness level. The most significant impact of C7 regards the understanding of team norms (E1).

The influence of asking team members for help during onboarding is significant and comprehensive, which means the deployment of this activity may help a lot for newcomers obtain knowledge regarding nearly every aspect.

C14 Team socializing

From the data, Team socializing is an efficient approach to gaining information about team norms (E1), company culture (E2) and the responsibilities, expertise and authority of other team members (E3). Interestingly, team socializing is the only activity among all 28 elements which involves entertainment that performs well in the onboarding process.

> *Team socializing is definitely a good way to enhance the knowledge of team norms, and company culture. The communications between team members may relate to the power structure of company or the person at high level position. And sometimes, people are liking to share the information of each other, saying who is good at what. (Tester)*

As mentioned in the quote, the involvement of the culture context is fairly high during these communications, which provides lots of information for newcomers allowing them to have a better understanding of company culture and values. However, the contributions of team socializing towards other onboarding outcomes is not noticeable.

C4 Training sessions

The pattern of the Training session contribution is very similar to Mentoring (C1), effecting the understanding of how to code and test to the team's expectations (E7) at a Very High level and contributing to the achievements of eight other expectations at a High level. Only two expectations are hardly influenced by Training sessions, i.e. (1) Understand what work to do/how to choose tasks (E5); and (2) Understand and meet the team's standards of work quality (E8). This may be led by the purpose of the Training

session. This activity is designed to guide newcomers toward a specific learning objective, and is normally is presented in the form of a course. Based on the data, knowledge of how to choose appropriate tasks and how to meet the team's standards of work quality cannot be passed on through a training session.

C13 Code Repository

According to Table 4-4, Code Repository influences the understanding of how to code and test to the team's expectations at a Very High level. A developer (below) has presented Code Repository as being suitable for learning how co-workers do programming.

> *I always browse the existing code, when I have trouble of understanding the structure and functionality of a specific feature. (Developer)*

Another outcome that can be impacted to a High degree by Code Repository is the development and adoption of an Agile mind set.

The most significant contribution of Code Repository in terms of onboarding is helping newcomers understand how to code and test to the team's expectations (E7). However, this approach rarely influences the outcome of onboarding regarding job responsibility, company structure, and project knowledge.

C10 Internal Documentation

According to row 7 in Table 4-4, Internal Documentation influences seven onboarding outcomes to a High degree: Understanding job responsibility; Understanding of project structure; Understanding of how to code; Knowing standards of work quality; Developing an Agile mind set; Learning how to use Agile artefacts; and Understanding project domain knowledge. More than half of the expected outcomes can be enhanced by Internal Documentation, which indicates the coverage of internal documentation in terms of information that helping with onboarding is high, so the adoption of internal documentation in onboarding may help newcomers in different ways.

C16 Stand up meetings

Five out of 11 expectations are influenced by Stand up meetings at a High level.

Our team have stand up meeting every morning during week days, it normally only last for 5 mins. Everyone need to describe what they did yesterday, what they will do today and what problem they met. (Developer)

From the quote, Stand up meetings are an effective way of obtaining information about the job responsibilities of other team members. And from Table 4-4, the understanding of team norms; work direction; project structure; and standards of work quality are also impacted by Stand up meetings at a High level.

C17 Pair programming

Similar to Stand up meetings, Pair programming is not designed for the onboarding process. Both of activities are part of the process of the development cycle. However, made the contributions are remarkable. Pair Programming influenced eight expectations at a High level, covering the area of company structure, job responsibility, technical skills and project domain. The only aspect that was at a Low level was the Agile process, which involves an understanding of the Agile mind set and usage of artefacts. The reason for the high influence of Pair Programming in onboarding might be related to the high interactions between team members during this activity.

C18 Being assigned simple tasks

Based on Table 4-4, being assigned simple tasks influences the understanding of how to code and test to the team's expectations at a Very High level. This activity also influences the outcomes regarding the understanding of team norms (E1), the Agile mind set (E9), and project domain knowledge and terminology (E11).

At the beginning, it is better to assign new staffs with simple task, especially who are not familiar with the tools and environment. (Team leader)

Being assigned simple tasks, as presenting in the quote, is a recommended activity that helps newcomers start their contribution to a project.

C3 Induction

According to Table 4-4, an induction program is a very effective approach for newcomers to understand team norms (E1) and company culture (E2). The downside is that the

contribution of Induction to understanding the team's standard of work quality (E8) and Agile artefacts and techniques (E10) is lower than for Orientation (C2).

C24 Self-learning (books and video)

The only outcome that is impacted by Self-learning (books or videos) is understanding how to code and test (E7). It has no remarkable influence on any other expected outcomes. From the data, it is clear that the knowledge that can be provided from books and videos is limited, only covering programming and testing.

Activity	Very High	High	Neutral	Low	Very Low
Orientation (C2) 1	E2	E1; E8; E10	E5; E9	E3; E11	E4; E6; E7
MSDM (C5) 1		E7			E1; E2; E3; E4; E5; E6; E8; E9; E10; E11
Agile Course (C6) 1	E3; E4; E5; E6; E8; E9		E1; E2; E6		E7; E11
Ask Team Leader for help (C8) 1	E1; E3; E4; E5; E6; E7; E9		E2		E8; E10; E11
Ask Project Manager for help (C9) 1		E1; E6; E11	E3; E4	E2; E5; E7; E8; E9; E10	
Checklists (C11) 1	E5	E1; E4	E2; E3; E6	E7; E9	E8; E10; E11
Floor map (C12) 1				E3	E1; E2; E4; E5; E6; E7; E8; E9; E10; E11
Meeting with other teams (C19) 1	E5; E10	E1; E3; E8; E11	E6	E2; E4; E7	E9
Education stipend (C20) 1			E3; E4; E7		E1; E2; E5; E6; E8; E9; E10; E11
Video of product function (C21) 1	E6; E11		E1	E7	E2; E3; E4; E5; E8; E9; E10
Electronic communication (C22) 1		E1; E2; E3; E4; E7; E9; E10; E11	E5; E6; E8		

Setting expectations (C23) 1		E1; E2; E5		E3; E4; E7; E8; E9; E10; E11	E6
Work conference (C25) 1	E11	E7; E9	E1; E2; E5;	E6	E3; E4; E8; E10
Project plan (C26) 1	E3; E4; E5; E6	E1; E2		E7; E8; E9; E10; E11	
Knowledge database (C27) 1	E10; E11	E6	E7; E8	E9	E1; E2; E3; E4; E5
Discussion group (C28) 1		E6; E10; E11	E7; E8; E9	E1; E2; E3; E4; E5	

Table 4-6 Influence of Activities on Achieving the Outcomes

ELEMENT	MEANING
E1	Understanding team norms
E2	Understanding company culture
E3	Knowing the responsibilities, expertise and authority of other team members
E4	Understand other's expectations of your own role's responsibilities
E5	Understand what work to do and when
E6	Understand the project structure and aims and the implications
E7	Understand how to code and test to the team's expectations
E8	Understand and meet the team's standards of work quality
E9	Understand and show the agile mind set
E10	Know how to use Agile artefacts and techniques that are part of the team's software development process
E11	Understand the project domain knowledge and terminology

The Table 4-6 is to analyze the effectiveness of activities which appear only once in the repertory grid.

C2 Orientation

The contribution of Orientation regarding of company structure is remarkable, especially in helping the understanding of company culture for newcomers (E2). This activity also influences the understanding of the team's standards of work quality (E8), and gives newcomers access to the artefacts and techniques used during software development (E10). However, the contribution of this activity towards knowledge of job responsibility and the project domain is limited.

C5 MSDN

The contribution of MSDM to the onboarding process is not distinctive; only one expected outcome was considered to be influenced by adopting this activity, i.e. Understanding how to code and test to the team's expectations (E7). The influence on the other expectations was unnoticeable.

C6 Agile Course

Seven out of 11 expected outcomes are Very Highly influenced by the use of an Agile Course. Based on the data, an Agile Course contributes the most to understanding job responsibility and the Agile process. The effectiveness of this activity for understanding of company structure, technical skills and project domain knowledge is Low.

C8 Team Lead

Compared with the help from other team members (C7), the help from the Team Leader is more noticeable, especially in the area of job responsibility, although more practitioners stated C7 than C8.

C9 Project manager

Like C8 (help from team leader) and C7 (help from other team members), the Project Manager was regarded as a person who could support the onboarding of new staff.

C11 Checklists

According to Table 4-4, the deployment of Checklists has a Very High influence on employees understanding what work to do and when to do it (E5) during the onboarding

process.

> *We ask newcomers to make a checklist, listing the tasks that they should complete in a day or a period of time. It is a good way to show them the work direction, as well as their responsibilities, especially useful for the first several weeks. (Team Leader)*

Based on the quote, Checklists are very helpful for getting newcomers on track and showing them their work direction and responsibilities. Besides, from the data in the repertory grids, Checklists also influence the understanding of team norms to a High degree.

C12 Floor map

All of the expectations, hardly any are influenced by the Floor map, which falls into the Very Low and Low categories. However, the interviewee who gave the idea of the Floor map pointed out that its use in their company helps not only newcomers but also senior staff find the right person according to their authority, contact details and the location.

> *The Floor map provides the location of every staff, along with their department, authority and contact number. If I were trying to find a person who had authority to book a meeting room, I could know where this person was working by following the Floor map. (Developer)*

From the quote, it is clear that the Floor map offers an access point for newcomers to know their responsibility to a certain degree, which does not match the results of the data in repertory grid.

C19 Meetings with other teams

From Table 4-6, two outcomes are influenced by meeting with other teams to a Very High degree: understanding what work to do and knowing how to use Agile artefacts.

C20 Education stipend

No expectation was affected by Education stipend at a High level or above. The contribution of this activity to all of the expectations was mediocre.

C21 Videos of product function

The effectiveness of the videos that recoding the product function towards the understanding of project structure and aims (E6), and understanding the project domain Knowledge and terminology (E11) are outstanding. However, the figures for the other nine expectations were Low or Very Low, which means the Videos of product function can help newcomers to achieve the expectations of their organization in only two ways.

C22 Electronic communication

Eight out of 11 expectations can be highly affected by electronic communication between colleagues, covering five separate aspects of expected outcomes. This activity does not contribute a lot to understanding what work to do (E5); understanding project structure and aims (E6); and understanding the team's standards of work quality (E8).

> *The Electronic communication is the only way in our organization to connect every one. We have different staffs operating in four different cities all over the word. We need to meet every week through skype. And the team leader of my project is living in America, so I email him or skype him to deliver information. (Developer)*

Electronic communication is not a technique that is designed for onboarding of newcomers, but it holds the key to daily communications between staff. And, based on the data, the contribution of electronic communication to the onboarding process is significant in different aspects.

C23 Setting expectations

According to the data, setting expectations is an effective way to help newcomers understand team norms (E1); company culture (E2); and know what work to do and when to do it (E5). However, the contribution of this activity towards other expectations is unnoticeable.

> *Setting expectations for newcomers helps them to have a direction of working, especially for graduates who need to acquire many different knowledges at the beginning. With an expectation from team leader or mentor, they will know the priority of working. (Developer)*

Different from checklists (C11), an expectation plan for a newcomer focuses on the goals that need to be achieved over a relatively long period of time, rather than a short list of tasks that need to be finished within one or two weeks.

C25 Work conference

The influence of the work conference on onboarding reflects in the aspects of understanding project domain knowledge; knowing how to code and test; and knowing the Agile mind set. According to interviewees, the influence can be various depending on the topic of the work conference.

> *We have working conference every three month, and the topics of each conference can be different. In my opinion, it is a good way for newcomers to acquire knowledge, as the focus of conference is related to their jobs. (Developer)*

The influence of this activity towards onboarding of newcomers is not consistent and can vary based on the context of conference. Therefore, a clear idea of how work conferences impact on onboarding cannot be given.

C27 Knowledge database

Two expected outcomes are influenced by the adoption of a knowledge database: understanding Agile artefacts and techniques, and understanding project domain knowledge.

C28 Discussion group

According to the last line of Table 4-5, there is no expected outcome can be impacted in a Very High level by Discussion group. Three outcomes are in the level of High influenced which are understanding of project structure, Agile artefacts, and project domain knowledge.

4.5.1 Discussion of Help from the team leader, project manager and other team members

Support for co-workers is regarded as a key contribution for onboarding newcomers, and

according to the interviewees, the roles that can provide help are divided into three classes. Based on Table 4-5, the team leader offers the most significant support for newcomers among the three roles in terms of understanding job responsibility and the development of an Agile mind set. In contrast, help from other team members (other than the team leader and project manager) is more general, covering nearly all the expected outcomes, but not are as specifically as the help from team leaders. The third role that given by interviewees is project manager. Compared with the other two groups, the contribution of helps from the project managers is less significant. Therefore, newcomers are recommended to find the team leader when they have a problem about their job responsibility and the Agile mind set. However, if they need help about other aspects, team members (not the team leader and project manager) can be a better choice.

4.5.2 Discussion of Orientation and Induction

Orientation and induction activities are set up to speed up the integration of newcomers, and are the first program that newcomers are involved in after they join their companies. The performance of Orientation programs is better than Induction, which might be caused by the duration and form. Induction normally takes one or two days, and during this process newcomers are told of the firm's history, beliefs, values, long term goals, and company structure. Safety regulations, security and health requirements are also included. Orientation, however, can last for more than a week. Several different activities should be completed by the teams, aiming to show newcomers about their job responsibility and how to fit into their role.

4.5.3 Discussion about the activities

According to Table 4-5 and 4-6, Mentoring (C1) is the only activity among 28 activities that impacts all of the desired outcomes in Very High or High level during the onboarding process, and the number of participant who chose Mentoring as onboarding activity also rank the top. Therefore, Mentoring is the most recommended activity in onboarding process which can contribution a lot in different aspect, and the deployment of this activity may also fasten the integration of newcomers. The activities, which are Asking Team Member for Help (except Team Leader and Project Manager), Training session, Internal Documentation, Pair programming, Agile Course, and Asking Team Leader for Helps, can also influence the overall results of onboarding, since six or more expected

outcomes are affected by these activities in Very High or High level. In contrast, the contributions of other activities that have not been mentioned either not significant or only limited in one or two aspects.

4.6 Comparison of Aggregated Outcomes

According to the emphasis of each outcome, the 11 expected outcomes have been arranged into five categories, which are listed in the Table 4-7.

	Number in repertory grid	Name
Company Context	E1	Understanding team norms
	E2	Understanding company culture
Job Responsibility	E3	Knowing the responsibilities, expertise and authority of other team members
	E4	Understanding other's expectations of one's own role's responsibilities
	E5	Understanding what work to do and when
Standard of work	E7	Understanding how to code and test to the team's expectations
	E8	Understanding and meeting the team's standards of work quality
Agile Process	E9	Understanding and show the Agile mind set
	E10	Knowing how to use Agile artefacts and techniques that are part of the team's software development process
Project Knowledge	E6	Understanding the project structure, aims and implications
	E11	Understanding the project domain knowledge and terminology

Table 4-7 Categories of onboarding outcomes

The five categories of expected outcomes are Company Context, Job Responsibility, Standard of Work, Agile Process, and Project Knowledge. The purpose of this section is to compare the effectiveness of each activity in these five different aspects. To get the level of influence of the activities on each outcome category, the data was aggregated and the results are attached in Appendix 8.

Only activities that have a Very High and High influence are given in Table 4-7 in order to provide the most effective approach to achieving the onboarding goals of the five aspects.

	Very High	High
Culture Context	C2, C7	C1, C3, C4, C8, C14, C19, C22, C23, C26
Job Responsibility	C6, C8, C19, C26,	C1, C4, C7, C10, C11, C22, C23
Standard of work quality		C1, C4, C10, C13, C17, C18, C22
Agile Process	C6	C1, C2, C4, C7, C13, C22, C27
Project Knowledge	C21	C1, C4, C7, C9, C10, C17, C18, C19, C22, C25, C26, C27, C28

Table 4-7 Activities that are most effective for onboarding

According to Table 4-7, orientation programs (C2) and help from team members (other than team leader and project manager) (C7) provides the most significant contribution to the understanding of culture context during the onboarding process, as they are the activities that have a Very High influence. However, these two activities are not the best approaches for newcomers to achieve other outcome goals, especially the standard of work. In terms of job responsibility, Agile course (C6), help from Team Leader (C8), meetings with other teams (C19), and project plan (C26) are activities with a Very High influence. Thus, adopting these four activities may significantly help newcomers know their job responsibility. It is also worth mentioning that the job responsibility category had the largest quantity of activities that rated Very High among these five groups.

In contrast, standard of work quality was not impacted at the Very High level by any activity, although seven activities were ranked High. Therefore, newcomers may find there are fewer information resources about work quality standards, which may pose a barrier to achieving a desirable outcome in terms of understanding the standards of work quality. The pedagogy in this area might need to be enhanced to fill in the gap. A similar pattern was found with the Agile process, having seven High level activities.

Both the Agile process and Project knowledge had one Very High influential activity. However, the number of High influential activities for Agile process is nearly twice the figure for project knowledge: 13 activities contribute to the understanding Project knowledge at a High level.

Overall, by comparing of five aspects, the activities that helps to achieve the understanding of project knowledge and job responsibility are the most. In contrast, the

accesses to knowledge of standard of work quality and Agile process for newcomers are less than other aspects.

4.7 Comparison of Employee-Initiated Activities, Employer-Initiated Activities, and BAU (Business as Usual) Activities

From the data that obtained from the interviewees, some activities were not deployed for the reason of helping newcomers onboarding, such as Team socializing and Stand up meetings, but were selected as effective activities that can influence the outcomes of onboarding.

At the same time, the initiators of the activities are different; some of them are employers, and others are employees. Based on the initiators, the activities that gathered from the interviews were divided into three classes: Employer Initiated, Employer Initiated, and Business as Usual.

Employer Initiated	Employee Initiated	BAU
Mentoring	Asking others for help	Team socializing
Orientation	Asking help form Team Lead	Stand up meetings
Induction	Project manager	Pair programming
Training	Online resources	Meetings with other teams
MSDN	Self-learning (books, and videos)	Electronic communication
Agile course		Work conference
Being assigned simple tasks		Discussion group
Checklists		Internal documentation
Floor map		Code repository
Knowledge database		Product function video
Setting expectations		Project plan
Education stipend		

Table 4-8 Initiation of activities

In Table 4-8, 12 out of 28 activities were employer initiated, which means 43 percent of the activities during the onboarding process were initiated by employers. Eleven activities belong BAU, which indicates that nearly 40 percent of the effective activities for onboarding happen as part of the daily business routine. The number of employee initiated activities is lowest in three categories, as they only account for around 18 percent of all

activities. Only Very High influence and High influence activities are analyzed in this section, since the aim was to compare the influence of the three classes of activities on each expected outcome. Table 4-9 to Table 4-19 are crated based on the table of influence level of activities in three group, which has been attached as Appendix 9. The numbers of three groups of activities in each level are counted as the indictor of influenced level in this section.

E1: Understanding company culture

	VH	H
Employer		7
Employee	2	1
BAU		6

Table 4-9

Based on the Table 4-9, two activities make a Very High contribution to understanding team norms and both of them are employee initiated. Among the High activities, half are Employer Initiated, and 6 out of 14 are BAU. Overall, the influence of employer initiated activities and BAU activities are on the same level regarding understanding of team norms, contributing more than 90 percent of High activities, but there is no Very High activity in these two groups. In contrast, the percentage of employee initiated activities is lower, but the influence is more obvious than for the other activities.

Therefore, a desirable outcome with regard to understanding and adopting team norms can be achieved if newcomers tend to adopt more employee initiated activities. At the same time, the activities initiated by the employer, as well as the daily business routine, may also provide newcomers with information about team norms.

E2: Understanding company culture

	VH	H
Employer Initiated Activity	2	3
Employee Initiated Activity		1
BAU Activities	1	4

Table 4-10

According to Table 4-10, 2 out of 3 Very High activities regarding understanding company culture are employer initiated, and the third Very High activity is BAU. Fifty percent of the High-level activities are BAU activities. Only one activity is employee initiated at both the Very High and High levels. The quantity of activities that are employer initiated and BAU are equal, which means the influence of these two forms of activities on the understanding of company culture are on the same level. However, the contribution of employer initiated activities may be slightly stronger than BAU activities, as the percentage of Very High employer initiated activities is higher than for BAU. By contrast, the influence of employee initiated activities is much lower than the other two types.

In summary, newcomers may find it is easier to understand company culture if they enroll in employer initiated activities, and they can also gain knowledge of company culture during BAU activities. However, the employee initiated activities are not recommended to achieve this expected outcome.

E3 Knowing the responsibilities, expertise and authority of other team members

	VH	H
Employer Initiated Activity	1	2
Employee Initiated Activity	1	1
BAU Activities	1	4

Table 4-11

Table 4-11 shows that there is a Very High influence activity in every group. However, the number of High-level activities in BAU is higher than the other two groups, accounting for 57 percent of High activities overall. The percentage of Employer Initiated activities in this range is slightly higher than Employer Initiated. In conclusion, the difference between the contributions of the three types of activities towards understanding the responsibilities, expertise and authority of other team members are not distinct since

the number of Very High activities for the three groups are the same.

E4 Understanding other's expectations of one's own role's responsibilities

	VH	H
Employer Initiated Activity	1	3
Employee Initiated Activity	1	1
BAU Activities	1	3

Table 4-12

A similar pattern is found between Table 4-12 and Table 4-11. There is one Very High influence activity in every group. This means, the contributions of the three types of activities for newcomers regarding understanding other's expectation of their responsibility can be valued in a similar way. The categories of Employer Initiated and BAU have exactly the same amount of Very High and High influence activities. With a lower figure for the High level, Employee Initiated activities rank bottom.

E5 Understanding what work to do and when

	VH	H
Employer Initiated Activity	2	2
Employee Initiated Activity	1	1
BAU Activities	2	2

Table 4-13

Based on the data from Table 4-13, 2 out of 5 activities with Very High influence are Employer Initiated, and the same number can be found in the High level. The two figures for BAU activities are identical to the Employer Initiated figures. With lower figures in both Very High and High levels, Employee Initiated activities rank bottom.

The influence of Employer Initiated and BAU activities on understanding of what work to do and when during onboarding process, are in the same level, and slightly higher than Employee Initiated Activities. Therefore, the activities initiated by employers might be more suitable for newcomers in terms of knowing what work to do and when is the best time to do it. Besides, the activities deployed throughout daily work (not specifically for onboarding purposes) can also help them achieve this goal.

E6 Understanding the project structure, aims and implications

	VH	H
Employer Initiated Activity		3
Employee Initiated Activity	1	2
BAU Activities	2	4

Table 4-14

From Table 4-14, 2 out 3 Very High influence activities regarding understanding of project structure, aims and implications are BAU activities, and the other Very High influence activity are Employee Initiated. The number of High Level activities in the three groups are not very different, but BAU ranks at the top, having 4 activities in the range. It is obvious that the BAU activities have the most effect on the expected outcome among the three groups. Overall, half of the High and Very High influence activities are BAU, which indicates that information about project structure, aims and implications is more easily obtained from the daily business routines.

However, activities that initiated by employees and employers can also help newcomers reach this goal to a certain degree.

E7 Understand how to code and test to the team's expectations

	VH	H
Employer Initiated Activity	3	1
Employee Initiated Activity	1	3
BAU Activities	1	4

Table 4-15

As seen in the Table 4-15, 3/5 of Very High influence activities are Employer Initiated. One activity is Employee Initiated and one is BAU. In contrast, BAU ranks at the top in the High level activities, followed by Employee Initiated. The contribution of Employer Initiated activities to understanding how to code and test to the team's expectations is most significant at the Very High level.

E8 Understanding and meeting the team's standards of work quality

	VH	H
Employer Initiated Activity	1	2
Employee Initiated Activity		
BAU Activities		4

Table 4-16

It is clear that the influence of Employee Initiated activity on the understanding of the

team's standards of work quality is very limited, with no Very High and High effective activity. Only one activity affects this outcome to a Very High degree, i.e. Employer Imitated activities. On the other hand, the number of High level BAU activities is greater than for Employer Initiated.

In summary, the activities initiated by employees is not recommend approach to help newcomers know the work quality standards. Employer initiated activities are more suitable for newcomers to capture the knowledge of this aspect. Besides, newcomer may also find their understanding of work standards can be enhanced during their working routine.

E9 Understanding and showing the Agile mind set

	VH	H
Employer Initiated Activity	1	3
Employee Initiated Activity	1	1
BAU Activities		4

Table 4-17

According to Table 4-17, two activities evaluated as Very High in helping newcomers understand and adopt an Agile mind set: one Employer Initiated activity and one Employee Initiated activity. The figure for the High Influence Employer Initiated activities is higher than for Employee Initiated, thus the contribution of Employer Initiated activities towards this expected outcome is stronger than Employee Initiated activities. In comparison, there is no Very High activity for BAU, but 50 percent of High level activities are in this group. Therefore, BAU activities can affect the understanding of the Agile mind set, but not as significantly as the other two types. Overall, the adoption of Employer Initiated activities may help the most newcomers develop an Agile mind set. Other Employee Initiated and BAU activities can also contribute to the outcome, but it might take longer for new staff to achieve the goal.

E10: Knowing how to use Agile artefacts and techniques that are part of the team's software development process

	VH	H
Employer Initiated Activity	2	3
Employee Initiated Activity		2
BAU Activities	1	2

Table 4-18

In Table 4-18, Employer Initiated activities rank at the top in both the Very High and High levels, which means the influence of these types of activities on knowing how to use Agile artefacts and techniques is most noticeable among the three groups. In contrast, the Employee Initiated activities are at the bottom, with no Very High influence activities and two High influence activities. The effectiveness of BAU activities is moderate. Thus, the Employer Initiated activities are regarded as the most recommended ways for newcomers to obtain the knowledge of Agile artefacts and techniques, and BAU activities take second place. Employee Initiated activities are the least recommended to help newcomers to achieve this goal.

E11 Understanding the project domain knowledge and terminology

	VH	H
Employer Initiated Activity	1	3
Employee Initiated Activity		2
BAU Activities	2	4

Table 4-19

As shown in Table 4-19, the BAU activities have the highest influence on understanding project domain knowledge and terminology, accounting for 67 percent at the Very High level, and 45 percent in the High level. Employer Initiated activities rank in second place, accounting for 33 percent in Very High influence activities, and another 33 percent in High influence activities.

The contribution of Employer Initiated activities to acquiring project domain knowledge is most significant, therefore these activities are most recommended for newcomers to know project domain and terminology. The activities initiated by employers can also help in the achievement of this goal, while, the adoption of Employee Initiated activities may lead to an inefficient result in terms of this goal.

Discussion of Influence of Employer Initiated Activities, Employee Initiated Activities, and BAU Activities on Expected Outcomes.

The influence of activities in the three groups on the onboarding process are different for most of the expected outcomes. Employer Initiated activities significantly impact five outcomes: understanding company culture; understanding how to code and test to the team's expectations; understanding and meet the team's standards of work quality; developing an Agile mind set; and knowing how to use Agile artifacts and techniques.

The Employer Initiated activities mostly contribute to understanding team norms. The activities that happen during daily business influence three expected outcomes at the most, i.e. understanding of responsibilities of other team member; understanding project structure and aims; and knowing how to use Agile artefacts and techniques. The influence of the three types of activities are at the same level for two outcomes: understanding own role's responsibilities; and understanding what work to do and when.

Overall, by comparing the quality and level of effectiveness of the three activities, the contribution of Employer Initiated activities to the whole process of onboarding is most significant, thus the efforts from employers play the most important role in the onboarding process for newcomers. The integration of newcomers could be slowed down if employers did not apply any onboarding activity or events, which might reduce the performance of the whole team, and the satisfaction of new staff.

4.8 The Implications of the Findings

The discoveries of the onboarding process in Agile software development have been the center of focus in this study with the purpose of revealing the relationship between current onboarding activities and onboarding outcomes. In the first part of this research, the expected outcomes for onboarding new employees were presented, and this may help both newcomers and employers to clarify the goals of onboarding, allowing practitioners to draw up a plan before the actual onboarding begins. Personalized onboarding plans with different goals are recommended for different newcomers, as their weaknesses can be various, and the planned goals would aim to remedy the weaknesses. For example, it might be more important for an experienced person to obtain information about company culture and team norms after he or she joins a new team, rather than learning techniques,

as the barriers during onboarding for him or her are more likely to be how to fit into new environment than how to program a specific function.

The activities that are used in current Agile software teams aiming to speed up newcomers' onboarding are stated, along with their effectiveness towards every expected outcome. The study provides clear visibility of how activities influence the outcome of onboarding. High- influence activities have been elaborated on, which enable newcomers and employers to choose suitable activities in their onboarding process. Doing the goal setting in advance, practitioners would schedule a set of activities by applying the findings of this study, which might not only save planning time, but ensure the efficiency of the process.

5 Conclusion

The research purpose of this thesis was to understand the onboarding process in Agile software development teams. This research has met its objective of discovering the factors and effective activities in the onboarding process, and conceptualizing the relationships between activities and expected onboarding outcomes. A clear and focused rationale has been adopted throughout the research, to ensure an in-depth understanding of the current state of the onboarding process in practice.

From the literature, three factors of the onboarding process were gathered: (1) new employee behaviors, (2) new employee characteristics, and (3) organizational efforts. To answer RQ1: what are the desired outcomes for the onboarding process, 11 expected outcomes were obtained based on the weaknesses of newcomers and expectations of employees towards onboarding process. According to the differences in emphasis, the expected outcomes were categorized into five groups. i.e. (1) culture context, (2) job responsibility, (3) work standards, (4) Agile process, and (5) project knowledge.

To give the answer of RQ2: what activities are currently used in practice in the onboarding process, the interviews were applied, and 28 practical onboarding activities used in Agile development team were capture. Besides, an advised duration of onboarding has been given as the answer for RQ4: what is the perceived duration of the onboarding process, and a proposal of what factors may influence the duration is also stated.

By utilizing the repertory grid technique, the effectiveness of each activity regarding each expected outcome has been evaluated, which is also the answer for RQ3: which onboarding activities contribute to each of the desired outcomes. As the result, Mentoring is the most recommended activity in onboarding process which can contribution a lot in different aspect, and the deployment of this activity may also fasten the integration of newcomers. On the other hand, the contribution of Employer Initiated activities to the whole process of onboarding is most significant, thus the efforts from employers play the most important role in the onboarding process for newcomers.

The level of influence of each activity on outcomes are various, and the analysis of how

activities impact on outcomes have been presented. Suggestions of how to achieve expected outcomes by adopting suitable activities are provided, which would be useful for both practitioners and researchers who are interested in exploring this area.

The findings of this study provide a deep understanding of the onboarding process with Agile software development teams. They map the relationship between practical activities and onboarding outcomes, and structure a set of guidelines for practitioner to follow. With a prepared plan of onboarding goals, they can select appropriate activities to hasten the integration procedure, which may the save time and financial resources of both employees and employers.

5.1 Threats of Validity

The sufficient detail and support literature of onboarding and the research process of this study is defined to ensure the reliability of the data. Therefore, by following the steps that provided in this thesis, the same study can be replicated by other researchers. The inclusion/exclusion criteria are also described to a level of detail that can be replicated by others and have little room for misinterpretation. The categorized of desired outcomes is a possible threat to validity although the detail of process is presented, it is uncertain that other researchers would have the same category of desired outcomes.

The internal validity is not a question in this thesis, since this study is trying to discover the person's perceptions and the relationship between desired outcomes and activities, rather than giving a causal conclusion.

The external validity is low, as this research is not statistic study, and the aim is to understand in depth of onboarding process. However, the patterns of relationship between outcomes and activities give the insight of onboarding, where may resonate with the situations of newcomers and practitioners.

There are two main indicators of construct validity which are the alignment of what is investigated to what the researchers had in mind, and the completeness of the results. The alignment of "onboarding process" is high because it is a specialized and well known word. The meaning of expected outcomes and desired activities of onboarding is

presented as discussed in the literature and described to the participants of interviews to ensure the validity, however, there still some room for the misunderstanding. The completeness of desired outcomes and practical activities of onboarding are unsure, as we had not preconceived the activities for the reason of discovering how participants associated with onboarding, and the research of literature are limited to the database because of the time frame.

5.2 Further research

A suggestion for studying how to personalize the onboarding process has been given, as the characteristics of newcomers can be different, and as described in previous studies, some specific characteristics dominate the people's behaviors. The behaviors of newcomers influence onboarding process, and as the result the expected outcomes can be distinguished based on their behaviors. Therefore, it would be valuable to know what activities are suitable for which type of personality.

Besides, a personalized onboarding process can also be applied at different levels in terms of previous experience. It has been stated that the prior experience of newcomers influences the outcomes of onboarding in many ways. Further study could therefore focus on grouping newcomers and finding effective activities for each group.

On the other hand, we gathered more data about desired outcomes of onboarding process, and challenges for newcomers during onboarding from interviews, but due to the emphasis of this study, the analysis of these two aspects are not done. Further research which focus on comparison of literatures and practical situations in terms of desired outcomes and challenges of onboarding process are needed.

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Appendix:

Appendix 1: Questionnaire of semi-structured interview.

The questions in the interview based on the background to the project where a new person joins the team of participants.

1. Please describe the main aim of the software project.
2. What was your role?
3. Please describe the agile software development process for this project
4. Was the new team member new to the organization?
5. Was he/she a graduate?
6. What was the team role of the new person?
7. Was the new team member new to the role?
8. Did they have any knowledge of the project domain? Expert or novice?
9. Did they have any knowledge of agile software development practices and tools, expert or novice?
10. What aspects of the new team member's behavior, attitudes, knowledge and capability did you think would change through the onboarding?
11. How long did you think the whole onboarding process would take?
12. How did you judge when the new team member was part of with the team and didn't need any more onboarding help?
13. What planned activities did you get the new team member to do to help a them with onboarding to the team?
14. Who was involved in the onboarding activities?
15. How long do you estimate that the onboarding of this team member took?
16. What do you think the main challenges or issues are with on boarding new team members to agile development teams?
17. What was done to address these challenges in your team?

Appendix 2: Consent form

Project title: ***Onboarding in Agile Software Development teams***

Project Supervisor: ***Jim Buchan***

Researcher: ***Jennifer Yang***

- ○ I have read and understood the information provided about this research project in the Information Sheet dated 10 June 2016.
- ○ I have had an opportunity to ask questions and to have them answered.
- ○ I understand that notes will be taken during the interviews and that they will also be audio-taped and transcribed.
- ○ I understand that I may withdraw myself or any information that I have provided for this project at any time prior to completion of data collection, without being disadvantaged in any way.
- ○ If I withdraw, I understand that all relevant information including tapes and transcripts, or parts thereof, will be destroyed.
- ○ I agree to take part in this research.
- ○ I wish to receive a summary of the research findings (please tick one): Yes○ No○

Participant's signature: .....

Participant's name: .....

Participant's Contact Details (if appropriate):

……..

……..

……..

……..

Date:

Approved by the Auckland University of Technology Ethics Committee on type the date on which the final approval was granted AUTEC Reference number type the AUTEC reference number

Note: The Participant should retain a copy of this form

Appendix 3: Participant Information Sheet

Date Information Sheet Produced: 20 June 2016

Project Title: Onboarding in Agile Software Development Teams

An Invitation

My name is Jennifer Yang. I am a student from Auckland University of Technology, currently doing a research thesis as partial fulfilment of a Master of Computer and Information Sciences degree. I would like to invite you to participate in my research into the area of onboarding new team members in Agile Software Development (ASD). In particular, this research relates to understanding the current state of onboarding practice for ASD teams to gain some insights into the activities, strategies, expectations and challenges. This will result in a clearer picture of good practice regarding onboarding in ASD, assisting practitioners with decision making and providing a structure for further research in this area.

Please note that your participation in this research is voluntary in nature, and you may decline or withdraw your participation without any adverse consequences. None of the participants are identified nor will the information gathered be used to hamper, hinder or harm your career.

The following questions and answers are intended to address the most common questions that the participant may ask about this particular research project. If you need further information, feel free to contact the researcher, Jennifer Yang. My contact details can be found at the end of this document. It is recommended that you use e-mail to reach me.

What is the purpose of this research?

This research aims to study the current state of onboarding practice for ASD teams, to gain some insights into the practices, challenges and expectations. This will result in a clearer picture of good practice regarding onboarding and recommendations will be made to address any gaps and challenges, using best practice from onboarding theory.

How was I identified and why am I being invited to participate in this research?

You have been identified from the Project Supervisor's personal network of industry practitioners as someone with expertise in the area of team-based agile software development.

How do I agree to participate in this research?

To follow up on this invitation to participate in this research, please confirm your acceptance by email. You will also reconfirm your consent to participate in the interview formally by signing the Participant's Consent Form which we will give you just prior to your interview.

Your participation in this research is voluntary (it is your choice) and whether or not you choose to participate will neither advantage nor disadvantage you. You are able to withdraw from the study at any time. If you choose to withdraw from the study, then you will be offered the choice between

having any data that is identifiable as belonging to you removed or allowing it to continue to be used. However, once the findings have been produced, removal of your data may not be possible.

What will happen in this research?

If you accept this invitation to participate, you will be interviewed by the researcher. This will be a loosely structured interview where you will be asked some open-ended questions related to your experience of onboarding practices in your team, as well as challenges you have encountered. You will then be asked to complete a short grid-like form related to those onboarding practices and expectations. The interviews will be held at your usual work place(s) or any neutral place if requested. The researcher will take some notes for later analysis and also record the interview as a memory aid. The analysis will involve coding the data to identify trends and themes that provide insights to practitioners' perceptions of Agile team composition and leadership. Note that it is anticipated that the recording of the interview will not be transcribed in full, but quotes may be extracted as evidence of patterns identified. The data will have all references to the organisation and individuals removed for analysis.

At the end of this research a report summarising the main results will be made available to you if requested on the Consent Form. Furthermore, it is expected that papers may be published in academic journals reporting the main conceptual findings of this research project.

What are the discomforts and risks?

During the interview session there is a possibility you may feel uncomfortable about sharing your point of view about the project operations.

You may feel uncomfortable that your line manager will know who is participating in the study and who has elected not to take up the invitation, and that this could affect their perception of you, and future prospects.

You may feel uncomfortable about having your interview recorded.

You may feel uncomfortable that your colleagues or line managers may overhear what you say during the interview, and that this could negatively affect their perception of you.

How will these discomforts and risks be alleviated?

In order to alleviate the first area of possible discomfort, you will be reminded of our assurance of confidentiality of all interview data at the start of the interview process. You may choose not to answer specific questions, and you can also withdraw from participating in the interview at any stage. You can also request that your interview data be withdrawn from the study before the completion of data collection.

The second possible area of discomfort will be addressed by stressing the voluntary nature of participation to both you and your company. We understand the time pressures faced by you as an employee, and recognise that it is not always feasible or practical to participate in such studies. While your line manager will know you have been approached, participation or non-participation will not

be specifically recorded or communicated apart from the need to organise a specific time and date for your interview.

Recording of the interview is not a prerequisite of conducting the interview. Before the interview begins you will be asked for permission to record the interview. Even if consent to record is provided, you will be reminded that you can request that the recording be stopped or wiped at any stage of the interview.

A soundproof room will be requested for the interviews at the company premises, or, at your request, the interview will be conducted at a neutral place away from work. This obviates the risk of being overhead.

What are the benefits?

As well as adding to the body of knowledge and influencing practice in this general area, the insights gained from this study will be made available to yourself and your colleagues and it is hoped that the knowledge gained will be useful for improving the practice in your organization.

How will my privacy be protected?

All of the materials related to the participants' information (consent form, tape, and interview notes) will be stored at AUT in a locked cupboard for at least 6 years. After that the material will be destroyed.

It is not anticipated that a transcriber will be involved transcribing the recorded interview. The researcher may transcribe small parts of the recorded material to use as exemplars and evidence of trends and claims resulting from the analysis.

The data from the interviews will be anonymised and analysed for principles and insights that are independent of the interviewee's identity. Furthermore, demographic data will be coded and the data stored in a separate place so that the identity of each participant will be separated from their responses.

If participants decide to withdraw from this research project for any reason before the completion of data collection, all of the materials relating to their interview will be destroyed as soon as practicable after their request.

In addition, your line manager will not hear or see the content of this research data. The only people who will have access to your data will be the researcher and the researcher's supervisors.

What are the costs of participating in this research?

Time is the only cost to you. The interview will take around one hour of your time.

What opportunity do I have to consider this invitation?

Due to time restrictions in undertaking the fieldwork for the research, we would ideally like to have notice of your agreement within a week of you receiving this invitation.

Will I receive feedback on the results of this research?

If you would like a report summarising the results of this research, please tick the appropriate box on the Consent Form, provided at the interview.

What do I do if I have concerns about this research?

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, *Jim Buchan; jbuchan@aut.ac.nz; Ph 09 921 9999 extension 5455*.

Concerns regarding the conduct of the research should be notified to the Executive Secretary of AUTEC, Kate O'Connor, *ethics@aut.ac.nz* , 921 9999 ext 6038.

Whom do I contact for further information about this research?

Please keep this Information Sheet and a copy of the Consent Form for your future reference. You are also able to contact the research team as follows:

Researcher Contact Details:

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Project Supervisor Contact Details:

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Approved by the Auckland University of Technology Ethics Committee on *11/08/2016*, AUTEC Reference number *16/277*.

Appendix 4: Interview Response Capture Form

Interview Questions for Onboarding and how they map to the Research Questions

Date: Interviewee:

Organization:

Thinking back to the last agile software development project you were involved in where one or more new team members joined your team:

Study Context

Please describe the main aim of the software project.

What was your role?

Please describe the agile software development process for this project.

Nature of the new Team member

Was the new team member new to the organisation? Are they new to working is a graduate?

What was the team role of the new person? Was the new team member new to the role?

Was their knowledge of the project domain, expert or novice?

Was their knowledge of agile software development practices and tools expert or novice?

Expectations of Onboarding

What aspects of the new team member's behaviour, attitudes, knowledge and capability did you think would change through the onboarding?

How long did you think the whole onboarding process would take?

How did you judge when the new team member was part of with the team and didn't need any more onboarding help?

Issues and Challenges

What do you think the main challenges or issues are with on boarding new team members to agile development teams?

What was done to address these challenges in your team?

The onboarding process

What planned activities did you get the new team member to do to help a them with onboarding to the team?

Who was involved in the onboarding activities?

How long do you estimate that the onboarding of this team member took?

These activities listed in this last set of questions on the on boarding process then form the constructs (C1, C2, etc) of the repertory grid (attached) and the participant is then asked to complete the grid for each element (E1 to E10), indicating the contribution that each activity (construct) has on each expected outcome (element), using a Likert scale 1-7, with 1 being very little contribution, and 7 being a very high contribution.

Appendix 5: Raw data of repertory grids

Participant 1:

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	Note
Training session	7	7	7	7	5	7	7	7	7	5	7	Most important part
Video of product function	4	1	1	1	1	7	2	1	1	1	7	
Assigned with simple tasks at beginning	7	4	4	2	1	3	7	2	7	2	4	
Stand up meeting	4	1	7	1	5	4	1	5	1	4	1	
Online resource	1	1	1	1	4	1	2	1	1	2	1	For technical difficulties
Code repertory	7	4	7	5	6	7	7	2	7	2	7	
Socializing (team building)	7	7	6	5	4	7	7	2	4	3	7	Very important

Participant 2:

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	Note
Training session	6	6	5	6	5	4	6	4	5	3	3	
Online resource	2	1	1	2	2	1	5	3	2	2	2	
Pair programming	6	6	3	3	5	1	6	2	6	3	2	
Mentoring	5	5	5	5	5	2	6	4	6	2	2	
Team socializing	6	6	4	2	2	2	2	1	4	2	2	
Code repository	2	1	3	1	2	2	6	3	5	2	2	
Self-learning	1	1	2	2	3	2	4	2	2	2	2	

Participant 3:

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	Note
Online resource	5	6	4	5	5	5	6	4	6	4	5	
Internal documentation	5	5	6	6	6	6	6	4	6	5	6	
Stand up meeting	6	6	6	6	6	6	4	5	5	4	4	
Ask other for help	5	5	6	6	5	5	6	3	6	4	4	
Project plan	6	6	7	7	7	7	3	3	3	3	3	
Mentoring	6	6	6	6	5	6	6	5	6	5	6	

Participant 4:

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	Note
Online resource	1	1	1	1	1	1	7	1	1	7	1	
Induction sections	7	7	3	1	1	1	2	1	1	1	1	
Training session	7	4	3	1	1	1	4	1	1	7	1	
Mentoring	4	1	5	5	1	1	7	1	1	7	1	
Team lead	7	4	7	7	7	7	7	1	7	1	1	

Participant 5:

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	Note
Training session	7	4	6	5	4	5	6	2	7	4	4	
Internal Documentation	1	2	1	1	2	6	6	2	6	5	6	
Ask helps for other team member	7	7	7	6	6	5	7	4	7	6	6	
Team socializing	5	6	1	1	1	1	1	1	1	1	1	Helps with social aspect-still important
Pair programming	7	5	5	5	2	4	7	3	7	7	6	

Participant 6:

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	Note
Mentoring	7	7	7	7	7	7	7	7	7	7	7	
Signed with simple tasks at beginning	1	1	1	1	1	1	6	1	3	2	4	
Pair programming	4	4	4	3	3	3	6	5	4	4	4	
Stand up meeting	2	2	3	2	3	2	2	3	3	3	4	
Daily communication software	6	6	5	6	4	4	5	4	5	5	5	
Internal documentations	5	5	4	2	3	2	5	3	5	3	2	
Socializing (team building)	6	6	4	2	1	1	1	1	3	2	2	
Set expectation	6	6	5	3	6	1	2	3	3	2	2	
Self-learning	4	4	3	2	2	1	4	2	3	2	2	

Participant 7:

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	Note
mentoring	7	6	7	7	7	6	7	3	7	5	7	
Team Socializing	6	6	6	6	1	1	1	1	1	1	1	
Working confluence	4	4	1	1	4	3	7	1	5	1	7	
Online resource	1	1	1	1	4	1	7	1	1	1	1	
Education stipend	1	1	4	4	1	1	4	1	1	1	1	
Agile course	4	4	7	7	7	4	1	7	7	7	1	
Asking help from other team members	7	7	1	1	1	7	7	1	7	1	7	
Code repository	1	1	1	1	1	7	7	1	7	1	7	

Participant 8:

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	Note
Team socializing	1	4	1	1	1	1	1	1	1	1	5	
Training session	7	7	7	7	7	7	7	2	7	7	7	
Discussion group	1	1	1	1	1	5	3	3	3	4	4	
Research online	1	1	1	1	1	1	1	1	1	5	5	
Stand up meeting	7	7	4	7	5	7	5	7	5	4	2	

Participant 9:

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	Note
Mentoring	7	7	7	6	7	7	5	6	7	7	7	
Internal documentation	1	1	4	1	7	7	6	7	5	5	7	
Training session	1	1	3	1	1	7	1	1	1	1	7	
Asking help from other member	7	6	6	5	1	1	5	1	1	1	6	

Participant 10:

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	Note
Assigned with simple tasks	5	1	3	6	7	7	7	6	7	6	6	
Pair programming	5	5	4	6	6	7	5	6	6	5	6	
Team socializing	3	6	2	2	1	1	1	2	2	2	1	
Internal documentation	4	5	3	2	3	6	4	7	4	6	7	
Asking help from other team member	5	4	4	3	3	4	3	2	2	3	3	
Online resource	1	1	2	1	1	1	1	3	1	6	2	
Code repository	1	2	1	2	1	4	6	5	2	2	1	

Participant 11:

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	Note
Mentoring	3	2	5	5	4	6	6	5	5	4	3	
Project manger	5	3	4	4	3	6	2	3	3	3	5	
Asking help from other team member	6	5	6	5	5	4	4	3	5	3	5	
Floor map	1	1	2	1	1	1	1	1	1	1	1	Useful in getting to personally know people
induction	4	6	5	4	4	3	1	1	2	2	2	
Online resource	1	1	1	1	2	1	6	5	5	6	6	
Code repository	1	1	1	1	1	2	6	2	5	3	1	

Participant 12:

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	Note
mentoring	6	7	3	4	7	5	6	2	5	3	7	
Asking help from others	7	7	7	6	5	6	5	6	7	6	7	
Internal documentation	4	1	6	5	3	4	1	2	1	5	1	
Meeting with different teams	6	3	5	7	7	4	2	6	1	7	6	
Checklists	6	4	4	6	7	4	2	1	3	1	1	
Code repository	1	1	1	2	1	3	7	1	7	7	1	

Participant 13:

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	Note
Mentoring	7	7	7	7	7	7	7	7	7	7	7	
Knowledge data base	1	1	1	1	1	5	4	4	3	7	7	
orientation	6	7	3	1	4	1	1	6	4	6	2	
MSDM	1	1	1	1	1	1	7	1	1	1	1	

Appendix 6: Influenced Levels of Activities towards Outcomes

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11
C1	0.6	0.48	0.6	0.6	0.58	0.41	0.78	0.14	0.55	0.41	0.4
C2	0.67	1	-0.33	-1	0	-1	-1	0.67	0	0.66	-0.33
C3	0.5	0.83	0	-0.5	-0.5	-0.67	-0.83	-1	-0.83	-0.83	-0.83
C4	0.55	0.27	0.39	0.17	-0.06	0.39	0.72	-0.38	0.22	0.16	0.28
C5	-1	-1	-1	-1	-1	-1	1	-1	-1	-1	-1
C6	0	0	1	1	1	0	-1	1	1	1	-1
C7	0.76	0.62	0.42	0.34	0.1	0.2	0.38	-0.38	0.34	0.19	0.48
C8	1	0	1	1	1	1	1	-1	1	-1	-1
C9	0.33	-0.33	0	0	-0.33	0.67	-0.67	-0.33	-0.33	-0.33	0.33
C10	-0.22	-0.33	0	0.39	0	0.39	0.22	0.06	0.17	0.28	0.28
C11	0.67	0	0	0.67	1	0	-0.67	-1	-0.33	-1	-1
C12	-1	-1	-0.67	-1	-1	-1	-1	-1	-1	-1	-1
C13	-0.67	-0.78	-0.72	-0.67	-0.78	0	0.83	-0.56	0.5	-0.38	-0.28
C14	0.33	0.62	0.33	-0.5	-0.81	-0.67	-0.9	-0.9	-0.57	-0.76	-0.43
C15	-0.79	-0.95	-0.83	-0.79	-0.5	-0.83	0.125	-0.54	-0.58	0.042	-0.376
C16	0.25	0	0.33	0	0.25	0.21	-0.33	0.33	-0.17	-0.083	-0.42
C17	0.5	0.33	0	0.083	0.25	0.25	0.33	0.33	-0.17	-0.083	0.17

C18	0.11	-0.67	-0.44	-0.33	-0.33	-0.11	0.89	-0.33	0.56	-0.22	0.22
C19	0.67	-0.33	0.33	1	1	0	-0.67	0.67	-1	1	0.67
C20	-1	-1	0	0	-1	-1	0	-1	-1	-1	-1
C21	0	-1	-1	-1	-1	1	-0.67	-1	-1	-1	1
C22	0.67	0.67	0.33	0.67	0	0	0.33	0	0.33	0.33	0.33
C23	0.67	0.67	-0.33	-0.33	0.67	-1	-0.67	-0.33	-0.33	-0.67	-0.67
C24	-0.5	-0.5	-0.5	-0.33	-0.5	-0.833	0	-0.33	-0.5	-0.33	-0.33
C25	0	0	-1	-1	0	-0.33	1	-1	0.33	-1	1
C26	0.67	0.67	1	1	1	1	-0.33	-0.33	-0.33	-0.33	-0.33
C27	-1	-1	-1	-1	-1	0.33	0	0	-0.33	1	1
C28	-1	-1	-1	-1	-1	0.33	-0.33	-0.33	-0.33	0	0

Appendix 7: Influenced Levels of Activities towards Outcomes (Colored)

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11
C1	H	H	H	H	H	H	VH	H	H	H	H
C2	H	VH	L	VL	N	VL	VL	H	N	H	L
C3	H	VH	N	L	L	L	VL	VL	VL	VL	VL
C4	H	H	H	H	L	H	VH	L	H	H	H
C5	VL	VL	VL	VL	VL	VL	H	VL	VL	VL	VL
C6	N	N	VH	VH	VH	N	VL	VH	VH	VH	VL
C7	VH	H	H	H	H	H	H	L	H	H	H
C8	VH	N	VH	VH	VH	VH	VH	VL	VH	VL	VL
C9	H	L	N	N	L	H	L	L	L	L	H
C10	L	L	N	H	N	H	H	H	H	H	H
C11	H	N	N	H	VH	N	L	VL	L	VL	VL
C12	VL	VL	L	VL	VL	VL	VL	VL	VL	VL	VL
C13	L	VL	VL	L	VL	N	VH	L	H	L	L
C14	H	H	H	L	VL	L	VL	VL	L	VL	L
C15	VL	VL	VL	VL	L	VL	H	L	L	H	L
C16	H	N	H	N	H	H	L	H	L	L	L
C17	H	H	N	H	H	H	H	H	L	L	H

C18	H	L	L	L	L	L	VH	L	H	L	H
C19	H	L	H	L	VH	N	L	H	VL	VH	H
C20	VL	VL	N	N	VL	VL	N	VL	VL	VL	VL
C21	N	VL	VL	VL	VL	VH	L	VL	VL	VL	VH
C22	H	H	H	H	N	N	H	N	H	H	H
C23	H	H	L	L	H	VL	L	L	L	L	L
C24	L	L	L	L	L	VL	H	L	L	L	L
C25	N	N	VL	VL	N	L	H	VL	H	VL	VH
C26	H	H	VH	VH	VH	VH	L	L	L	L	L
C27	VL	VL	VL	VL	VL	H	N	N	L	VH	VH
C28	VL	VL	VL	VL	VL	H	L	L	L	N	N

Appendix 8: Influenced level of activities against five categorized desired outcomes

The Data of group of culture context (E1 & E2)

Activity	E1	E2	Average Value	Level		Activity	E1	E2	Average Value	Level
C1	0.6	0.48	0.54	H		C15	-0.79	-0.95	-0.87	VL
C2	0.67	1	0.835	VH		C16	0.25	0	0.125	H
C3	0.5	0.83	0.665	H		C17	0.5	0.33	0.415	H
C4	0.55	0.27	0.41	H		C18	0.11	-0.67	-0.28	L
C5	-1	-1	-1	VL		C19	0.67	-0.33	0.17	H
C6	0	0	0	N		C20	-1	-1	-1	VL
C7	0.76	0.62	0.69	VH		C21	0	-1	-0.5	L
C8	1	0	0.5	H		C22	0.67	0.67	0.67	H
C9	0.33	-0.33	0	N		C23	0.67	0.67	0.67	H
C10	-0.22	-0.33	-0.275	L		C24	-0.5	-0.5	-0.5	L
C11	0.67	0	0.335	H		C25	0	0	0	N
C12	-1	-1	-1	VL		C26	0.67	0.67	0.67	H
C13	-0.67	-0.78	-0.725	VL		C27	-1	-1	-1	VL
C14	0.33	0.62	0.475	H		C28	-1	-1	-1	VL

The Data of group of Job Responsibility (E3 & E4 &E5)

Activity	E3	E4	E5	Average Value	Level		Activity	E3	E4	E5	Average Value	Level
C1	0.6	0.6	0.58	0.5933333	H		C15	-0.83	-0.79	-0.5	-0.7066667	VL
C2	-0.33	-1	0	-0.4433333	L		C16	0.33	0	0.25	0.1933333	H
C3	0	-0.5	-0.5	-0.3333333	L		C17	0	0.083	0.25	0.111	H
C4	0.39	0.17	-0.06	0.1666667	H		C18	-0.44	-0.33	-0.33	-0.3666667	L
C5	-1	-1	-1	-1	VL		C19	0.33	1	1	0.7766667	VH
C6	1	1	1	1	VH		C20	0	0	-1	-0.3333333	L
C7	0.42	0.34	0.1	0.2866667	H		C21	-1	-1	-1	-1	VL
C8	1	1	1	1	VH		C22	0.33	0.67	0	0.3333333	H
C9	0	0	-0.33	-0.11	L		C23	-0.33	-0.33	0.67	0.0033333	H
C10	0	0.39	0	0.13	H		C24	-0.5	-0.33	-0.5	-0.4433333	L
C11	0	0.67	1	0.5566667	H		C25	-1	-1	0	-0.6666667	L
C12	-0.67	-1	-1	-0.89	VL		C26	1	1	1	1	VH
C13	-0.72	-0.67	-0.78	-0.7233333	VL		C27	-1	-1	-1	-1	VL
C14	0.33	-0.5	-0.81	-0.3266667	L		C28	-1	-1	-1	-1	VL

The Data of group of Agile process (E7 & E8)

Activity	E7	E8	Average value	Level		Activity	E7	E8	Average value	Level
C1	0.78	0.14	0.46	H		C15	0.125	-0.54	-0.2075	L
C2	-1	0.67	-0.165	L		C16	-0.33	0.33	0	N
C3	-0.83	-1	-0.915	VL		C17	0.33	0.33	0.33	H
C4	0.72	-0.38	0.17	H		C18	0.89	-0.33	0.28	H
C5	1	-1	0	N		C19	-0.67	0.67	0	N
C6	-1	1	0	N		C20	0	-1	-0.5	L
C7	0.38	-0.38	0	N		C21	-0.67	-1	-0.835	VL
C8	1	-1	0	N		C22	0.33	0	0.165	H
C9	-0.67	-0.33	-0.5	L		C23	-0.67	-0.33	-0.5	L
C10	0.22	0.06	0.14	H		C24	0	-0.33	-0.165	L
C11	-0.67	-1	-0.835	VL		C25	1	-1	0	N
C12	-1	-1	-1	VL		C26	-0.33	-0.33	-0.33	L
C13	0.83	-0.56	0.135	H		C27	0	0	0	N
C14	-0.9	-0.9	-0.9	VL		C28	-0.33	-0.33	-0.33	L

The Data of group of Agile process (E9 &E10)

Activity	E9	E10	Average value	Level		Activity	E9	E10	Average value	Level
C1	0.55	0.41	0.48	H		C15	-0.58	0.042	-0.269	L
C2	0	0.66	0.33	H		C16	-0.17	-0.083	-0.1265	L
C3	-0.83	-0.83	-0.83	VL		C17	-0.17	-0.083	-0.1265	L
C4	0.22	0.16	0.19	H		C18	0.56	-0.22	0.17	H
C5	-1	-1	-1	VL		C19	-1	1	0	N
C6	1	1	1	VH		C20	-1	-1	-1	VL
C7	0.34	0.19	0.265	H		C21	-1	-1	-1	VL
C8	1	-1	0	N		C22	0.33	0.33	0.33	H
C9	-0.33	-0.33	-0.33	L		C23	-0.33	-0.67	-0.5	L
C10	0.17	0.28	0.225	H		C24	-0.5	-0.33	-0.415	L
C11	-0.33	-1	-0.665	L		C25	0.33	-1	-0.335	L
C12	-1	-1	-1	VL		C26	-0.33	-0.33	-0.33	L
C13	0.5	-0.38	0.06	H		C27	-0.33	1	0.335	H
C14	-0.57	-0.76	-0.665	L		C28	-0.33	0	-0.165	L

The Data of group of Project knowledge (E6 &E11)

Activity	E6	E11	Average value	Level		Activity	E6	E11	Average value	Level
C1	0.4	0.41	0.405	H		C15	C15	-0.376	-0.83	-0.603
C2	-0.33	-1	-0.665	L		C16	C16	-0.42	0.21	-0.105
C3	-0.83	-0.67	-0.75	VL		C17	C17	0.17	0.25	0.21
C4	0.28	0.39	0.335	H		C18	C18	0.22	-0.11	0.055
C5	-1	-1	-1	VL		C19	C19	0.67	0	0.335
C6	-1	0	-0.5	L		C20	C20	-1	-1	-1
C7	0.48	0.2	0.34	H		C21	C21	1	1	1
C8	-1	1	0	N		C22	C22	0.33	0	0.165
C9	0.33	0.67	0.5	H		C23	C23	-0.67	-1	-0.835
C10	0.28	0.39	0.335	H		C24	C24	-0.33	-0.833	-0.5815
C11	-1	0	-0.5	L		C25	C25	1	-0.33	0.335
C12	-1	-1	-1	VL		C26	C26	-0.33	1	0.335
C13	-0.28	0	-0.14	L		C27	C27	1	0.33	0.665
C14	-0.43	-0.67	-0.55	L		C28	C28	0	0.33	0.165

Appendix 9: The Influence Levels of Three Group of Activities

The group of employer initiated

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11
C1	H	H	H	H	H	H	VH	H	H	H	H
C2	H	VH	L	VL	N	VL	VL	H	N	H	L
C3	H	VH	N	L	L	L	VL	VL	VL	VL	VL
C4	H	H	H	H	L	H	VH	L	H	H	H
C5	VL	VL	VL	VL	VL	VL	H	VL	VL	VL	VL
C6	N	N	VH	VH	VH	N	VL	VH	VH	VH	VL
C11	H	N	N	H	VH	N	L	VL	L	VL	VL
C18	H	L	L	L	L	L	VH	L	H	L	H
C20	VL	VL	N	N	VL	VL	N	VL	VL	VL	VL
C23	H	H	L	L	H	VL	L	L	L	L	L
C12	VL	VL	L	VL	VL	VL	VL	VL	VL	VL	VL
C27	VL	VL	VL	VL	VL	H	N	N	L	VH	VH

The group of employee initiated

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11
C7	VH	H	H	H	H	H	H	L	H	H	H
C8	VH	N	VH	VH	VH	VH	VH	VL	VH	VL	VL
C9	H	L	N	N	L	H	L	L	L	L	H
C15	VL	VL	VL	VL	L	VL	H	L	L	H	L
C24	L	L	L	L	L	VL	H	L	L	L	L

The group of BAU

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11
C10	L	L	N	H	N	H	H	H	H	H	H
C13	L	VL	VL	L	VL	N	VH	L	H	L	L
C14	H	H	H	L	VL	L	VL	VL	L	VL	L
C16	H	N	H	N	H	H	L	H	L	L	L
C17	H	H	N	H	H	H	H	H	L	L	H
C19	H	L	H	L	VH	N	L	H	VL	VH	H
C21	N	VL	VL	VL	VL	VH	L	VL	VL	VL	VH
C22	H	H	H	H	N	N	H	N	H	H	H
C25	N	N	VL	VL	N	L	H	VL	H	VL	VH
C26	H	H	VH	VH	VH	VH	L	L	L	L	L
C28	VL	VL	VL	VL	VL	H	L	L	L	N	N