Group Development Theories and Agile Practices

A

Research Report

By

Nosipho Mdlovu

778674

Submitted in partial fulfilment of the requirements for the degree
MCom in Information Systems

Faculty of Commerce, Law and Management
University of the Witwatersrand

Supervisor:
Prof Ray M Kekwaletswe

September 2021

Plagiarism Declaration

I, Nosipho Mdlovu (Student Number: 778674), declare that this is my own unaided work and is, to the best of my knowledge and belief, original.

I have read and understood the Senate policy on plagiarism and am aware that plagiarism is the intentional or unintentional "failure to acknowledge the ideas or writing of another" or "presentation of the ideas or writing of another as one's own". In this context "other" means any other person including a student, academic, professional, published author or other resource such as the internet. Failing to acknowledge the use of ideas of others constitutes an important breach of the values and conventions of the academic enterprise.

I am aware that plagiarism offences will be dealt with in terms of Senate policy and may be subject to disciplinary action.

I have appended a copy of all references used in this essay.

Name and Surname: Nosipho Mdlovu

Signed:  Date: September 2021

Acknowledgements

I would like to thank my supervisor for showing a lot of commitment and encouraging me to do this work. Thank you for taking your time to review and give constructive feedback on a continuous basis. I will always be grateful for your time, presence and contribution.

I would also like to thank the company that allowed me to carry out the research within their teams as well as everyone who was a participant in the study.

I am also grateful to all my family and friends who have provided me with a lot of support throughout especially my mother, Jabu Mdlovu.

ABSTRACT

There is a significant increase in the use of Agile software development methodologies. to ensure business process delivery, Agile methodologies and processes are highly dependent on teams that work well together. To this point, there has been a need for studies that focus on how Agile teams can function better, in order to enhance the understanding of the practice.

Using the Garfield and Dennis model of integrated development as a lens, the purpose of the study was to explore and describe how agile teams could be developed effectively. The study was conducted on two Agile teams to see how their group maturity and the stage that they are in with regards to their development as a team affected the way they applied and understood agile practices. The case study addressed the following questions; What elements of the Integrated model of group development are exhibited in agile development teams? What routine activities of Agile teams facilitate group development and how do the activities lead to project completion? What and how do collaborative technologies facilitate group development and project completion?

The study found that most of the elements of the integrated model could be identified within the Agile teams. The study also found that the routine activities of Agile methodologies facilitate group development and project completion. There was no empirical evidence to indicate that the use of collaborative technologies facilitated group development.

Keywords: Agile methodology, Agile practice, Agile teams, Garfield and Dennis model of integrated development

Table of Contents

List of figures

List of Tables

CHAPTER 1: INTRODUCTION AND BACKGROUND

This chapter serves to introduce and provide the background to the study.

1.1 Background to the field of Study

The terms group and team are often used interchangeably in workplace settings. However, they both refer to a number of individuals who are working together to achieve a common goal or objective. Fisher, Stephen, Hunter, Macrosson, and Keith (1997) found that groups and teams differ in that groups are formed instantly while teams evolve or develop over time.

Organizations have transitioned from assigning work to individuals but instead allocate work to different groups within an organization. These work groups are then considered to be teams (Fisher et.al, 1997). Teams are, therefore, now considered to be the core of how work is conducted (Kozlowski, 2018).

The value that can be derived from people working together can only be seen as beneficial over time as the team matures and their work processes are defined. The success of a project is highly dependent on how team members work well together in order to ensure delivery (McDonough, 2000). This is also noted by Thomas and Fernández (2008) who identified project team satisfaction as one of the project success criteria.

Over time, there have been studies conducted on how groups develop, with the most popular models for group development being the Linear stage model of group development (Tuckman, 1965) and the Punctuated equilibrium model (Gersick, 1988) that speak to different stages that teams reach or achieve in terms of their development. However, Bushe and Coetzer (2007) contrast the concept of group development in that it should not be viewed as a final state that teams reach where they are considered to be developed but rather a constant process that occurs on an ongoing basis. These different models that define how the teams work together are known as group development theories.

The Linear stage model, which is also widely known as the Tuckman model of group develop, has a number of stages where the team moves from a stage of forming, storming to the stage of norming and performing. Over a period of time between the different stages, a group would move from the forming stage, when they initially meet, to a storming stage which is characterized by conflict as they try to find ways to work together (Tuckman 1965). Once they start to understand each other and their different mannerisms, they move into a norming stage where they are more familiar with each other and the manner in which each individual works. This then leads to the performing stage, where they start producing tangible results as a team.

The punctuated equilibrium model (Garfield & Dennis 2012), consists of two phases There is a first meeting during which groups are quick to form and usually decide on work processes very soon after meeting for the first time. They also decide on their tasks and goals, which usually remain consistent until the group reaches a temporal midpoint.

During that mid-point transition, the group then takes time to re-evaluate their goals and make changes where necessary. They start to re-evaluate how they work. From doing this, they might decide to work differently or change the nature of their tasks and roles (Gersick, 1989).

Garfield & Dennis (2012) brought together the linear stage model and the punctuated equilibrium model in an integrated model. They proposed that model because they believed that groups usually follow both models at the same time, instead of just following one or the other.

Over the past few years, there has been an increase in the uptake of the agile software development methodology (Matharu, Mishra, Singh & Upadhyay, 2015).

Agile development is a software development methodology that is based on being able to deliver working software in an iterative and incremental manner in short time frames. It mostly focuses on people and the amount of knowledge that they can contribute, and in most instances the people work in small teams to ensure delivery (Mahrin & Yusoff, 2016). This has led to the interest in studying how teams function together.

1.2 Background to the research problem

Study location and context

The integrated model of group development was initially tested on 6 groups of nurses by who when, where, and why? This then showed that the groups followed the integrated model of group development.

There has been a significant increase in the use of agile methodologies within companies that develop software (Gandomani & Nafchi 2016). Agile processes are highly dependent on effective team work (Dorairaj, Noble, & Malik 2012). As the initial study was conducted within the healthcare sector, the present study sought to explore whether Agile teams within the financial services industry would also display similar patterns.

Dispersed Agile teams exhibit lower productivity and less quality work than when compared to co-located teams (Cohen & Thias, 2009). One of the issues that causes this is the lack of regular face to face communication in dispersed teams, while co-located teams communicate more frequently, which has an effect on their productivity. Advances in communications and collaboration technology makes it appear as though there is no need for face to face communication but the decreased productivity in dispersed Agile teams indicates that as not being the case (says who?). One of the things that the present study sought to explore was whether collaboration technologies would increase productivity.

1.3 Problem statement

There is a need for studies that focus on how teams can function better. Previous studies such as Torkar and Feldt (2017) and Jovanović et al., (2016) focused on teams; however, there is still a need for studies that focus specifically on agile teams and group development as that is still considered a new field to study.

A study conducted by Teh (2012) focused on group norms and how the way in which the individuals in the group conformed to these norms contributed to the team being able to complete tasks effectively. Garfield and Dennis (2012) say that the routines

that groups perform create patterns in the way people work, as well as define structure and provide guidance with regard to behaviour that is acceptable or not acceptable.

Agile software development comprises certain ceremonies such as sprint planning, sprint retrospectives and sprint reviews that are performed regularly. These form part of the routines that teams subscribe to. Studying these routines and how the different ceremonies are performed within agile teams may allow a better understand of how these teams function. Gren et al. (2017) argues that the maturity of groups have an effect on a team's performance and effectiveness, and therefore, the present study provides an evaluation of this in the context of agile teams.

1.4 Purpose of the study

There are two models of group development that have been widely used, namely the Linear stage model of group development and the Punctuated equilibrium model. Garfield & Dennis (2012) proposed a model that integrates these two development models. They studied the two models and found that these are noticeably different and used by groups under different conditions. They proposed a new integrated model that integrates the differences between the two models. This model focused on studying group development using the routines that people within groups perform.

The purpose of the present study was to explore and describe how the elements of the Garfield & Dennis (2012) model happen in agile development teams.

1. 5 Goal of the study

The goal of the study was to determine how agile practicing groups can be developed to achieve efficiency and effectiveness.

1.6 Study Objectives

The Study Objectives were:

- To explore and identify which elements of the Integrated model of group development Agile teams exhibit

- To explore the routines that Agile teams follow and how the activities have an effect on the groups' development as well as how they lead to projects being completed
- To explore whether the collaborative technologies used within agile teams have an effect on the teams' development and how that may lead to projects being completed

1.8 Research Questions

The following research questions were addressed in the study.

1. What elements of the Integrated model of group development are exhibited in agile development teams?

2. What routine activities of Agile teams facilitate group development and how do the activities lead to project completion?

3. What and how do collaborative technologies facilitate group development and project completion?

1.9 Research report Outline

The structure of this research report is as follows:

Chapter 1 provided an introduction and background of the study; it outlined the, purpose, problem statement and the research questions.

Chapter 2 surveys the scholarship by reviewing literature on agile software development methodologies

Chapter 3 discusses the theoretical frameworks underpinning the study

Chapter 4 discusses the research methodology followed in conducting the study.

Chapter 5 is the data analysis and study findings.

Chapter 6 serves as a reflection on the underpinning theory and contrasts the model against the study findings

CHAPTER 2: SURVEY OF SCHOLARSHIP AND THEORETICAL FOUNDATIONS

Introduction

This chapter reviews existing literature that provided foundations to the present study. The chapter covers the following; agile software development, collaboration technologies and group development.

Agile or Agility

Conboy (2009:337) describes Agility as "the continual readiness of an information systems development (ISD) method to rapidly or inherently create change, proactively or reactively embrace change, and learn from change, through its collective components and relationships with its environment." Although there are different types of Agile methodologies, they are all perceived to share the same values of agility and flexibility (Neves, Rosa, Correia & de Castro Neto, 2011).

Agile software development

Agile software development is a methodology that allows for software to be developed and deployed in short iterative cycles by allowing flexibility in software development (Maruping, Venkatesh & Agarwal, 2016; Dybå & Dingsøyr, 2008). It allows for working parts of a system to be released in small phases and improved upon, unlike the old waterfall methodology where projects would take years to be developed only to find that some components are no longer relevant. At times this would lead to projects costing more and taking much longer than initially estimated (Rasnacis & Berzisa 2015). As Agile is based on iterations, it allows the customer to see or derive value from the project at an early stage as a working software is constantly delivered (Tarwani & Chug, 2016; Dybå & Dingsøyr, 2008).

An important part of agile development is on using simple approaches when developing a software. This allows for designs and processes to be re-usable and easy to change (Misra et al., 2012).

The Agile Manifesto (Fowler & Highsmith, 2001; Misra, Kumar, Kumar, Fantazy & Akhter 2012) comprises the following principles:

Individuals and interactions over processes and tools

This mainly encourages people to talk to each other and interact with each other whenever possible rather than using processes and tools (Laanti, 2014). For example, a person might take a while to respond to a question that was sent via email but when you go and talk to them personally then they are able to give you a response quickly, and you can clarify whatever you need to clarify without having to wait for a while (Fowler & Highsmith, 2001; Nidagundi & Novickis, 2017).

Working software over comprehensive documentation

It is more important to have software that actually works instead of a lot of documentation that might not be used much. When you have the minimum amount of documentation that you can possibly have, it makes it easier to update as changes are made and, in some instances, people regard working code as documentation (Dybå & Dingsøyr, 2008).

Customer collaboration over contract negotiation

Collaborating with the customer allows you to understand better what the business problem is as well as understand your customer so as to build products that are well suited for their needs as well as to suggest alternative solutions whenever the need arises (Schnitter & Mackert, 2010).

Responding to change over following a plan

Agile software development allows for changes in requirements at different stages of a project. Its iterative nature allows people to review and make changes to the requirements as they discover or learn of new information. This feedback then allows them to make changes in requirements even at later stages of the development process. With other methodologies, the inability to make or adapt to changes to requirements once they have been signed off has been one of the reasons that have contributed to project failure (Maruping et al., 2016).

There are different types of agile methodologies and these are summarized in the following table.):

Table 1: Types of Agile methodologies (Tarwani & Chug, 2016)

Methodology	**Brief Description**
Extreme programming	The user creates stories according to a release plan. The stories are then broken down into tasks that are completed in iterations, the user then forms part of the acceptance testing to test the requirements.
Scrum	Work is broken down into user stories, which are prioritized on a backlog and allocated to small cycles known as sprints. User stories are then developed in accordance to the priority that they have been allocated for that particular sprint.
Test driven development	Developers create test cases before creating the code in order to perform unit testing. These test cases allow the developers to think of all the different scenarios that the system or user might

	encounter in performing the task, and in turn improves the quality of the code.
Lean	Lean is mainly focused on increasing value by reducing waste in product development.
Kanban	Kanban is a Japanese word that means "visual sign" or card is a visual framework that is used to implement agile by showing what to produce, when it should be produced as well as how much should be produced.

Nidagundi & Novickis (2017) views Scrum as a software development framework, while Lean is used to optimize the development process. Lean is more focused on the process, whereas Scrum focuses more on the people (Schnitter & Mackert, 2010). Both of these are viewed as agile techniques. Kanban was derived from Lean.

Scrum is based on time-based iterations whereas in Kanban, activities can be done at any point in time. They are both focused on delivering software early and often. The main similarity amongst all these are that they are team based, and the team is the most important part in ensuring that projects are successful (Schnitter & Mackert, 2010; Dorairaj, Noble, & Malik, 2012).

Agile uptake and usage

There has been an increase in the uptake of Agile methodologies and this is largely due to the number of success stories and improvements that that have been reported

by people using agile (Misra et al.2012). In a study conducted on teams recruited from the Norwegian Agile conference in 2011, it was found that the quality of teamwork is a major factor in improving team performance (Lindsjørn, Sjøberg, Dingsøyr, Bergersen & Dybå, 2016). However, there are still some people that believe that Agile is glorified because people don't really understand it, it has not being used or applied properly or appropriately (Irons 2006, cited in Misra et al., 2012).

Senapathi and Srinivasan (2014) conducted a study that focused on factors that were affecting the use of Agile as well as benefits that could be derived from using agile. This was mainly based on the belief that the benefits of using something can only be realized once that item or concept has been fully utilized. They argued that although the use of Agile software development methodologies has increased, there is not really much evidence that using them has proved to be effective or that it improves software development. The impact of agile methodologies on an organization's system development activities can, therefore, only be assessed when they are used widely and deeply in an organization (Nidagundi & Novickis, 2017).

Agile usage affects agile effectiveness, which is the perceived improvement in the outcomes of using agile methodologies (Senapathi & Srinivasan 2014). The measures that are used to assess agile effectiveness are predictability, productivity, quality of development process, and customer satisfaction

Elements of independence and structure are necessary in order for software development teams to function effectively, and so managers need to find ways to balance out the two (Maruping et al., 2016). Part of software development is being able to manage relationships effectively in order to ensure that critical skills are used well (Maruping et al., 2016).

Agile software development advocates for having smaller teams where the members of the teams are co-located and have a mixture of different roles, including the product owners or business users (Schnitter & Mackert, 2010). This allows for constant communication and collaboration, which in turn facilitates higher productivity and also results in products being developed at a much quicker pace (Neves et al., 2011). Allowing the customer to be involved throughout the development processes helps the

developers to understand the requirements more clearly (Tarwani & Chug 2016). This means that the formation and functioning of the development teams are critical to the success of agile development.

When individuals initially form part of a team, it is highly unlikely that they will get along from the beginning or work well together from the onset. And most people expect to work with people that are considered great team players; however, they need to go through different stages of group development in order to evolve into these functional teams (Mackey 1999). Understanding the challenges that people face while working towards becoming a team that works well together is essential to building the success of projects in organizations (Mackey 1999).

Collaboration technologies

There are various ways in which teams can collaborate in order to improve their performance.

Gloge et al. (2005) cited in Wang, Wei, Ding & Li (2016) defines knowledge collaboration as the capability that the organization has to convey the right information to the people that need it at the time in which they need it. This includes gathering of distributed knowledge resources and making these available to the team. When working on tasks that require decision making, it is essential to have access to information that can guide your decision making at the time that you need it without having to wait for other people.

Collaboration is also widely used in software development. Collaboration, communication, and coordination are enablers of software development (Mishra, Mishra & Ostrovska, 2012). These have been found to work effectively in an open plan environment where the physical work space allows for collaboration. It is not the case for virtual or dispersed teams who have to find other ways in which to collaborate effectively.

A study was conducted in Canada on two large software development projects to ascertain the relation between the collaboration network of developers and the quality of the software modules. The study found that it is challenging to coordinate work within software development teams when developers are in different locations

(Çaglayan & Bener, 2016). In instances where team members work in different time-zones, having some hours that overlap during the day helps with communication in virtual teams because during those moments members are able to get quicker responses or feedback from their team mates.

When there are more regular and intense communication processes, the potential of the technology being used can only be limited by a lack of proper collaboration. Communication is a very important factor for ensuring the success of virtual or dispersed teams (Henderson, Stackman & Lindekilde, 2016). Zigurs and Khazanchi (2008) found that the communication part of the collaboration technologies was more important than any processing capabilities that the software has. So to collaborate effectively requires communicating effectively.

Although a number of software packages that support collaboration and communication have been developed, most virtual and co-located teams still mainly use email as the main tool for communicating (Zigurs & Khazanchi, 2008). This was done by examining the task technology fit theory where patterns are viewed as practices by the different team members that contribute to either the effectiveness or ineffectiveness of a team.

In virtual teams, when completing tasks, team members are mostly likely to follow practices that have worked for them in the past, using collaboration technologies to resolve the specific problems they face at a given moment (Khazanchi & Zigurs,2005).

In a study aimed at improving collaboration amongst agile teams and in turn improving their performance, Inayat and Salim (2015) found that an important aspect in agile teams, especially where team members are dispersed, is ensuring that adequate infrastructure allows for collaboration as well as monitoring the collaboration efforts to see where they can be improved.

Group development theories

Tuckman (1965) initially introduced the idea that there might be certain stages or processes in which groups form. Although there were some shortcomings that were

identified in that study such as most of the literature being based on therapy settings and observation studies which implied biases from the observers, it set the stage for additional studies to be performed on group development.

The initial Tuckman model proposed that groups form in four stages, forming, storming, norming and performing. These stages could be observed in a social realm as testing-dependence, conflict, cohesion and functional roles and in a task realm as orientation, emotionality, relevant opinion exchange and the emergence of solutions (Tuckman 1965).

Although in Tuckman's initial study there was no empirical testing, a study was later performed by Tuckman & Jenson (2010) to determine if any testing had been conducted based on the initial study. This was done through a review of literature, which indicated that although some studies had been conducted based on the initial model, only one of them actually tested the model.

The study conducted by Runkel, Lawrence, Oldfield, Rider and Clark (1971) tested the Tuckman four stages model in a classroom setting where three groups of fifteen to twenty college students were observed to see if they displayed any of the behaviour described in the Tuckman model. Although the study confirmed the theory in Tuckman's model, it was considered as unreliable because of the research methodology used.

Weber and Karman, (1991) looked at the Tuckman model in combination with team role theory and situational leadership to demonstrate how leadership develops as a team moves through the different stages and how this affects the team's performance. In this study, it was identified that the following are required at each stage; a directing leadership style at the forming stage, a coaching leadership style in the storming stage, a supportive leadership style in the norming stage and a delegating leadership style in the performing stage.

Information technology has changed the nature of how people work, and because of this the need for studies on teams has now increased as employers and organization now value teamwork more (Betts & Healy, 2015).

CHAPTER 3: THEORETICAL FRAMEWORKS

Introduction

The purpose of this chapter is to give an overview of the group development theories that underpins the present study.

Theories of group development

There are two widely used models of group development, namely the Linear stage model which is also referred to as the Tuckman model, as well as the Punctuated equilibrium model (Garfield & Dennis 2012).

Garfield and Dennis (2012) argue that the two models are quite different and unique. The way in which the group develops can be studied properly by looking at the different routines that groups follow when doing work. When group members initially meet, they use routines that are most suitable for what they need to do.

Linear stage model

The Linear stage model was first introduced by Tuckman (1965). The initial study was done on different types of groups, which comprised training groups, therapy groups, and groups that were formed naturally or formed to study aspects of group behaviour.

Tuckman (1965) reviewed fifty-five articles to understand the development of small groups and to observe common characteristics amongst them (Tuckman, 1965).The development stages of the model were structured according to the formation of interpersonal relationships, which was referred to as the group structure as the task activities related to the different stages.

Table 2: Group Structure and task activity (Tuckman, 1965)

Group structure	**Task Activity**
Testing and dependence	Orientation to the task
Intra group conflict	Emotional response to task demands
Development of group cohesion	Open exchange of relevant interpretations / discussing oneself and other group members
Functional role relatedness	Emergence of solutions

Tuckman (1965) allocated these into categories now known as forming, storming, norming and performing, the proposed model of group development. The initial article by Tuckman has been widely used in literature since then, it has been cited 6815 times according to Google Scholar.

Bonebright (2010) also identified the following historical developments in the model. In the 1960s, organizational research focused more on how individuals were performing, and their productivity. Then in the 1970s and 1980s, there was an increase in developing and building teams and during this time the Tuckman model was used in different workplace settings. Then from the 1990s, until around 2010, as more people worked as groups or teams in the workplace, there was an emphasis on working as teams as the key to organizational success.

The Tuckman model of group development comprises the following stages; the first four, as discussed by Garfield and Dennis (2012) and Betts and Healy (2015) are:

The forming stage is when group members are still testing out things and familiarizing themselves with the tasks that they need to perform. They are getting acquainted with

one another as well as trying to understand the existing work processes. They then move to the storming stage, which is characterized by conflicts amongst group members with members being emotional when facing task demands. There is an increase in conflicts amongst the group members as they constantly question the work processes. The norming stage then follows, where group members are now more comfortable to work together and have developed into their different roles. There is now less conflict in the group as members have started to build trust and now have a shared understanding of roles and tasks. During the performing stage, group members have now developed routines and agree on the manner in which they work. Group members as a whole are focused on performing their assigned tasks and there is an increased group activity

Another stage which was added to the model later is the adjourning which occurs as the group separates or their work comes to an end, and this is characterised by feelings of anxiety and sadness (Betts & Healy, 2015).

There has been criticism of the Tuckman model such as the following:

The initial literature review was not a representation of the type of settings where small group processes would be performed (Bonebright, 2010). It was also found that some groups fit into a five-stage framework instead of four stages, and that groups vary in terms of their behaviour depending on their different contexts when they are in the conflict stage (Bonebright, 2010). The model did not address how groups change over time as well the development of creativity of teams when solving problems. They also criticized the model in that it lacked a discussion on groups failing to succeed in performing their tasks and what groups need to do to improve their performance (Bonebright, 2010).

The Punctuated equilibrium model

The Punctuated equilibrium model was first introduced by Gersick (1988) who had identified a gap in traditional group development models in that they lacked information on what triggered group development or how an environment could influence the development of groups. Gersick (1988) conducted a field study that showed how naturally occurring teams that had time constraints were able to perform and complete their tasks. The outcome of that study was a new model, done by observing eight

groups that displayed different development patterns than those that had been described by the models that existed at the time.

The Punctuated equilibrium model consists of two phases (Garfield & Dennis, 2012):

There is a first meeting during which groups are quick to form and usually decide on work processes very soon after meeting for the first time. They also decide on their tasks and goals which usually remain consistent until the group reaches a temporal midpoint.

The next stage is known as the temporal midpoint, and this is when there are changes in the group, and group members start to reconsider the way in which they work. They start to focus more on tasks and thereby improve their performance. They also take time to re-evaluate their goals and make changes where necessary. When groups reach a midpoint transition, they start to re-evaluate how they work. From doing this they might decide to work differently or change the nature of their tasks and roles (Gersick, 1989).

The midpoint transition would not always happen. In instances when it did occur, the focus was on how exactly it had happened as well as the changes that the group underwent as a result of the transition (Gersick, 1989). Later, she expanded on her research to show how the Punctuated equilibrium model could be applicable in other contexts and be more generalized.

Time pacing as used by groups in the Punctuated equilibrium model was seen as an important factor to consider. This was additional research that was conducted focusing on the midpoint transition (Okhuysen & Waller, 2002).

Understanding groups is mainly about understanding the routines that they perform. In Agile software development, teams adopt certain practices and routines that they follow as part of the methodology (Garfield & Dennis, 2012).

Routines are considered as repetitive tasks that are performed by a number of people, and these can be of a formal or informal nature. Groups form routines around how they work and interact with each other, and when these are no longer working out for them, then they develop new routines.

Garfield and Dennis (2012) brought together the Linear stage model and the Punctuated equilibrium model in an integrated model. They proposed the integrated model because they believed that groups usually follow both models at the same time, instead of just following one or the other. They also believed that introducing a new technology or any new process has an influence on how group development occurs, it may disrupt the routines that the groups perform.

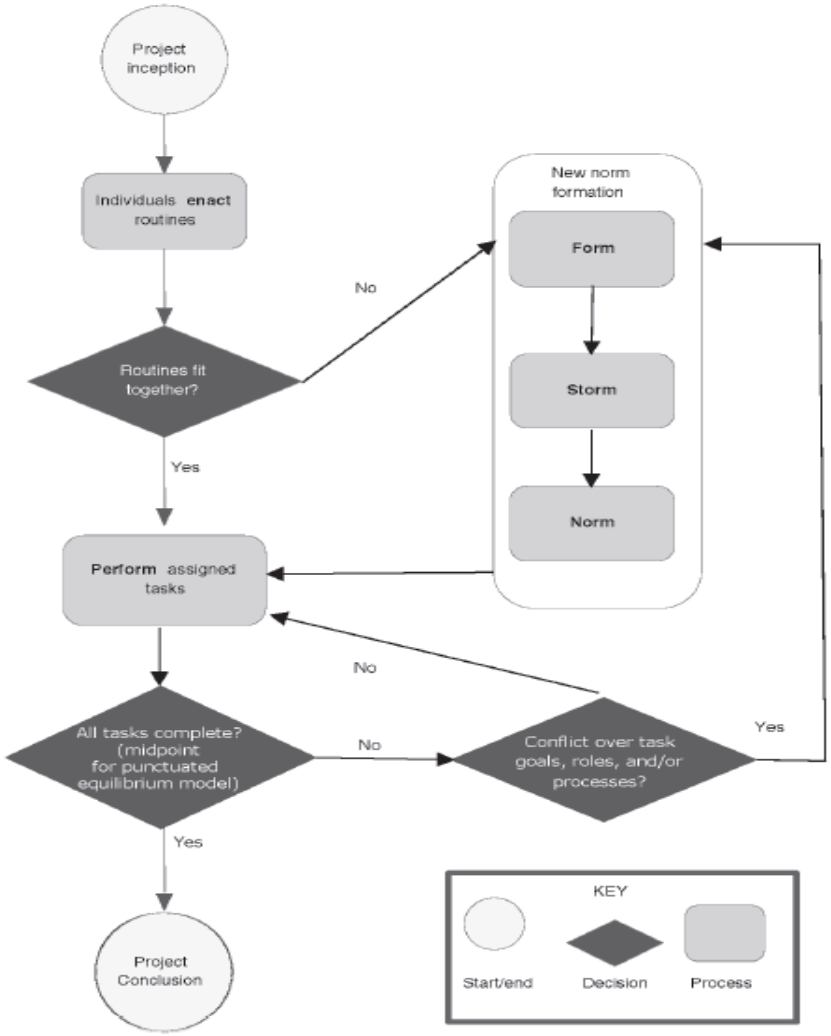


Figure 1: Integrated model of group development (Garfield & Dennis, 2012)

When a group initially meets, members form routines that are suitable for the situation that they are in at that point in time. If these routines are common amongst the group members, then they will start performing tasks but if they are unable or disagree about

how to perform these routines, then they need to agree on roles and work processes before they can start performing tasks (Garfield & Dennis, 2012).

Group members constantly reflect on their progress when they finish tasks or when something unexpected happens. While reflecting, if they become aware of differences or disagreements about how they should be working, they go through another cycle where they agree on their roles and work processes by forming, storming and norming until they can start performing again. Where the reflection was initiated because a certain period of time had elapsed, this can be considered as a midpoint transition or evaluation (Garfield & Dennis, 2012). During the storming stage an observation was made by Hackman and Wageman (2005), that when a team has issues with regard to their performance, that team is likely to "exhibit interpersonal difficulties, such as communications breakdowns, conflict among members, leadership struggles, and so on".

To get teams to that stage where they are performing and tasks are getting completed, it is important to ensure that members of a team have developed a shared understanding of the tasks to be performed and their specific roles and responsibilities, as well as the roles of the other team members. Bittner and Leimeister (2014) state that there is limited research that has been done around this shared understanding that is required by teams and the development of it.

This study examined the functioning of agile teams in a South African financial services organization. The study was initially meant to replicate the study conducted by Garfield and Dennis (2012), but since this was not feasible because of the nature of the initial study, the integrated model was used to inform the study by testing if agile teams would also follow the same group development pattern identified in the integrated model.

CHAPTER 4: RESEARCH METHODOLOGY

This chapter discusses how the present study was conducted. It follows the Saunders and Tosey (2013) research onion.

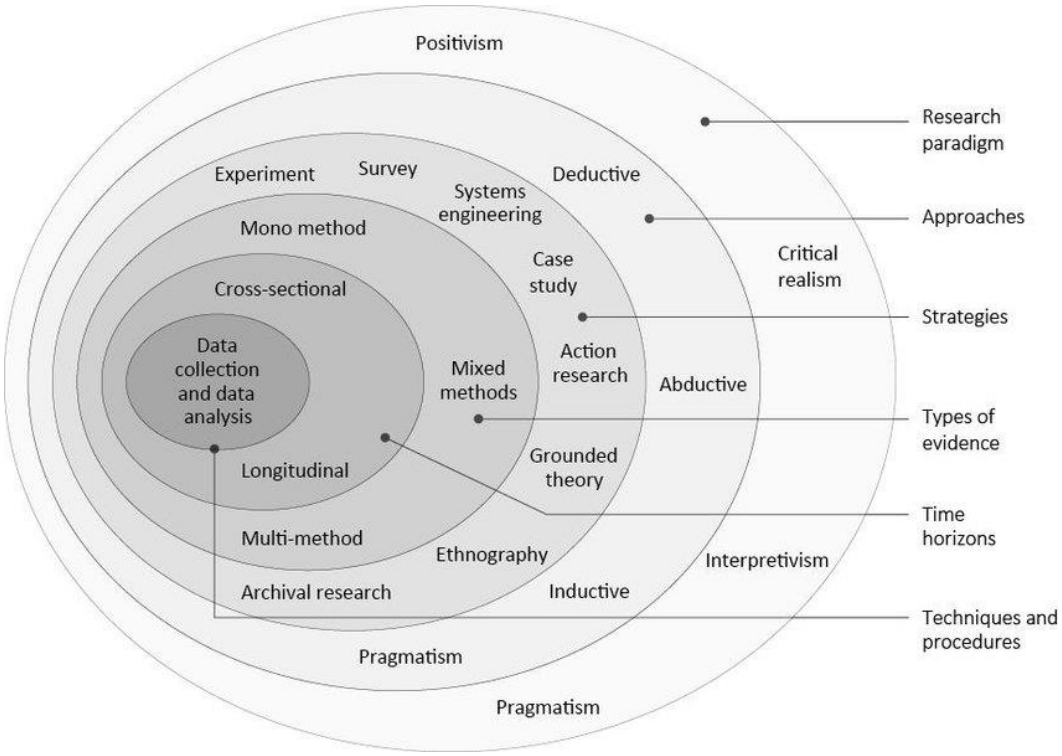


Figure 2: Research onion (Saunders & Tosey, 2013)

4.1 Research Paradigm

The purpose of the present study was to explore and describe how agile teams develop, using the Integrated model as a theoretical lens.

The present study followed an interpretivist paradigm and a qualitative research approach. Interpretive research is more focused on exploring and describing how certain concepts or subjects relate to each other with regard to their social settings (Oates, 2006; Webber, 2004). This is done by understanding how people view the world and trying to understand it from their viewpoint.

In interpretive research, there can be different interpretations of the data as the researcher's personal views and beliefs may affect how they analyse and interpret the research data. The outcome of such studies are not easily replicable as different

researchers might interpret the results differently (Oates, 2006; Battacherjee, 2012). Hence, the need to ensure that the findings are valid and reliable (Kelliher, 2005).

An interpretivist study allows for the interpretation of the results based more on social settings and to gather data using a small sample size (Voss, Tsikriktsis & Frohlich, 2002). Conducting the research within a setting where the two Agile teams were operating enabled for the nature in which the teams work to be explored and described within the context wherein they operate (Elliott & Timulak, 2005). This is why interpretive research was deemed suitable for this study

4.2 Research approach

An inductive research approach was used to explore and describe how the different teams apply agile practices. Inference was drawn from the primary data gathered from participants (Bhattacherjee 2012). The data that was gathered as part of this study not only explained what was happening, but it also explains why the study findings are as they are.

4.3 Research Design and strategy

The research design was exploratory and descriptive in nature, which allowed for a collection of data from a small sample of participants to learn more about group development theories and agile teams.

A case study was used as the research strategy. Using a case study strategy allowed the study to happen in a natural setting as well as to examine the phenomenon in the context in which it occurred (Oates, 2006). A case study examines in detail, features or instances of two or more occurrences of a specific concept in a particular setting. Yin (1981) uses the analogy of a detective investigating two crimes to describe how a comparative case study can be conducted by explaining each case individually and yet being able to see what similarities and differences exist between the two in order to expand on the original case. And thus a comparative case study can be used to identify patterns in the different teams.

The researcher that was conducting the present study has seven years of experience working as part of a software development team, four of which were in an agile

environment. Of those three years working in agile teams, one was as a Test analyst and three are in her current role of a business analyst. Hence, the researcher was comfortable and familiar with the work that was being studied with regard to agile methods. The researcher conducted the study using other teams in her workplace setting and not a team that she formed a part of in order to minimise bias when interpreting the empirical evidence.

4.5 Time horizon

The study was cross-sectional in nature. The initial plan was to gather the data over a period of one month to allow for two sprints to occur. However, because of the unavailability of participants and interviews constantly being postponed, data collection was done over a two-month period. This just extended the time frame but did not affect the findings.

4.6 Data collection Methods

Data was collected using interviews as the data collection method.

Interviews

Interviews were conducted to gain a more in depth understanding of how the teams work. Interviews were conducted with the scrum masters, business analysts, test analysts and developers that form part of the two teams that participated in the study.

The interviews were semi-structured where there were some pre-planned questions, as depicted in Appendix A, as well as allowing for other themes and subjects to emerge during the interviews (Bhattacherjee 2012).

Sampling and respondents

The study was conducted in an IT department of a South African financial services organization. The study participants included agile teams. The organization had adopted agile methodologies and was, therefore, a good study location.

Two teams participated in the study, Team A and Team B. Each team had a scrum master. They both use physical stand up boards for their daily meetings and Jira, which

is an electronic board, for managing their backlog. Each team also had a product owner.

Team A had been working together for a period of 18 months at the time of the study. There had been a lot of role changes and movement within the team. The team structure was made up of one business analyst, three developers and two test analysts, a scrum master and a User Interface (UI) designer. The team is composed of people who have been with the organization for a while and have a lot of domain knowledge. The initial phase of their project had gone live, and they were now working on the subsequent releases.

Team B has been working together for 2 months, and they were working on a new project together as a new team, although most of them had been with the organization for a while. At the time that the research was conducted the team was composed of one product owner, two developers, two test analysts, one scrum master and a UI designer. All the team members had some domain knowledge as they had all been working in the organization, in the same department but in different teams before they were brought together to form a new team.

4.7 Techniques and procedures

The data which was collected from the interviews was analysed using thematic analysis technique. Thematic analysis is a method used to describe and present qualitative data that may include interview transcripts as well as other documentation that may form part of a study (Braud & Anderson, 1998). It is most suited to analyse text such as interview transcripts.

It allows the researcher to identify common themes in the study by filtering the data and identifying similarities in the information gathered from different participants to create different categories (Green, Willis, Hughes, Small, Welch, Gibbs & Daly, 2007).

The first step in thematic analysis is characterized by immersion in the data, by observing how the participant responds to interview questions and their body language or any hesitations and noting this down at the time when the interview is conducted to form part of the analysis later (Green et al., 2007).

Once that has been completed, the next step is then coding, which constitutes repeated reading of interview transcripts as well as listening to recordings where these are available to ensure that the information contained in each interview and the whole data set is examined.

Codes were based on elements of the integrated model of group development, as well as criteria for agile effectiveness. The researcher used theoretical coding using the constructs used by Garfield and Dennis (2012) in the Integrated model of group development to identify which parts of the model each group has followed in terms of their development.

4.8 Ethical Considerations

As part of this study, the researcher received consent from the organization (Appendix D), to ensure that they were aware of the study being conducted and that they were comfortable with it being conducted there.

The researcher also received consent from (Appendix F) team members who participated the study.

To ensure that the right to privacy of the participants were kept, their identities remain anonymous, reference is not made to their different roles either.

4.9 Limitations

The study could only be conducted in one department of the organisation and only limited to two teams because consent could only be provided in those teams. This limited the data that could be used, as having more teams would have resulted in a much richer data set to substantiate the findings.

CHAPTER 5: DATA ANALYSIS AND DISCUSSION OF FINDINGS

Introduction

This chapter analyses the data collected and discusses the findings thereof. The

How the analysis was done

The data analysis process started with conducting interviews with members from each team. The interviews were recorded with the consent of participants. All the interviews were then transcribed, and once that process was completed, each interview transcript was then coded.

Data was initially collected by interviewing some members of team A and once that had been completed members from team B were then interviewed.

The coding process was conducted on each interview. The initial codes that were created were those that were derived from the literature to help answer the research questions. Then, additional codes were created from analysing the data collected.

During the coding process, themes from the interviews were highlighted, then a code was assigned to the different themes and subthemes. This was done using Atlas.ti. This ensured that the number of responses assigned to each code and the number of different codes allocated to each interview document could be easily observed.

‘The following table lists the codes derived from the literature, together with examples of text assigned to each code.

Table 3: Coding and themes

Element of Model	Code Assigned	Example of coded text	Count / number of items coded
Project inception	Inception	“There was a formal introduction with the team members and how the team works and what is the process about the project and what project we are working on, and what the deliverables are, so all the information was provided”, (R1TA, Line17).	11
Individuals enact routines	routines	“It has ceremonies, there is spring planning, sometimes there is a sprint planning 1 and sprint planning 2. Sprint planning 1 is where we decide what we are going to take into the sprint, and then sometimes sprint planning 2 is when the design takes place. Then we have scrum every day, 15 minute stand-up to say what you did yesterday, what you are going to do today and what’s blocking you. We work off stories that have descriptions and acceptance criteria, and we give points to that story. So, the points differ from team to team. Grooming is done often, especially when there is a new feature that needs to be groomed”, (R2TA, Line78).	25
Routines fit together?	routines fit	“Keeps everyone accountable because you can’t say the same things every day. You can see when you are struggling, you can see when	12

		something is not working fast. You fail fast, work is visible, and people keep each other accountable", (R5TA, Line108).	
Lack of fit	Lack of fit	"She changed the role and moved to another team because she felt that she didn't have work in our team because everyone in the team could actually do what she was doing, so there wasn't much for her to do", (R2TB, Line 41).	3
Perform assigned tasks	Performing	"Mostly focused on doing the work as they are delivery driven.", (R2TB, Line 41)	6
All tasks complete? (midpoint for punctuated equilibrium model)	Tasks complete Tasks incomplete		
New norm formation (Form, Storm, Norm)	Form	"So, in that first week, in that team lift off, we did a working agreement, so we worked out how we are going to work together and also did a definition of ready and definition of done exercise. So now it's the fourth sprint, and we have revisited those agreements", (R1TB, Line 99).	18
	Storm	"We were fighting at first. Goals, we didn't have an issue with goals because we are all working towards one specific goal to deliver quality and a working product. But then acceptance criteria would have differences as it was a new project. Some were not properly defined, some were not there at all or missing scenarios that you had to add maybe while you are	5

		testing. That's when you realize that this is the outcome, then you have to add it. And, because the BA didn't know that this is the acceptance criteria, so you add it", (R2TB, Line 80).	
	Norm	"So, we had to define our own processes. So, at the end of each sprint we do a retro, at the retro we review our way of work, what has worked in the previous sprint and what is it that we need to change because we believe there is constant improvement that is required", (R4TA, Line 69).	15
Conflict over task goals, roles, and/or processes?	Conflict task goals	"We had a problem where our requirements or acceptance criteria was not clearly defined, so we found that we are doing a lot of guess work and refining the requirement. So now we actually had a meeting where we sat down with the BA, developers and scrum master to define the way of work because there was a gap that we picked up in the requirements", (R3TA, Line 123).	17
	Conflict roles	"Some developers and designers who are contractors have left the team. Some left because they were shared resources between different teams and moved to focus on one team", (R4TB, Line 35).	3
	Conflict processes	"In terms of the scrum master, the leadership style that she used. I didn't really agree to it, and we questioned a lot about it. Then now we have another scrum master who is more relaxed, and we can communicate. She lets us decide what we want to do and obviously directing us into building the team to be a better team", (R2TA, Line 41).	13

Most of the elements from the Integrated model were identified in the responses, except for “Tasks complete” and “Tasks incomplete”.

During the data analysis, more themes were identified. These themes did not reflect elements from the Integrated model but seemed relevant to address the research questions, hence it was necessary to also include them.

Table 4: Additional coding and themes

Code Assigned	Example of coded text	Count / number of items coded
Collaborative technologies - use	“JIRA helps us with the user stories, and the burn down charts and estimations, and it also helps us with creating small tasks on the stories so that you know that when you are working on a certain task you pull it in and when you are done you close it. Then we use the Slack channel for alerts and communication and sending screenshots. Then WhatsApp is our main communication channel where we discuss everything from work, to when you won’t make it if there is a major issue and when we go for releases. That’s our main basic chat”, (R2TB, Line 74).	11
Collaborative technologies - type	“We use all three; JIRA, slack and WhatsApp”, (R2TB, Line 74).	10
Conflict	“There was a time when one of the mobile developers had conflict with the product owner. The requirements were seen differently by both of them. They had arguments, during the sprint. They resolved it and had to include the BA to clarify the requirements. They mentioned it in stand up, and it was resolved and handled professionally”, (R4TB, Line 28).	15
Conflict resolution	“It’s tense, but I think the one thing that I have even spoken to one of my team members is that we go through the conflict then it’s done. It’s	7

	business, so there is never a time when there are bad vibes. If they talk it out, then it's done", (R2TA, Line 60).	
Experience	"Since 2015, almost 3 years", (R5TA, Line 11).	11
Productivity	"Because we deliver every sprint. Then I must make sure that in two weeks, I have something to showcase, otherwise I am in trouble. It pushes me to push the team that I need to deliver", (R4TA, Line 133).	18
Punctuated equilibrium	"So, we had to define our own processes. So, at the end of each sprint we do a retro, so at the retro we review our way of work, what has worked in the previous sprint and what it is that we need to change because we believe there is constant improvement that is required", (R4TA, Line70).	8
Role	"I am a scrum master.", (R1TB, L7)	18
Role routines	"So, the scrum master's role is to enable the team to do stuff. So, what I do is, I help the team understand Agile and then understand the practice of scrum. I help facilitate the sessions that take place to ensure that there is an outcome in the sessions and that the outcome is good for the team. I coach the product owner and make sure that there is a backlog and that the backlog is done correctly and that it is easy for the team to understand the items. I also help with removing impediments for the team", (R1TB, Line 9).	8

Roles fit	“Yeah, it’s wonderful, and I got to learn a lot of different things from the team so overall it’s been good”, (R1TA, Line 25).	8
Team Coherence	“Because we have known each other for so long, it’s easy to work with her because I know her, and she knows me. When we are busy with the same thing if there is something that we don’t agree on, we talk it out and solve it, but it’s never really conflict”, (R2TA, Line 52).	10

5.1 Match of the model to agile practices

Introduction

This section analyses data collected to answers the research question: Which elements of the integrated model of group development can be observed in Agile development teams?

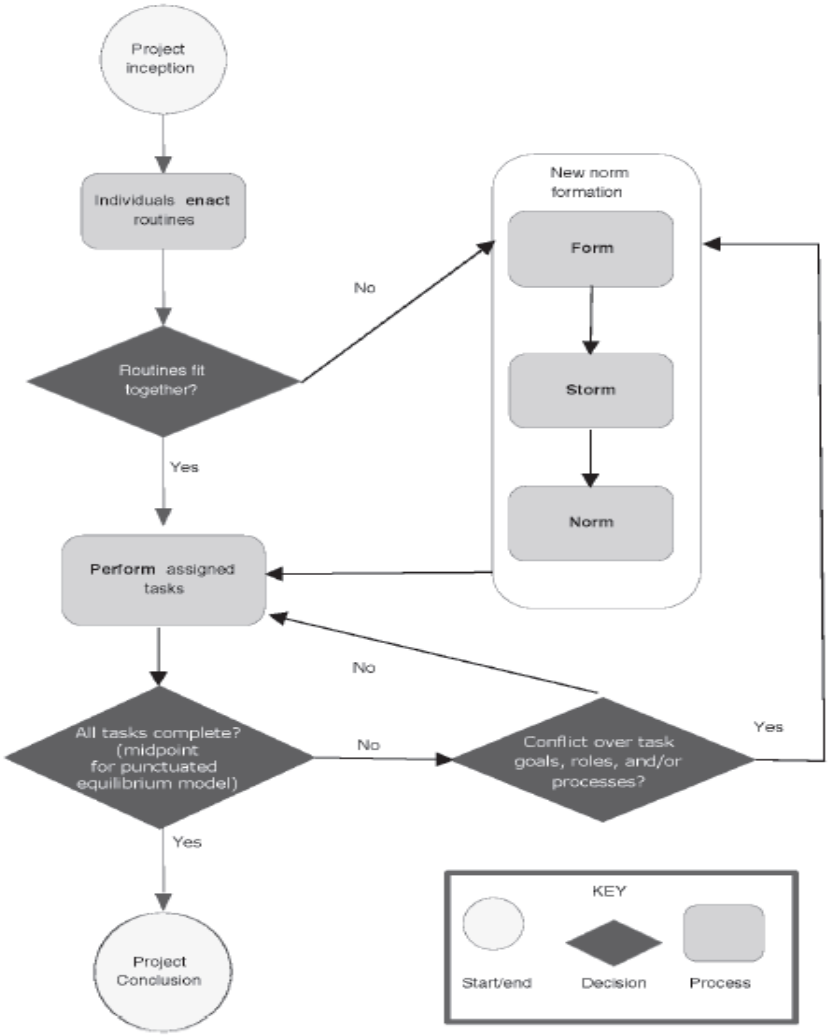


Figure 3: Integrated model of group development, Garfield & Dennis (2012)

From the interviews, most of the elements of this model can also be seen in Agile development teams.

Inception

Within team A the different responses from the participants indicate that there were different ways in which different people joined the team where one member was part of the inception "*There was a formal introduction with the team members and how the team works and what is the process about the project and what project we are working on, and what are the deliverable, so all the information was provided*", (R1TA, Line 19).

The team members from team A had different experiences of what can be viewed as their inception, as they joined the project at different points. Some team members joined team A when they joined the company while others were moved from other teams," *so I was actually moved from another team, I think I started right after inception dev part of the project*", (RT3A, Line 16). At some point once the team was already formed they had to then define a way of work as it wasn't clear how they were working.

Another participant joined the team while they had already started working together.

> *"So it was quite challenging the way they were working, but when I started we had to define the way of work, especially for analysis, because the team was complaining that the stories were not refined to the level where they could actually start working on them, which made them not to deliver, so well, there was.", (R4TA, Line104)*

What was interesting to observe here is that when a member joins a team that is already working together is that is seems as though they view themselves as an outsider and refer to the other members of their team as "they" somehow excluding themselves from identifying as a member of that particular team.

Team B was a team formed from members of different teams within the department as the whole department was undergoing a restructuring process. To establish and kick-start the team, a way of work was defined which governs how the team members work together and interact with each other. This is what one of the team members had to say,

“Had first meetings where teams defined way of work, definition of done, rules for the team and expected working hours. We also discussed what is expected if a person works from home and came up with way of work guidelines which are constantly evolving, we do what works and make changes as needed “, (R3TB, Line 42).

Another team member described how the inception process took place as follows;

“*We were called into a meeting of the whole tribe, about 60 people then the tribe mission was explained, the tribe leader was saying what the mission of the tribe is. Then he said there are 5 squads in the tribe, then the product owners called out the names of the people in each of their squads. Then we just sat and did a meet and greet in the tribe, some people knew each other, some people didn’t know each other. I didn’t know most of the people, and then I knew the product owner from previously, we worked together at a different company, and we have a good relationship. We have worked well together in the past, so we just connect well. We thought it would be a good idea if we just do something with the team. I think it was two days after that initial meeting, we went to capital craft for just relaxing together with the team. That started the initial connection with the team. I think because we did that, the team just bonded. In the first week that we worked together we did some team lift off things, the first thing that we did was, we did a team name so that we can have an identity, and that identity is ingrained in the people*”, (R1TB Line 35).

None of the other team members mentioned this, although all of them were just aware that they are following scrum way of work.

As part of their inception stage, team B created a working agreement which the team would adhere to, then they later made changes to it based on what was working and what was not. The point at which they created the working agreement can be seen to characterise elements of the norming stage of development as well as the midpoint equilibrium where once they had passed that stage they changed how they work. By re-evaluating their work processes,

they were able to decide to work differently or change the nature of their tasks and roles (Gersick 1989).

"So, in that first week, in that team lift off, we did a working agreement, so we worked out how we are gonna work together and also did a definition of ready and definition of done exercise so now if the fourth sprint we revisited those agreements", (R1TB, Line 103).

The teams have found ways to work with each other and understand each other's personalities and differences. With team B one of the things that made it easier for them to get along well from when the team was formed was that they had a kick-off session which was like a mini team building lunch which allowed them to get to know each other before they started to work together so this somehow helped them to bond.

> *"So now as a collective they believe in each other, they trust each other. So, when we have challenges in the team, it came very naturally for them. So, when we have challenges in the team, because we have such a strong connection with each other, it is much easier to resolve those challenges, and we can speak frankly with each other, and it helps with resolving things and there are no hidden agendas" (R1TB, 52)*

Routines

The routines that the teams enact or follow were observed when looking at the scrum ceremonies that both teams perform. The team member define scrum as being "*an iterative process*". One of the participants also mentioned that "*scrum is not Agile, scrum is just a framework*", (R1TB, Line 95) and this is relevant as most people follow the scrum framework and define that as Agile where Agile is much broader than just how it is applied using scrum. One of the teams had indicated that they were considering using the Kanban framework, but had decided not to because it would not fit into how the rest of the teams in the department work. Agile software development is a software development methodology that allows for software to be developed and deployed in short

iterative cycles by allowing flexibility in software development (Maruping, Venkatesh & Agarwal 2016). Teams in general will usually try out scrum and Kanban and eventually just adopt whichever framework works better for them or gives them the best results.
Agile is practised or applied using different frameworks, which allow teams to apply the Agile principles within the frameworks. Scrum and Kanban are such frameworks, and teams usually try out different frameworks until they find one that is suitable for them.

Both teams work in two weeks sprints, within these sprints the ceremonies that the team members take part in include daily stand-up meetings, sprint planning sessions, backlog grooming or refinement sessions, review or demo session and a retrospective (R1TA, R2TA, R3TA, R4TA, R5TA, R2TB, R3TB, R4TB).

The daily stand-up meetings are fifteen-minute meetings that are held by each team, "*each day we have a stand-up* ", (R3TA, Line73). The stand-up follows a structured format, respondents say, "*so we discuss what we did last day and what we will be doing today, so that is very standard, it happens*,"(R1TA, Line 81) and, where*we define or rather we say what we did yesterday, what we are working on today, if we have any impediments*", (R3TA, Line 75). Most of the team members find these meetings valuable in that they give visibility to what everyone else in the team is working on or if they have issues everyone is then aware of them.

A backlog grooming session is a ceremony where the team meets and looks at the different user stories to decide if they are ready to be added on to the next sprint. Backlog grooming sessions are held as required where the user stories are discussed, broken down, sized and prioritized to prepare them for sprint planning," *we actually have backlog grooming and then from then we do our sprint planning*", (R3TA,Line 69), "*Backlog grooming, we need that to prepare the stories for the next sprint*,"(R2TB,Line 99), respondents say.

Team A initially used to have their grooming sessions once per sprint, but then realized there was a need to do them more frequently as new features came in.

"*Once we all agreed on what we are taking in, we give story points, we size the effort, then after that there is, our sprint starts*", (R3TA, Line 7), this process is what is then done by the two teams during their respective sprint planning sessions.

Retrospectives are held to review the previous sprint," *After that we have a retro where we look back to what we did and if there is anything we can improve on*", (R3TA, Line 79). The teams indicated that the retrospectives are not being held consistently as they skip them in some sprints, but there was no indication of why this was the case," *It really hasn't changed much but yeah, everything remains the same, sometimes we don't do retros*", (R3TA,77). They also felt that the retrospectives would be more valuable if the action points that come up from the retrospectives were being executed because when they aren't being addressed what ends up happening is that the same issues come up every time there is a retrospective." *With retro, it is good if at the end the actions. If we have the actions and not actioning them, there is no use. We should have action points and resolve them*", (R2TB, Line 100).

Some team members indicated that one of the things that works about the format of how different sprints are set up is that there is a certain deadline that is allocated for the work that they need to complete during a sprint, and they have to ensure that they complete the work that they have committed to within that deadline.

> " *Transparency, being accountable for what you are doing and, I am more for Agile than waterfall because at least everything is transparent, and all the risks are there, and everyone can see. You don't have to wait for six months until something is developed, then you see it later only to find that we should have sat together during requirements and groomed everything and see". (R2TA,178)*

As Agile is an iterative process, it allows people to learn and improve by continuously reviewing the work processes to see what works and what doesn't, then make the appropriate changes.

As the different members leave or join the team, there are noticeable changes as to how the other team members feel and interact with the different people.
" *Then now we have another scrum master who is more relaxed, and we can communicate. She lets us decide what we want to do and obviously directing us into building the team to be a better team* ", (R2TA, Line 48). "*We had one BA she left because she has another project then there is a new BA now, I don't think it has been a month, but we are still trying to build a relationship but so far, so good*", (R2TA, Line 51).

"*Yes, there is a new developer who has only been with us maybe about two months, but he seems to be gelling with the team and can communicate with everyone. The developers are from India, so they know each other from there. So now when they bring the other one they already know each other, so it's only us that they need to get to know. Then we had another developer who had to leave our team for another team, he was one of our best developers. Things change you must just go with the times", (R2TA, Line 82).*

The movement in the different roles was indicated mainly in team A, as people would leave, and new people would join the team. With team B the difference lies in that most of the people were leaving and there were no other people being brought in to fulfil their roles. As team B was a new team, most of the changes were really seemed geared towards getting to a more stable number of people.

"At first, we had to find common ground as everyone came from different teams and different way of work, so we had to define that, the way of work first. So, it wasn't easy. We discussed that, we discussed definition of done, we discussed definition of work readiness", (R2TB, Line 51).

When routines don't fit / New norm formation

There have been instances where routines don't fit.One participant said that they" *came up with a way of work guidelines which are constantly evolving. We*

do what works and make changes as needed", (R3TB, Line 45).There have also been issues with the different roles not being a fit, as explained by this participant, "*She changed the role and moved to another team because she felt that she didn't have to work in our team because everyone in the team could actually do what she was doing, so there wasn't much for her to do*", (R2TB, Line 41). Sometimes team members are not being a fit or do not pull their weight, not necessarily the routines themselves," *The other guy was the one who was not pulling his weight*", (R3TB, Line26).

Team A has gone through several forming stages as there was movement of team members who either left or were replaced by others.

When the different teams form, the leadership or roles within a team are not necessarily determined by the team members themselves, as each member is usually required to fulfil a certain function.

"When the team forms there are certain individuals that are selected to be part of the team, they are selected because of their skills and because of their skills they do certain roles. So, you don't necessarily agree on roles per se in the team after the team is formed, it is kind of inferred by the skills that you have", (R1TB, Line 27).

One of the team members from team B mentioned that even though they were using scrum, their team was set up as a squad forming part of a bigger tribe which is based upon the Spotify model and this was done while the team was being set-up.

The Spotify model was initially used by Spotify, which is a music streaming company, to scale agile teams to enable them to grow at a quicker pace. A big team is divided into a tribe, then from there each tribe has smaller teams of people working together on certain projects or features (Kniberg & Ivarsson, 2012). The Spotify model is used mainly to scale up Agile processes within bigger teams. This is done because initially the Agile methodology was used mainly by Start-Ups which would have smaller teams of people working on

projects. It basically determines how bigger teams are split up and structured, and they will also follow either scrum or Kanban within their smaller squads so that they have a uniform way of working but can still deliver value faster.

"A Squad is similar to a Scrum team and is designed to feel like a mini-start-up. They sit together, and they have all the skills and tools needed to design, develop, test, and release to production. They are a self-organizing team and decide their own way of working – some use Scrum sprints, some use Kanban, some use a mix of these approaches" (Kniberg & Ivarsson, 2012).

A squad will normally have a mission that they need to fulfil and will not have anyone assigned as a leader, but like a scrum team in a squad there is a person who acts as a product owner (Kniberg & Ivarsson, 2012).

Conflict

There were several instances where members from the different teams encountered some issues, "*we were fighting at first*", (R2TB83)," *which arose within their respective teams and others that involved external teams, so there was conflict which was created, the testers it was a problem for them to work in this way*", (R1TA, Line100). In all instances where conflict arose, team members found amicable ways to resolve it," *they mentioned it in stand up, and it was resolved and handled professionally*", (R4TB,Line31).In instances where they found this difficult they then escalated their issues and involved other people who then acted as mediators," *so, we then involved other experts like the architects and dev managers* ", (R5TA,51) and helped them to reach a point where they were able to work together again.

When interviewing the team members, they would initially seem reluctant to agree that their team has faced some conflict or try to downplay its effects or impact.

"Well, I won't say conflict exactly because when you are working in a team there will be disagreements because you have different types of people, everyone had their own thinking and their own way of working, so you really cannot say anything or stop people from saying anything. In fact, you should listen to them and try to understand their position and their understanding", (R1TA, Line 34).

All three of the types of conflict identified in the model were present

The two teams have gone through different conflict situations where there was:

- conflict of task goals,

  " I remember sometime our channel manager wanted a certain requirement, they usually pass it to me and I need to pass it to the team so at that time I didn't know how it was done, and I had to take it to the team and the team disagreed, they said no it shouldn't be done that way", (R4TA, Line 40).

  "We had a problem where our requirements or acceptance criteria was not clearly defined, so we found that we are doing a lot of guess work and refining the requirement. So now we actually had a meeting where we sat down with the BA, developers, scrum master because we wanted to define our way of work because there was a gap that we picked up in the requirements when they come through and were not sort of like sizing the requirements right and the acceptance criteria was ambiguous in most cases, so it was leaving the developers and testers to guess and that in turn increased the scope of work that one was working on."(R3TA,Line 124)

  "We didn't have issue with goals because we are working towards one specific goal to deliver quality and a working product. But then acceptance criteria would have differences as it was a new project. Some were not defined properly, some were not there at all or missing scenarios that you had to add maybe while you are testing. That's when you realize that this is the outcome, then you must add it. And because the BA also didn't know that this is the acceptance criteria, so you have to add it." (R2TB, Line 83)

- conflict of roles, "*The conflict was between the testers and the developers. The testers felt that they had more of a testing backlog and the developers felt that the testing team was not testing enough*"; (R5TA, Line 45)

  "*So now we are facing a bigger change where our developers, so we mostly have back -end developers but now because of the restructuring that has been happening in the company and no new hires are expected, our back-end developers are expected to do front-end as well, so that's a big thing for them, but it's also a good thing because with the few front end developers that we have they have to collaborate as well and share their skills, although it's a very big constraint.",(*R4TA,Line 49)

- as well as conflict with processes," *depends on what kind of conflict, we could be disagreeing on something on how it's supposed to be done*". (R4TA,37)

  "There was a gap that we picked up in the requirements when they come through and were not sort of like sizing the requirements right and the acceptance criteria was ambiguous in most cases, so it was leaving the developers and testers to guess and that in turn increased the scope of work that one was working on.", (R3TA, Line 128)

"*Conflict I believe every family has one*", (R2TB, Line 30). In all instances where there was some conflict within each of the teams they always found ways to resolve it and there was no case where the conflict was continuous or remained unresolved.

Most of the conflict was observed around task goals which was coded 17 times from the interviews, as well as conflict around processes which was coded 13 times. There was less conflict around roles, with it being coded only 3 times from the interviews. The reasons for this could be that there aren't really a lot of issues when it comes to the roles, or the interview participants might have been reluctant to share that information as freely as they shared everything else.

Team A has gone through several iterations where they get to a point where they reach a norm and what also contributes to this are the various movements within the team where people have left, and new people have joined the team which always changes the team dynamics as the changes occur.

In terms of performing, the teams go through several ceremonies which form part of their routines to get to a point where they are performing. In certain instances the team members indicated that their teams spend more time discussing the work than actually doing the work, but this is mainly to iron out disagreements and get to a point where they all understand what they are doing "*When we decreased the discussion it was when we were discussing with the right subject-matter experts*, *so productivity basically is that you need to talk to the right person at the right time"*, (R3TA, Line 111). Some team members felt that the sprint deadlines are what drives them to perform because they feel that they have no other choice but to deliver.

Summary of findings

All in all, most of the elements of the Integrated model were also observed from the study. Those that were not clearly indicated from the interviews themselves such as tasks complete or incomplete were implied by the outcomes of the work as the teams continuously achieved their sprint goals and in instances in which they would find themselves stuck they would have discussions until they have figured how to move forward and complete their different tasks. The constant changes in team composition for the members of team A indicate that as new members are being introduced and other members leave the team then the routines don't fit, so there is a continuous new norm formation that occurs caused by the changes in team composition.

5.2 How Agile Activities facilitate group development and project completion

Introduction

The purpose of this section is to understand what the research data indicates in relation to the question: How do the routine activities of Agile facilitate group development and project completion?

Members of each team have indicated that the different routines that they perform allow them to gain visibility of the work that other team members are performing as well as allow them to know of issues early on as they report on progress daily during the stand-up and this allows them to "*Account to each other as team members*", (R3TBLine 76). "*I am aware of what other team members are doing and the link between me and them and the actual product in the end. We constantly update each other during stand up*", (R4TB, Line 83). This allows group members to improve communication within the team and ensures that team members build better relationships with each other through communication.

There were some issues with the retrospectives one was that they were not being held consistently," ***sometimes we don't do retros***" (R3TA, Line 83), and hence the feedback would not be constant. Then the second issue was that sometimes team members would raise issues during the retrospectives which would be put up as action items but would not be acted upon, thus discouraging the team members to even raise those issues to begin with. "*With retro, it is good if at the end there are actions. If we have the actions and not actioning them, there is no use. We should have action points and resolve them*" (R2TB, Line 100).

The retrospectives facilitate group development as they allow team members to give each other feedback on a continuous basis," *we have a retro where we look back to what we did and if there is anything we can improve on*", (R3TA, Line 79). During some retrospectives the teams have revised their way of work agreements to ensure that they are constantly improving so far, for example they say" *we redefined our working agreements*", (R5TA, Line 82) and," *we did a working agreement, so we worked out how we are gonna work together and also did a definition of ready and definition of done exercise so now if the fourth sprint we revisited those agreements*" (R1TB, Line 97). The retrospectives allow members to reflect on team processes and find ways in

which these can be improved. The only negative impact is that they can also be discouraging when they are not being acted upon, leaving team members to feel like they are constantly dealing with the same issues.

The planning sessions and the backlog grooming sessions facilitate group development in that the team members get to discuss the work openly and raise disagreements if any. They said" *sprint 1 planning is where we decide what we will take into the sprint the sometimes sprint 2 planning is when the design takes place*", (R2TA, Line 97). They also enable the team to perform as this is when they break down and size the work and commit together to their sprint goals which is what they work towards," *we groom the stories and then after that we sort of prioritize based on the grooming what we can take in*", (R3TA, Line 71). The planning sessions allow the team members to plan for each sprint but also ensures that there is buy-in and commitment from each of the team members

The review sessions allow the team to demo what they have been working on during a sprint and give an indication to the business owners as to how the team is adding value with the work that they are doing. This enables the team to report outwards to external stakeholders.

Agile teams have various ceremonies or routine activities which they continuously perform, which sets the structure for how they work. The way these routines can be said to facilitate completion of projects is because the work is divided into smaller components which need to be completed within a certain period. "*You have a deadline and have to work within that deadline, so you have to be really efficient, and you have to complete work on time*", (R1TA, Line 139).

Team members have also indicated that working in this manner has also somehow enabled them to focus better so that they are able to complete certain tasks, "*it helps you to focus, it helps you to work on things that are relevant now, and it helps you to get to value quicker*", (R1TB, Line 147). This sets the pace for the team and keeps the project moving.

"You don't have to wait for 6 months until something is developed, then you see it later only to find that we should have sat together during requirements and groomed everything and see. It's good because you fail fast, but you don't fail big things, you fail small things faster, and then you can fix them and at least there is no time boxing to say this project must go ", (R2TB,Line 178).

This allows the team to fail fast and to manage risks more easily as they come across them. An organization is there able to derive value as projects are successfully completed. Agile practises enable this to happen as they drive continuous delivery through the routines that teams enact.

5.3 The effect of collaborative technologies on group development and project completion

Introduction

The purpose of this section is to evaluate how the data that was collected during the interviews answers the research question: How do collaborative technologies facilitate group development and project completion?

The teams use JIRA, Slack and WhatsApp as collaborative technologies for different purposes. JIRA is used by both teams.

JIRA is a software collaboration tools that allows users to plan and track user stories, as well as report on the progress of a sprint. It is an electronic board where users can visualize work as they would normally do on a physical white board. Users can create and close sprints, add user stories and tasks with descriptions. This allows for electronic collaboration within teams.

JIRA is mainly used as an electronic board, to create stories and bugs, as well as to track them. To record the sprint and sprint tasks. It shows burn down charts and estimations, "*for visibility, keeping track of output and delivery, recording artefacts and*

effort in what goes into fulfilling a delivery", (R5TA, Line 98). In this instance it allows for coordinating of team tasks and activities.

Also enabling coordination of tasks and activities is Slack, which is a tool used mostly by software development teams as a collaboration tool.

It allows team members to communicate as well as share screens to work together faster. Slack is used mainly by the developers to transfer files in team B and team A does not use it at all. The team that is using it also uses it to "*integrate if something goes wrong and to know issues first*", (R3TB, Line 57).

Both teams use WhatsApp as their main communication channel, where people communicate if they will not be coming in to work or when there are major issues that need to be resolved for releases, "*for communication, in case someone is not at work or if we need something and the person is not around*", (R5TA, Line 100).

There is a WhatsApp group that some members from all the teams in the department belong to, which is used for releases. At some point this group was viewed as a negative element by members of team A as they discussed issues they were having during a release and this backfired on them as external teams started questioning their work. Because of that they now only communicate about the different statuses for the release and not any issues that they are trying to resolve. Some team members also feel that WhatsApp as a communication channel in the workplace is sometimes abused as there are too many messages which might not be directed at them personally but that they also get to see.

One of the teams uses Skype as they have a member who is based in another country, and they dial him in for stand-up's and have a space for him during meetings where they also dial him in and include him in any sessions that they have. Collaboration technologies also facilitate remote work for the teams in instances where this is required.

There was one instance in team B where one of the team members mentioned that they also use Skype to communicate with a team member who is in another part of the world to include dial him in during their stand-ups and other meetings, but none of the other team members mentioned this.

“We have someone in India, a team member in India, so we have him in skype for all of our sessions, so when we have stand up we dial him on skype, and we have him in the stand-up area, and we can see him, and he can see us, and when we have team meetings, and we skype him in, and he can participate, we have a place reserved for him, so you can see him sitting there. You cannot see his body, but you can see his face, so he is there.” (R1T1, Line 129)

Summary of findings

The data gathered does not indicate whether collaborative technologies facilitate group development; however, it does show that they enable the team to collaborate and communicate easily. The findings from data analysis show that collaborative technologies also facilitate project completion as they allow team members to share information and raise issues early instead of waiting to see a person or be with them before raising issues, hence speeding up the time frame for problem resolution. So even when people are at home, they can log in and check an issue remotely and try to resolve it without having to wait until they are at the office.

CHAPTER 6: INTERPRETATIONS, RECOMMENDATIONS AND CONCLUSION

6.1 Reflection on the Integrated model

This study was underpinned by the integrated model of development, which indicated that when a group initially meets, members form routines that are suitable for the situation that they are in at that point in time. If these routines are common amongst the group members, then they will start performing tasks but if the routines differ or members disagree about how to perform these routines then they need to agree on roles and work processes before they can start performing tasks, this is called a new norm formation (Garfield & Dennis, 2012).The findings from the present study shows that because of movements group members found themselves constantly going through a new norm formation because as people join or leave the team, the routines are disrupted and hence they go through the norm formation cycle again.

Group members constantly reflect on their progress when they finish tasks or when something unexpected happens. While reflecting, if they become aware of differences or disagreements about how they should be working, they go through another cycle where they agree on their roles and work processes by forming, storming and norming until they can start performing again. Where the reflection was initiated because a certain period had elapsed, this can be considered as a midpoint transition or evaluation (Garfield & Dennis 2012). The retrospectives that Agile teams participate in allow them to reflect on progress and give each other feedback, which fosters feedback within the team, which in turn allows the team to grow.

Answer to the research questions

What elements of the Integrated model of group development are exhibited in agile development teams?

In the Integrated model, after project inception individuals enact routines and if they fit together then they perform their assigned tasks, and if they don't then they move into a new norm formation where they form, storm and norm until their routines fit together.

There were instances where routines were not a fit but were actually a fit elsewhere. Within the Agile teams that formed part of this study, what became apparent is that it is not always that the team is complete from project inception and if there are constant changes with team members leaving or join teams, this creates a cycle where the team continuously undergoes this process whereby they have a new norm formation.

There is not really an indication of teams reaching a point where they have a punctuated equilibrium as projects are mostly ongoing and because the nature of the routines is one that is continuous there is constant reflecting rather than one midpoint equilibrium where they would reflect. Conflict would occur, but the longer teams work together, the easier they find it to resolve conflict. The different routines where the teams have different ceremonies enable them to reflect and find ways to continue working together. Most of the conflict experienced by the teams was around task goals and processes, and less around roles. The conflict would also cause a new norm formation as seen in the integrated model of group development. So most of the elements of the integrated model can be observed in Agile teams, apart from the temporal midpoint which forms part of the punctuated equilibrium.

This could be understood in terms of the literature in that it showed how this type of model was mainly prevalent in naturally occurring teams which were formed to do projects that had time constraints were able to perform and complete their tasks. The Agile teams that formed part of the study cannot necessarily be considered as naturally occurring teams since they are structured in a certain manner, and although they also commit to completing certain tasks in a certain period this is not necessarily a time constraint issue.

What routine activities of Agile teams facilitate group development and how do the activities lead to project completion?

Agile teams perform various activities which are known as ceremonies that give some structure to the way they work. The study findings show that these routine activities facilitate the following:

- Improving communication within the teams
- Enable team members to reflect on processes and to improve those processes
- Ensure that there is planning and buy-in within the team for any work that they undertake
- Reporting outwards to the external stakeholders about the activities that are performed by the team

Where members of teams can communicate and reflect on the work that they do, then they are able to resolve conflicts that might arise much quicker, and this allows them to facilitate group development. When team members feel that they are contributing, and their opinions are being heard by ensuring that there is buy-in from them, this ensures that they are committed to the success of projects and that in turn facilitated both group development and project completion. This is because the team members take accountability as individuals as well as part of a team. Constantly giving feedback and reporting to external stakeholders ensures that the team stays on track in terms of delivering the correct requirements.

What and how do collaborative technologies facilitate group development and project completion?

The study findings indicate that collaboration technologies enable collaboration and coordination, facilitate communication and also enable remote work. In the literature review it was found that when working on tasks that require decision-making, it is essential to have access to information that can guide your decision-making at the time that you need it, without having to wait for other people. Using collaborative technologies on a continuous basis has proven quite useful to the agile teams, for instance when they have releases, they are then able to communicate and collaborate easily.

Literature shows that collaboration is widely used in software development. Together with communication and coordination they are viewed as enablers of software development Mishra, Mishra & Ostrovska (2012). It cannot be confirmed fully whether collaboration technologies facilitate group development and project completion. However, when teams can communicate and collaborate in an easier way, then this

enables them to keep track of their work. The different tools like JIRA, WhatsApp and Slack used by the two teams ensure that everyone in the team is always aware of the work that is taking place within the team.

6.2 New insights

The way teams are structured and the way in which they work ultimately determines which of the group development theories they eventually conform to. Where there is constant communication, collaboration and feedback between team members it fosters group development and ultimately when teams work well together and get along well they can deliver high-quality work and complete projects.

6.3 Contribution of the study

This study had contributed theoretically and practically in the following manner:

Theoretical

The contribution to literature is in exploring and describing how group development in an agile team context, through the theoretical lens of the Integrated model, This extents literature regarding group development of agile teams.

The initial study that was conducted by Garfield and Dennis (2012) was done on a group of nurses where 6 teams were formed which were selected from the Department of Nursing at the American Medical centre (AMC) as well as nurses from the American Physicians Corporation (APC).

In a study conducted by Nicolopoulou, Koštoma & Campos (2006), which looked at group dynamics amongst virtual team members and identified how virtual teams also followed the same group development processes as those usually followed by co-located teams. They highlighted group activities that relate to how teams perform and communicate, which increased the literature available on studies which relate to teams. This study has expanded on literature on group development and agile teams, therefore increasing knowledge on the development of agile teams.

Practice

Group issues have been identified as a key factor for building agile teams and agile frameworks do not focus on this, hence the need for studying group development theories in an agile context (Gren et al. 2017).

Gren et al., (2017) proposes studying how agile teams at different maturity levels adopt agile principles and practices differently. Understanding this would be useful in practice in order to manage expectations with regard to team performance in projects, especially in instances where new teams are formed, and hence understand how managers can better support teams as they go through the different stages of development. Recommendations can be made to managers of agile teams or agile coaches based on the outcomes of the study

Limitations

As the study was cross-sectional in nature it meant that because it only represented the data over a certain period of time, this might have yielded different results if the data was collected over a longer period of time.

Studying more IT teams would have made a difference in that there would have been a much richer data set to analyse and draw conclusions from.

If more than one department participated in the study, the results might have been different because in certain organizations different teams practise or apply Agile methodologies differently. Therefore the routines and ceremonies followed by different departments might have differed and yielded different results for the study.

A further limitation to the research were that the data was self-reported by the participants.

Further research

Further research could possibly be done in teams within a different type of industry to see if they conform to the integrated model of group development.

6.4 Conclusion

This research report is about agile teams and group development. The study explored and described Agile teams and how the elements of the integrated model happen within Agile teams, looking at the group norms and routines that the teams follow. To understand how teams function and whether the routines that they follow lead to project completion.

The study found that most of the elements of the integrated model could be identified within the Agile teams. The study also found that the routine activities of Agile methodologies facilitate group development and project completion. There was no empirical evidence to indicate that the use of collaborative technologies facilitated group development.

REFERENCES

Bhattacherjee, A., 2012. Social science research: principles, methods, and practices.

Betts, S. and Healy, W., 2015. Having a Ball Catching on to Teamwork: An Experiential Learning Approach to Teaching the Phases of Group Development. *Academy of Educational Leadership Journal*, *19*(2), p.1.

Bittner, E.A.C. and Leimeister, J.M., 2014. Creating shared understanding in heterogeneous work groups: Why it matters and how to achieve it. *Journal of Management Information Systems*, *31*(1), pp.111-144.

Bonebright, D.A., 2010. 40 years of storming: a historical review of Tuckman's model of small group development. *Human Resource Development International*, *13*(1), pp.111-120.

Braud, W. and Anderson, R., 1998. *Transpersonal research methods for the social sciences: Honoring human experience*. Sage.

Bushe, G.R. and Coetzer, G.H., 2007. Group development and team effectiveness: Using cognitive representations to measure group development and predict task performance and group viability. *The Journal of Applied Behavioral Science*, *43*(2), pp.184-212.

Çaglayan, B. and Bener, A.B., 2016. Effect of developer collaboration activity on software quality in two large scale projects. *Journal of Systems and Software*, *118*, pp.288-296

Cohen, B. and Thias, M., 2009, August. The failure of the off-shore experiment: A case for collocated agile teams. In *2009 Agile Conference* (pp. 251-256). IEEE.

Conboy, K., 2009. Agility from first principles: Reconstructing the concept of agility in information systems development. *Information Systems Research*, *20*(3), pp.329-354.

Dorairaj, S., Noble, J. and Malik, P., 2012. Understanding team dynamics in distributed Agile software development. *Agile processes in software engineering and extreme programming*, pp.47-61.

Dybå, T. and Dingsøyr, T., 2008. Empirical studies of agile software development: A systematic review. *Information and software technology*, *50*(9-10), pp.833-859.

Fisher, S.G. and Hunter, T.A., 1997. Team or group? Managers' perceptions of the differences. *Journal of Managerial Psychology*.

Fowler, M. and Highsmith, J., 2001. The agile manifesto. *Software Development*, *9*(8), pp.28-35.

Gandomani, T.J. and Nafchi, M.Z., 2016. The Essential Prerequisites of Agile Transition and Adoption: a Grounded Theory Approach☆. *Journal of Internet Computing and Services (JICS)*, *5*, pp.173-183.

Garfield, M.J. and Dennis, A.R., 2012. Toward an integrated model of group development: disruption of routines by technology-induced change. *Journal of Management Information Systems*, *29*(3), pp.43-86.

Gersick, C.J., 1988. Time and transition in work teams: Toward a new model of group development. *Academy of Management journal*, *31*(1), pp.9-41

Gersick, C.J., 1989. Marking time: Predictable transitions in task groups. *Academy of Management journal*, *32*(2), pp.274-309

Gersick, C.J., 1991. Revolutionary change theories: A multilevel exploration of the punctuated equilibrium paradigm. *Academy of management review*, *16*(1), pp.10-36

Green, J., Willis, K., Hughes, E., Small, R., Welch, N., Gibbs, L. and Daly, J., 2007. Generating best evidence from qualitative research: the role of data analysis. *Australian and New Zealand journal of public health*, *31*(6), pp.545-550.

Gren, L., Torkar, R. and Feldt, R., 2017. Group development and group maturity when building agile teams: A qualitative and quantitative investigation at eight large companies. *Journal of Systems and Software*, *124*, pp.104-119.

Hackman, J.R. and Wageman, R., 2005. A theory of team coaching. *Academy of management review*, *30*(2), pp.269-287.

Henderson, L.S., Stackman, R.W. and Lindekilde, R., 2016. The centrality of communication norm alignment, role clarity, and trust in global project teams. *International Journal of Project Management*, *34*(8), pp.1717-1730.

Inayat, I. and Salim, S.S., 2015. A framework to study requirements-driven collaboration among agile teams: Findings from two case studies. *Computers in Human Behavior*, *51*, pp.1367-1379.

Jovanović, M., Mesquida, A.L., Radaković, N. and Mas, A., 2016. Agile retrospective games for different team development phases. *Journal of Universal Computer Science*, *22*(12), pp.1489-1508.

Khazanchi, D. and Zigurs, I., 2005. Patterns of Effective Managment of Virtual Projects. *PMI Journal*, pp.1-106.

Kniberg, H. and Ivarsson, A., 2012. Scaling agile@ spotify. *online], UCVOF, ucvox. files. wordpress. com/2012/11/113617905-scaling-Agile-spotify-11. pdf*. Viewed15 January2019

Kozlowski, S.W., 2018. Enhancing the effectiveness of work groups and teams: A reflection. *Perspectives on Psychological Science*, *13*(2), pp.205-212.

Lindsjørn, Y., Sjøberg, D.I., Dingsøyr, T., Bergersen, G.R. and Dybå, T., 2016. Teamwork quality and project success in software development: A survey of agile development teams. *Journal of Systems and Software*, *122*, pp.274-286.

Laanti, M., 2014, May. Characteristics and principles of scaled agile. In *International Conference on Agile Software Development* (pp. 9-20). Springer, Cham.

Mackey, K., 1999. Stages of team development. *IEEE Software*, *16*(4), pp.90-91.

Mahrin, M. and Yusoff, R., 2016. Influential Factors on the Awareness of Agile Software Development Methodology: A Systematic Literature Review. *인터넷정보학회논문지*, *17*(5), pp.161-172.

Maruping, L.M., Venkatesh, V. and Agarwal, R., 2009. A control theory perspective on agile methodology use and changing user requirements. *Information Systems Research*, *20*(3), pp.377-399.

Matharu, G.S., Mishra, A., Singh, H. and Upadhyay, P., 2015. Empirical study of agile software development methodologies: A comparative analysis. *ACM SIGSOFT Software Engineering Notes*, *40*(1), pp.1-6.

McDonough III, E.F., 2000. Investigation of factors contributing to the success of cross-functional teams. *Journal of Product Innovation Management: An International*

Publication of the Product Development & Management Association, *17*(3), pp.221-235.

Mishra, D., Mishra, A. and Ostrovska, S., 2012. Impact of physical ambiance on communication, collaboration and coordination in agile software development: An empirical evaluation. *Information and software Technology*, *54*(10), pp.1067-1078.

Misra, S., Kumar, V., Kumar, U., Fantazy, K. and Akhter, M., 2012. Agile software development practices: evolution, principles, and criticisms. *International Journal of Quality & Reliability Management*, *29*(9), pp.972-980.

Mkoba, E. and Marnewick, C., 2020. Conceptual Framework for Auditing Agile Projects. *IEEE Access*, *8*, pp.126460-126476.

Neves, F.T., Rosa, V.N., Correia, A.M.R. and de Castro Neto, M., 2011, June. Knowledge creation and sharing in software development teams using Agile methodologies: Key insights affecting their adoption. In *Information Systems and Technologies (CISTI), 2011 6th Iberian Conference on* (pp. 1-6). IEEE.

Nicolopoulou, K., Koštomaj, M. and Campos, A., 2006. How to address group dynamics in virtual worlds. *Ai & Society*, *20*(3), pp.351-371.

Nidagundi, P. and Novickis, L., 2017. Introducing lean canvas model adaptation in the scrum software testing. *Procedia Computer Science*, *104*, pp.97-103.

Oates, B.J., 2005. *Researching information systems and computing*. Sage.

Okhuysen, G.A. and Waller, M.J., 2002. Focusing on midpoint transitions: An analysis of boundary conditions. *Academy of Management Journal*, *45*(5), pp.1056-1065.

Rasnacis, A. and Berzisa, S., 2015. Adaptation of Agile Project Management Methodology for Project Team. *Information Technology and Management Science*, *18*(1), pp.122-128.

Runkel, P.J., Lawrence, M., Oldfield, S., Rider, M. and Clark, C., 1971. Stages of group development: An empirical test of Tuckman's hypothesis. *The Journal of Applied Behavioral Science*, *7*(2), pp.180-193.

Saunders, M.N.K. and Tosey, P.C., 2013. The layers of research design. *Rapport*, (Winter), pp.58-59

Senapathi, M. and Srinivasan, A., 2014, May. An empirical investigation of the factors affecting agile usage. In *Proceedings of the 18th international conference on evaluation and assessment in software engineering* (p. 10). ACM.

Schnitter, J. and Mackert, O., 2010, July. Large-scale agile software development at SAP AG. In *International Conference on Evaluation of Novel Approaches to Software Engineering* (pp. 209-220). Springer, Berlin, Heidelberg.

Tarwani, S. and Chug, A., 2016. Agile Methodologies in Software Maintenance: A Systematic Review. *Informatica*, *40*(4), p.415.

Teh, A., Baniassad, E., Van Rooy, D. and Boughton, C., 2012. Social psychology and software teams: Establishing task-effective group norms. *IEEE software*, *29*(4), pp.53-58.

Thomas, G. and Fernández, W., 2008. Success in IT projects: A matter of definition?. *International journal of project management*, 26(7), pp.733-742.

Tuckman, B.W., 1965. Developmental sequence in small groups. *Psychological bulletin*, *63*(6), p.384.

Tuckman, B.W. and Jensen, M.A.C., 1977. Stages of small-group development revisited. *Group & Organization Studies*, *2*(4), pp.419-427.

Voss, C., Tsikriktsis, N. & Frohlich, M. (2002). Case research in operations management, *International Journal of Operations & Production Management,* 22(2), 195-219

Wang, J., Wei, W., Ding, L. and Li, J., 2017. Method for analyzing the knowledge collaboration effect of R&D project teams based on Bloom's taxonomy. *Computers & Industrial Engineering*, *103*, pp.158-167.

Weber, R., 2004. Editor's comments: the rhetoric of positivism versus interpretivism: a personal view. *MIS quarterly*, Vol. 28 Issue 1, preceding p1-1.

Weber, M.D. and Karman, T.A., 1991. Student group approach to teaching using Tuckman model of group development. *Advances in Physiology Education*, *261*(6), p.S12.

Yin, R.K., 1981. The case study crisis: Some answers. *Administrative science quarterly*, *26*(1), pp.58-65

Zigurs, I. and Khazanchi, D., 2008. From profiles to patterns: A new view of task-technology fit. *Information systems management*, *25*(1), pp.8-13.

Appendix A: Interview questions

Interviews will be open ended to allow the researcher to gather as much information as possible from the various people that will take part in the interviews.

The purpose of the interview is to understand the extent to which appropriate routines existed and could be used by the group, whether there was any forming, storming, norming stages and whether any conflict emerged over the tasks. The questions below are in three sections:

Interview questions

Section A. Questions about roles and leadership

1. How long have you been working with Agile teams or within an agile environment
2. Describe your role in this team
3. How did you get to be part of this project? (Was it at the beginning or in the middle)(If the responded was moved from another team, ask if they were happy to be moved?)
4. How did you agree on roles and leadership within the team?
5. Tell me about the relationships in the team?
6. Tell me about a time when there was conflict in the team? What happened? When was it? How did you resolve it?
7. How have group roles changed over time and what has been behind the changes

Section B. Questions about work processes and practices

1. What Agile practices does the team use? (Describe)

2. How have these practices changed over time?

3. When this team started working together, how did you agree on work processes? Was that quick or was there some debate about it?

4. Would you say that this team is mostly focused on doing the work or on discussing how to do the work? Why? Has there been a point where you stopped discussing work processes and productivity increased? When was that?

5. Do you use any collaborative technologies (Jira, slack, whatsapp)? In what way do they contribute to your work processes and practices?

Section C. Questions about goals and performance

1. When this team started working together, how did you agree on task goals?

2. Were the task goals clear and understood by everyone?

3. Has there been conflict over goals?

4. In what ways do Agile processes improve your productivity?

Appendix B: Sample transcript

Interview questions

Section A. Questions about roles and leadership

1. ***Researcher: How long have you been working with Agile teams or within an agile environment***

Respondent: It's over 4 years

Researcher: and how long in this team?

Respondent: Since last year September so that would give us round about 10 months.

2. Researcher: Describe your role in this team

Respondent: A java developer, basically what it does is I handle most of what you call back-end development so that would mean creating of services, connect to the database, those kinds of things.

3. Researcher: How did you get to be part of this project? (Was it at the beginning or in the middle?) (If the responded was moved from another team, ask if they were happy to be moved?)

Respondent: Yeah, so I was actually moved from another team, I think I started right after inception dev part of the project

Researcher: Were you happy to be moved from the other team

Respondent: (laughs) Yes, I actually joined the company as a front-end dev but I didn't like my role and I actually spoke with my manager who was then the dev manager to move me and yeah it took a while until he could move me to this team

Researcher: Oh ok, so you are happier now

Respondent: Yeah

4. Researcher: How did you agree on roles and leadership within the team?

was there any agreement around that?

Respondent: Ah, there wasn't any agreement but normally what happened is I joined a team that was already there so there was sort of like a hand-picked leader who was already in the team

5. Researcher: Tell me about the relationships in the team?

Respondent: Like in what sense, like is it a productive relationship, like in what sense

Researcher: However, you want to explain it, do you feel that it's productive; do you get along with the people?

Respondent: So I think for myself, I get along well with people, I think the team dynamics it's like at the beginning of a relationship there is usually that friction where you are trying to understand the other person, you are trying to understand how they act, how they think and how they go about doing certain things, also you are trying to align to yours, so right now I would say the relationship is good cos I now know what do I expect from each individual

6. Researcher: Tell me about a time when there was conflict in the team? What happened? When was it? How did you resolve it? If you can think of anything like that.

Respondent: Well usually in the type of work that I am involved in, technical work; in most cases there is probably more than one way of doing things so the last time we has conflict we ended up ,the conflict was about we had a technical debt right, the issue was should we work on the technical debt or should we see it later. So we all had different opinions on how to resolve it but we ended up working on some of the technical debt we had so that we can meet the sprint goals. But basically in most cases when there is a conflict we try to find common ground and we try also to voice our opinions and then we see which one is the better option, especially if it's a design or a pragmatic thing which can be solved in a logical way. We think differently as people and as part of ones upbringing you are sort of inclined to do things in a certain way and when someone tells you to do something in a different way that you are not comfortable it kind of causes friction but you have your own opinion and they have their own opinion, you could both be right but it's different outlooks.

7. Reseacher: How have group roles changed over time (your team roles over time), were there new people who came in?

What has been behind the changes?

Respondent: Yeah, there were new people who came in and mostly because we had set like a deadline which we needed to meet, and we didn't have capacity to fulfil the requirements which we had, so they brought in new people so that we can meet the deadlines.

Section B. Questions about work processes and practices

1. Researcher: What Agile practices does the team use? Or processes?

Respondent: We use scrum

Researcher: how would you describe it? Do you know what happens in scrum?

Respondent: So, I think scrum, the basic idea is having collective people come in and working on a common problem to achieve whatever they want to achieve, I am not an expert in definition but that's my assumption of what it is. It also has supporting ideologies and frameworks like stand-up

Researcher: So, you said there is stand-up, and what else? The different ceremonies?

Respondent: Before stand-up we actually have backlog grooming and then from then we do our sprint planning, we groom the stories and then after that we sort of prioritize based on the grooming what we can take in. Once we all agreed on what we are taking in, we give story points, we size the effort, then after that there is, our sprint starts, it's two weeks, each day we have a stand-up at 10. Where we define or rather we say what we did yesterday, what we are working on today, if we have any impediments. So, it's sort of like a progress report, and then we have a demo every two weeks, the last day of every sprint we have a demo where we showcase to our stakeholders what we achieved as part of this sprint or what we wanted to achieve. After that we have a retro where we look back to what we did and if there is anything we can improve on.

2. Researcher: How have these practices changed over time? Have they changed?

Respondent: It really hasn't changed much but yeah, everything remains the same, sometimes we don't do retros'

Researcher: Do you know why that happens?

Respondent: I don't know, I think as humans sometimes you just break out of a routine and say you don't wanna do certain things. There is no reason.

3. Researcher: When this team started working together, how did you agree on work processes?

Respondent: So it wasn't really a matter of me agreeing to a process because when you just get into a team or an existing environment they already have a way of doing things so you sort of like get into this system of how they do things, so even if you have opinions sometimes they are too late to actually contribute to that process so I just went with the flow.

4. Researcher: Was that quick or was there some debate about it?

5. Researcher: Would you say that this team is mostly focused on doing the work or on discussing how to do the work? Why? When was that?

Respondent: I think in most cases there are a lot of discussions that happen but I don't think those discussions are very effective because of a number of reasons, 1 you might be having the discussions with the wrong people and 2 is because we never get to, I think the problem really is the requirements, I don't wanna lie to you. There is a huge gap in the way the requirement and the communication to get it to software there is a big gap. I think it's an organizational problem where the way we work is not correct because a requirement will come then someone will dictate how it needs to be done but they are not the right person to be doing that so when it comes to you the person who is doing it, you have your own opinions which you raise that certain things will not work because a,b,c. So, there is an internal miscommunication that happens, so we spend most of the time discussing.

Researcher: Has there been a point where you stopped discussing work processes and productivity increased?

Respondent: eh, no. The reason being I think discussions are good, but we are having the discussions with the wrong type of people. When we decreased the discussion, it was when we were discussing with the right subject matter experts, so productivity basically is that you need to talk to the right person at the right time.

6. Researcher: Do you use any collaborative technologies (Jira, slack, WhatsApp)?

Respondent: Jira, we have slack but we don't use it much and a lot of WhatsApp's ,many groups

Researcher: Is it, how many groups are you one?

Respondent: I think I am in three or 4 groups

Researcher: Would you say that they contribute to your work processes and practices?

Respondent: I think yes, JIRA does, but WhatsApp I find sometimes it gets abused because there is a lot of noise that goes in there that is not directed at you.

Section C. Questions about goals and performance

1. Researcher: When this team started working together, how did you agree on task goals or acceptance criteria?

Respondent: We had a problem where our requirements or acceptance criteria was not clearly defined so we found that we are doing a lot of guess work and refining the requirement. So now we actually had a meeting where we sat down with the BA, developers, scrum master because we wanted to define our way of work because there was a gap that we picked up in the requirements when they come through and were not sort of like sizing the requirements right and the acceptance criteria was ambiguous in most cases so it was leaving the developers and testers to guess and that in turn increased the scope of work that one was working on

2. Researcher: Were the task goals clear and understood by everyone?

Respondent: they were not understood

3. Researcher: Has there been conflict over goals or what the goals of the stories are?

Respondent: Yes, there has been conflict but mainly it was because we all interpreted the requirements wrong or we all had our own opinion.

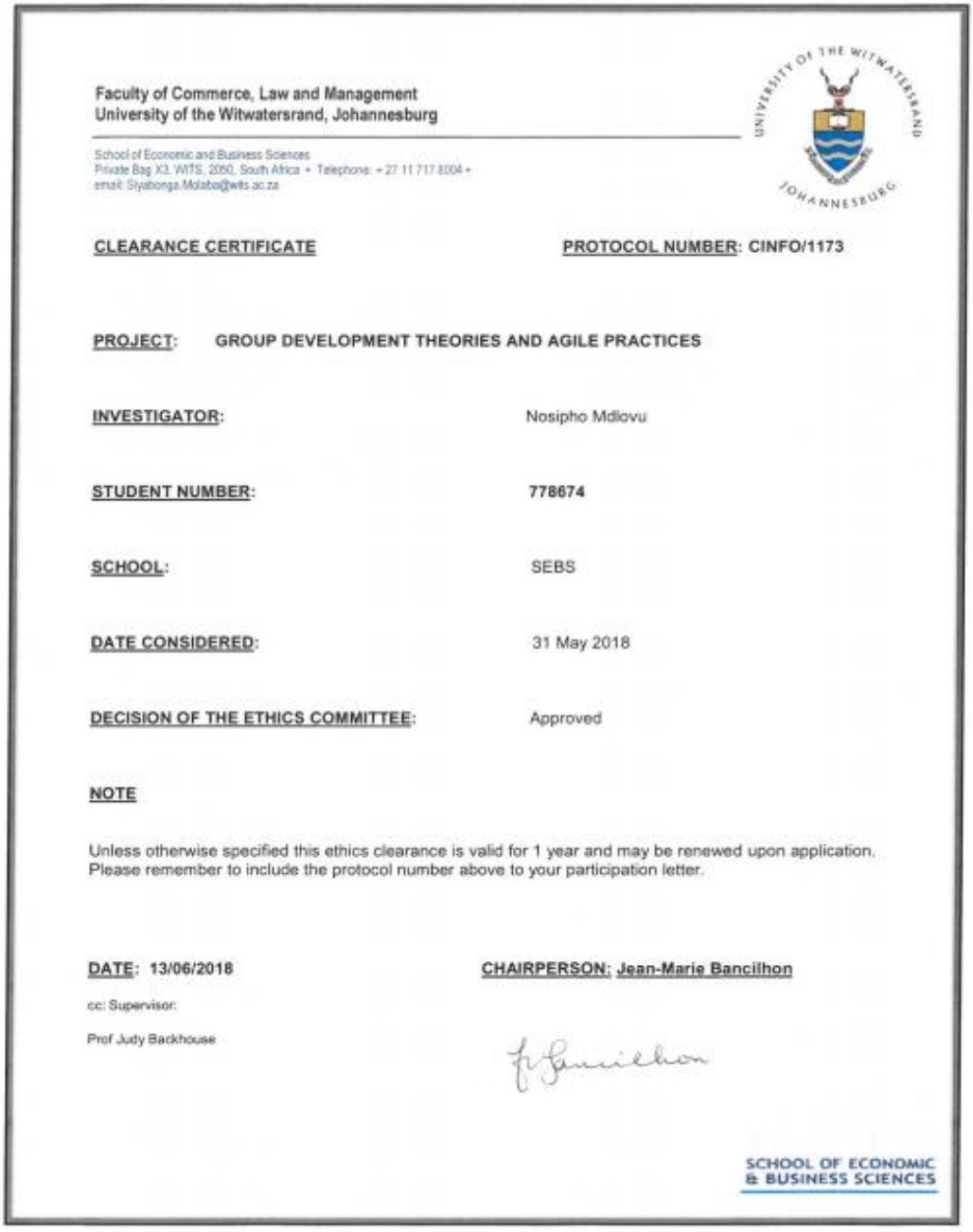
4. Researcher: In what ways do Agile processes improve your productivity? Do you feel that they improve your productivity or not?

Respondent: To me I feel like Agile works when it is done right, by that what I mean is you need to have the right collaboration where people are open to change because the problem is if you are not willing to change certain things your Agile will never work because you are sort of like trying to make a square with a circle, sort of like you are force fitting things, so I think Agile works but I think it works well in smaller companies or set ups because they don't have these big structures and you know. Because I have worked in a smaller company where I have seen it work well. It is very difficult for big companies because they already have their flows and how they do things so trying to change that is really not easy.

Researcher: do you want to add anything else.

Respondent: The only thing I can emphasize here is collaboration and people should be open minded to new things or other ways of doing things and I have seen here there is a lot of heroes who are late to save the day and that causes a lot of problems

Appendix C: Ethics clearance certificate



Faculty of Commerce, Law and Management
University of the Witwatersrand, Johannesburg

School of Economic and Business Sciences
Private Bag X3, WITS, 2050, South Africa + Telephone: + 27 11 717 8004 +
email: Siyabonga.Molaba@wits.ac.za

CLEARANCE CERTIFICATE **PROTOCOL NUMBER: CINFO/1173**

PROJECT: **GROUP DEVELOPMENT THEORIES AND AGILE PRACTICES**

INVESTIGATOR: Nosipho Mdlovu

STUDENT NUMBER: **778674**

SCHOOL: SEBS

DATE CONSIDERED: 31 May 2018

DECISION OF THE ETHICS COMMITTEE: Approved

NOTE

Unless otherwise specified this ethics clearance is valid for 1 year and may be renewed upon application.
Please remember to include the protocol number above to your participation letter.

DATE: 13/06/2018 **CHAIRPERSON: Jean-Marie Bancilhon**

cc: Supervisor:

Prof Judy Backhouse

SCHOOL OF ECONOMIC & BUSINESS SCIENCES

Appendix D: Letter of consent from the organization

24 May 2018

To whom it may concern,

I have been informed of Ms. Nosipho Mdlovu's line of research and the nature of her intervention which will include interviews with the relevant participants.

We hereby support Ms. Nosipho Mdlovu's application for a Masters by Coursework student from the University of the Witwatersrand to conduct a survey with our Agile teams for a period of 4 weeks, between Friday the 1st of June and Tuesday the 31st of July inclusive.

Therefore, permission is granted to Ms. Nosipho Mdlovu subject to her obtaining ethical clearance to conduct research from the Ethics Committee of the University of the Witwatersrand - Johannesburg and by abiding to its terms.

Yours truly,

CIO: Frikkie Cronje
Momentum Retail Digital & Technology Solutions - Business Analysis

MMI Holdings Limited
268 West Avenue, Centurion, 0157 PO Box 7400, Centurion, 0046, South Africa
T +27 (0)12 671 8911 F +27 (0)12 675 3911 E info@mmiholdings.com www.mmiholdings.com

Refer to the MMI Holdings website for directors and company secretary details
Reg. No. 2000/031756/06

Appendix E: Information participant letter

Date: 20 April 2018

Good Day

My name is Nosipho Mdlovu and I am a Masters student in the Information Systems Division at the University of the Witwatersrand, Johannesburg. I am conducting research on Group development theories and Agile practises.

As members of Agile teams at Momentum, you are **invited** to take part in this research. The purpose of this study is to explore the integrated model of group development by conducting a study of two teams and how they understand and apply agile practices. The integrated model of group development is a model that combines the linear stage model with the punctuated equilibrium model in order to form one integrated model. This model is interesting because it offers a different perspective on thinking about how teams develop and evolve over time.

A case study that comprises of two teams will be conducted over a four week period in order to see which group development theories are applicable to the selected teams and how the maturity of the team affects how they understand and apply agile practices. This study will be used to explore the integrated model of group development that was proposed by Garfield & Dennis (2012) by applying it in agile teams in order to understand and advise our Agile teams. This will be done by conducting interviews and doing document reviews of some of the documents that are produced by the teams.

Your response is important and there are no right or wrong answers. This research is both confidential and anonymous. Anonymity and confidentiality are guaranteed by not needing to enter your name on the questionnaire that will be used for the interviews as well as not specifying your role on the final research report. Your participation is completely voluntary and involves no risk, penalty, or loss of benefits whether or not you participate. You may withdraw from the process at any stage.

The interview comprises 25 open ended questions. Please provide as much detail as possible when responding to the questions. The interview should take about 30 minutes to an hour to complete. The research was approved by the SEBS Ethics Committee (Non-Medical), Protocol Number: CINFO/1173.

Thank you for considering participating. Should you have any questions, or should you wish to obtain a copy of the results of the survey, please contact me on 071 402 1220 or at 778674@students.wits.ac.za.

My supervisor's name and email are: Judy Backhouse – judy.backhouse@wits.ac.za.

Kind regards
Nosipho Mdlovu
Masters Student: Division of Information Systems
School of Economic and Business Sciences
University of the Witwatersrand, Johannesburg

Appendix F: Participant consent form

Participation Consent Form

Title of research project: Group Development theories and Agile practices
Name of principal researchers: Nosipho Mdlovu
Department/research group address: Division of Information Systems
School of Economic and Business Sciences
University of the Witwatersrand, Johannesburg
Telephone: 071 402 1220
Email:778674@students.wits.ac.za

Name of participant:
Nature of the research: Qualitative interview
Participant's involvement: Interview participant

What's involved?
Risks: There is no risk involved.
Benefits: This research will serve to increase the literature in Group development theories and Agile practices within a team context and the ways in which teams develop and work together. It can be used to make recommendations to managers and agile coaches based on the study outcomes.

I acknowledge the following:

- I agree to participate in this research project.
- I have read this consent form and the information it contains and had the opportunity to ask questions about them.
- I agree to my responses being used for education and research on condition that my privacy is respected, subject to the following:
  - I understand that my personal details will not / may be included in the research / will be used in aggregate form only, so that I will not be personally identifiable (delete as applicable.)
  - I understand that I am under no obligation to take part in this project.
  - I understand I have the right to withdraw from this project at any stage.

Signature of Participant / Guardian (if under 18):
Name of Participant / Guardian:

Signature of person who sought consent: 
Name of person who sought consent: Nosipho Mdlovu
Date: /07/2018