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# An Agile software development adoption framework for the South African financial industry

A thesis presented to the Information Systems Department for the completion of the Masters in Information Management

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# Acknowledgments

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# Abstract

There have been multiple developments and growth within the software development methodologies in the Financial Industries in South Africa. These developments and growth have been for constant process improvement to maximize the outcome with the shortest lead time possible. Agile software development methodologies have been the most popular in recent years. The methodologies are flexible to adapt to any type of process requirements because they have multitude variations for process improvements. Quality tends to be compromised when rushing to meet deadlines. However, with adaptive Agile methodologies, quality is not compromised when being rushed with shortened process time. Agile methodologies are not only beneficial to the organisation but also to the developers as they provide them with individual benefits, which open the gateway for more productivity. In this study the adoption of the Agile software development methodologies will be investigated. Having a smooth transition into a new method of completing software development processes along with well managed change management, increases the likelihood of acceptance by the organisation. The structure of the methods has been examined, and how an organisation is affected by the adaptation of their methodologies. To understand this view, the Agile software development adoption methods were investigated and then looked at to see how innovation has been used to implement them or how innovation has been implemented as a result of these methods. An online questionnaire study has been conducted. Based on the findings, we provided an updated Agile methodology adoption with best practices for the Financial Industry within South Africa is provided and an adaption framework for Agile development methodologies. This framework is also based on best practices as it will be looking at improving and providing innovation to the current development life cycle which gives a basis for the extension of the body of knowledge. A combination of quantitative and qualitative research methods has been used for data collection. This research thesis has shown not only what the focus of the organisation should be on the adoption of the methodology but also how defining the strategy dealing with the change should be defined. This research thesis has also shown how innovation has been the result of having implemented Agile methodologies.



Key Words: Agile Software Development Methodologies, Agile Adoption, Digital Innovation, Processes, Requirements, Frameworks.

# Contents

# Table of Figures

# Chapter 1 – Problem statement and analysis of the problem

## 1.1 Context

In an increasingly competitive digital economy organizations have become more strategic in their development and use of technology and have focused on gaining a competitive advantage over others. There are many factors which contribute to this organisational competitiveness. One of the main components of organizations' competitive advantage is software and data, which is used to assist with decisions for the improvement of processes. These are critical for the development and growth of organizations to gain an advantage in industry.

Each industry within the global, digital marketplace deals with different types of information and handling it depends on what the accepted best practices for that industry's organisational processes are. Many of these organizational processes are managed using computer software and databases that manage the information, and then provide statistics for decision-making.



The software which is being used in the financial industry to run and manage organizational processes is developed by a team of software developers who require accurate results each time. In order for the team to function productively and design software successfully, many factors are considered before any actual development, or coding, takes place. Software development begins with an idea which translates into design and coding which brings this idea to life. In order for this to work, there needs to be a process which is followed as the task may be split up into sections which are subsequently brought together or are worked on with a single goal in mind. Typically, this process is called the Software Development Life Cycle, or SDLC (Rosenvinge & Tempelman, 2020).

There are many variations of the SDLC. These software development processes are referred to as software development frameworks or methodologies (Manchanda, Agarwal, & Bhati, 2017). These methods are followed in order to manage the development of the software through people, processes, and technology.

## 1.2 The aim of the research

The aim of this study is to provide the Financial Industry within South Africa with a more focused Agile Software Development Methodology adoption framework which is tailored specifically for the financial industry and aimed at improved digital innovation. The result of this research is an improved process framework based on Agile adoption frameworks, providing a roadmap and guidance for an organization when adopting this software development approach. The discussions and focus will also be on the Agile transformation process from a wider perspective such as change management. There is also an aim to improve an organization's understanding of what Agile Methodologies are and how they are being used in the financial industry.

## 1.3 Research problem

The research problem is identified within the Financial Industry in South Africa with the core elements being of understanding the software development methodologies used, and their adoption within the financial sector. These methodologies will be closely studied and from them a framework would be proposed that would assist with the Agile adoption process. Agile methodologies have gained traction in South Africa, however, there are barriers which appear during its adoption which the impact on the software being developed.



Primary Research Question:

- What are the key success factors for Agile Software Development Methodology adoption within the Financial Industries in South Africa?

Secondary Questions:

- Which Agile Software Development Methodologies are being adopted by financial industry organizations in South Africa?
- What Agile adoption frameworks were used by these organisations?
- What challenges were experienced by industry during the adoption process?
- What digital innovations have the users of Agile methodologies brought into the organisation?

## 1.4 Research Objectives

The objective of this research is to get a holistic view of understanding the ways in which the Agile Methodologies have been adopted in the Financial Industry in South Africa, and - as a secondary concern - to what extent they have brought innovation into the organisation. Another objective is to gain a better understanding of what the methodology promises compared to what is actually experienced. The study aims to investigate whether the disparity between what Agile promises and reality is due to poor adoption processes or something else. Although there is more to the actual methodology which would assist and guide the organisation, the focus of this study is on the importance of the adoption process.

Based on research of the literature, there is no structured framework for the adoption of Agile software development Methodologies (Chiyangwa & Mnkandla, 2017). Such research would reveal how the organisations in South Africa have been adopting their methodologies, and from this it would be possible to develop a unique structured framework for Agile adoption. The structured framework for adopting Agile software development methodologies would give a basis for organisations to increase the innovation potential of their software development teams through the successful adoption of Agile methods.

For the convenience of this thesis, the study focused on organisations based in Cape Town. Based on this investigation, a framework was developed for best practices when adopting the Agile software development methodology by combining a collection of frameworks and insights from primary data, which could assist an organisation during the adoption of Agile methods. This framework can not only be used by organisations but by learning institutions where more improvements can be made based on further research within the field.

## 1.5 Research Method

A mixed-method design data collection has been used within Cape Town, South Africa, where the study has been conducted amongst a group of the companies within the Financial Industry. A questionnaire has been compiled which consists of Agile adoption related questions and focuses on how Agile adoption had been conducted within the organizations and whether there has been a digital innovation increase due to the adoption.
The following Financial organisations were approached with the questionnaire: Old Mutual, Momentum, Sanlam, Woolworths, First National Bank, Rand Merchant Bank (RMB), Standard Bank, African Bank, ABSA, Fintech, and Hollard. The total number of participants

which have completed the questionnaire was 22 participants. The questionnaire was presented to the Software Developers and to those who are involved with the software development methodology usage on a daily basis.

The objective of the questionnaire was to determine which Agile Methodology had been used within the organisations in the Financial Industry in South Africa, how it had been adopted and what were the innovations and challenges that came from the adoption.

## 1.6 Importance of this research

This research has contributed to the body of knowledge in the Information Systems development field which allows for further growth thereof. The body of knowledge has been enriched by the evidence that has been provided by this study. There is currently limited literature on Agile adoption methods in the South African financial industry and this research fills that gap. The gap revealed in the literature was that there is no specific process or framework which assists with the adoption of the Agile methods in the financial industry.

This study will therefore provide a framework which can assist organisations to take a holistic approach when adopting Agile methods. The recommendations that arise from this research provide methods that fit the ways of the financial industry. The methods look at how to improve processes and how to avoid making common mistakes with the aim of completing a successful implementation. Organisations that are hesitant towards the adoption of new methods can learn from this research which will ensure that it is possible to succeed through the use of the correct methods.

## 1.7 Summary and organization of this thesis

Chapter two covers the history of adopting Agile methods and provides an understanding of where Agile methods originated. It describes how the methods started and how they have evolved into what they have become today.

Chapter three provides a literature review on the current Agile adoption methods and focuses on the Financial industry in South Africa. The literature provides insights into the development areas and how improvements can be implemented into the processes for better results.

Chapter four covers the research design and methodology used in order to gather the required information which is used to draw conclusions and make recommendations as well to contribute to the enrichment of the body of knowledge. The methods used for data collection and to manage the way the data is be analysed, are described.

Chapter five discusses the results of the data collection and provides an in-depth analysis for a better understanding. Using the results current methods are discussed in order to understand which adoption frameworks have been used for Agile methods.

Chapter six discusses the key themes identified from literature in order to understand how they play a role within the organisation. These key themes have created the base for this research.

Chapter seven answers the research questions, draws conclusions and makes recommendations based on the research outcomes. Based on this research, the key success factors for an Agile adoption within South Africa's financial industries are identified.

# Chapter 2 – Agile software development adoption history

For more than 50 years, the technology society has been developing software development methodologies. Within recent years, there have been many new software development methodology adoptions taking place as industries strive to improve their methods and techniques for software development. Frequently the software was developed without much consideration for other matters such as long-term solutions, and the design of the system only assisted with decisions that were short term in the organisation. These methods usually worked for smaller systems, although as the systems grew, the more complicated it became for developers to add additional features and the system bugs became harder to remove (Hoda, Salleh, & Grundy, 2019).

From 1960 to 1990 this quick fix development style was used until an alternative solution captioned “methodology” took the industry by storm (Hoda, Salleh, & Grundy, 2019). Methodologies were introduced which imposed a more systematic process upon software development with an end result that allowed for development to be more predictable and more efficient (Awad, 2005).

A system development methodology (SDM) is defined as the methodology that is used to structure, plan, and control the process of developing an information system. These methodologies are used by software development teams for the enhancement of the software development processes in terms of increasing its productivity of information technology (IT) personnel and the quality of the IT solutions. These methodologies have to be introduced into an organisation by the use of frameworks and an agile methodology needs processes to implement it into an organisation (Hoda, Salleh, & Grundy, 2019).

Industries have seen and heard of the numerous benefits a structured process can offer, which then flooded the industry with aspirations to adopt these processes. The benefits looked for are an improved speed of return on investment, improved quality of the software and finally improved customer satisfaction. Up until this day, publicly, no structured processes are in place for the adoption of the Agile practices (Abdalhamid & Mishra, 2017).

Successful adoptions have led to the production of software which improved quality being developed, the enhancement of the moral of the developers, and results at a lower cost than other approaches.

The adoption process has three major dimensions which are (1) efficiency, (2) effectiveness and (3) reusability. These are used to evaluate the development framework being adopted. A software development methodology will not be efficient if it is unable to enhance the productivity in the development process (Abdalhamid & Mishra, 2017). If the adoption process has not been implemented effectively, then the organisation will not be able to improve its quality and the system's reusability.

Agile methodologies are however difficult to follow through with as sometimes there are low tolerances to methodology adoption as experienced developers simply ignore the new processes. Processes are treated as rational processes even though they may not be, and they are assumed to be universally applicable, even though they should be adjusted according to each situation (Abdalhamid & Mishra, 2017). In summary, adoption frameworks should not only guide and assist the implementation of the new system development methodology but also enhance an organisations digital innovation by having the methodology being used to its full potential.

## 2.1 Background to Agile adoption methods

The background to Agile adoption, based on research, has shown that there are no historical methods that lead to a perfect adoption for Agile methods into an organisation (Abdalhamid & Mishra, 2017). The adoption methods are a learning process for the organisation. Since each organisation is different with different needs, there are no perfect sets of rules of adoption methods that would assist the organisation fully, but there are methods for preparations for adoption. There are general preparation methods for the organisation to follow which allow for a smooth adoption.

Adoption methods have been changing ever since Agile methods have been developed. Some organisations tend not to adopt the full spectrum of Agile, instead they only do part-adoption, and this method is different to a full-adoption as the final phase has a different end point.

The adoption methods allow for learning and development based on previous methods used. If there are any complications or confusion during the process, it can be rectified and noted for improvement when dealing with it again. Agile adoption methods have been seen as a means to prepare the organisation for change, change management has also been part of this process. These processes promote and allow acceptance by the employees and the

organisation. These adoption methods are explained in detail in the next chapter which is Chapter 3 – Literature Review.

## 2.2 Background to Agile methods

Agile methodologies were developed following on from those methods used in the period from the 1960s to the 1990s. New software development methodologies were developed to resolve many critical issues within the IT industry. New methodologies were designed after the software crisis which happened between 1965 – 1985, where projects ran over budget, over schedule and provided unreliable software. The software crisis was caused by the increasing demands and increasing complexities which brought in new challenges. These challenges and obstacles were unable to be resolved as there was no increase in the size of the workforce; while the same methodologies were used, as well as the same tools (Hoda, Salleh, & Grundy, 2019).

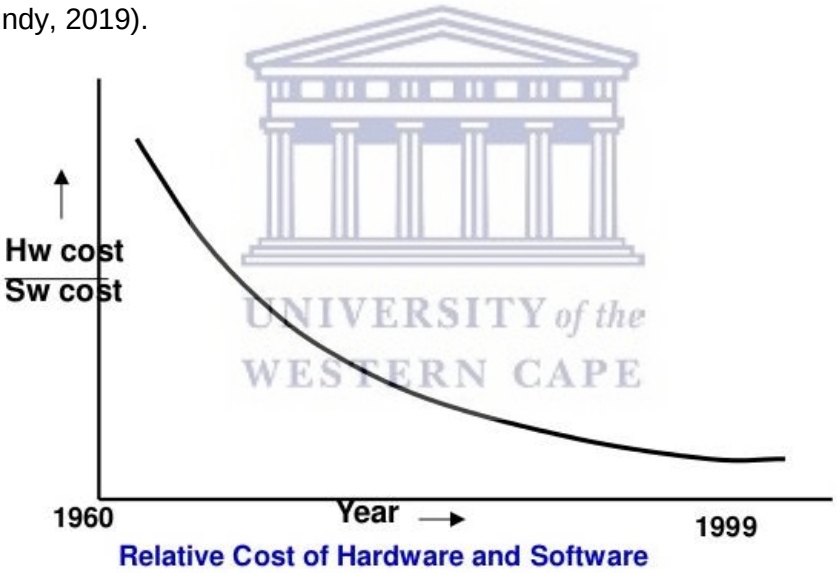



Figure 1: Software Development Crisis
(Sarma, 2012)

Practitioners have gathered to create methodologies which have been mainstreamed to resolve time, quality, and costings of software (Varhol, 2017). Once the requirements are understood, the high-level design is developed to understand the process as a whole which is then completed by the development of the software and inspection. Agile methodologies started in the mid-1990s (see Figure 2), which emerged to become the Agile Software Development Manifesto.

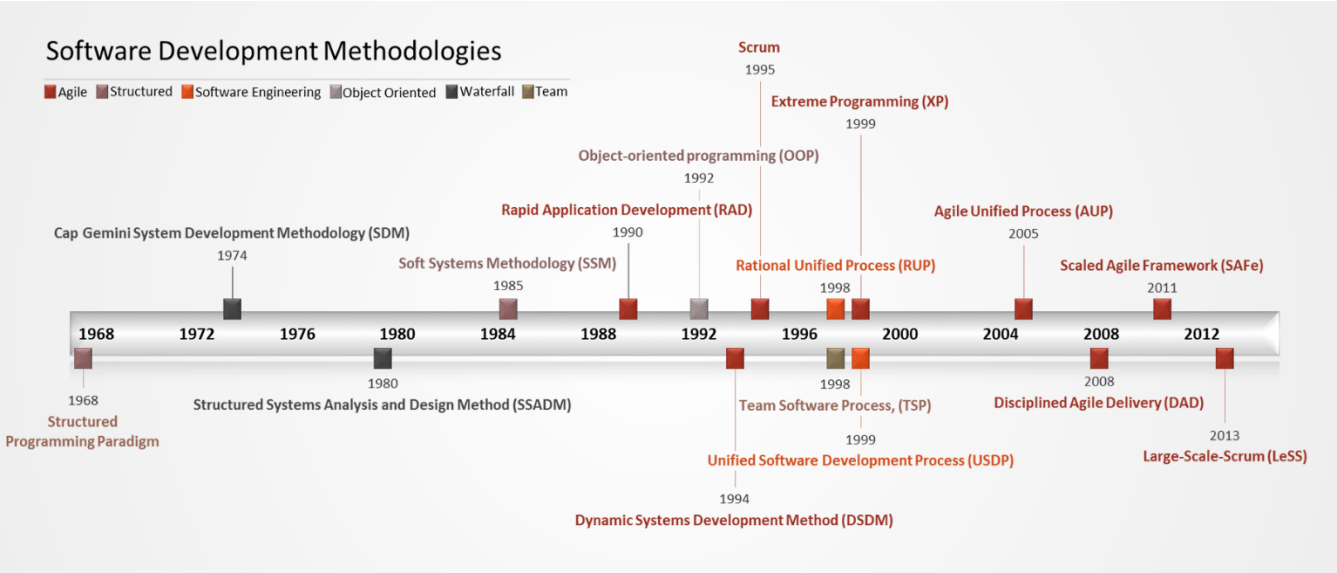



Figure 2: Software Development Methodologies

(Timelines, 2016)

The reason for this development was that many practitioners had found that the methodologies had become frustrating and impossible to fit to projects. As the growth of technology was moving so fast, requirements of the projects kept changing whilst the methodologies remained the same.

The needs of the customer became more complex to understand as the needs kept changing and these needs could not be stated up front whilst having to expect more from the software. To deal with this situation practitioners had to develop improved of methods which could respond to these changing customer needs (Varhol, 2017).

Agile methods have a more focused approach than previous methods and show improved value as they are much more flexible than traditional methods. The evolution of these methodologies grew from improvements of the software processes, and these processes were built on failures and success of previous developments.

## 2.3 Definition of Agile

Agile is defined as being able to move quickly and easily where there are no restrictions or rules, where it is being flexible and adaptable to any scenario (Alahyari, Svensson, & Gorschek, 2017). The understanding of the word does vary in practice, this section explains

its proponents in literature and how other researchers have explained Agile who also define it as a philosophy.

Cockburn's (2001) definition of Agile is that "Agile implies being effective and manoeuvrable. An Agile process is both light and sufficient. The lightness is a means of staying manoeuvrable. The sufficiency is a matter of staying in the game".

Boehm (2003) describes the methods as "an outgrowth of rapid prototyping and rapid development experience as well as the resurgence of a philosophy that programming is a craft rather than an industrial process. In general, agile methods are very lightweight processes that employ short iteration cycles; actively involve users to establish, prioritize, and verify requirements; and rely on tacit knowledge within a team as opposed to documentation"

Larman (2004) states that, "It is not possible to exactly define agile methods, as specific practices vary. However short time boxed iterations with adaptive, evolutionary refinements of plans and goals are a basic practice various methods share".

Agile methods have been explained through definitions which are essential for forming an understanding of the definition of Agile. Based on this, this thesis defines Agile Methods from the understanding which relates them to software development in the IT industry. Agile methods are adaptive, iterative, incremental, and people oriented which are the key elements to designing software (Manchanda, Agarwal, & Bhati, 2017).

The following 3 components play a huge role in making an environment Agile:

### 2.3.1 Adaptive

Change is what the methodology welcomes as in the changing environment of technology and user requirements; it does not restrict any decisions going forward. It also responds to feedback based on previous work completed and allows for total control over unpredictability (Hoda, Salleh, & Grundy, 2019). Every aspect has been considered to ensure that the changes have been made correctly to meet the requirements.

### 2.3.2 Iterative and incremental

The development of the software is from several iterations which are in all processes from the planning to the delivery. In each of the processes of the system, it is being tested and improved while there is constantly functionality improvement. The system therefore grows incrementally where each new function is available with each new release. Once all the iterations are completed, it is released to the customer who will provide feedback (Abdalhamid & Mishra, 2017).

### 2.3.3 People-oriented

> *"People are more important than any process. Good people with a good process will outperform good people with no process every time. In an Agile method, people are the primary drivers of project success"* (Abbas, Gravell, & Wills, 2008, pp. 95).

Agile methods therefore are there to support the teams' development by determining the best way to handle and complete the task. Also, there is constant communications within the team that is emphasised using face-to-face communications and also with the customer who is involved in the process of development instead of just being passed written documents. In summary, unpredictable activity is always expected in a software development environment which needs an adaptive process to control the development (Abbas, Gravell, & Wills, 2008).

## 2.4 Agile Methodologies

The Agile methodologies will now be discussed in detail to understand how each methodology plays a role within the organisation and what is required of the organisation to ensure they are using the method completely to benefit from it. The top seven methodologies currently being used within the Financial Industry in South Africa will be discussed.

### 2.4.1 Waterfall Model

The first methodology to be introduced was the Waterfall Model which would approach the building of the software by having fully completed one step before moving onto the next. The first step was where the user's requirements were fully understood before heading into the functional design step. It did not allow for the next step in the cycle to take place until the

current one was finished, and it did not allow the design to go back to the previous step. Although, the model was designed to allow for change and accommodation, it was still difficult to use as in practice there would be budget and time constraints as well as changing user requirements (Andrei, Casu-Pop, Gheorghe, & Boiangiu, 2019).

Even though the Waterfall Model was very popular in the 1980s and 1990s, many people thought there was no other solution, whilst these ideas were not accepted by some, James Martin initiated the design of the Rapid Application Development (RAD) model (Varhol, 2017). The methodology was designed for diving more quickly into the development phase so that the preparations phase time could be reduced to allow for the teams' collaboration to design a prototype within a few days.

### 2.4.2 Scrum Methodology

At the same time, in 1995, there were other iterative methodologies which had been developed such as the Scrum Model designed by Jeff Sutherland and Ken Schwaber (Hayat, Rehman, Khawaja, Wahab, & Abbas, 2019). The methodology name was directly linked to the game of rugby where the team works towards a common goal. The model was based on the developments for new complex products where results were improved if the teams were given objectives instead of specific assignments. It was up to the team to decide how to go about meeting those objectives which gave them more freedom on their approach. The methodology was defined as time-boxed iterative as the development cycle ensured that a working software was presented.

Agile Scrum methodology is an iterative and incremental process that allows for the development of any type of work request (Alahyari, Svensson, & Gorschek, 2017). The methodology focuses on how the team members should be functioning in a constantly changing environment while producing system flexibility. Once an iteration has been completed, then a set of potential functionalities has been designed for the work request/development. This methodology rarely requires or provides specific software methods/practices to be used; instead, it requires more management practice and tools where it prevents any chaos from occurring by unpredictability or complexities (Anwer, Aftab, & Muhammad, 2017). Figure 3 shows the Scrum practices which are as follows:

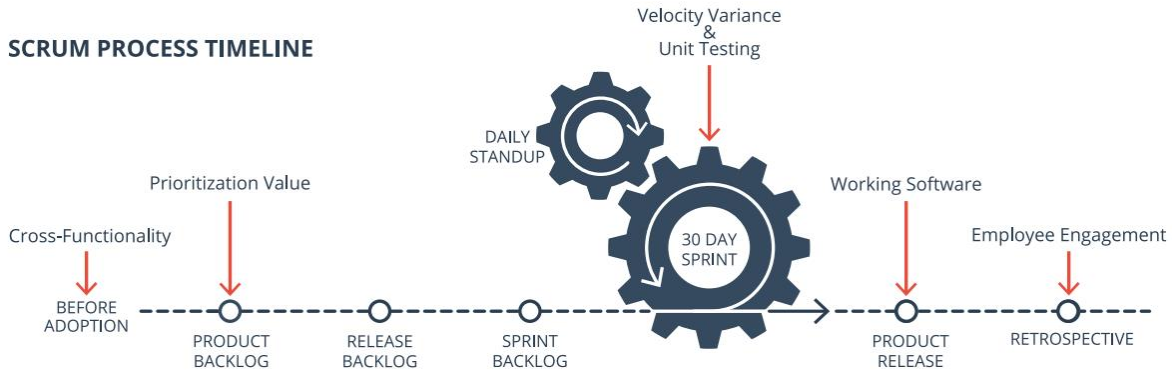



Figure 3: Scrum Process Timeline

(Payton, 2014)

### *2.4.2.1 Product Backlog*

Product Backlog is a prioritized list which consists of the different features and changes which are to be made to the system which are desired by the different teams involved, such as the customer, marketing, and sales (Hayat, Rehman, Khawaja, Wahab, & Abbas, 2019). The Product Owner responsibilities are to maintain the Product Backlog by constantly keeping the list up to date as it represents what the end result should be.



The system or products requirements that are being developed will be listed and grouped within the Product Backlog category. The prioritization of this list to meet the requirements is managed by the Product Owner where the contents of the project are stored together with the team's availability. This Backlog consists of everything that is needed or an idea that should be considered whilst in the development of the product (Hayat, Rehman, Khawaja, Wahab, & Abbas, 2019). The list consists of items such as the functions, features, enhancements, technologies, and bug fixes that are found in the changes that will be made for future releases. Anything and everything that the product should consist of is in this Backlog list, such as:

- Allowing the users to access or view account balances for example
- Supporting the development teams
- Enhancing the scalability of the product
- Simplifying the installation when multiple systems are used
- Identifying and determining the workflow which can be added to the product

The Product Backlog will never be completed, but it allows for the initial development to take place with those requirements that are clear and well understood. The Backlog can be formal or informal, however the organisation wants to host it. The requirements for the Backlog can be from a vision that the client has, which would then allow for a brainstorming session where something is derived which can be the basis for the development. In order to get to the next step, there needs to be enough content that would drive a 30-day Sprint, and this Sprint can only begin from the concepts and wish list (Anwer, Aftab, & Muhammad, 2017). The Product Backlog evolves as the product and the environment develops and as new ideas begin to form. The Backlog only exists if a product exists; it is a dynamic aspect as there are constant changes made to the product which need to be useful, competitive, and appropriate. The Backlog can originate from many different sources, such as:

- Product marketing which would generate the features and functions
- Sales would ensure that the product is competitive
- Engineering would introduce the technology backlog which brings the product together
- Customer support who provides the service to fix any major product flaws

The Product Backlog is listed in the order by which the items are prioritized; the top items on the list are driven immediately for development activities. The higher the item on the backlog priority, the more urgent it is as there is more consensus with regards to its value (Anwer, Aftab, & Muhammad, 2017). It also means that the item prioritized has more clarification to it which allows it to be completed and better estimations can be made as it is clearer with more detail. At the other end of the priority list are items with lower priorities; these are the ones where there is less detail known and not much can be done until more detail is provided. They are constant issues that need to be resolved before the backlog can be worked on. For example, if the response time is unpredictable and it is spoken about within the stakeholders, then it will be included as an issue.

The issue however is not defined to be developed into a product yet, but it needs to be dealt with so that it could potentially be turned into features or technologies that can be developed. The Owner of the Product Backlog is responsible for turning issues into work for the team and until it is converted to a regular Product Backlog, the item will still remain “unworkable” (Hassanein & Hassanien, 2020). This grouping ensures that the team is not given unnecessary issues. The value of a product increases as it gets used and as feedback is given, the Product Backlog reduces and is constantly changing. For a Scrum, all that is

needed is a product vision which has a priority list that enables the beginning of a Sprint for the development of the product.

#### *2.4.2.2 Sprints*

This practice is usually a 30-day length process, which is a procedure of adaption to the variables of the ever-changing environment and results in improved software (requirements, technology, and knowledge). These are managed by meetings called stand-ups (Hayat, Rehman, Khawaja, Wahab, & Abbas, 2019).

The heart of the Scrum where a product that is released is either partially completed or usable. Through the development effort of a Sprint, it will always have consistent durations, where a new Sprint will begin once the previous one has been completed. These Sprints contain the planning, daily scrums, development, reviews, and the Sprint retrospective.

When the Sprints are in progress, the following takes place:

- There would be no changes as this would put the Sprint goal at risk
- The quality of these goals which are set do not decrease
- Clarification and re-negotiations on the scope take place between the product owner and the development team as more is learned



Sprints are used to accomplish a goal as they are only one-month, therefore each Sprint is defined as to what needs to be built, designed, and there is a plan in place which guides the team towards the end product. If a Sprint duration changes, these definitions would change, but this will increase the complexity as well as the risk. If a Sprint needs to be cancelled, only the product owner is able to do so, it must also be done under the influence of the other members such as the team and scrum master (Hassanein & Hassanien, 2020).

If the project becomes obsolete, the Sprint will be cancelled, this usually occurs if there are changes made to the Sprint. If there is a cancellation of the Sprint, the Product Backlog is then reviewed, although, if part of the work which is completed is releasable, the Product Owner would accept it. Whilst the incomplete items are then re-estimated and put back on the list for Product Backlog. A cancellation of a Sprint requires a lot of resources and since there has to be another regroup, another Sprint planning would then begin, however, cancellations are very uncommon.

Sprint Planning meeting:

These meetings are attended by all parties involved; the clients, the users, as well as management, the product owner and scrum team for the goal and functionality development of the software (Anwer, Aftab, & Muhammad, 2017). The Scrum Master (management) and the team then focus on the product implementation during the Sprint practice.

During these planning meetings, the capacity of the team is determined; this identifies their availability and the amount of work which they are comfortable to complete during the Sprint. There should be an agreement as to the meaning of “done” for the Product Backlog list items that are selected for the Sprint. When there is an agreement, it gives confidence to the teams knowing that they know what is completed and ready for delivery with the necessary components of the product (Hassanein & Hassanien, 2020). This ensures that fewer deficiencies will arise within the product as the goals are set out. The goals that are determined have a short description of what will be achieved within the Sprint. Once completed, an assessment will be made against the goals at the Review meeting, instead of making an assessment against the Product Backlog item list specifically.

Negotiations take place with the Product Owners, but the selected items can only be completed by the team who are committing to how much they can complete. Therefore, the Product Backlog has to be prepared before this meeting is held with the Product Owner as items on the list can be removed. If there is no Product Owner, this meeting can be a complete failure; however, a Scrum Master should be able to stand in for the Product Owner by completing the necessary preparations for the meeting. The Product Owner and the Stakeholder are responsible for deciding which items of the Product Backlog will be included in the Sprint whilst the team is still able to make suggestions and negotiate.

The meetings consist of two separate segments. In the first part of the meeting the team meets with the Product Owner, management, and the users for the next Sprint so as to determine and understand the functionality which needs to be built. In this part of the meeting a decision is made about the time to be allocated to analyse what is within the Product Backlog, whilst more analyses can be done while the sprint is in operation (Anwer, Aftab, & Muhammad, 2017). The items for the next sprint should be listed according to what the Product Backlog needs to target and complete next. The highest priority features are explained to the team during the session; however, every item gets described. This depends

on factors such as the speed of the team, the size of the backlog. Only the highest priority items are discussed as it is these that add the most value; whilst discussions for the lower priority items are saved for the next meeting.

The second segment of the meeting begins as soon as the first segment is completed, which is when the team determines by itself how the next sprint build for functionality will be within the product's development increment. There is also a time allocated which defines the time to begin the work once all the planning is completed. The team is therefore required to complete the work on their own during this meeting; selected items on the product backlog may still need questions to be answered by the Product Owner, who must be available (Hayat, Rehman, Khawaja, Wahab, & Abbas, 2019). The team determines how items on the product backlog can be built into the increment of the production functionality. The team is given enough time for asking the necessary questions in the meeting so that they are able to commit to items selected for the sprint, after which the product backlog items are turned into tasks.

The outcome of the second segment provides a list which consists of the tasks' completion estimates and the team's ability for the functionality development. The list is comprised of what needs to be completed to show the commitment of the team and encourage them at the beginning of the sprint, although the list may not be complete. Tasks will need to be completed by the team which are in addition to the committed items as business begins to gain traction and progresses (Anwer, Aftab, & Muhammad, 2017). The amount of time allocated for the meetings may vary; as the Scrum Master facilitates the meeting and ensures that the times allocated are followed strictly. The time to build the product may be reduced if the Sprint planning is extended by another day.

Sprint Backlog:

This feature contains a list of features/tasks which are assigned to the Sprint; once all of them are completed, a new design of the system will be delivered (Fitzgerald & Stol, 2015).

#### *2.4.2.3 Daily Scrum*

These are daily meetings which take place for the organisation for keeping track of the progress made and they also allow for any obstacles to be addressed which have been faced by the team. The purpose of these daily stand-up meetings which have been arranged beforehand at a certain time and place is for the team to have a brief discussion. An organisation goal is the main purpose of these Daily meetings; they can be arranged as formal or informal meetings. Discussions at these meetings are generally unrecorded as they are task and decision oriented and are conducted in casual conversation styles. There is however a set of questions that each team member has to answer in order to determine how far out of reach the organisational goal is (Anwer, Aftab, & Muhammad, 2017). The three questions are:

- What has been done since the last meeting?
- What is planned to be completed before the next meeting?
- What obstacles have you came across which prevents you making progress?

This meeting within the Agile methodology is a 15-minute meeting for each team to have their work synchronized and planned for the way forward. These meetings are known for their speed, intensiveness, co-operation from the team members and the development which comes from this co-operation. (Hassanein & Hassanien, 2020). The reason for the effectiveness of this meeting is that:

- It improves the communication within the teams
- It identifies and removes the obstacles as soon as they are discovered
- It promotes quick decision making
- It improves the knowledge for everyone that is involved

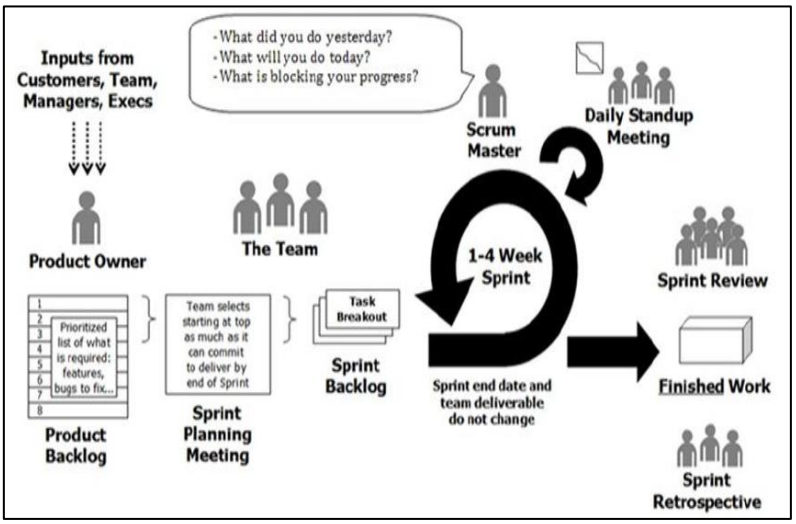



Figure 4: Scrum process flow diagram

(Anwer, Aftab, & Muhammad, 2017)

#### *2.4.2.4 Team*

The team which delivers the customers' requirements is a group that is self-governing, and which stands independently. The team needs cross functional representation to cover all the skills and knowledge within the data, tools, and the infrastructure.



These teams consist of the following members:

- Product Owner
- Scrum Master
- Architects / Analysts
- Designers
- Developers

The characteristics and responsibilities of the team are:

- Resources that are allocated to the Sprint full-time
- Cross functional in nature across skills, applications, data, and organisational knowledge
- Self-empowered
- Responsibility to deliver the product
- Determining the tasks that feature requires
- Estimating each tasks effort that is required
- Developing the features
- Resolving issues

There are two types of roles which are categorized within this scope; interested roles and committed roles (Leybourn, 2018). Interested roles belong to those who have an interest in the software development whilst they do not provide great input, such as those who have committed roles, but should still be kept up to date with the progress. The interested roles belong to the Users, Customers, and the Product Owners. The Committed roles belong to those who “do” the work, that are responsible for the development. These roles are those of the Scrum Master, the Team and Testers.

These two roles can also be categorized as Business and Technical.

| Role | Primary Responsibility | Typical | Does Not |
|---|---|---|---|
| **Users** *Interested Role* | • Use the software<br>• Identify issues &<br>• Provide feedback | • There are no typical users. | • Set Scope<br>• Test Work |
| **Customers** *Interested Role* | • Define, start and end the project | • Internal managers<br>• External Clients | • Direct Work |
| **Product Owner** *Interested Role* | • Manage the product backlog<br>• Set the scope<br>• Approve Releases | • Project Manager<br>• Product manager<br>• Customer | • Manage the Team |
| **Scrum Master** *Committed Role* | • Manage the Agile process<br>• Report on progress | • Project manager<br>• Team Leader<br>• Team member | • Prioritise features |
| **Developers** *Committed Role* | • Develop features<br>• Resolve issues | *cross functional*<br>• Developer<br>• Designers<br>• Writers<br>• Administrators | • Prioritise features |
| **Testers** *Committed Role* | • Test<br>• Approve or reject features for release | • Existing developers<br>• Dedicated testers | • Test their own code |

Figure 5: SCRUM Roles for each team member (Leybourn, 2018)

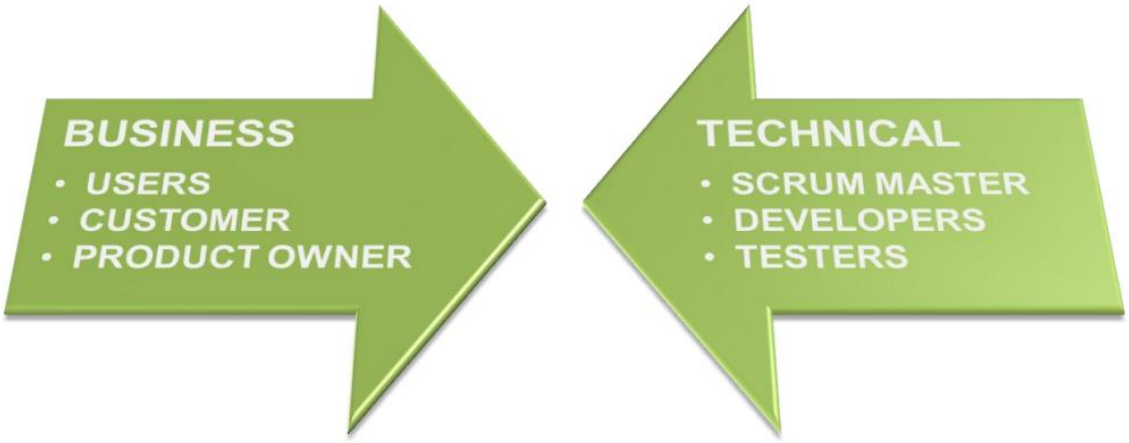



FIGURE 6: BUSINESS VS TECHNICAL ROLES

Figure 6: Business vs Technical Roles (Leybourn, 2018)

### 2.4.3 Extreme Programming

Whilst these Scrum developments were taking place, Kent Beck was assigned to an experimental software development project where he would be the project leader at Chrysler. He developed a methodology called Extreme Programming (XP) which was also an iterative technique. The Extreme programming (XP) method has many elements; it can be defined by development cycles, planning, continuous feedback, the reliance on communication and design (Manchanda, Agarwal, & Bhati, 2017). Since 2001, with the publication of the Agile Manifesto with its 12 principles for software development, Agile as a SDM has grown to become the leading SDM in developed countries (Henriques & Tanner, 2017).

The XP method evolved from obstacles that were caused by the lengthy cycles of development using traditional models. With regards to this method, the programmers following this XP method can respond with more courage to a changing environment which assists with those complicated tasks. According to (Manchanda, Agarwal, & Bhati, 2017), the XP members split their time by spending minutes on each process such as programming, designing new models, project management tasks and team building. The terminology “extreme”, is derived from taking the common principles and practices to an extreme level (Anwer, Aftab, & Muhammad, 2017). There are 12 core XP practices, displayed in Figure 7, which are as follows:

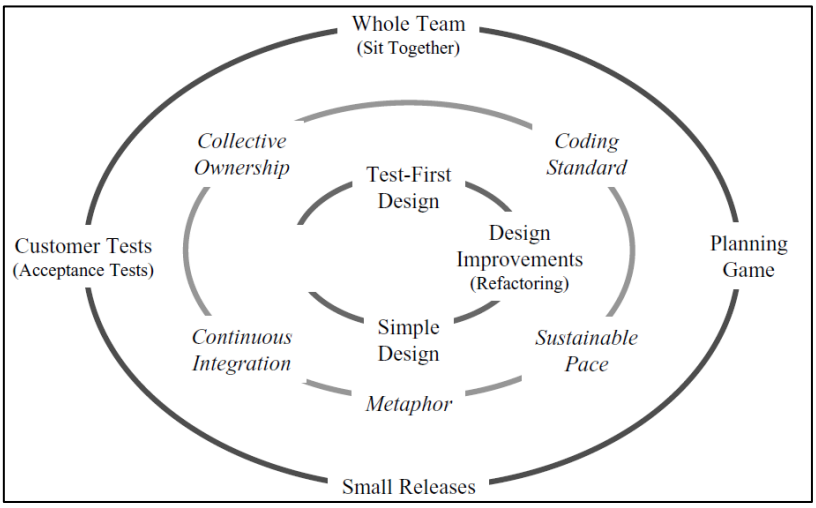



Figure 7: Extreme Programming and Agile Methodologies
(Anwer, Aftab, & Muhammad, 2017)

#### *2.4.3.1 Planning*

This is the planning by the programmer who looks at the required efforts based on the client's stories and decisions are made on a scope and time based on estimations. This planning determines what would be accomplished by the upcoming due date of the project and exploring what needs to be done next. There is more emphasis on the actual steering of the project rather than predicting what will be needed to understand the tasks and assignments and how long they will take. The two key steps within planning are:



##### 2.4.3.1.1 Release planning

This is when the customer explains and presents what they would like to be done to the programmers who can then determine how difficult the tasks will be to execute (Singh, Kumar, & Bansal, 2015). Having the cost estimations on hand, the customer can then specify the importance of having the features and can lay out the desired plan of the project. Initial release of the plans is not accurate nor are the estimates of what needs to be done confirmed; and even when the actual work has begun, there is still no true knowledge of how fast it will be completed. Although the first release plan has enough detail for decision making, the teams have to revise it regularly to ensure that the plan is updated.

#### 2.4.3.1.2 Iteration planning

The teams are updated weekly with directions as to what needs to be done (Singh, Kumar, & Bansal, 2015). The XP teams design software within a two-week scope which delivers useful and running software at the end of each iteration. During each iteration planning, the customer can present what is desired for the next two weeks to the teams. The teams then break down these plans from the customer into tasks which allows them to give a cost estimation which is more detailed than the one given in the release planning. Dependent on the amount of work that has been competed in the previous iteration, the team signs up for what will be completed within the subsequent iteration.

The planning steps explained are very simple as they provide detailed information with direct steering of what needs to be done as presented by the customer. Each time an iteration is completed, the progress of what has been completed is visible, since a feature is either completed or not. As the progress is so visible, customers can decide to change, cancel, or continue with the project, as the next steps that need to be completed are very visible.

### *2.4.3.2 Team*

When the planning takes place, all the members involved sit together as one team. The main member of the team is the customer, this is the business representative that provides the necessary requirements, sets the priorities, and steers the project forward. It is important that the customer knows the domain and what is needed so that the project progresses in the right direction (Henriques & Tanner, 2017). There are testers that are in the team that assist the customers with the acceptance tests. The requirements that are presented to the team by the customer are assessed by the Analysts who help in defining it. Facilitating the process, by keeping the team stay on track, is managed commonly by a coach and by a manger that coordinate activities. The roles that are played in the team are not necessarily owned by one individual everyone and anyone can contribute.

### *2.4.3.3 Simple Design*

The design is kept to the simplest form and any unnecessary complex code is removed. Once the design has started it is kept simple, the programmers test and improve the design consistently and keep the design simple (Henriques & Tanner, 2017). The design is kept specific to only what is needed in order to be ready for what is next for the design of the

software. These design steps are within the release planning and iteration planning, with the team's involvement engagement in quick design sessions.

#### *2.4.3.4 Small Releases*

The Extreme Programming team does two releases, firstly, the team releases the software to the customer which has been tested and which delivers the business value. The release may be passed onto the end users or can be evaluated; the customer has the option to do either (Henriques & Tanner, 2017). Once each iteration of the process has been completed, the software is then presented and given to the customer; this ensures that there is good communication between the two parties. Secondly, quite frequently these releases are also presented to the end users; they can be released as often as daily or even monthly.

#### *2.4.3.5 Design Improvement*

Extreme programming focuses on value being delivered within each iteration and for this to be accomplished, the software must be designed well. For this to take place there are continuous design improvements which take place, and this is called "refactoring". Refactoring focuses directly on the system where restructuring is taking place, by the removal of duplications, improvements of communications and also simplifying while improving flexibility without the programs functionality having to change (Anwer, Aftab, & Muhammad, 2017). Refactoring is supported by continuous testing which ensures that nothing is broken and there is continuous development of the design.

#### *2.4.3.6 Test-Driven Development*

Feedback is as important within extreme programming as within the development of software; having good feedback requires there to be good testing. There is a process of having work done in short cycles and then having them tested. This ensures that the code which has been developed is always working correctly by using test codes (Moe, 2019). Tests are written and executed by the testers once the code is released, which ensures that the code is working correctly. The programmers get feedback immediately on where the necessary changes need to be made to improve the code's value.

### *2.4.3.7 Pair programming*

The code which is being used for the operating of the software is written on one computer by two programmers. All the production software is designed by a pair of programmers that sit alongside one another both using the same machine. The reason for this type of practice is that all code can therefore be reviewed by at least one other programmer which results in a better product (Anwer, Aftab, & Muhammad, 2017). Research shows that being paired produces better code than code produced by programmers who work singly. This type of practice does take time to adjust to for the programmers but produces good results after a few weeks. Programmers therefore prefer this type of programming, and it is recommended for all teams as communication of knowledge is shared amongst the team. Programming teams also witch with each other which creates new paired programmers; this allows everyone to get the benefit of everyone else's knowledge. This allows everyone's skills to improve which adds value to the teams for the benefit of the company.

### *2.4.3.8 Collective ownership*

The code can be changed at any time as the developments have no single ownership, nor is the code split into individual code sections (Anwer, Aftab, & Muhammad, 2017). This means that the code's quality improves automatically, and the defects are reduced as the code gets the attention of everyone. An important benefit of this is also that the there is no required feature of an individual within the code that is misplaced, which tends to happen when there is one programmer. Collective ownership could cause issues when the people work blindly on code of which they have no understanding, and this could introduce new obstacles. However, extreme programming has two techniques which avoid these problems, which have already been described:

1. The programmers identify these mistakes
2. Paired programming which is seen as the preferred way to work

This type of ownership also improves the communication amongst the team as the knowledge of each person is shared and this allows for growth of the team.

#### *2.4.3.9 Continuous Integration*

There are constantly new pieces of designed code, which are integrated into the system, when it's ready, and each piece has to pass all the necessary testing of the build. Extreme programming keeps full integrity at all times while the build can be changed multiple times per day. The reason for having these types of builds is that having fewer changes made less frequently would prevent everything from breaking without knowing why (Anwer, Aftab, & Muhammad, 2017). Infrequent integration can lead to serious problems for the project: firstly, if it is not tested for integrity often and if people are not familiar with how the system works. Secondly, if the code is buggy, a situation where these issues are seen too late because the system is not tested often enough. Thirdly, code freezers tend to happen if there is a weak integration process which means that programmers are not able to work immediately on important shippable code features because they are held back. This style is not recommended as it does not allow for continuous improvement.

#### *2.4.3.10 Productivity*

The team members are in this build for the long term as they need to work hard consistently at a pace that does not put the deadline in jeopardy (Anwer, Aftab, & Muhammad, 2017). They need to maximize their productivity during the day and only work overtime when it is effective and necessary to be done. The company looks at ways to push the programmers to ensure that their productivity is up to standard so as to minimize the cost of overtime to the staff. These costs can be avoided if there is enough pace on the work.

#### *2.4.3.11 Customer Tests*

The client is alongside the development team at all times to oversee the production (Anwer, Aftab, & Muhammad, 2017). The customer does automated tests that show the features that are presented to them are working. These tests are built by the team to prove to themselves and the customer that features have been implemented correctly. The test is automated as it will run more quickly than doing manual testing when there is limited time. Once a test has been successful, the feature/program will not fail but only be improved when more features are added.

### *2.4.3.12 Coding Standards*

These standards are rules set in place to bring consistency to the code which allows for better communication amongst those who are on the development team (Anwer, Aftab, & Muhammad, 2017).

### *2.4.3.13 Metaphor*

The extreme programming teams develop a common vision of how the program is to work which is known as a “metaphor” (Anwer, Aftab, & Muhammad, 2017). It is basically just a detailed explanation of how the program works. At times such a metaphor does not arise within the process, but the teams just use a common system where they are all aware of how the system works.

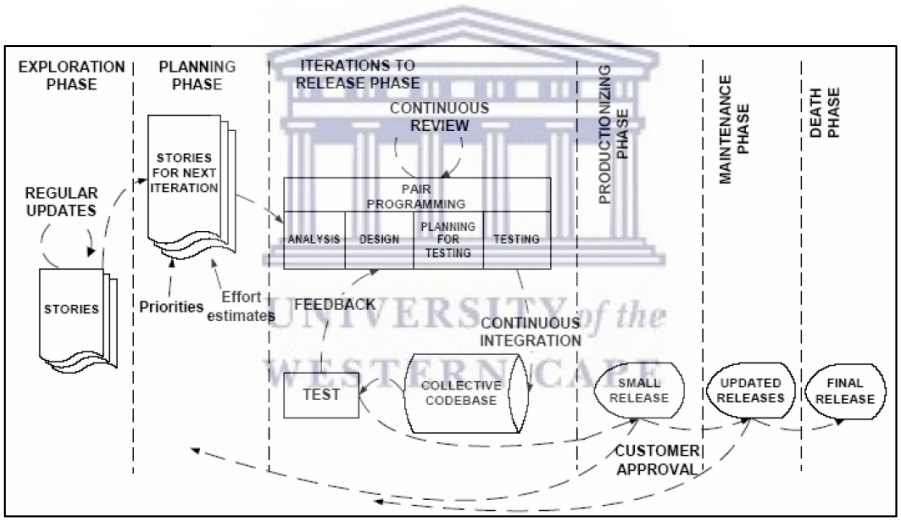



Figure 8: Extreme Programming lifecycle
(Anwer, Aftab, & Muhammad, 2017)

The XP lifecycle (Figure 8) has six phases:

- Exploration phase
- Planning phase
- Iterations to release phase
- Production phase
- Maintenance phase
- Death phase.

The Exploration phase is where story cards are written out by clients to explain what they would like to see included in their program (Anwer, Aftab, & Muhammad, 2017). This leads to the Planning phase where the priorities of each story and schedule are set for the development approach. The Iterations to Release phase is the development of the first iteration; this phase creates the system with an architecture structure followed by continuous improvement and code testing. The Production phase consists of more testing and checking of the system. Once completed, the program is then released to the client. The Maintenance phase is there for any ideas which have been postponed, these suggestions are documented for implementation at a later stage for the updated releases. The Death phase occurs when all the postponed implementations are completed, when all the necessary documentation has been written and no more changes need to be made.

### 2.4.4 Lean Methodology

Lean software development has a basis similar to Scrum; the process is more a set of project management practices instead of a definite process to complete the task. Lean methods were developed by Bob Charette in 2001 and are based on the success that Lean Manufacturing gained in the automotive industry in the 1980s which then started getting traction in all other industries (Shahzeydi & Gandomani, 2016). Whilst all other methodologies look at the changing the development process, Charette truly believes that changing how the company works from the top down speaks directly to Agile innovation. Lean Development is mainly focused at changing and considers the change with regards to the management who are in control of projects. The methodology is based on thinking minimalistic by ensuring that the only processes that are in place are the ones needed to complete the task. Lean has its origins in production by the Toyota Automotive manufacturing company (Shahzeydi & Gandomani, 2016). The following are the ways in which Lean development is executed (Figure 9):

#### *2.4.4.1 Eliminate waste*

This principle refers to the removal of any waste which adds no value to the product; this value is observed by the client. In the methodology, the thinking is around the removal of anything that gathers dust and has no function (Shahzeydi & Gandomani, 2016).

#### *2.4.4.2 Amplify learning*

The development of an idea is an exercise in discovery as it is something new, while production can be seen as the reducing of variations and for this, lean development, results in practices that are different to those of lean production practices (Fitzgerald & Stol, 2015). The best way to enhance the software development is to create an environment where learning is amplified.

#### *2.4.4.3 Deciding as late as possible*

The development practice provides options for the approach as it allows for late decisions to be made that are effective in the areas of uncertainty. Having decisions delayed can be valuable as it allows for a better growth which is based on fact and not based on speculation. Having capacity to delay a decision when developing a complex system is a key strategy; its outcome is a better response as more time is given to evaluate all options.

#### *2.4.4.4 Deliver as fast as possible*

Delivery time is important but having a more cautioned approach can have much more value, as the rapid software development has not been valued. There are however advantages to rapid development but there should be a balance between quality and time with projects. But if there is no speed then decisions are not made, nor is reliable feedback given. Clients get what they need now from speedy deliveries but not so much reliability, it does however help them to make up their mind about what they actually need (Shahzeydi & Gandomani, 2016).

#### *2.4.4.5 Empower the team*

The team is able make better technical decisions and better process designs if they are all equipped with the necessary expertise and have guidance by a leader. The pull technique which is used to schedule work and contains signalling mechanisms is a communication method to notify one another of what needs to be done (Dubey & Gunasekaran, 2015). The pull mechanism is when the software is refined and delivered at regular intervals so that the teams are updated constantly. This is achieved through the daily meetings, charts, and testing.

### *2.4.4.6 Build integrity in*

When a system has conceptual integrity, it means that its concepts work smoothly and cohesively as a whole which is a critical factor in perceived integrity. The software does however need additional levels of integrity as it needs to maintain its usefulness over time even though software does evolve as it adapts to the future (Fitzgerald & Stol, 2015). Software that contains integrity has coherent architecture, has a high rating for its usability, fulfils its purpose and is maintainable, adaptable, and extensible. Integrity that is delivered in complex systems requires deep expertise and knowledge in the focused areas.

### *2.4.4.7 See the whole*

An issue that still stand is that part of the product that is focused on rather than focusing on the overall systems performance. This happens often when individuals or organisations are measured on their specialised contribution instead of the overall performance of the product, which is likely to lead to sub-optimization (Alahyari, Svensson, & Gorschek, 2017). This issue tends to grow even bigger when it involves two companies, that prefer to maximize their own company's performance instead of working together for the benefit of the client. It is challenging for practices to be implemented that avoid sub optimisation.




Figure 9: Lean Methodology
(Shahzeydi & Gandomani, 2016)

### 2.4.5 Kanban

Kanban Agile methodology was developed by Toyota, a Japanese automaker, during the 1950s. Kanban was developed for the optimization of the production improvement process. This methodology was then transferred to the IT industry in 2007 where it has improved efficiency for projects with production processes. Kanban ensures that bottlenecks are avoided which could potentially slow down the production process, thus faster turnaround times are achieved (Placeholer). Kanban supports the coordination of tasks that take place through its production process which is monitored to ensure rapid turnaround time. There are three components that make up Kanban: workflow visualization, work-in-progress (WIP) and cycle time.

#### *2.4.5.1 Workflow visualization*

A Kanban visualization is presented through a Kanban board which can be written or be in a digital form. This board consists of columns that show the different activities in the value chain that each task has to complete.

#### *2.4.5.2 Work-in-progress*



Work-in-progress (WIP) describes or shows the total number of tasks that can be processed simultaneously and each of the columns has its own limit. If the task limit is exceeded, this will create a bottleneck that will slow down the production process.

#### *2.4.5.3 Cycle time*

The cycle time specifies the total time needed for the task to be completed and in order for this to be calculated, the task must go through all the steps of the value chain within the workflow board.

#### *2.4.5.4 Kanban compared to traditional project management methods*

Project managers are occasionally reluctant to change to an Agile project management as the risks often seem high and the support by management is not guaranteed. However, Kanban can be combined with traditional methods but there may be complexities and dynamics within individual projects (Bhavsar, Gopalan, & Shah, 2020).

#### 2.4.5.4.1 Project Management

In the traditional methods, roles and responsibilities are clearly defined and the project organizer has the key position. The different areas of responsibility are therefore assigned to the manager and the members of the project team. The project leader is therefore the main actor, and often, these role definitions are not equal to the capabilities needed within the project (Placeholer). The Kanban method describes the roles more abstractly whereby the team member is considered to have a certain professional character within the project and the tasks are not tied to a role within the team. Responsibilities and roles that are distributed according to the situation prove to be effective and teams who are solution orientated and self-organized realize this. The team's focus is not to be forced to adhere to roles, procedure, and processes, but to an open communication where their responsibility for solution steps is based on the situation and implementation. In traditional management, the understanding of all involved and the internal and external cooperation is usually standardized with the process models that have typical common goals. The status of the project is the centre of attention as the project members are interchangeability and the comparability of projects and measurement (Bhavsar, Gopalan, & Shah, 2020). The agile method primarily is not about the processes or the tools but the values, transparency, communication, and cooperation. Core elements of Kanban also ensure that there is rapid and flexible response to changes, implementation that is flexible, customization and its communication and responsibility. Achieving customer satisfaction involves the customers through all the phases of the project and its goal is to work closely and cooperatively.

#### 2.4.5.4.2 Scope Management

In traditional methods, the standardized procedure models assign tasks through the work breakdowns (WBS). The roles and responsibilities are clearly defined in advance for the work packages and tasks. Work packages are independent of one another, and the services are continuously measured and assessed. Kanban methodology assigns the tasks differently as each task is recorded on a card, and depending on the process status, it will be moved from left to right until the task is completed (Zayat & Senvar, 2020). The tasks that are mutually coordinated are limited to the availability of the task cards, and it must be ensured that the tasks are always in progress so that there is a constant workflow. The workflow is created by the transferring of task cards after certain processing cycles, and this usually happens at the daily stand-up meetings where team members discuss the progress of work in front of the board. These daily stands ups take place at fixed times and increase the

transparency of the work in progress. In other words, the traditional method is task-orientated, and the Kanban method is people-orientated which increases work motivation as the team members take over their own tasks as the teams work more independently (Placeholer). Kanban reduces the management efforts and increases the processing speed of tasks, and any changes required, even in late phases, can be implemented flexibly and cost-effectively for the customer. This is not the case for traditional management as the later in the phase that changes occur, the greater the additional costs for the customer.

#### 2.4.5.4.3 Schedule and Resource Management

In traditional methods, models indicate that participants are interchangeable among projects and each role is clearly described which can be reoccupied. A suitable candidate with a certain role profile is looked for if a role needs to be filled due to an event of exchange and integrated into the team, the role profiles ensure that there is a smooth process. Team building is a key issue in agile projects and teams as the work is more intense than in a classic environment, and within these teams, replacements are more situational (Bhavsar, Gopalan, & Shah, 2020). The need of the team is more important than the exact replacement of the predetermined role and in the agile method, technical factors are not the main aspect, more emphasis is placed on experience and knowledge. New members can be quickly integrated due to the daily stand-up meeting culture and active knowledge transfer in the projects. Bottlenecks can occur at Kanban, especially when a large number of cards are with a person and at this point, system improvements need to be made by the redistributing of work and resources.

#### 2.4.5.4.4 Quality Management

In traditional methods, there is a lack of measurability of the benefits for the customer whilst the Agile methods are more appropriate because the actual benefits are identified in the product progress measurement. The project phases of requirement, design, development, and testing are passed throughout the production progress, and at the end of each phase, the ratio results are achieved, and the resources can be measured and presented (Bhavsar, Gopalan, & Shah, 2020). The early measurement of completion will ensure customer satisfaction and trust whilst in traditional methods, the central parameter is the degree of completion. The procedure model's milestones are based on the key figures of deadlines and costs.

#### 2.4.5.4.5 Communications and Information Management

In traditional methods, the roles and relationships are often defined and written down which creates an expectation between members. This ensures everyone knows what they have to do and what is expected of them and often the project process is not structured clearly. Communication habits are shaped throughout the project and are different from those at the beginning, as the events that occur cannot be foreseen (Placeholer). The communication internally or with other teams is not restricted with the Kanban methodology as it promotes initiative and responsibility. There are rules and standards that are used in both methods but there is more flexibility with an agile method.

### 2.4.6 Scaled Agile Framework (SAFe)

The Scaled Agile Framework was developed using the Agile Manifesto principles since the 1960s, and there have been developments to align software development with hardware development (Turetken, Igor Stojanov, & Trienekens, 2016). The focus of agile was on small to medium sized teams that were collocated, however, it was not the total solution as there was an accelerating economy where technology was advancing that had more demanding customers wanting better features and quality. Larger organisation production was required to meet the need demands and the use of Scaled Agile Framework was considered and was introduced in 2011 to assist with the large-scale development (Khoza & Marnewick, 2021). This transformation introduced new complexities and new areas of innovation which are grouped into the four areas: Portfolio, Large Solution, Program and Team.

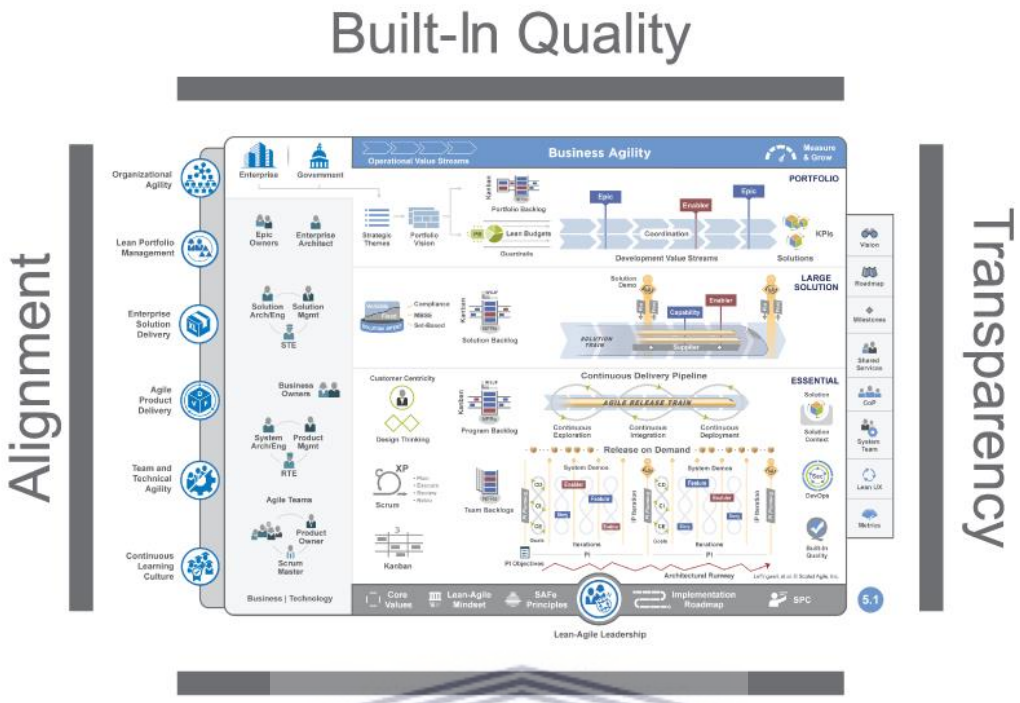



Figure 10: Scaled Agile Framework (SAFe)

(Stojanov, 2015)



### *2.4.6.1 Portfolio and Large Solution level*

The Portfolio level is essentially the organisations visions, goals and strategies which are determined by the executives and leaders. Challenges that arise such as funding, product mapping and management are aiding by the framework and Lean principles are incorporated for progress measurement to achieve their goals (Khoza & Marnewick, 2021). The Large-scale solution is the result of the implementation at these levels where the portfolio level, architectural epics, and visions are determined. The determined visions and epics are passed on to the Program level where it is scheduled to complete.

### *2.4.6.2 Program level*

The Program level uses Agile Release Train (ART) which is expected to deliver the value of a specific project. ART consists of teams that are between 5 and 12 that ensure that all infrastructure and roles needed to produce and test, functioning and a system-level software (Stojanov, 2015). These ARTs are associated with a specific value stream (goal) within the

process and ensure that prioritization of the list of features is overseen by a program manager.

#### *2.4.6.3 Team level*

The Team level deals with traditional agile teams and Scrum processes which ensure that teams are self-organizing, self-manging and cross-functional units. Sprints are planned where the team defines the efforts and work needed to meet the sprint requirements (Turetken, Igor Stojanov, & Trienekens, 2016). These sprints are over a two-week period where daily meetings take place to discuss the progress of the project. At the end of each iteration, there are discussions around what issues have arisen and how they have been dealt with to prevent them from happening again in the next iteration. The process is the same as the Scrum methodology, however, these sprints are restricted to 2 weeks only.

### 2.4.7 Feature Driven Development (FDD)

Feature Driven Development (FDD) is an iterative software development methodology that is model driven where it establishes an overall model which will incorporate all the details of the project. Feature Driven Development has been developed as an alternative methodology to the traditional Waterfall methodology (Gahyyur, Hasan, Ahmed, & Ullah, 2018). It has the same approach as the Waterfall methodology where the project is divided into stages where it will move onto the next stage once the previous stage is completed. However, the weakness of the Waterfall approach is that design errors are not discovered until the deployment time of the project and these errors are expensive to recover from whilst Feature Driven Development is able to pick up issues throughout iterations which are 2 weeks apart. These feature driven designs are small, client-valued functions which are completed using a 5-step process.

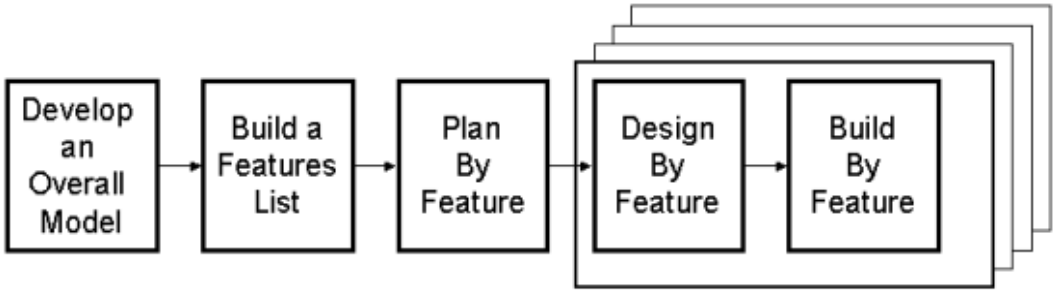



Figure 11: Feature Driven Development (FDD)
(Aftab, Anwer, Waheed, & Muhammad, 2017).

#### *2.4.7.1 Develop an Overall Model*

Developing an overall model is the firsts step and follows a discussion between the client and the development team. This is achieved by working together; the client presents the context and the systems requirements (Al-Zewairi, Biltawi, Etaiwi, & Shaout, 2017). The development team then designs the model based on the client's requirements and a process of adjusting the model is agreed on for the final model.

#### *2.4.7.2 Build a Features List*

Build a features list, which is the second step, allows the team to formulise the information gathered in the previous step through the feature list production. The features that are developed are small because the FDD concept is to produce results every two weeks which allows the team to determine if there were any issues and how to overcome them, therefore these features need to take less than 2 weeks to implement (Aftab, Anwer, Waheed, & Muhammad, 2017). The feature list identifies features and prioritizes them according to the client's satisfaction and determines the weight (or divides into smaller features) of the features to ensure that the 2-week deadlines are met. The list has the features grouped together into sets and they reflect dependencies on one another.



#### *2.4.7.3 Plan by Feature*

Plan by Feature is the third step that uses the features to plan development and organise the team for the preparation of implementation. The development plan orders the feature list to reflect the development sequence, and these are converted into goals (Gahyyur, Hasan, Ahmed, & Ullah, 2018). The team uses a selection process to choose a chief programmer to lead each feature set for a 2-week cycle. The chief programmer selects developers to form a feature team to work with on the feature sets.

#### *2.4.7.4 Design by Feature and Build by Feature*

Design and Build by Feature are the last two steps that are iterative and last 2-weeks. Each chief programmer takes on the next feature and the team work on diagrams and the general design of the features (Al-Zewairi, Biltawi, Etaiwi, & Shaout, 2017). The final step of FDD consists of coding, testing, integrating and inspection. FDD has a little room for

experimentation and a clearly structured approach is adopted which is a key benefit to ensure that the project is completed within the time frame expected.

## 2.5 Traditional and Agile Software Development

The Software Development processes can be grouped into four phases: specification, design, testing, and implementation known as the Waterfall approach. Even though all the methodologies follow these different phases, they get traversed in different manners. Traditional Software Development methodologies are sequential and iterative, the approach is process-driven and is tool-orientated for completing tasks. These approaches are planned upfront with all requirements, documents, and the development cycles. The beneficial part of this approach is that it works well with projects that have known scopes and features. However, if these change and if there are deviations, then there has to be an expensive re-iteration of the previous stages (Afflerbach, Kratzer, Röglinger, & Stelzl, 2017).

As things progressed in the development space, there was a demand for more flexible methods which were developed through the use of Agile Software Development in the 1990s. Agile Manifesto took the world by storm in 2001, when it became the revolution for software development. The idea behind agile methodologies is to be more focused on individuals and interactions instead of dealing directly with the processes and tools (Manchanda, Agarwal, & Bhati, 2017). The method is used primarily for being able to react quickly to any requirement changes because it allows the developers to be creative and produce autonomous thinking. Although there are so many upsides to these methodologies, it does rely heavily on trustful relationships with its customers, developers, and the managers to use it to its full potential (Conboy & Carroll, 2019).

Whilst traditional methods were very plan-driven and lacked flexibility for the development process, many organisations were frustrated as these methods were not simple and easy to use. Agile methods delivered working software within a shorter completion time which allowed the organisation to seize opportunities that arose sooner (Conboy & Carroll, 2019). Agile methods tend to deal with uncertainties much better as they rely on the people's creativity rather than the actual process, unlike traditional methods. Therefore, Agile brings out the skills within the team; this promotes collaborative decision making which involves all parties, including all the stakeholders. The rotation of members encourages the creativity of each team member and ensures the cross-pollination of knowledge. "Agile processes are

designed to capitalize on each individual and each team's unique strengths" (Afflerbach, Kratzer, Röglinger, & Stelzl, 2017).

The following benefits are identified by (Afflerbach, Kratzer, Röglinger, & Stelzl, 2017) when implementing Agile methods:

- Rapid learning: this allows for the best of scientific methods of discovery, these develop the skills and thought processes and help the development of the design.

- Early return on investment: since Agile methods allows for a shorter completion time, there are more opportunities for more developments that the organisation can take on and the sooner the software can be in use.

- Satisfied stakeholders: the stakeholders are very much involved in the design process of the development which allows them to make meaningful contributions to the outcome.

- Increased control: the development process makes sure that the goals are being met and that a satisfactory level is always maintained.

- Responsive to change: agile methods are flexible, they are able to embrace changes in requirements rather than having to reject them, they accommodate the changes so that the development does not go on hold which could prevent completion on time.

These benefits according to (Afflerbach, Kratzer, Röglinger, & Stelzl, 2017) which are gained in the principles of Agile methods will be experienced by the organisation if the implementation is done carefully and correctly.

# Chapter 3 – Literature review

Literature has revealed multiple frameworks which assist with the implementation of software development within an organisation. All frameworks specifically in South Africa have been examined, by understanding their components for process improvement for the adoption process. Software development adoption methodologies have been compared in order to search for the most suitable method which would be a best fit for the financial industry. Based on the outcomes, a methodology has been established which is tailor made for South African financial industries to assist with the growth of development. The development life cycle has also been examined as it is a critical aspect for development. All these components are linked to one another; these are used to provide guidance and assistance with leading processes to ensure that industries are utilizing their business improvement processes.

## 3.1 Motivation for the Agile Adoption Framework

Agile methods can be described as package that can be manipulated to suit the business culture and assist with ways of working. However, these methods are difficult to introduce into the business if there is already a different way of working. However, by having an adoption framework in place, waste that comes with organisational change management will be minimized.



There are different Agile Adoption Framework/guidelines available in literature that can assist with these changes and minimize waste:

1) Factors that influence the Adoption of Agile (3.2)
2) General Adoption Framework (3.3)
3) The Agile Adoption Process framework (3.4)
4) The Agile software development adoption framework (3.5)

### 3.1.1 Adoption Framework of Agile Methodologies

Since each organisation has different processes, there is not an official adoption framework which would work for all types of organisations, each adoption needs a unique set of practices and rules when implementing a new methodology. The adoption is not a simple

process as there are multiple aspects to prepare for an organisational implementation (Hussain, 2021). The list of different types of methodologies does not make the adoption process any easier as each methodology requires different identifications and requirements of the organisation.

The adoption process not only consists of the actual implementation of the methodology but also of the organisation's preparation for the adoption. These preparations are critical as they will determine the outcome of the adoption; whether it will go smoothly or encounter many obstacles. The preparation involves each aspect of the organisation that needs to adapt to a new process (Manchanda, Agarwal, & Bhati, 2017). These frameworks have been designed based on first-hand experience to ensure that should there be yet more adoptions of new processes, these will also follow these same steps and guidelines.

Agile software development adoption has grown exponentially, from questions being asked as to why to adopt Agile, to questions being asked on how to adopt Agile instead. This has led to the thinking around those who are interested in Agile as questions began coming up as to how agility works or does not. Instead, the questions that should have been asked are those around what assistance and guidance there is on how to implement agility in their situations (Alahyari, Svensson, & Gorschek, 2017). There might have been many successful adoptions of the Agile methodology, but they cannot be generalised as many of them were narrowly focused within an organisation. These successful stories are unable to be of guidance and assistance to any other organisation as each organisation has different needs, however, these successes have brought questions asking if the same generalised approach would work in other organisations.

These success stories have led to generic guidelines to assist with the identification of the correct Agile adoption practices for the organisation that is considering adopting these methods. These guidelines establish the pitfalls which are possible when adopting certain practices (Conboy & Carroll, 2019). These answers are based on these authors' own experiences, and they are also limited as project sizes are different. Organisations that would like to adopt agility, need to identify which agile practices would best fit their needs before they make any moves towards agility.

The purpose of having an adoption methodology in place is to minimize the amount of waste the organisation creates when implementing new processes. There are various types of waste within an organisation which can be managed by a set of rules and regulations

(Andrei, Casu-Pop, Gheorghe, & Boiangiu, 2019), these allow the organization to understand how to maximise cost savings such as:

### 3.1.2 Process waste

Process waste is the creation of unnecessary reviews of a process. This allows the completion of the cycle within an efficient amount of time. It can also be the development of a review methodology that determines the steps taken that is used to measure the efficiency of the process. Process waste slows down productivity as there are signoffs that need to take place and agreements that allow for the process to move on. Processes do, however, ensure that the necessary steps are taken in order to get the approval of the current work done, but this can be streamlined for more efficiency in the process cycle.

### 3.1.3 Product waste

Product waste is the development of features that will not be used in the final product designed. These features might be nice to have attached to the product, but they would be unnecessary. Maybe the features are add-ons which go above and beyond the client's request; omitting these could assist the client with decision making and simplify the build method of the final product. Such decisions do help save time on the build for the developers, when a feature that is not necessary or one that the client was expecting or requested in the initial briefing, can be omitted.

### 3.1.4 Communication waste

Communication waste is the design of communication paths that do not add any value within the system. These communications paths are designed out of the actual requirements if they are not beneficial or not requested. Communication is essential throughout the build of the product to ensure that the product meets the client's requirements as discussed by developers and managers. However, this communication also slows down productivity also if it includes a step that seeks approval before continuing with the product build. The communication process can be restructured in a way that does not slow down productivity by only having just enough communication to ensure that the client's requirements are being met.

### 3.1.5 Productivity waste

Productivity waste comes from a lack of motivation within the development teams which can reduce the output of each member. This speaks directly to what is expected of each team member as it looks at one's values and drive to complete the task. Productivity within the team can be affected by multiple factors that directly impact the developers/teams drive within the workplace. These factors can however be mitigated by working closely with the developers to understand how things can be done differently to allow for more productivity.

### 3.1.6 Summary

Once there is reduction in the amount of waste within the organisations development systems, the organisation can begin to save money and increase their product delivery time. This has a direct impact on the performance of the organisation which allows for an efficient and smooth transition of development.

## 3.2 Factors that affect adopting agile methodology



In South Africa challenges began to arise with the adoption of Agile methods ever since it began to gain traction. Agile development approaches have been taken on immediately and the adoption period has been successful in some cases although sometimes a full transition may take years to complete (Tam, Moura, Oliveira, & Varajão, 2020). In addition, organisations may not seek all aspects of a full-on Agile method, this becomes a part Agile methodology adoption.

These adoption methods cause confusion; therefore, the organisation has to decide which aspects of the Agile methods they need and only focus on those adoption methods. This is a huge role for the team members as they need to be encouraged to adopt the process and also to ensure that there is minimal resistance to change (Abdalhamid & Mishra, 2017). Although the adoption of Agile methods can improve current software development processes, resistance is still an issue as humans are reluctant to change if they are comfortable with the current processes (Tam, Moura, Oliveira, & Varajão, 2020).

However, there may be other factors that could pose challenges in the adoption methods. These challenges could be related to a previous process adoption that did not work out well and left a bad reputation with all adoptions. Lack of understanding of Agile methods could

also be a challenge as team members feel it will not make a difference to the development process. The understanding would point out what issues will be resolved once a successful adoption has taken place.

There are factors that have to be managed when adopting Agile methodologies, since all stakeholders need to agree to the adoption process, as it is critical that all aspects are taken into consideration. These factors can also be seen as a prerequisite for the adoption as one cannot run before they are able to walk. The preparation of the organisation as a whole is the make-or-break factor for a successful adoption which will lead to further innovation. The following factors should be considered (Abdalhamid & Mishra, 2017):

### 3.2.1 Organizational culture change and transition

The organisation has to be able to change its culture and attitude for the new methodology being introduced as without a new way of thinking, there will be no growth or acceptance. The focus should be on the organisation as a whole as all teams and managers have to deliver new practices for the development of better agility to produce a smooth transition. Although, there are many challenges faced in the organisation, if there are aspects which are preventing the adoption, these need to be resolved so the process can continue. An organisation will feel discouraged if there is an absence of an investor since the financial wellbeing of an organisation speaks to dedication and commitment (Abdalhamid & Mishra, 2017). The team has to keep up with the new developments and if anything is lacking, it is likely that a rejection of new methodologies will take place. The larger the organisation, the more complicated the preparations become especially if there is no official logistical plan for the implementation.

### 3.2.2 Agile training and education (People)

The people factor is one of the most significant parts in the adoption process and the preparation of their mind set is important. People need an educational background on the Agile strategies and understand how to apply it. Client relations is also a major aspect in the successful adoption, as the better the relationship, the more willingness there is to accept the methodology. Communication amongst one another during the process is essential as everyone needs to be in it together as a team to deal with the transformation (Abdalhamid & Mishra, 2017). If, however, there is a lack of skill sets, the chances are that the adoption process will not be accepted as people tend to pull away because they do not understand.

Those who are project managers should also have the necessary competences to deal with the process since they affect the transition from the top down.

### 3.2.3 Team Dynamics/Communication

Team dynamics in an Agile adoption software development process are those interactions among team members that determine the performance of the team through patterns. An effective team provides interaction avenues that allow the team members to state their ideas and opinions without barriers, and there are those who listen actively to understand the team members concerns and provide suggestions to the problems that are faced by the team. The team interactions are significant for the development of a successful adoption agile team within the software development industry.

These Agile teams are occasionally distributed but usually operate within the same space, these ways of working contribute on how interactions taking place, which can be via face-to-face communications as well as through technology mediated communications. When communications are made through technology mediated communications (non-verbal communication) features, such as facial expression and hand gestures, are often missed; this can cause a decrease in the awareness of team member actions (Dorairaj, Noble, & Malik, 2012). These interaction methods all play a major role in Team Dynamics in the Agile environment.



### 3.2.4 Technical practices change management

Technical practices allow an organisation to deliver the processes over with high knowledge and understanding of the group, for an efficient product to the client. The practices involved, such as the test-driven development, which assists in the refactoring and programming instances results in a more productive way of adoption (Abdalhamid & Mishra, 2017). The correct tools and technologies should be considered for this aspect as this factor is one of the easier mentionable failure aspects of this adoption. The technical aspect focuses specifically on ensuring that the client is consistently updated through continuous integration. As a result, there will be more productivity from the team when adopting these practices.

### 3.2.5 Project Management to meet deadlines

As Agile is a methodology that deals with changing environments, projects that are not organized tend to look towards a methodology that can deal with its type of pressure without any difficulty (Abdalhamid & Mishra, 2017). Projects that have unique processes are most likely to suffer if they are not managed accordingly, as change might affect the course and derail the project.

### 3.2.6 Process integration ability

There are multiple methodologies within the Agile stable, and it is important that the organisation selects the correct one for the projects involved as it should have the ability to be integrated to any process too. The process of delivering software regularly is vital, along with the correct clarification of the processes involved (Abdalhamid & Mishra, 2017). There should be clear requirements to ensure that the process is following the correct procedure for the adoption of the methodology chosen. The important part of processes is to have a tracking mechanism in place to avoid any confusion amongst the teams.

### 3.2.7 Productivity management



Productivity in an Agile software development environment has shown an increase when compared with traditional methods. Productivity usually entails the ratio of the team output (e.g., product features, product functions) to the input by the team (e.g., time, effort). Productivity is essentially how quickly problems are solved and how quickly an idea can be showcased to the client. Agile methods are based on the premises of how to adapt to different conditions, and constant testing that provides rapid feedback through regular meetings in order to allow problems to be solved earlier (Shah, Nyfjord, & Papatheocharous, 2016). Productivity is also influenced through the management structure within an Agile environment. The Agile environment can assist with the management of the workload and help to remove barriers that reduce productivity.

### 3.2.8 Quality assurance

Quality in an Agile software development environment is accomplished through an iterative approach which promotes improvement in quality. The benefit of the iterative approach ensures that there is the ability to review and validate the requirements which are monitored

through regular meetings with the client. The use of the regular meetings allows changes to be made which complete the specifications and ongoing input given by the client. These regular meetings ensure that proper testing practices are in place (both manual and automated) such as code reviews, continuous integration, and automated unit and regression testing. Agile teams that work this way can test quality up front and therefore correct errors and defects early in the software development cycle, when the costs are the least (Karhapää, Behutiye, & Rodríguez, 2021).

## 3.3 General Adoption Framework

The chapter understands the general adoption pattern that most organisations would follow and then would show popular patterns which have been a joint approach from personal experiences.

The general adoption process includes the following steps as the guidelines:

- the identification of the most appropriate methodology
- understanding the organisations requirements
- the adaptation and the implementation (Rasnacis & Berzisaa, 2016).



Figure 12 shows an overview of the framework. It is followed by a description of each phase in the framework:

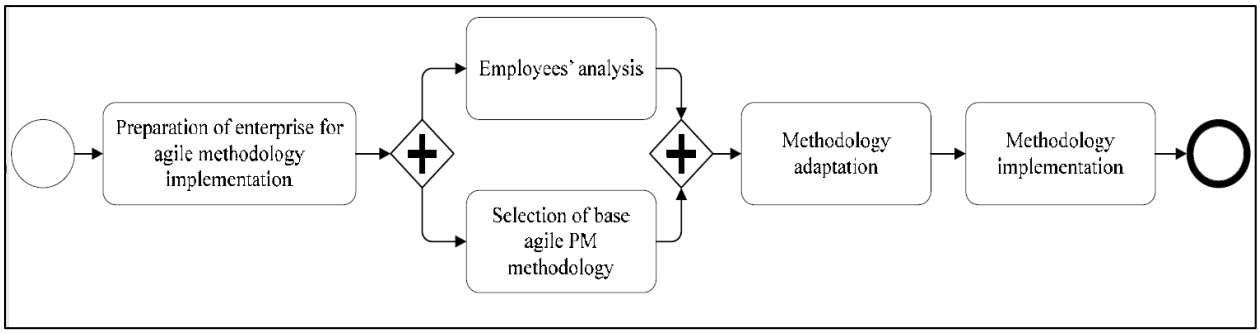



Figure 12: General adoption framework phase's overview (Rasnacis & Berzisaa, 2016)

### 3.3.1 Preparation phase

This is the basic preparation for change within the organisation where employees and systems are doing the necessary evaluations and putting processes into place for making it an easy transition. The physical processes of the organisation will be changing, and this situation forces the users to be open minded and think out of the box (Rasnacis & Berzisaa, 2016). The employees need to be educated around the abilities which the Agile methodology will bring and understand the usefulness of it in achieving the organisation goals and milestones. The factors which need to prepare the organisation have links to the awareness, desire, ability, promotion, and transfer for the impact upon the structure around the methodology improvements.

### 3.3.2 Employees' analysis phase

This phase specifically focuses on motivating the employees, but also on building the relationships amongst the teams as the methodology will affect each one differently, but everyone has to adapt accordingly in order to accept the change. This phase is also where the information is shared about how the different roles in the adoption will be shared so that each employee in the adoption process understands their part. The phase has analysis tools which can be based on two methods known as sociometric and motivation. The sociometric is a quantitative survey which understands the interpersonal relationships and also the small social groups (Rasnacis & Berzisaa, 2016). The surveys that are completed are formal and informal as they can be conducted within any situation that the team members are dealing with. The motivational research method is used to understand the factors that motivate and uncover the problems that are based on Maslows hierarchy of needs (Rasnacis & Berzisaa, 2016). Both these methods follow basic steps which are used to manage the process: preparation, data collection and data analysis. The complete process is illustrated in the Figure 13 which shows the flow of how the methods are followed.

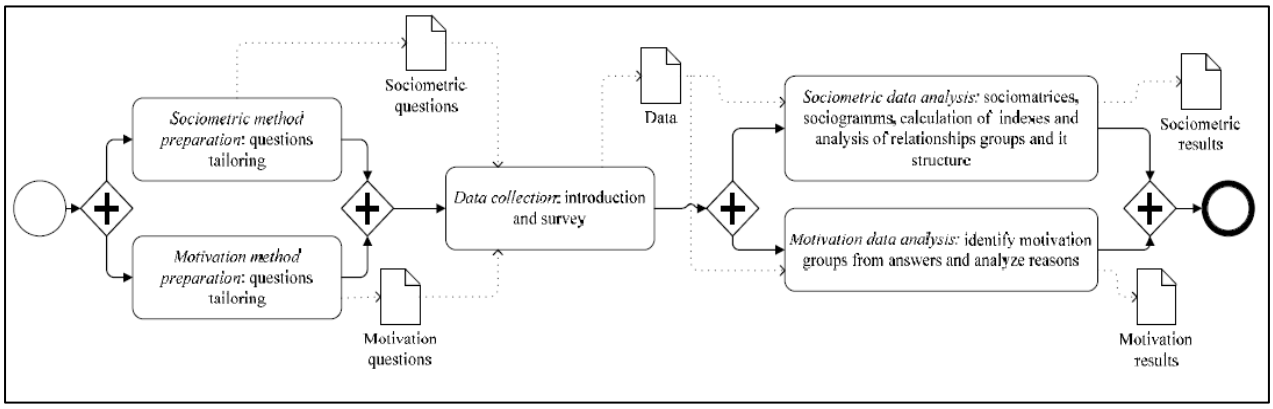



Figure 13: Overview of employees' process flow

(Rasnacis & Berzisaa, 2016)

The questions that are related to the current situations are tailored, along with the design which is completed during the preparation steps. The data collection process takes many factors into account that are determined by the type of survey, the location, and the participants' circumstances. The sociometric data analysis is based on different calculation indices, analysing the relationships internally and the structures origin that are used for the analysis of social networking.

| | |
|---|---|
| Mutual relation index $=\frac{R}{N-1}$ | Calculated depending on the number of mutually positive choices (R) and count of respondents (N). |
| Group cohesion degree $=\frac{P}{((N-1)/2)}$ | Calculated in accordance with number of mutual positive choice pairs (P) and count of respondents (N). |
| Group integration index $-\frac{1}{S}$ | Calculated in accordance with number of respondents who do not receive any choice (S). |
| Intragroup consolidation index $=\frac{R*(1-(\frac{d}{N-1}))}{U*(\frac{d}{N-1})}$ | Calculated in accordance with number of mutual positive choice pairs (P), number of unilateral choices (U), number of choices permitted to be made by one respondent (d) and count of respondents (N). |
| Referral index $=\frac{P}{A}$ | Calculated in accordance with number of positive choices (A) and number of mutual positive choice pairs (P). |

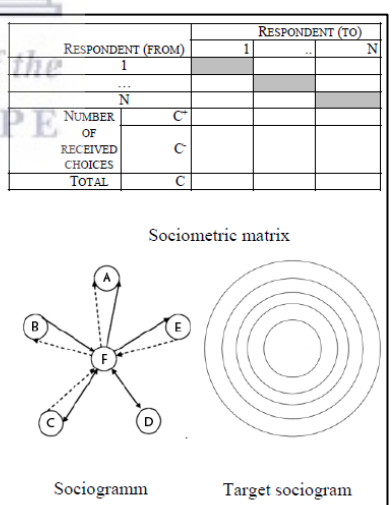



Figure 14: Methods for analysis of sociometric data

(Rasnacis & Berzisaa, 2016)

Illustrated in Figure 14 is a summary of the methods used for the data analysis. The analysis completed for the motivation methods will identify the group's motives which are based on the Maslow hierarchy from the answers and reasons for analyses. These are the phase of the adoption as follows:

### 3.3.3 Base Agile methodology selection phase

The selection phase should be focusing its efforts on the methodology which is most suited for the organisation based on the type of company characteristics, the teams and the projects involved. In most cases the organisation should choose a methodology and adapt it accordingly to focus on the method as closely aligned as possible to the particular Agile method selected (Rasnacis & Berzisaa, 2016). Every methodology has its pros and cons; therefore, it is essential that organisations get this phase correct as it sets the organisation up for success or failure.

### 3.3.4 Methodology adaptation phase

The adaptations of the teams and projects will have beneficial outcome when the methodology requirements are matched according to the methodology implementation. The conflicts between the methodology and the organisations principles can be analysed and resolved by the correct adaptations of the methodology being implemented.

The elements of the methodology such as the roles, artefacts, processes, and practices need to be analysed during the adaptation phase for the transition to take place. These Agile roles can be managed accordingly by reorganising the current roles, introducing new Agile roles and also by adapting the Agile roles to existing roles. The organisation needs to examine the chosen roles and the implementation possibilities before the actual new role implementation can take place. These methods and guidelines that can be used are specially chosen for the adaptation process and are displayed in Figure 15.

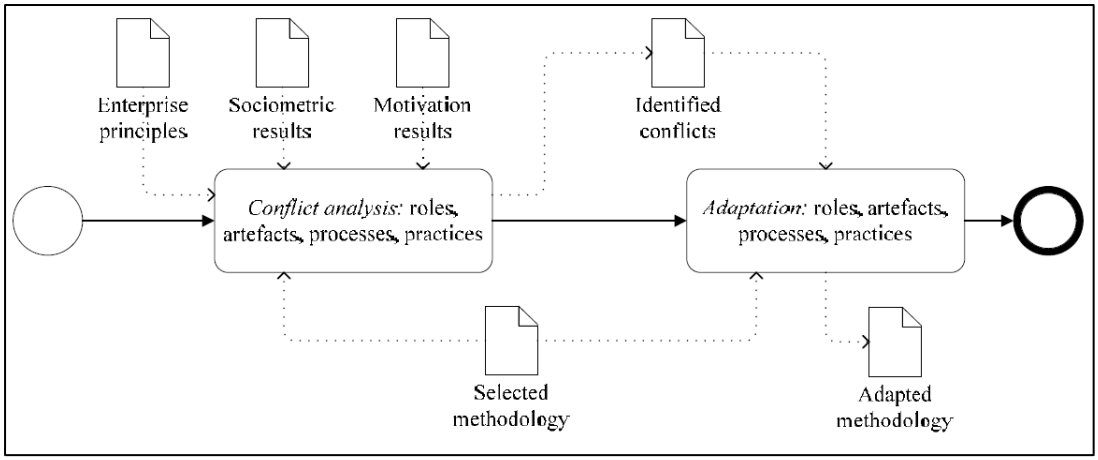



Figure 15: Overview of adaptation methodology phases
(Rasnacis & Berzisaa, 2016)

### 3.3.5 Methodology implementation phase

The final phase should focus the approach on starting small and then gradually adjusting as change is implemented throughout the organisation (Rasnacis & Berzisaa, 2016). The process improvements will produce enhanced quality, since the organisation has been preparing for a smooth transition, as shown in Figure 16.

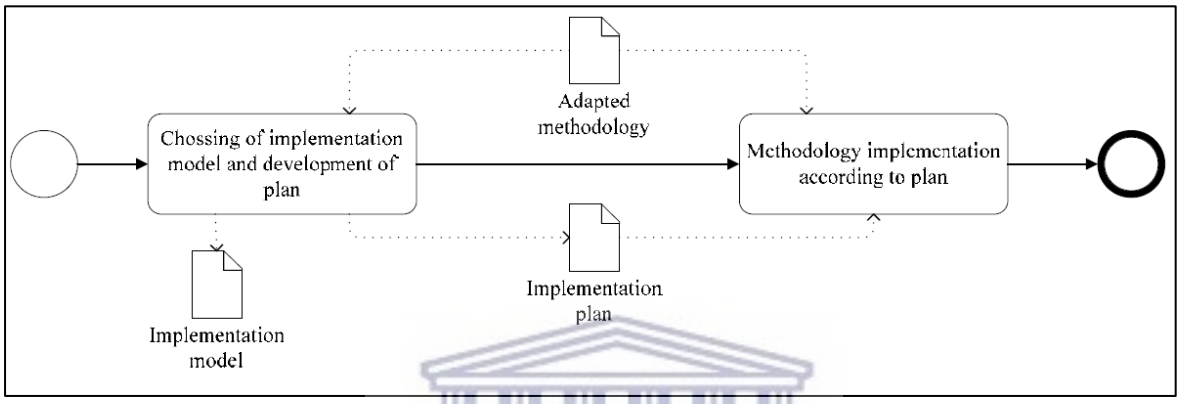



Figure 16: Methodology implementation phase
(Rasnacis & Berzisaa, 2016)

The general adoption framework has an approach that is phased, only on the completion of each phase, can the team continue onto the next phase. The approach is very standard and not organisation or industry specific; this allows flexibility so that all types of organisations can implement this adoption framework.

## 3.4 The Agile Adoption Process Framework

This adoption process, designed by (Singh, Kumar, & Bansal, 2015), looks at variables which if answered accordingly, will assess the readiness of a business for the Agile methodology to be implemented. These variables contribute towards the absence of the issues and give guidance and assistance through a structured approach. These variables determine:

- Whether the organisation is ready for agility
- Which practices should the organisation adopt
- The difficulties which could arise potentially when adopting them
- The preparations for the necessary practices

The Agile adoption process framework has attempted to deal with issues that have been mentioned through a structured and repeatable approach which guides the process for the efforts that are being made. The reason for the framework is to support the agile community where there is a demand for growth for those wanting to adopt the practices (Singh, Kumar, & Bansal, 2015). The Agile adoption framework uses the Sidky Agile Measurement Index (SAMI) as a measurement by the management who wish to identify the Agile potential of projects and organisations (Pahalavithana, 2017). For the best fit into the organisation's environment, the framework consists of a four-stage process that guides and assists the organisation.

The stages are as follows:

- Stage one: Identifying factors that could prevent the process from being successful.
- Stage two: Completing assessments of the SAMI for the determination of the targeted level of agility.
- Stage three: Assessing the readiness with SAMI for the agility
- Stage four: Reconciliation of those assessments completed for the determination of the targeted agility and readiness of the organisation.



As the stages outlined, the framework promotes successful adopting practices although there are more elements which need to be considered, all of which need to be interpreted by management (Pahalavithana, 2017). Below in Figure 17 is displayed the Overview of the Agile Adoption Process.

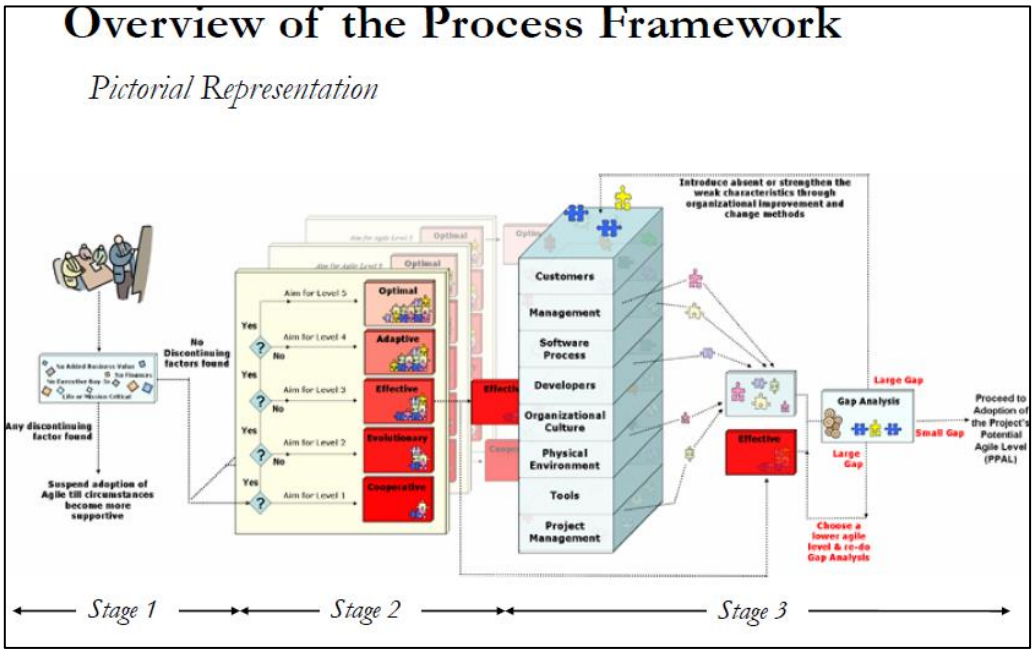



Figure 17: Overview of the Agile Adoption Process

(Sidky A. , 2006)

### 3.4.1 Agile measurement index

Organisations have to first be able to determine on how Agile they are able to become before thinking about how they are going to adopt Agile practices. The circumstances around the project and organisations are influenced by the Agile potential which refers to the extent of the likelihood that Agile can be adopted (Singh, Kumar, & Bansal, 2015).

The Agile measurement index consists of the following five components:

Agile levels are a set of practices that when adopted, will make a significant improvement when involved within the software development process, and they will support the realisation of the core values of agility.

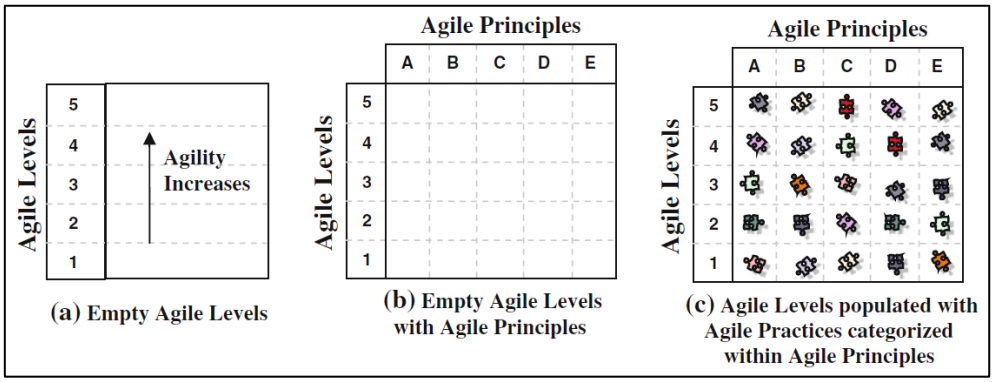



Figure 18: Agile Principles

(Sidky A. , 2006)

In Figure 18, these levels are used as a unit's measurement scale that accounts for the agility degrees of how likely the organisation or project will be suited for agility. The likelihood of agility within the organisation is expressed through the measurement scale which displays the highest level the organisation can achieve. The outcome of this scale will determine how much is still needed to be ready for this Agile development process so that it can be realised and embraced by the organisation. For example, once the elements of inheriting improved communication and process collaboration have been embodied within the development process then Agile level 1 has been achieved, Level 2 status can only be moved onto once Level 1 has achieved all its goals (or achievable).

These different levels of agility do not represent the qualities that an Agile method has but rather the core qualities of the Agile Manifesto. These core qualities have been identified through five important aspects which are used by the Sidky Agile Measurement Index (SAMI) (Pahalavithana, 2017):

#### *3.4.1.1 Level 1: Collaboration*

The level means that all the stakeholders have developed and are growing good communication and collaboration. This is the foundation on which the Agile development process is built.



#### *3.4.1.2 Level 2: Evolutionary*

The evolutionary development is fundamental, it is assumed present within every Agile method because it represents the early and continuous delivery of software.

#### *3.4.1.3 Level 3: Effective*

The level improves the efficiency of the process development by adopting practices from engineering which can deliver higher quality working software. The process is therefore developed by allowing responses to change within the requirements without jeopardy of the systems software that is being developed.

#### *3.4.1.4 Level 4: Adaptive*

This level establishes the responsiveness to change in the process without interfering with the quality. The adaptiveness responds to multiple levels of feedback a feature which is essential to this level.

#### *3.4.1.5 Level 5: Encompassing*

An organisation has to adapt to a new culture within its processes since the nature of Agile is that it needs an environment that is reflective and supportive of the software development process. This level ensures that throughout the organisation there is a focus on establishing an encompassing environment for continuous acceptance.

These levels are designed from Agile practices that ensure quality is introduced and sustainable at each level (Singh, Kumar, & Bansal, 2015). Each of the agile levels is composed of a set of agile practices that introduce and sustain the agile quality pertinent to that level. The practices and concepts which are assigned to a level are based on the guidance of the measurement index component that are Agile principles.



### 3.4.2 Agile Principles

Agile principles in essence are the guidelines or characteristics that needs to reflect within the organisations processes to ensure that the development process is Agile and for it to be considered as Agile. For example, two key agile principles can be considered: human centric and technical excellence. Human centric refers to the reliance on the interactions between the people whilst technical excellence means that the highest quality of code is ensured by the use of correct procedures. Agile Manifesto explains the 12 most important principles that are characterized as agile development processes (Abdalhamid & Mishra, 2017). Once they have been grouped and summarized, there are six most essential points which can be defined as:

#### *3.4.2.1 Embracing change to deliver customer value*

Customer value is delivered through the efforts of a successful software development process. in many cases, the team and customer are in a learning process that is continuous as the requirements that are necessary to realize improved customer value reveal

themselves. Therefore, an attitude that welcomes and embraces change would be beneficial as it should be maintained throughout the efforts of development.

#### *3.4.2.2 Planning and delivering software frequently*

The delivery of working software should be completed early and frequently as this permits customer to review and provide feedback sooner. The planning for iterations can be shaped with more detailed direction and scope if the development is guided by this feedback which is provided by the customer. The human centric aspect is therefore the core function since the communication between the team and customer is the cornerstone of the definition of Agile software processes.

#### *3.4.2.3 Technical excellence*

High quality code is what Agile developers strive for as it leads to a faster development environment which is a characteristic of Agile. The code is not compromised by time but yet it is still providing quality in a shorter amount of time. This situation gives the team more development time.



#### *3.4.2.4 Customer collaboration*

This stems from the agile manifesto focus statement, which encourages significant and frequent interaction between the development team, the customers, and the stakeholders in order to ensure that the final product satisfies the customer's needs. The Agile principles are therefore used to ensure that agile levels are embedded within the characteristics of agility. The Agile quality is promoted through the principles which are reflected in the agile practices. For example, all these practices within the Effective Level will promote the development of high-quality code and working software which is displayed an effective manner. The objective is therefore achieved and determined by the Agile principles which are spanning each level. At the same time, these technical excellence principles promote the objective by focusing on the development of the technical aspects of the processes while the practices of human centric promote development in the human aspect process.

### *3.4.2.5 Agile practices and concepts:*

There are concrete activities and practical techniques which are used in development and management when dealing with software projects which are consistent with Agile principles. For example, components such as paired programming, user stories and collaborative planning are all Agile practices. The basic foundation of the Agile measurement index are the Agile levels; they consist of the practices which are composed of the principles. The level has only been reached/achieved once the practices that are related to the level have been adopted.

### *3.4.2.6 Indicators*

These indicators are used for the assessor who questions the separate parts of the characteristics such as the people, culture, and environment for their readiness to adopt a practice within the organisation. These practices are the supporting components that are used in the production of the software development processes. The principles are seen as goals which introduce the goal-question-indicator-metric (GQIM) which was designed by Basili and Rombach and which was evolved by Park et al. at the Software Engineering Institute (Singh, Kumar, & Bansal, 2015). This paradigm has designed an approach for moving from goals to the measures used to deal with the agility issue through decision making. Based on these goals set by agility, a designed approach has been derived which can determine the extent to which the goal has been met.

The answers to the questions provide a set of indicators that are mapped by their metrics and are accompanied by each Agile practice within the measurement index. These indicators give the particular characteristic measurement which is essential for a successful adoption of the practice and is related to an indicator. These metrics and indicators are used by the Agile coach to determine the readiness of adoption within the organisations processes. For example, the coach would like to understand to what extent the coding standards are ready for this adoption (Level 1, technical excellence). Therefore, two of the characteristics need to be assessed to understand firstly, how much the developer understands the benefits behind the coding standards, and secondly, how able/willing they are to be conformed to having coding standards. These types of indicators are used to understand and assess each of the characteristics such as willingness to accept change and will the participants abide by these standards even when under pressure from a time aspect.

The Sidkly Agile Measurement Index consists of around 300 different indicators for at least 40 different Agile practices.

## 3.5 The Agile software development adoption framework

The four-stage agile adoption framework is steady and is known as the backbone of the assessment process (Pahalavithana, 2017). In Figure 19, the organisation must determine whether or not it is ready to move towards agility, based on the assessment components. The process identifies which practice the organisation should adopt using the guidance and assistance of the agile coach who leads the process.

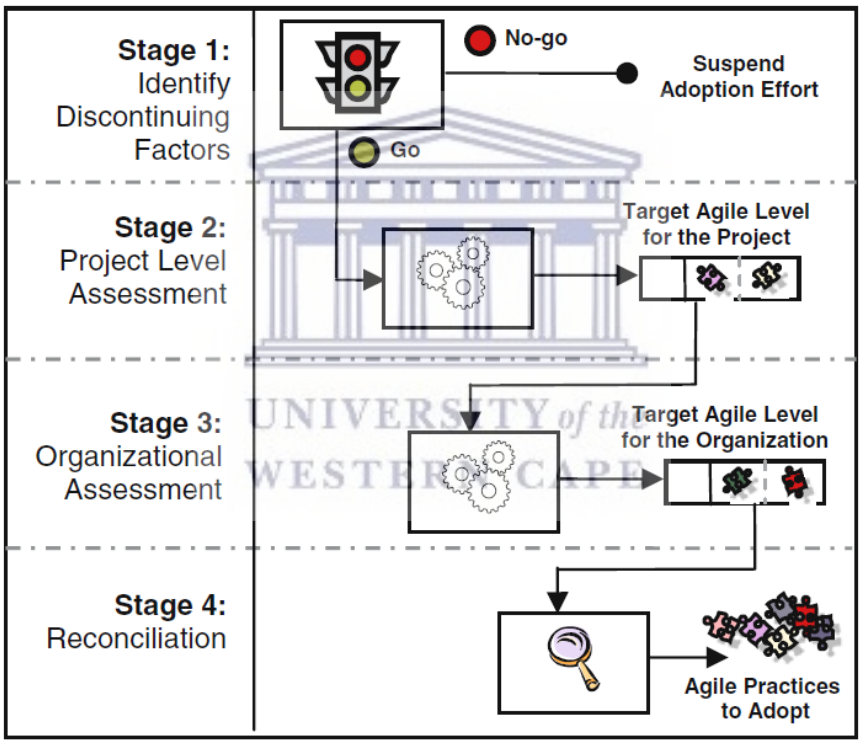



Figure 19: Overview of the Agile Adoption Framework
(Sidky, Arthur, & Bohner, 2007)

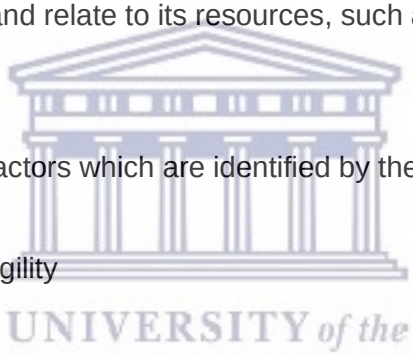
The organisation needs to decide whether or not it will accept the agile adoption initiative as the first objective step at the beginning the journey. In order for the adoption to proceed, a pre-assessment phase needs to be completed before the initiative is decided on as the practices are fundamentally a software process improvement (SPI) undertaking.

Traditionally when an organisation is planning to commence an SPI initiative, there is a pre-assessment to determine the organisation's abilities. (Singh, Kumar, & Bansal, 2015).

Organisations that do not implement the SPI due to the lack of factors are considered to be "not ready" for an Agile adoption, and it is therefore postponed until those missing factors are present. Any factors that exist that would be barriers then need to be eliminated, allows for the continuation of the adoption effort. These assessment processes prevent an initiative failing by identifying the missing factors; this is important as it saves the organisation time, money, and effort. The stage 1 of the process is described below; it guides and assists in the adoption of the agile practices by identifying whether or not the organisation is ready. The pre-assessment activity identifies any discontinuing factors that will prevent adoption.

### *3.5.1 Stage 1: Identifying discontinuing factors*

These key factors must be identified within stage 1 of the process; stage 1 alerts the organisation to any missing factors. These factors which are called discounting factors are different for each organisation and relate to its resources, such as the leadership, money, time, and effort.




Below are three discontinuing factors which are identified by the framework:

1. Inappropriate need for agility

It specifically views the situation from a business and software development perspective assessing whether or not agility will add any value to the organisation's processes.

2. Lack of sufficient funds

If the organisation lacks sufficient funds to support the adoption effort, then the process is not feasible.

3. Absence of executive support

Change in the organisation will not happen if there is no committed support from the executive sponsors; this is another reason or non- adoption.

If any of these three discontinuing factors are identified by the SPI, the organisation is deemed unprepared for moving towards agility and should not proceed until there is more support for the adoption environment (Dubey & Gunasekaran, 2015). The evaluation of each

organisational characteristic is assessed by the assessor who uses one or more of a set of indicators. For example, the second characteristic needs to know what funds are available. An indicator therefore uses questions to assess the funding available and whether the funds can be spent on any activity that would deliver process improvement. The indicator may lead on to more questions to ascertain if there are any restrictions on the types of activity for which the funding can be used. These indicators are included in the adoption framework for the assessment of the discontinuing factors within the organisation.

The agile journey can begin if the stage 1 indicators have identified and eliminated any factors which would not allow the process development to take place. Now the organisation must determine the most suitable Agile practices and concepts to adopt. The appropriate agile practices are determined by assessing the ability of each particular project to adopt the agile adoption framework and not the entire organisation. The degree of agility can be different as it depends on the context which is the basis of the framework. The project is therefore given guidelines which identify the most suitable practices; these are provided by the last three stages of the process.

### *3.5.2 Stage 2: Project level assessment*

The SAMI is utilized in the second stage of the adoption process to identify the agility level that the project can achieve (Dubey & Gunasekaran, 2015). Projects aspire to reach this highest level of agility, however, in reality there are obstacles that are out of the organisation's control. These circumstances therefore affect the organisations adoption ability and limit the level of the agility which the projects can reach. Face to face communication is an example of level three agility which is a desirable level to aim for and this type of factor, which is dependent on near team proximity, is needed to facilitate this practice.

The organisation has no say when assuming the project has these obstacles as they are out of the organisations control. If the assessment level shows that there is a factor missing (for example, near team proximity) then the agility level for the project would be the same level as is found in the agile practice, which is level three. The circumstances which are outside of the organisations control therefore influence the highest level of agility which can be achieved (Palminteri & Wilcox, 2017). The assessment level is identifying the practices and concepts that the successful adoption levels rely on. The agile practices are therefore limited if the characteristics of the project need support practices that are not present. The

attainable level of agility is limited when the inability to adopt the practice is caused by constraints.

The target level is determined in stage two of the assessment process. It specifically examines the factors which are associated with the limitations of agile practices and the extent to which they are present within the measurement process. The indicators that are related to the limiting agile practices are what the assessment uses to conduct its identifications. The process begins at stage one which examines the limiting practices which would then follow on upward on the scale (Abdalhamid & Mishra, 2017). When the factors are found that are missing within the adoption process, the assessment would then stop, and therefore set the highest-level agility attainable where the limiting practice is found. In summary, once the discovery of the limiting adopting practice or concept is not found, it is then when the target level of agility is set, and no organisation influence can be made to change the circumstances of the result. Once this target level has been identified, the determination of the set of agile practices is conducted through the assessment which is done through the journey of the organisations readiness that can be adopted.

### *3.5.3 Stage 3: Organizational readiness assessment:*

Once the target level has been established, the next determination is the extent to which the project can accommodate the process development. The identification of the target level does not mean that the organisation is able to reach that level. The level of achievement depends on, the readiness to adopt new practices and concepts and this is assessed to be the target level.

The probability of a successful transition for agility is increased when time and effort is spent on the pre-adoption phase as this minimizes the risks associated with the agile adoption process. These target level to be achieved is determined by the indicators. The target level is used as a basis for the assessment stage because the organisation will save time and money by using and adopting the assessment of the readiness which is related to the five agile levels (Abdalhamid & Mishra, 2017). The extent to which organisation characteristics are associated with the agile practices, is measured by the assessor's set of indicators. The readiness assessment to adopt the concept is determined by the organisational characteristics that need to be present within the organisation, such as a collaborative management style, a management that supports adoption, management transparency and a general support of the agile adoption practice.

A range of questions is used to assess the organisations characteristics and depending on the questions, the answers would be given by the manager, developer, or the assessor. The characteristics of the organisation are related to the agile practices and concepts which the SAMI measures through the 300 indicators. The extent of an organisations achievement is (the result of) determined at the organisation's assessment stage (Abdalhamid & Mishra, 2017). This method allows attention to be focussed on those characteristics that the organisation needs to attend to, those that might cause the adoption to fail. Therefore, if there are characteristics that are unachievable, then this indicates that the organisation is not ready for an adoption to take place. Hence the level of agility which can be achieved is limited if an organisational characteristic is missing and cannot be found.

### *3.5.4 Stage 4: Reconciliation:*

This is the stage that allows for the most progress to be made, by settling the differences. Identification of the target level and the organisations readiness are used to determine the final set of practices which will be implemented.

There are three different scenarios which is possible during this stage:

1) Organization readiness > project target level:



When the organisations readiness is more than the target level, there is no reconciliation needed since such measurements allow agile practices to be chosen for the adoption. These cases where the project environment is contained within the organisation's characteristics, are very rare.

2) Organization readiness level = project target level:

No reconciliation is necessary as the chosen adoption practices are equal to what is required for the organisation and the project level. Such situations are ideal as the project is achieving its 100% potential of agile level.

3) Organization readiness level<project target level:

In this case steps are needed to achieve reconciliation, as the readiness is below the target. Reconciliation can be completed using one of two options:

Option 1:

This option relies on the readiness and willingness of the organisation to adopt process changes and improvements. The results of the assessments will identify which characteristics are preventing the organisation from achieving the agility level (project level) (Shahzeydi & Gandomani, 2016). If the characteristics have to be changed, then the organisation has to undertake the steps for the improvement. Once changes have been implemented successfully, the organisation is able to achieve the project target level.

Option 2:

This option is for the organisation that prefers to just adopt practices that are within their current capacity. This course of action saves the organisation from putting time, effort, and money into the process for making change (Shahzeydi & Gandomani, 2016). Therefore, it is recommended that organisations only adopt the practices that they are ready for. This option permits the project to be restricted to not operating at a full agile potential level.

This stage it shows what practices the organisation can realistically adopt. The stage gives guidance for improvements to enable the project to reach a higher potential of agile. The organisation can reduce the impact of the adoption process by utilizing this approach; by making sure that the necessary preparations take place before the introduction of the practices into the development process.

## 3.6 Framework for Agile Method Adoption – Conceptual Framework

This is the section of this chapter that is written specifically for the Financial Industry of South Africa for the Adoption of Agile methods into their organisations. These methods that follow are based on the above-mentioned adoption frameworks which have been selected from the best adoption methods within the industry.

### 3.6.1 Preparation phase

In this phase the basic preparations for change within the organisation are made where employees and systems carry out the necessary evaluations and put processes into place for making agile adoption an easily transition. The physical processes of the organisation will be changing which will force the users to be open minded and think out of the box (Rasnacis

& Berzisaa, 2016). The employees need to be educated around the abilities which the Agile methodology will bring so that they understand the usefulness of the methodology in achieving the organisation's goals and milestones. The factors which prepare the organisation are linked to the awareness, desire, ability, promotion of the employees, and their ability to transfer their thinking in order to appreciate the impact upon the structure and the methodology improvements.

#### *3.6.1.1 Change management*

These preparation actions are then communicated to the organisation; this initiates the Agile intervention that will assist with the development of the software. Change management means that the leaders have to be the strategists for their employers. Change management therefore needs to be understood and conceptualised so that the whole organisation knows what is being changed. The organisation consists of four major aspects: tasks, people, technology, and structure. The production core of the organisation consists of the first three in this list. The technology is utilised by the people to execute those tasks that have been set out by the organisation. The production core is governed by the structure which is the framework. Change management consists of changing one or more of these parts within the organisation (Karud & Årvik, 2017). Educating the informal leaders and managers of Agile ensures that the correct steps are followed for this preparation phase. The employees as well as the organisation and the infrastructure need to adapt to this new way of working. The environmental changes should be considered when striving for a more dynamic and flexible organisation.

#### *3.6.1.2 Leadership Agility*

Leadership agility is the ability to effectively lead the employees when there is rapid change and uncertainty which requires multiple views and priorities for consideration. The process is accomplished by understanding the real time conditions when a decision needs to be made in order to gain a broad perspective and new insight into what needs to be done. This process requires the use of enhanced awareness and intentional effectiveness for the benefit of the organisation. According to (Karud & Årvik, 2017), there are 5 levels of leadership agility that mangers and leaders should follow in order to establish and improve a sustainable leadership in an unpredictable environment. These levels can be incorporated with three kinds of actions: pivotal, team-focused, and organisational.

The 5 levels are as follows:

1. Expert
2. Achiever
3. Catalyst
4. Co-creator
5. Synergist

These levels demonstrate the strength of leadership that has the ultimate goal of reaching the final level of Synergist. The Expert (1) is a professional with knowledge and position, the Achiever (2) is not only focused on authority but is also the motivator of people.
The Catalyst (3) ensures that culture is important in the organisation and the Co-creator (4) delegates responsibilities and stands behind working autonomously. Finally, the Synergist (5) combines all these responsibilities into a master in Agile leadership. Complexity and response to change increase with every level. (Detollenaere, 2017)

### *3.6.1.3 Organisation functioning*

Agility does not only influence the organisation but also its functionality; this is what encourages companies to follow this path in order to be transformed drastically. These factors that have been transformed enable the organisational structure to make fast and unexpected decisions. The organisation's culture should reveal a behaviour change through its way of working. The organisation's objectives with relation to the change should be well formed; there should be a clear understanding of how these changes will influence the outcomes for the organisation. The organisation's workforce should display this agile attitude as its essential in order for the organisation to survive. It is the technological infrastructure, the knowledge culture as well as the empowerment of employees which support the workforce in order to create an efficient workflow. These changes will make the organisation adaptive, flexible, and also dynamic, all of which will redefine the existing organisation.

### *3.6.1.4 Employee Analysis*

This phase specifically focuses on motivating the employees it is important to build good relationships amongst the team as the methodology affects each member differently, but everyone has to adapt accordingly to accept the change. This phase is also where the information is shared about how the different roles in the adoption will be shared so that

each employee in the adoption process understands their part. The phase has analysis tools which are based on two methods known as sociometric and motivation. The sociometric is a quantitative survey which understands the interpersonal relationships and those of small social groups (Rasnacis & Berzisaa, 2016).

The surveys can be completed both formally and informally apply to any situation that a team member is dealing with. The motivational research method is used to understand the factors that motivate and undercover the problems; the method is based on Maslows hierarchy of needs (Rasnacis & Berzisaa, 2016). These methods both follow basic steps which are used to manage the process: preparation, data collection and data analysis. The organisation should provide a clear vision to the workforce, but before the adaptive transformation environment can be begin, the organisation needs to change within.

The employee analysis determines the readiness of the workforce and understands what more needs to be done with the employees before beginning any transformation. The employees are a major component as they will need to be more adaptive and flexible with their decision making when designing solutions. The organisation will need to have training sessions implemented for the workforce to enable their understanding and knowledge of the new methods.



### 3.6.2 Base methodology

After the Preparation phase, the adoption process should enter the Base methodology phase. This is the selection process that examines the current Agile methodologies (refer to section 2.4) which are: Waterfall Methodology, Scrum Methodology, Extreme Programming, Lean Methodology, Kanban, Scaled Agile Framework and Feature Driven Development.

The base methodology is important as this will determine how the organisation needs to adapt their adoption process to fit the methodology. In most cases the organisation should choose a methodology and adapt it to be as closely aligned as possible to the selected Agile method (Rasnacis & Berzisaa, 2016). Every methodology has its pros and cons; therefore, it is essential that organisations get this phase correct as this choice sets the organisation up for success or failure.

The base method selected should align as closely as possible to the organisation's culture and ways of working, as this method is the one most likely to be adopted. This chosen

method needs to be analysed and understood before making any amendments. It will be adjusted and changed to fit the organisations needs within its processes and structure.

For example, the traditional Agile Adoption selection process takes place in the following order: Scrum methodology, Kanban Methodology, Lean Methodology and Extreme programming. The reason for this order is that there is a focus in the beginning on team management (Scrum methodology), then on project management (Kanban methodology and Lean methodology) and finally on the development of management (Extreme Programming).

Smaller companies, more often than not, have no specific plan in mind. The changes that happen are those that are obvious, such as the technological infrastructure and the processes that are without supportive components like culture and structure. In the beginning, there are always challenges that need to be overcome, these challenges are however minor since the organisation can handle the environment based on the chosen approach. The adaptability and flexibility of the organisation will need to change quickly as the environment changes and evolves. The organisation will need to structurally transform by seeking out processes and systems that can provide a sustainable solution for this transformation.



### 3.6.3 Adoption and Implementation

The adaptations of the teams and projects will have a better outcome when the methodology requirements are matched well to the methodology implementation. The conflicts between the methodology and the organisation's principles have to be analysed and are then resolved by making adaptations to the methodology being implemented. The elements of the methodology such as the roles, artefacts, processes, and practices need to be analysed during the adaptation phase for the transition to take place. These Agile roles can be managed accordingly by reorganising the current roles, introducing new Agile roles and also by adapting the Agile roles to its existing roles. The organisation will need to examine the chosen roles and the implementation possibilities before the new role implementation can actually take place.

The final phase should focus the approach on starting small and then gradually adjusting as change is implemented throughout the organisation (Rasnacis & Berzisaa, 2016). The process improvements will give enhanced quality since the organisation has been preparing for a smooth transition. The general adoption framework has an approach that is phased;

each phase must be completed before the next phase can begin. The approach is very standard and not organisation or industry specific; gives flexibility so that all types of organisations can implement this adoption framework.

### 3.6.4 Innovation

Innovative measures are required for the development of abilities that will not only provide an effective response to the changes in the business environment but will also lead to accomplishing effectiveness, efficiency, and customer satisfaction. Responding quickly to the changing environment, being flexible within the operations and achieving competency can be achieved by the implementation of innovation practices, tools, and techniques by management. For organisations to produce products, services or processes that possess novelty standards in a world that is increasingly volatile, requires innovation to be an important feature within the agile enterprise in order to adapt to constantly changing environments.

The innovation process gains knowledge through the market's information, this information is used in an Agile enterprise as an impulse to react and respond in order to implement new standards. For the enterprise to identify these opportunities through the market and to make those impulse decisions having gained new information, they need to have the ability to analyse and evaluate their resources and obtain the necessary resources for their innovation needs (Olak & Rzepka, 2017).

## 3.7 Innovation through Agile Methodologies

Based on the methodologies presented, Agility allows an organisation to adapt to projects and deal with a changing environment. Agility therefore forces innovation in the organisation, as constantly new ways of thinking are needed to cope with the adapting methodologies for the completion of project work (Olak & Rzepka, 2017). One of the Agility aspects is that the conceptual model which drives designing and learning, provides a loop of sensing and responding, this leads to innovation. Innovation is seen as the experimentation and discovery which forms part of the production of organisational learning. These learning methods usually take place during the system designing and learning space, which is a basis of continual learning activities for process improvements. A study has been completed by (Palminteri & Wilcox, 2017), using 15 participants, about understanding how knowledge is shared through the use of Agile Methodology. The results reveal that there have been direct

relationships between the application of an Agile mind-set and the innovation of an employee. As Agile thinking becomes more dominant within the development space, not only has it been seen in the IT industry, but the innovation has now been used to maintain a competitive edge amongst the users. Figure 20 is a visual of the research completed:

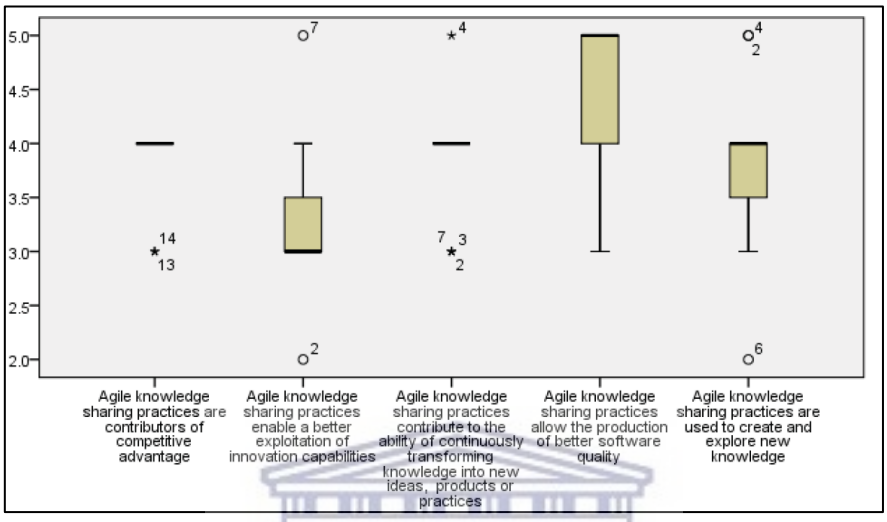



Figure 20: Boxplot - Agile knowledge sharing as enabler of innovation measurements (Palminteri & Wilcox, 2017)

Innovation is understood as a process when there is learning and knowledge creation because new problems have been resolved by developing new knowledge. This process is based on ideas that are filtered, developed, modified, and then finally implemented. Innovation can basically be seen as the creation and implementation of new ideas that are meant to deliver commercial benefits to the organisation. Innovation begins with the organisation's employees, it is their ideas, creativity and problem-solving abilities that can be classified according to the changes they bring (Palminteri & Wilcox, 2017).

The solutions to challenges that are faced by management rely heavily on people and being able to find the niche solution requires a unique product resulting from the implementation of an innovation process (Balcerzak & Pietryka, 2017).

To identify the connections between agility and innovation, various studies have been conducted in different contexts. Theoretical analysis has been completed by researching various dimensions that are a part of the business functionality. The result of this research has proved that there is a close connection between agility attributes, and their contribution to the innovative capacity of an enterprise (Rzepka, 2017). In Figure 21, the table shows the research that is connected with the influence of the agility of an enterprise on innovation.

| Researcher | The result of research |
|---|---|
| V. Sambamurthy, A. Bharadwaj and V. Grover | - indicating a significant impact of investments made in innovation in the field of IT, supported by the attributes of agility on the company's success and gaining competitive advantage |
| R. Raschke | - indicating a positive correlation between IT infrastructure flexibility and agility of business processes<br>- indicating a positive correlation between the agility of business processes and the effectiveness and quality of business performance of an enterprise |
| A. Shahin, M. Nikjoot and A. Nilipour | - indicating a close relationship between the internal and external factors and product innovation<br>- indicating that the introduction of innovative products and services in the last five years, and a higher rate of success in the implementation of new products and services in relation to competitors, is a derivative of achieving product innovation<br>- indicating that there is a link between internal (strategy, organizational structure, information system, the personality of employees) and external factors (network of business partners, the level of science and technology, the presence of network communication and transfer of information) and process innovation |
| C. Wang and P. Ahmed | - enumerating indicators for product and process innovations<br>- identifying indicators in terms of product innovation as: the increased number of innovations compared to competitors; recognizing the company as an active organization in introducing innovative products or services; describing products of a particular company as innovative; high success rate in the area of introduction of new products and services in relation to competition |

Figure 21: List of research on how the agility of an organisation influences innovation (Olak & Rzepka, 2017)



The research presented in Figure 21 has confirmed that there is a close connection between the formation of agility features and obtaining innovation at a high level. The introduction of innovation can encourage rapid decisions whereby new challenges align with the organisation's paradigm of agility (Olak & Rzepka, 2017).

The competitive position of an enterprise is never permanent as there are unpredictable and volatile aspects which affect the environment when adapting to change. This means that the organisation should be constantly looking for ways to improve and survive these challenges and in order to do so, the following attributes of agility features should be included:

- Speed and flexibility
- Response to change and uncertainty
- Launching key competences
- Synthesis of different technologies
- Company integration

An organisation that has those attributes will be able to be successful and innovative. These studies have shown that agility and innovation work together and having these attributes ensures that the enterprise will be in a better competitive position and maintain a higher level of innovation (Rzepka, 2017).

The tool of Agile methods has the power to accelerate discovery and innovation within the development. The acceleration of discovery and innovation has been identified through the creativity support tools. This then poses the question of how these program designers that develop these interfaces and interactive tools enable people to be more creative more frequently. According to one of the most prominent leaders in the field of human-computer interaction, Ben Schneiderman, there is a four-stage framework for creativity which can assist the design for the users by supplying the correct tools (Olak & Rzepka, 2017).

1. Collect – the gathering and learning of information through previous work that has been stored online or in libraries.

2. Relate – consultation with peers and mentors for the understanding

3. Create – exploring, composing, and evaluating possible solutions on previous work where there are gaps

4. Donate – provide results/outcomes and contribute to libraries



Shneiderman (2000) emphasises that “Education could expand from acquiring facts, studying existing knowledge, and developing critical thinking, to include more emphasis on creating novel artefacts, insights, or performances”.

Universities have successful examples of these processes which have been shown through the use of cross-disciplinary design research. These creativity and innovation processes have been established through student engagement where parameters and principles have been helpful with organizing and conducting the work. A variety of projects have been developed whereby these parameters and principles have been illustrated. With the focus on making, creativity has been seen through the ability to make things.

Warr & O’Neill (2015) have shown the understanding and analysis of design as social activity. Identifying the theoretical account of why social creativity should be more effective

than individual creativity, three social influences on design explain their findings to the contrary in terms of social blocking, evaluation apprehension and free riding.

### *3.7.1 Social blocking*

Social blocking occurs when a group expresses their ideas verbally in a way which has the potential to harm the group's creativity. If ideas are not be expressed simultaneously other members feel prohibited from expressing their ideas. For the effects of social blocking to be mitigated, researchers have introduced synchronous forms which allow members of the group to express their ideas through writing and distributing them to all members of the group.

### *3.7.2 Evaluation apprehension*

This happens when members are afraid to express their ideas and materialise their thoughts because of the possibility of being criticised by other members of the group. This type of fear within the group reduces the quantity of ideas being expressed which ultimately reduces the overall innovation and creativity. The way to mitigate this is by having members express their ideas anonymously; by removing their identities, the members are encouraged to express more ideas.



### *3.7.3 Free riding*

This is also known as social lofting, where members become lazy and begin to rely on other members in the group. This leads to them not contributing as many ideas as they could. Increasing the accountability for each member's performance encourages a higher motivation level and social stimulation which reduces the number of free riders.

Authors therefore suggest that research should support the innovation design process by focusing on mitigating these social influences effects on creativity of a whole team's design (Warr & O'Neill, 2015). Authors have also identified and examined the differences in software developers' creative styles. The expectation is that those who are innovators would show higher levels of job satisfaction and performance than those who are less innovative. A survey has been conducted with firms that have client/server development. The results have shown that there is a pattern to the creative styles of the employees, their attitudes to innovation, their job satisfaction, and their performance (Olak & Rzepka, 2017).

## 3.8 Summary

Based on this review of the literature, it has been found that the Preparation and Analysis phase of Agile Adoption is well covered. However, the phases of Base Methodology, Adoption and Implementation and Innovation, are not so well covered. These views are displayed in Figure 22 below. The table below highlights the themes from literature and identifies the gaps in literature which could be expanded on.

| Adoption Phase | Factors influencing Agile Adoption - from General Adoption Framework (3.3) | Factors influencing Agile Adoption - from the Agile Adoption Process Framework (3.4) | Factors from Innovation studies (3.7) | Survey Questions (Chapter 5) |
|---|---|---|---|---|
| Preparation and analysis | • Organizational change management capability<br>• Employee change management capability<br>• Employee level of experience | • Organisational cultural change and transition<br>• Agile Training and education (People)<br>• Team Dynamics/Communication<br>• Technical practices change management<br>• Project Management to ensure deadlines are met<br>• Process integration ability<br>• Productivity management<br>• Quality assurance | | • Question 4 – 8 |
| Prepare for Base Methodology | • Technology preparation/maturity<br>• Team Dynamics/Communication<br>• Project Management | | | • Question 9 |
| Adoption and Implementation | • Organisational principles aligned with methodology<br>• Analysing processes and practices during transition<br>• Productivity measurement<br>• Project Management<br>• Process Change Management | | | • Question 13 - 19<br>• Question 23 - 24<br>• Question 26 – 27<br>• Question 32 |
| Innovation | | | • Learning and knowledge creation through problem solving<br>• Innovation through Team Dynamics/Communication<br>• Innovation through Knowledge sharing | • Question 11 – 12<br>• Question 31 & 33 |

Figure 22: Literature review summary


Figure 23: Key success factors from Literature

# Chapter 4 – Research design and methodology

This chapter covers the Research Approach, Research Strategies, Research Methodology Choices, Time horizon, and Data collection Techniques and Procedures chosen for this study towards answering the research question using the Research Onion as presented in Figure 24.

The primary research question for this study is:

“What are the key success factors for Agile Software Development Methodology adoption within the Financial Industries in South Africa?”

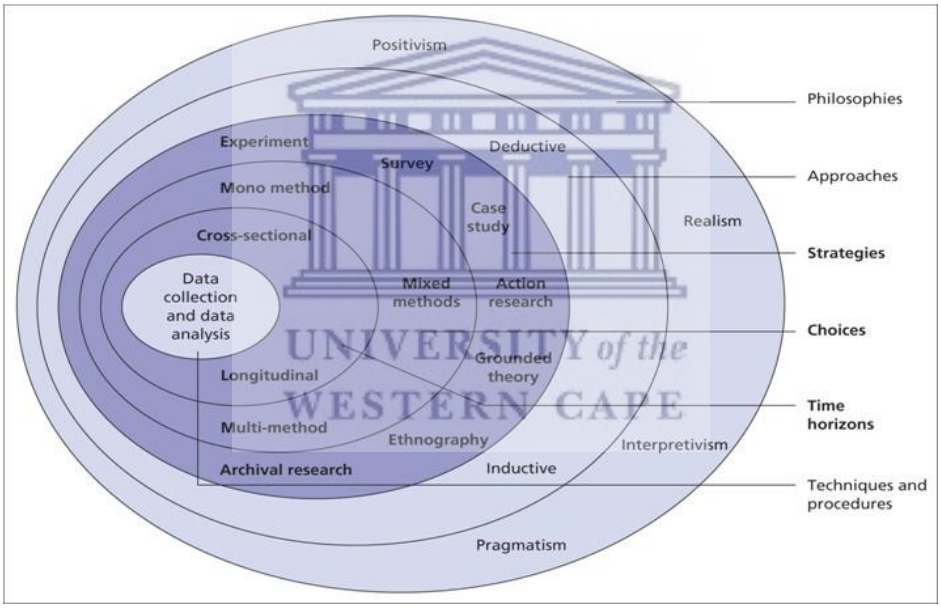



Figure 24: Research Onion
(Saunders, Lewis, & Thornhill, 2019)

## 4.1 Research Approach

There are currently 2 research approaches according to (Saunders, Lewis, & Thornhill, 2019), inductive and deductive as depicted in Figure 24.

The Inductive approach uses observations and theories to search for patterns. It aims to generate meaningful patterns and relationships that build a theory. There are however no limitations as to the use of existing theories to formulate the relevant questions that needs to

be explored. The patterns, resemblances and regularities that are experienced (premises) are observed for the generation of theory. These learnings are therefore based on the experiences that are observed to reach conclusions (Wilson, 2016).

The Deductive approach is the reasoning that is applied to general theories and principles that are aimed at reaching a specific consequence. This consequence, which is also known as a conclusion, is based on the assumptions and premises by which it is presented. The hypotheses are narrowed down, and the premises are tested through further observations and experiments to determine a conclusion. The approach uses that of a mathematical induction whereby it is based on deduction (Abdalhamid & Mishra, 2017). The method is also known as the “top-down approach” as it first looks at the theory, followed by hypothesis, observations, and confirmation.

The approach which was used for this research was the Deduction method, as the research completed was to test and understand the use of the different theories of Agile adoption methods which allow for improved innovation within the Financial Industry.

## 4.2 Research Strategies



Viable research strategy options for answering the main research question of this study include surveys, interviews, and case study approaches. In this section, each option is defined and the choice of strategy: surveys is clarified.

The survey strategy is often directly linked to the deductive research approach. However, surveys tend to also be used when doing quantitative research projects; surveys can use a representative sampling method using only a proportion of the population. A survey is “one of the finest and economical research strategies” according to (Thesismind, 2019) as it captures rich and reliable data. This publication also mentions that “The Survey strategy is mostly used to observe contributing variables among different data. It permits the collection of vast data that will be used to answer the research question.”

The Interview strategy presents open-ended questions to the respondents; this is generally a qualitative research technique. There are multiple methods within this strategy that allow for data collection, such as, personal interviews, telephonic interviews and email or web page interviews. In each scenario, the interviewer is the subject matter expert who intends to understand the respondent’s answers through a series of questions. Interviews are similar to

surveys as far as the data gathering methods are concerned but entirely different in other ways as the groups are smaller and surveys are often quantitative in nature. An interview that is effective is one where the necessary data is provided concerning the objectives of the study and the decisions made by the researchers are made using this information.

The case study strategy is a focused approach as it can offer insights, specifically into the nature of any example and establish the importance of cultural and contextual differences. Case studies allow for the exploration and investigation of the contemporary real-life phenomenon with detailed contextual analysis of a number of events, conditions, and their relations (Yin, 2003). Yin also identifies the following components which are applicable to case studies: the study's questions, the propositions (if any), the units of analysis, linking data to the propositions and the criteria for the interpretation of the findings (Yin, 2003). This approach could not be used in 2020 due to the restrictions that were put in place because of the Corona Virus global pandemic.

The research strategy used for the collection of data was through the use of a survey. The reason for this strategy was that the respondents could think about their answers before responding and with no time pressures like there is in an interview. This approach allows the respondents to provide their honest perspective on the topic. This method is the only method that allows for these capabilities, which ensures that the results from which conclusions are drawn, are more accurate.



Survey describes the population through its characteristics, no other research method can provide this broad capability. This method uses a particular sample to gather targeted results from which to draw conclusions and make important decisions. Surveys that are conducted anonymously are seen to provide an avenue for more honesty and unambiguous responses compared to other types of strategies, especially when it's stated that the survey answers will remain confidential. These are the research questions to be answered:

Primary Research Question:

- What are the key success factors for Agile Software Development Methodology adoption within the Financial Industries in South Africa?

Secondary Questions:

- Which Agile Software Development Methodologies are being adopted by financial industry organizations in South Africa?
- What Agile adoption frameworks were used by these organisations?
- What challenges were experienced by industry during the adoption process?
- What digital innovations have the users of Agile methodologies brought into the organisation?

## 4.3 Research Methodology Choice

There are 3 different research methods according to (Saunders, Lewis, & Thornhill, 2019), Mono Method, Mixed Method and Multi-Method.
A Mono Method is the use of only one type of information gathering technique that is either quantitative or qualitative methodology. These methods cannot be combined as the Mono Method only allows one or the other type of information gathering (Thesismind, 2019).

A Mixed Method uses both types of data collection methodologies, quantitative and qualitative. Quantitative data is generally in a numerical form and qualitative data is mainly in textual form. It is a combination of data collection which allows for structured questions (multiple choice) and unstructured questions (free text). Quantitative data collection gives calculable answers from participants, which is good for analysing, whilst the Qualitative data collection helps with adding the perceptions of participants into the answers and speaks about their nature (Elkatawneh, 2016).

A Multi-Method is the use of both quantitative and qualitative information gathering methods, which is quite similar to the Mixed Method choice, however, this method does not create a single data set of results, it is split into two segments quantitative and qualitative (Thesismind, 2019).

The method selected was the Mixed methods, which will allow for the types of questions to be combined (qualitative and quantitative) to collect the information. The reason for choosing this method is so that it is possible to get a deeper understanding through the answers so that full knowledge can be gained for this research. Both types of questions have been asked in this survey: open-ended and closed questions. The open-ended (Qualitative) questions are used for an in-depth understanding of the information given, having no limits

as to what can be said. The closed ended (Quantitative) questions are used for a general understanding and grouping of participants on the results.

## 4.4 Time Horizon

There are 2 types of time horizons according to (Saunders, Lewis, & Thornhill, 2019) that describe the required time needed for the completion of the research, Cross Sectional and Longitudinal.

The Cross-Sectional time horizon is an established time set or once-off period during which the data must be collected. The Longitudinal time horizon is the collection of data repeatedly over an extended period which examines how the results change over time (Saunders, Lewis, & Thornhill, 2019).

Therefore, this research paper used a Cross Sectional research method as the survey was provided to different organisations to complete within a specific period. This research was conducted across financial organisations and the period was a snapshot of their views at a specific period. The results were then analysed after the collection period.



## 4.5 Techniques and Procedures

The technique by which the data has been collected was through the use of a survey via Google Forms; the survey has been distributed via email addresses. The data has then been stored on Google cloud from which it has been retrieved for analysis. This is a primary data collection as it is collected directly from the participants.

The survey has been conducted using 22 participants who have been contacted through LinkedIn and through mutual colleagues. The survey has been given to Methodology owners (Agile team leaders) and the Methodology users (software developers). The participants have also been contacted directly via telephone or cell phone to request their participation in the study and to collect their email addresses. They have been given a detailed explanation about the purpose of the study and the importance of providing accurate information to ensure a reliable set of responses. After they have indicated their willingness to participate, they have been sent an email with the link to the survey questions. All respondents have remained anonymous since no login is required to access the questionnaire. The study has consisted only of companies that are using Agile methods.

### 4.5.1 Sampling

The population size is currently unknown; however, experts suggest that a proportion of the population may be used for the gathering of data in order to provide an outcome from which rising trends can be observed from the responses. 22 IT professionals completed the questionnaire. The research problem seemed to be ubiquitous / prevalent in most of the South African financial organizations represented by the participants. The 22 sets of survey answers were received, no new themes or issues related to the research questions were identified, which meant that there had been sample saturation. (Glaser & Strauss, 1967) state “the criterion for judging when to stop sampling the different groups pertinent to a category is the category’s theoretical saturation. Saturation means that no additional data are being found whereby the sociologist can develop properties of the category.”

## 4.6 Summary

In summary this study used deductive, survey based and mixed methods, in which quantitative and qualitative data were collected. These tools were used for the completion and answering of the research questions that have arisen within the financial industry. The results which have been captured and evaluated, will be presented in Chapter 5.

# Chapter 5 – Data Presentation

In this chapter, the results and analysis of the qualitative data and quantitative data based on the Questionnaire (Appendix C) results which have been completed online for the findings of this research study will be reviewed. This chapter will follow the same structure as the Conceptual Framework (3.6)

| Adoption Phase | Factors influencing Agile Adoption - from General Adoption Framework (3.3) | Factors influencing Agile Adoption - from the Agile Adoption Process Framework (3.4) | Factors from Innovation studies (3.7) | Survey Questions (Chapter 5) |
|---|---|---|---|---|
| Preparation and analysis | • Organizational change management capability<br>• Employee change management capability<br>• Employee level of experience | • Organisational cultural change and transition<br>• Agile Training and education (People)<br>• Team Dynamics/Communication<br>• Technical practices change management<br>• Project Management to ensure deadlines are met<br>• Process integration ability<br>• Productivity management<br>• Quality assurance | | • Question 4 – 8 |
| Prepare for Base Methodology | • Technology preparation/maturity<br>• Team Dynamics/Communication<br>• Project Management | | | • Question 9 |
| Adoption and Implementation | • Organisational principles aligned with methodology<br>• Analysing processes and practices during transition<br>• Productivity measurement<br>• Project Management<br>• Process Change Management | | | • Question 13 - 19<br>• Question 23 -24<br>• Question 26 – 27<br>• Question 32 |
| Innovation | | | • Learning and knowledge creation through problem solving<br>• Innovation through Team Dynamics/Communication<br>• Innovation through Knowledge sharing | • Question 11 – 12<br>• Question 31 & 33 |

Figure 25: Literature review summary

The order in which the data will be presented is as follows:

5.1) Demographic Information of the research respondents

This section will present the demographic information supplied by the respondents which describes who has completed the questionnaire. These results show Gender, Age and Language.

5.2) Agile Adoption Preparation and Analysis phase

This section will present the respondent's descriptive statistics of their current roles in detail and a background to their current organisation within the Financial Industry. The results will reveal the respondents job title, software development duration, the number employed within their organisation, their team size and how long they have been involved in Agile Methods.

5.3) Selection of a Base Methodology phase for Agile Adoption

This section will present the respondent's descriptive statistics of the current Agile methodology/methodologies being used within their team/organisation.



5.4) Adoption and Implementation Framework phase

This section will present the respondent's detailed descriptive statistics of the Agile adoption process within their organisation and provide understanding of how this assisted with the Agile implementation.

5.5) Innovation within an Agile Methodology

This section will present the respondent's descriptive statistics of the Innovations through Agile methodology/methodologies within their organisation

## 5.1 Demographic Information

The number of participants that have responded to the questionnaire is 22 IT professionals out of the 60 contacted; they have completed the questionnaire via the online link which is a 37% response rate. Twenty-one of the 22 respondents were male, with 40% in the age group of 30-39 years old, and 73% with English as their first language.

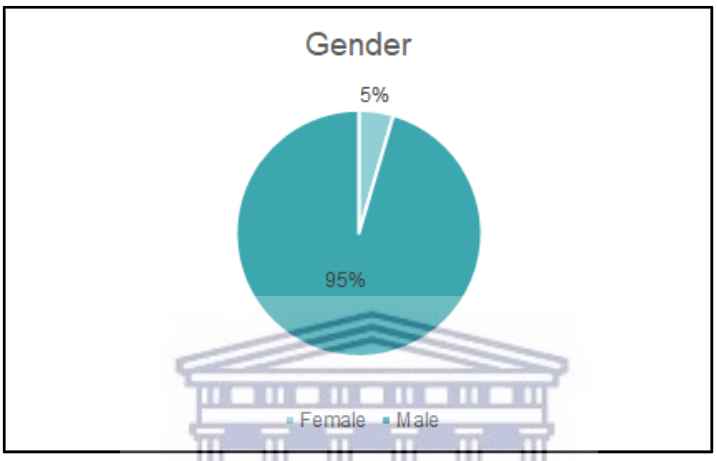



Figure 26: Gender

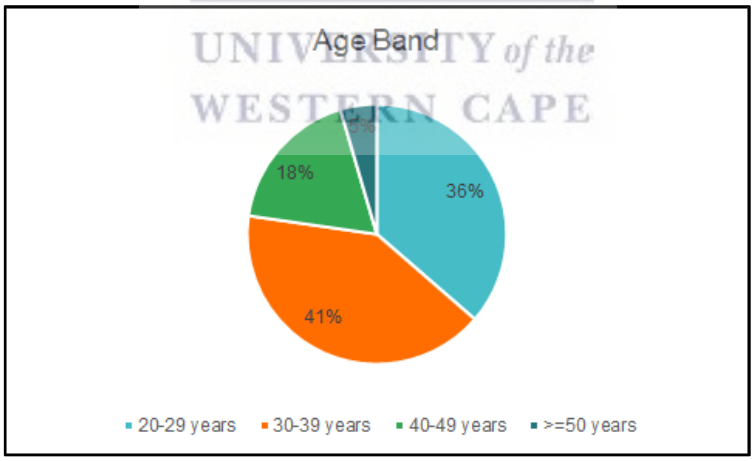



Figure 27: Age Band

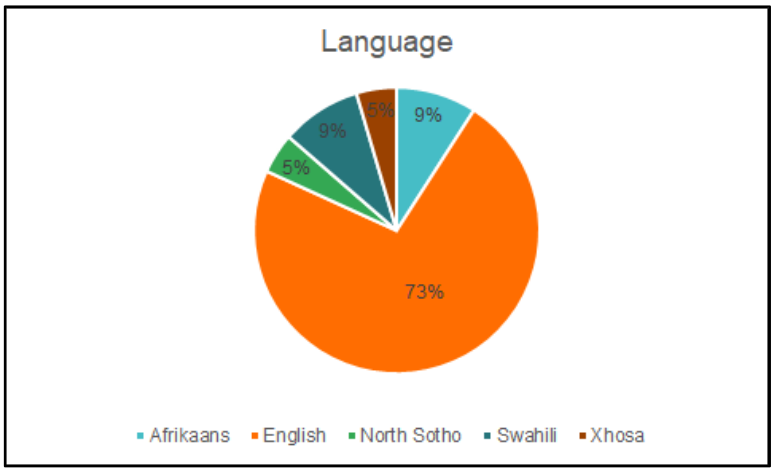



Figure 28: Language

In the next section of the Adoption phases, as set out in the Conceptual Framework, the starting point will be the Employee/Employer analysis.

## 5.2 Agile Adoption Preparation and Analysis phase

### 5.2.1 Employee/Employer analysis (Preparation Phase of Agile Adoption Framework)



In this section the following questions were asked:

| |
|---|
| 4. What is your job title (or similar to)? |
| 5. How long have you been involved with software development? |
| 6. How many people are employed within your organisation? |
| 7. How many people are engaged in your software development team? |
| 8. How long have you been involved with Agile Methods? |

**What is your job title (or similar to)?**

The majority of the respondents (11) were Software Engineers with 50%, 64% have been within their IT professional role between 4 – 8 years whilst 36% have been within their role for more than 9 years.

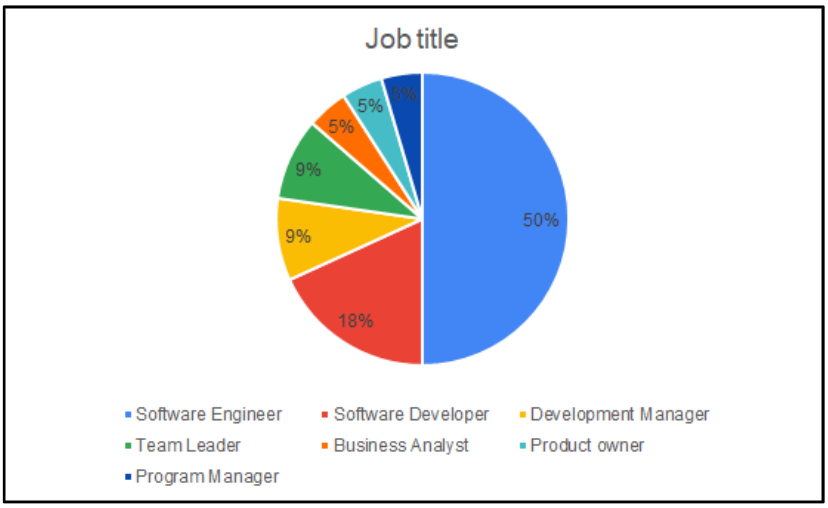



Figure 29: Job Title

**How long have you been involved with software development?**

The majority of the participants (55%) have been within their roles between 4-8 years, 32% have been in their current role for 9 or more years and the remaining 14% have only been in their role for 1 - 3 years. This indicates that the majority of the participants 86% which is 19 out of 22 have been in their role for more than 3 years.



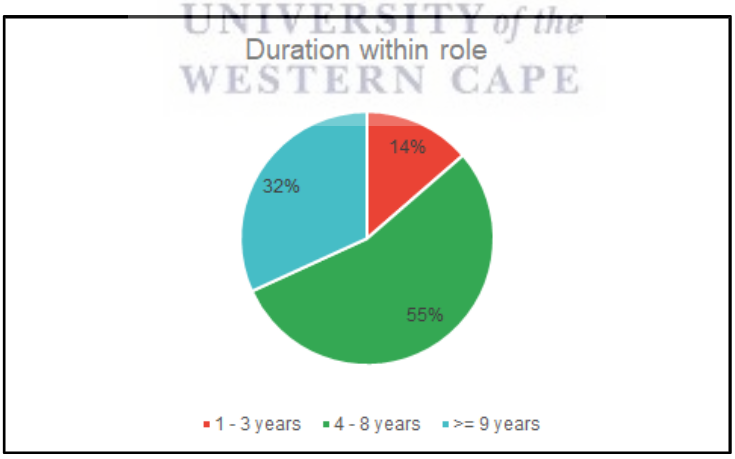



Figure 30: Duration within role

**How many people are employed within your organisation?**

Ten participants (45%) were employed within an organisation with fewer than 500 employees.

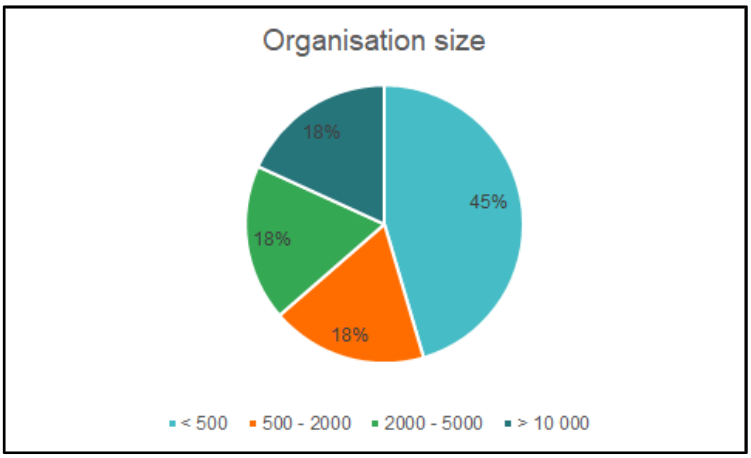



Figure 31: Organisation size

**How many people are engaged in your software development team?**

Fourteen participants (64%) were engaged within a software development team of between 5 and 10 people.

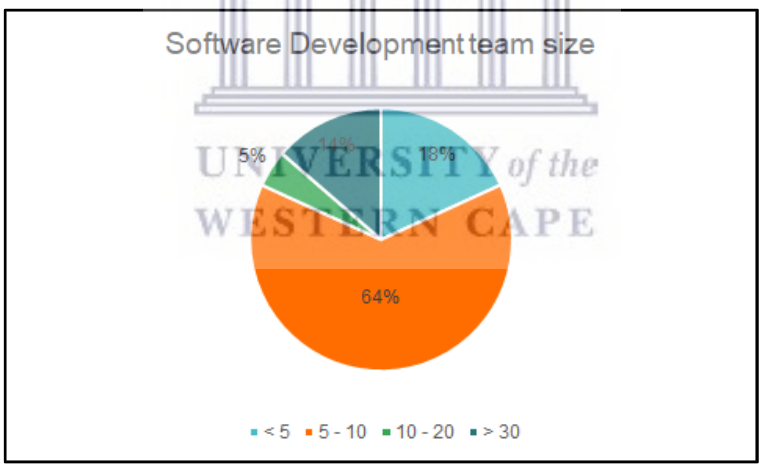



Figure 32: Software Development team size

**How long have you been involved with Agile Methods?**

Fifty five percent (55%) of the participants have been involved in Agile methodologies between 4 and 6 years.

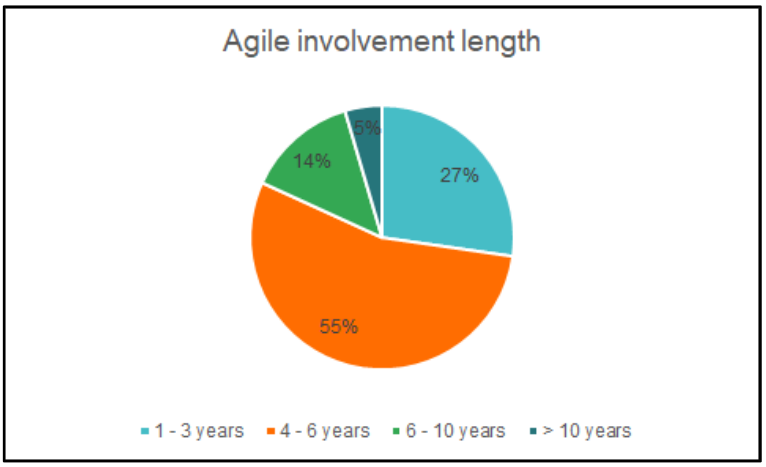



Figure 33: Agile involvement length

The responses confirm that the participants that participated in the questionnaire are experienced within an Agile environment and can comment meaningfully on Agile Methodologies adoptions within the financial industry. A majority of the participants (55%) have been in their roles between 4 and 8 years, 32% have been in their current role for 9 or more years, thus showing the depth of their understanding of Agile methodologies within their current positions.



| Themes from Phase 1 – Preparation and Analysis phase |
| --- |
| This phase focuses on the employee and employers to ensure that the environment is set up and ready for an Agile Adoption. It is important to have this phase done correctly in preparation for the next phase.<br>• Organizational CM capability (General Adoption Framework): The organisation's ability to adapt and introduce new processes<br>• Employee CM capability (General Adoption Framework): The employee's current ability to adapt when organisational processes change<br>• Employee level of experience/training (General Adoption Framework): Experienced (and well prepared) employees adapt to new working methods better |

In the next section of the Adoption phases, the Base Methodology phase will be discussed.

## 5.3 Selection of a Base Methodology phase for Agile adoption

### 5.3.1 Base Methodology

In this section the following question was asked:

| 9. What current Agile Development Methodology is being used? (Refer to 3.9.2) |
|---|

**What current Agile Development Methodology is being used?**

A majority of the participants are using a hybrid/combination of Agile methodologies; 23% of participants work in an environment with Scrum and Kanban methods, while 3 participants have selected Scrum, Kanban, and Lean methodologies as their current Agile methods.

Scrum methodology was selected by 77% of the respondents which indicates that Scrum Methodology is the most popular method amongst the software development teams working within South Africa. This methodology rarely requires or provides specific software methods/practices to be used; instead, it requires more management practice and tools where it prevents any chaos from occurring because of unpredictability or complexities. This is the base methodology for Agile; it is primarily a management styling technique for workload management and is used in conjunction with another methodology to fully utilize and assist the Agile processes.

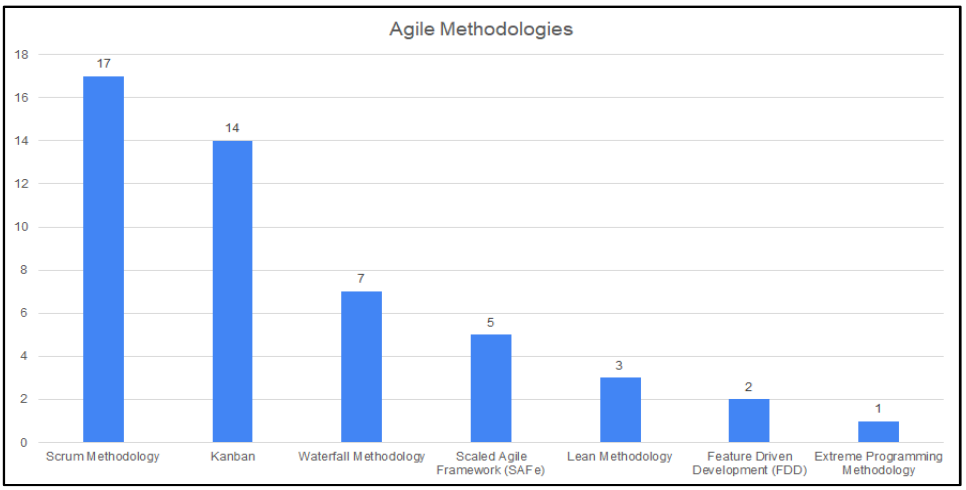


Figure 34: Agile Methodologies

The key theme related to this section is that having the foundation methodologies in place is important. The foundation methodology will assist with adopting the methodology which will be discussed in the next chapter.

| Themes from Phase 2 – Base Methodology |
| --- |
| • Selection of the correct Base Methodology (primary data): The process begins with understand and analysing each Agile methodology, then selecting the most appropriate methodology for the organisation.<br><br>• Start the adoption process with the adoption of the correct (most applicable) Agile Methods (Base Methodology): Once the selection process is complete, the organisation will then slowly adapt their methods/processes according to the new methodology selected.<br><br>• Technology preparation/maturity (General adoption framework): The organisations technology ability to adapt to the new infrastructure requirements<br><br>• Team Dynamics/Communication (General adoption framework): The team's preparation to adapt and to support one another through the process<br><br>• Project Management (General adoption framework): The management of projects through the preparation and the beginning phase of adoption by adapting to change |

In the next section of the Adoption phases, the Adoption, and Implementation Framework phase, which consists of Team/Leadership Agility and the Organisation functioning will be discussed.

## 5.4 Adoption and Implementation Framework phase

In this section the following questions were asked:

| |
|---|
| 13. Was there an adoption method (process) used when implementing the Agile methodology (mentioned above in Question 9)? (Refer to section 3.5) |
| 14. If you selected "Yes" in the previous question (Question 13), on a scale, please rate the difficulty level per process when adopting the methodology? (1=easy, 5= very difficult) |
| 15.A. When adopting the methodology, rank the efforts your organisation invested in the adoption for "Team Dynamics"? (Refer to section 3.2.3) |
| 15.B. When adopting the methodology, rank the efforts your organisation invested in the adoption for "Productivity"? (Refer to section 3.2.7) |
| 15.C. When adopting the methodology, rank the efforts your organisation invested in the adoption for "Quality"? (Refer to section 3.2.8) |
| 16. What was the outcome of using the adoption methodology for the Agile method(s) implemented? |
| 17. What has worked in the current Agile adoption process and how does it help with having a positive attitude to being more innovative? (Refer to section 3.8) |
| 18. What does the adoption process lack in terms of dealing with complex Agile methods which prevent flexibility to "think out of the box"? |
| 19. If any, what types of challenges has arisen when adopting the Agile methodology and how were these challenges dealt with? (Refer to section 3.2) |
| 23. What was the length of the last project iteration that you were involved in, and how did using Agile methods assist? |
| 24. Would you suggest that having an adoption plan for Agile Methods in your organization would improve the quality of the products developed by Agile software development teams? (Refer to section 3.5) |
| 26. When implementing an Agile process, what is the biggest risk when not following a structured adoption process? |

| |
|---|
| 27. What would be the outcome of a failed adoption process in terms of costs to the organization, and what would the impact be on the reputation of the organization? |
| 32. Consider the following question: Is the Agile methodology working in your organisation? |

**Was there an adoption method (process) used when implementing the Agile methodology?**

Sixty four percent (64%) of respondents indicated that they had a structured process of adoption in place. The remaining respondents have not used a process, or they are not aware of it, which made up the remaining 36%.

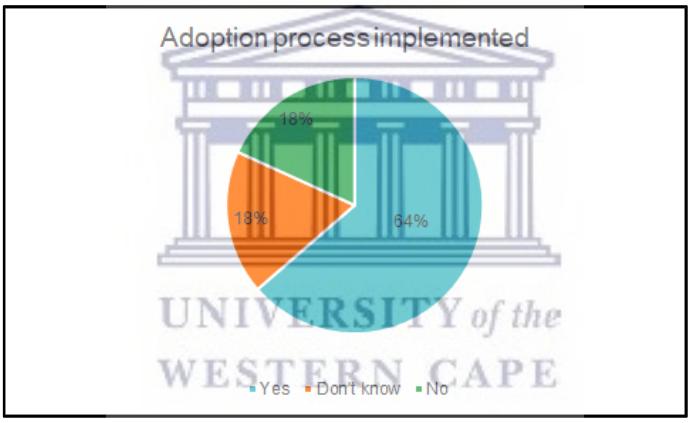



Figure 35: Adoption process implemented

**If you selected "Yes" in the previous question (Question 13), on a scale, please rate the difficulty level per process when adopting the methodology (1=very easy, 5= very difficult):**

The Medium difficulty level experienced amongst the participants was 60%, which were 14 participants. Four of the participants had mentioned their difficulty level was Level 4 making up 27%, whilst only 2 participants indicated that it was an easy Agile adoption process on Level 2 difficulty which was 13%.

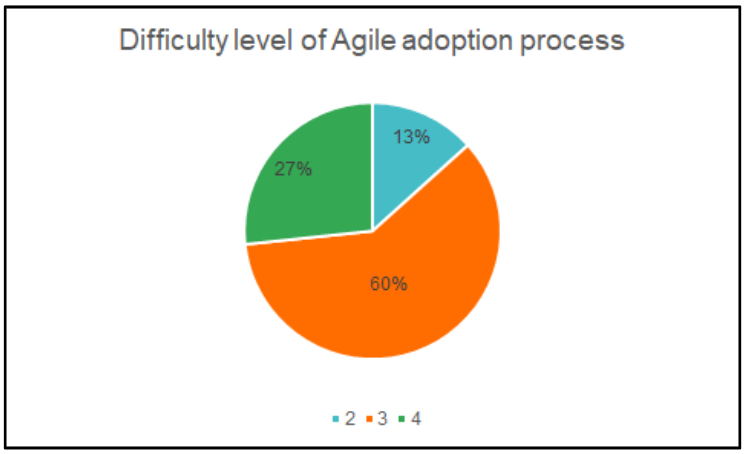



Figure 36: Difficult level of Agile adoption process

**When adopting the methodology, rank the efforts your organisation invested in the adoption for "Team Dynamics".**

Team dynamics play an important role when using Agile Methodologies, it promotes the continuous face-to-face interactions between the team members to foster teamwork and build trust within the team (refer to section 3.2.2). It allows for open communication and emphasizes on the exchange of ideas/thoughts within the team. The team therefore needs to interact regularly through team meetings or when working on a project together, this will allow for a one team mindset and team collaboration.



Thirty six percent (36%) of the respondents selected Level 3 (most effort) as the efforts invested by their organisation in Team Dynamics, whilst 45% indicated Level 2 (medium effort) and 18% selected least effort.

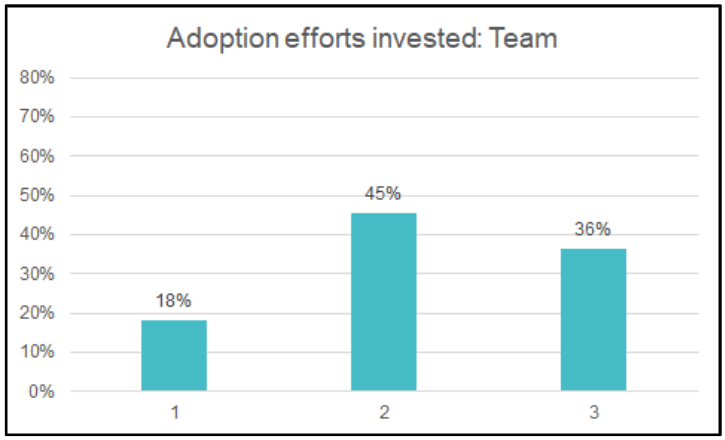



Figure 37: Adoption efforts invested in Team Dynamics

**When adopting the methodology, rank the efforts your organisation invested in the adoption for "Productivity"**

Agile methodologies are generally effective in productivity because they ensure that everyone within the team is focused on one task at a time (refer to section 3.2.6). This eliminates the confusion concerning what needs to be done by whom and ensures that everyone is on the same page when completing tasks/projects. It makes it easier to prioritise tasks and estimate timelines to meet deadlines

Fifty nine percent (59%) of the respondents have mentioned that most efforts were invested in the Productivity during the Agile adoption process, whilst 32% indicated that medium efforts were invested and 9% indicated least effort invested.

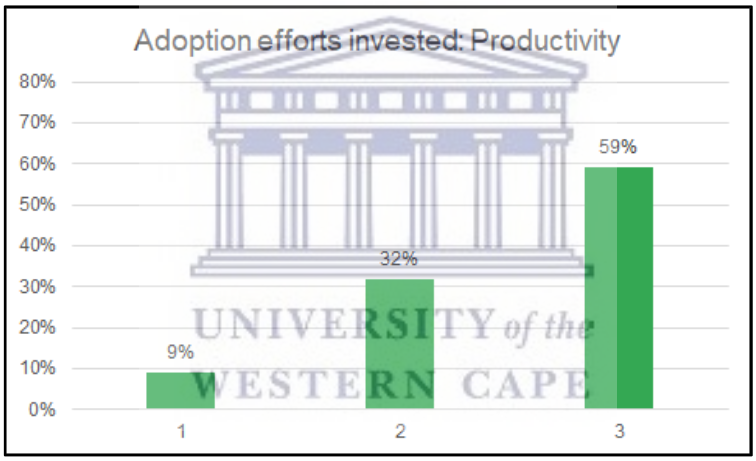



Figure 38: Adoption efforts invested in Productivity

**When adopting the methodology, rank the efforts your organisation invested in the adoption for "Quality"**

Agile Methodologies principles are focused directly and indirectly on quality within an Agile environment as they ensure that teams can produce valuable and working functionality (refer to section 3.2.7). The quality is a measure of products working correctly and meeting the needs of project stakeholders. The stakeholders are also involved in the development of the quality through regular feedback which the developers can immediately incorporate into the product; this enables increase the product quality to increase on a regular basis.
Fifty percent (50%) of the respondents have mentioned that during the Agile adoption process, that most efforts were invested in the Quality, whilst 41% indicated that medium effort has been invested and 9% has indicated the least effort invested.

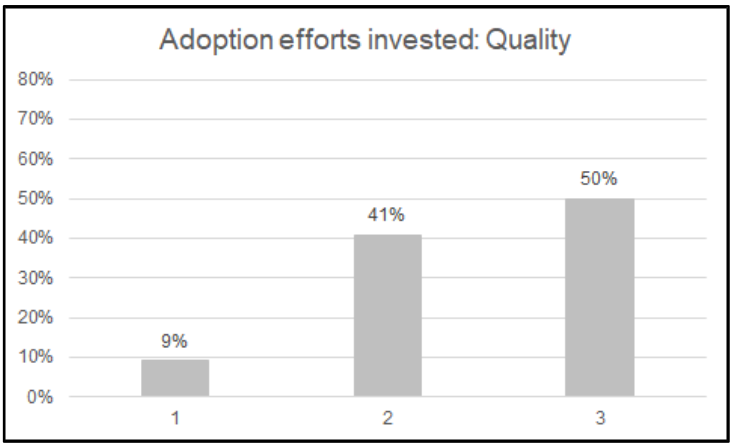



Figure 39: Adoption efforts invested in Quality

The respondents overall have rated that the efforts of their organisation are spent mostly on Productivity and Quality, whilst less effort is put into the Team. This could indicate that Team dynamics come naturally as all team members are driven to ensure that other aspects are not compromised.

**What was the outcome of using the adoption methodology for the Agile methods implemented?**



Seventy seven percent (77%) mentioned that their Agile adoption methodology was successful whilst the remaining 23% said they are not sure if it had worked within their development team.

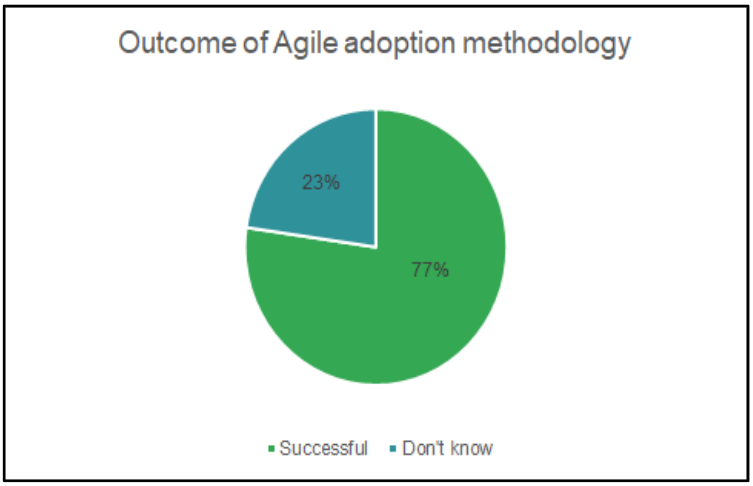



Figure 40: Outcome of Agile adoption methodology

**What has worked in the current Agile adoption process and how does it help with having a positive attitude to being more innovative?**

Thirty two percent of the respondents have mentioned having the ability to adapt to meet new requirements set out by the client and that having regular meetings allows for planning and discussions.

*"Ability to pivot when new requirements come in from clients has helped us change direction."*

*"The iterative development process allows also for quick wins and having regular guidance to ensure that the developers are on the correct path."*

*"How rapid we can make changes it definitely helps knowing things aren't set in stone"*

*"Every 2nd week review/demo to clients (feedback positive) and team retrospective with developers (deal with internal issues and helps with positivity), daily stand-ups help with minor technical issue and team awareness. lastly cross skilling junior and senior"*

*"Having a positive attitude towards the change, as a developer as well as a manager, is crucial to being more innovative. Breaks the limitation set by older methodologies which reduces time taken to develop high quality solutions. Frees up more time to look at enhancements."*

*"Shorter sprints and frequent demos keep stakeholders interested and ensure requirements are well understood. System can be adjusted early in the process due to stakeholders having early visibility of the actual functionality. Ensures developers do not go off too far in the wrong direction."*

*"Openness of team members to think out of the box, and have ideas of each member discussed"*

*"In order to succeed, we needed to apply Agile methodologies that speaks to our business need to allow us to be flexible to change. We constantly adapt our approach and have a mixture of methodologies where it makes sense. Our ultimate goal is to be a high performing customer focused portfolio and we adapt as we grow."*

**What does the adoption process lack, in terms of dealing with complex Agile methods, which prevents flexibility to "think out of the box"?**

Forty one percent said that the team/managers do not understand the adoption process which makes it hard for them to think out of the box. The team members should also have the roles defined and the managers need to enforce clarity on what is expected and what requirements need to be met.

*"Some teams interpreted the process as completely fixed, which is not the case. We adapt the process to fit the teams."*

*"Staff capacity and capability to focus on adoption of the Agile process/methodology."*

*"These methods do not always work with the inexperienced team members, since understanding of the software takes time and thinking out of the box is more difficult when not understanding the bigger picture of software."*

*"Agile needs a solid team way-of-work, everyone needs a common understanding of "definition of done" and how we get work done in the project. Our company lacked processes that made being productive easier."*



*"It's fast-paced process so sometimes you don't have enough time to think out of the box. Some ideas come after the project implementation."*

*"Key misconception is that Agile does not required documentation. One needs documentation to clarify requirements and have proper system designs. Developers assume the system will just evolve as we go along. Without docs there is not sufficient planning, and more time is actually wasted. Docs should be kept concise but not discarded."*

*"In our case there was no limiting of 'think out of the box', creativity is encouraged, and the mindset is to change the status quo, push the boundary etc. However, the downside, the exco has unrealistic expectations as they think Agile method is going to rapidly increase product development and new features/ products will be launched in a very short space of time"*

*"Staff capacity and capability to focus on adoption of the Agile process/methodology"*

**If any, what types of challenges have arisen when adopting the Agile methodology and how were these challenges dealt with?**

Half (50%) of the respondents have mentioned that the biggest challenge that was experienced was understanding the Agile methodology by the team; sending the team on training, assisted with dealing with this challenge.

*"Getting all members of the development team to buy into the methodology."*

*"Getting the team to adopt and implement together at the same time. Helping those struggling with the adoption understand how to do so efficiently"*

*"Sprints being too long (2 weeks is sometimes too long). It's only a process, should be able to tweak whenever you want."*

*"Getting everybody to keep up with system changes across teams has proven difficult. but this ties back into not having solid processes as mentioned in previous answers"*

*"Getting the team to adopt and implement together at the same time. Helping those struggling with the adoption understand how to do so efficiently"*



*"Some developers went able to finish their tasks on time because of the amount of work they have per 1 week sprint. The developers underestimate the number of hours it will take to finish tasks. the developers were able to give the right estimates as they gained experience working on different projects."*

*"Agile rituals that don't fill the needs of the team. They always need to serve the team. We keep them short concise and stick to the work we committed. Also disallowing scope creep."*

*"Need proper skilled staff who are disciplined otherwise the quality suffers. Rushing through an iteration without proper testing results in numerous bugs and wastage through reworks. Too much reliance on a tester or business analyst to do the testing."*

**What was the length of the last project iteration that you were involved in, and how did using Agile methods assist?**

Seven of the participants (32%) have had their last project iteration in the last 2 weeks, these participants were assisted by getting feedback from the clients who gave guidance to ensure that the project is on the correct path. These regular meetings help the developers understand exactly what the client has in mind.

*"2-week sprints, knowing what to do and what is expected and getting feedback on new development helps with building a better product and keeping the client happy since deliverables are in such quick succession." Client perspective*

*"2 weeks, Kanban for workflow management and daily scrum stand-ups to keep the team up to date and motivated to finish the sprint in time." Dev perspective*

*"Our sprints are typically 2 weeks long. It allowed us to get rapid feedback at the end of every 2 weeks and improve our process"*

*"2 months, however using Agile methods, client's requirements were constantly met timeously because projects were broken down using FDD and feature priorities were set before commencing the project. Client expectations were managed well because the mindset was clear from the start of the project."*

*"1-month, allowed us to focus on getting more features to market quicker"*

*"3 months. Mapping out the sprints across several weeks with tons of backlog grooming and sprint planning as we went along."*

*"It was supposed to be about 8 months and ended up being more than a year, this was due to the impact of regulation. Agile methodology enabled us to spot the regulatory requirement early in the process."*

*"6 months - getting weekly user feedback on features being built"*

**Would you suggest that having an adoption plan for Agile Methods in your organization would improve the quality of the products developed by Agile software development teams?**

A majority of the respondents, 86%, has indicated that if an organisation should have an Agile adoption plan in place it would improve the quality of their products

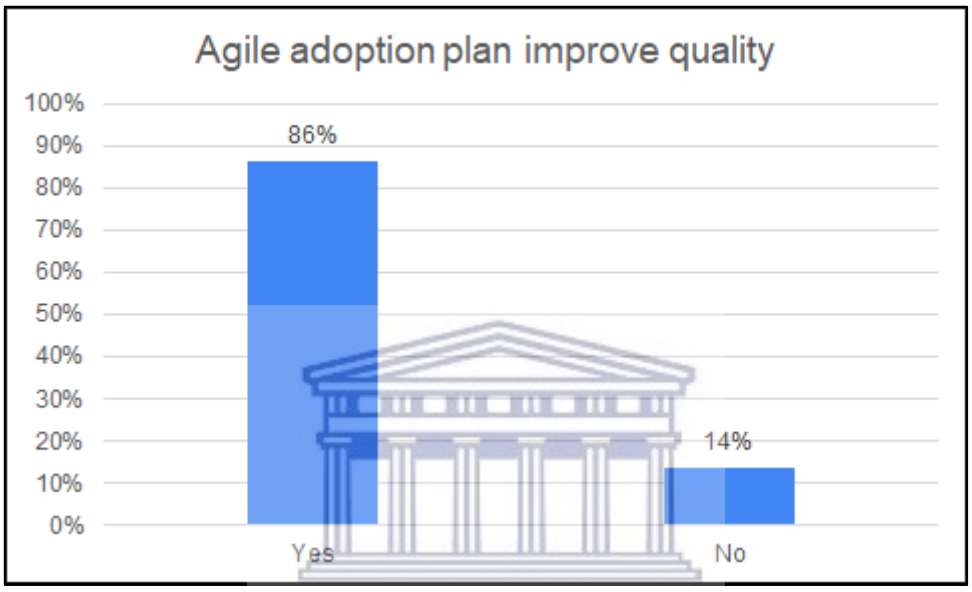



Figure 41: Agile adoption plan to improve quality



**When implementing an Agile process, what is the biggest risk when not following a *structured adoption process?***

More than half of the participants (59%) mentioned that the biggest risk when not following an adoption plan is that the outcome would be a partial adoption which would still bring up issues throughout the project build. This would mean that many team members would still struggle to understand the Agile process and would rely on the team to upskill and teach them.

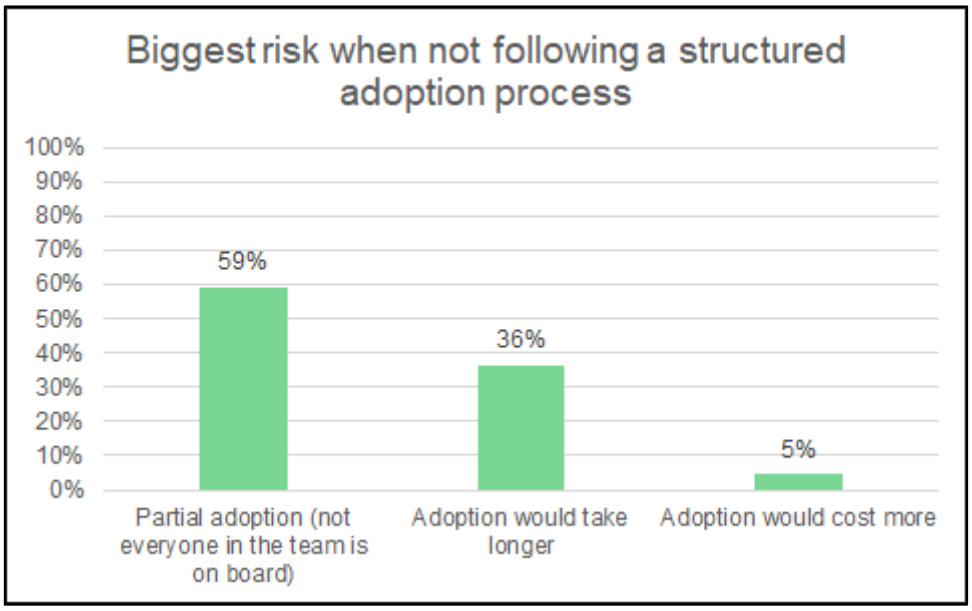



Figure 42: Biggest risk when not following a structured process

**What would be the outcome of a failed adoption process in terms of costs to the organization, and what would the impact be on the reputation of the organization?**

A majority of the participants (64%) indicated that the delivery of the software would either take longer to complete or it would not be completed due to a failed process.



*"Delivery of software would take longer or might not even be completed at all, or quality of work will not be existent."*

*"Missed deadlines and lack of being competitive. Customers impacted and lost revenue. Loss of business."*

*"It costs a lot of money especially if you use a 3rd party company to do software development. They get paid for incomplete work especially if the project is not managed probably. You end up with a software that has a lot of bugs and users don't trust the system."*

*"The outcome would be additional sprints that would increase delivery time. This would lead to stakeholder frustration that would negatively impact reputation."*

*"Unclear path for an organization as mindset would be different for each team-member. It might be considered a failure and could damage the morale of the team and company."*

*"Projects will run over time and budget. The initial promise of Agile success will just create more disillusioned stakeholders."*

*"Missed deadlines and lack of being competitive. Customers impacted and loss of revenue. Loss of business."*

**Consider the following question: Is the Agile methodology working in your organisation?**

The bulk of the respondents (77%) agreed by saying that Agile methodologies are working within their organisation, whilst the remainder are either neutral (18%) or disagree (5%). Agile methodologies allow many requirements to be altered without interrupting the build of the project and this situation improves the overall development.

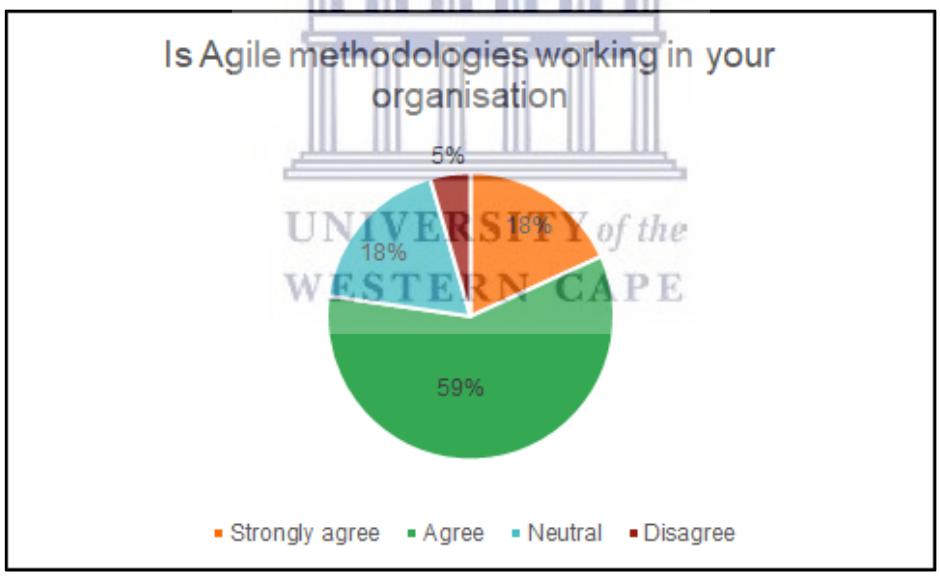



Figure 43: Is Agile methodologies working in your organisation

The key themes discussed in this section are how Agile has assisted team adaptation to meet new requirements, ensuring that they are aligned, understand the meaning of Agile and realise how the delivery of the project will be longer/not completed if an adoption process has failed. These themes will be discussed in the next chapter.

### 5.4.1 Team/Leadership Agility

In this section the following questions were asked in this section:

| |
|---|
| 20. How did team members' roles change when the adoption process seemed to be failing? (Refer to section 3.2) |
| 21. What skills and experience do the team members need in order to participate in an Agile environment? (Refer to section 3.5.2) |
| 22. What skills and experience does the Agile leader need when giving guidance to the team members to ensure an innovative mind set? |
| 25. Does being Agile assist with the development by providing an open-minded state (thinking out of the "box")? |

**How did team members' roles change when the adoption process seemed to be failing?**

A majority (82%) of the participants have mentioned that the roles of their team members did not change they just had to adapt, to ensure that the process did not fail. The team members assisted each other to accommodate the process by upskilling and learning/understanding the process.

*"Team roles were updated to overlap where possible, cross skilling and learning were made available to up skill as well."*

*"Team members assists each other as best possible"*

*"They would not change however focus would be put on how to overcome the issue by the team lead."*

*"The team is able to plug the gaps throughout the process."*

*"Roles didn't change, dedicated scrum masters were introduced."*

*"People tend to volunteer to fill the gaps where needed. I think this is in line with agile methodologies of having "self-organising" teams. Often problems are highlighted in sprint retrospectives and these problems then get volunteers to fix it, or the team decides who is best fit."*

*"Leaders always rear their heads in these situations, and teams with strong leadership and strong community get through failed implementations and are ready for the next. Some don't end up pushing through that strongly."*

*"Team members started speaking up about how their roles could be better defined as expectations did not meet reality in terms of their capabilities. This did however open the door to a clearer outlook on their individual career roadmap and gave each member a better view of how they could improve."*

**What skills and experience do the team members need in order to participate in an Agile environment?**

There were 3 main aspects that were required of the team members: communication, technical skills, and open-mindedness.



**Communication:**

Communication seemed to be the most demanded skill by team members as this creates an environment which allows for flexibility and change, and these need to be communicated amongst the team members.

*"Communication skills are much more important, and most developers seem to be lacking in this department."*

**Technical skill:**

Technical skills are a combination of analysis, design, flexibility and understanding the data, these were some of the detailed technical skills required by the team members who are working in an Agile environment. Working under pressure was also a common skill requirement mentioned by respondents.

*"Depending on the role e.g., UX/UI designers need to be able to use the design tools, while the coders need to be able to code, product owners need to be able to manage the process of build. "*

**Open-minded:**

Open-mindedness has also been a theme which stood out, since being in an Agile environment, things change often and having this trait allows for these changes not to be an issue.

*"An open mind. Fairly good technical skills coupled with the ability to communicate effectively and ask for help or delegate where needed."*

**What skills and experience does the Agile leader need when giving guidance to the team members to ensure an innovative mind-set?**

The team leader should be able to make tough decisions which will not slow down the team, and these decisions need to be rapid so that the team may continue. The workload should also be managed to ensure that deadlines are met, and also allow for innovation throughout each project. The leader should understand the team's roles and responsibilities when delegating the workload so that there is no hold up simply because the team members are not sure which step to complete next.

*"Ability to keep the team focused and supportive when and where needed"*

*"Agile leaders need to have experience and understanding of all roles in the team. Needs to have a sense for when a sprint estimation is unrealistic. Needs to be active in identifying dependencies and obstacles and ensure the obstacles are dealt with so that the team can focus on delivery"*

*"Needs to be able to size work effectively, able to delegate well and help with work timelines (but not how exactly the work gets done, that freedom remains with team members)"*

*"A course on agile scrum would be useful. Some of the best scrum masters I have worked with are friendly people, have good interpersonal skills and can understands what the teams'*

*capabilities are and knows how to get the team working constructively through good mediation during planning sessions etc.'*

*"Ability to keep the team focused and supportive when and where needed"*

*"Prioritizing, adaptability, analysis of situations. Many times, while working on a sprint a production bug can come up which the Agile leader must then prioritize as well as refocus the team and sprint to still meet the needs of the client."*

*"High EQ, understanding when some team members need to be encouraged or need a break and also the ability to disseminate tasks into small pieces of work that's manageable"*

*"Agile leader needs to have experience and understanding of all roles in the team. Needs to have a sense for when a sprint estimation is unrealistic. Needs to be active in identifying dependencies and obstacles and ensure the obstacles are dealt with so that the team can focus on delivery."*



**Does being Agile assist with the development by providing an open-minded state (thinking out of the "box")?**

Seventy seven percent of the respondents have agreed that being in an Agile environment encourages them to be open-minded; this type of attitude assists when any changes need to be made throughout the development process of the products.

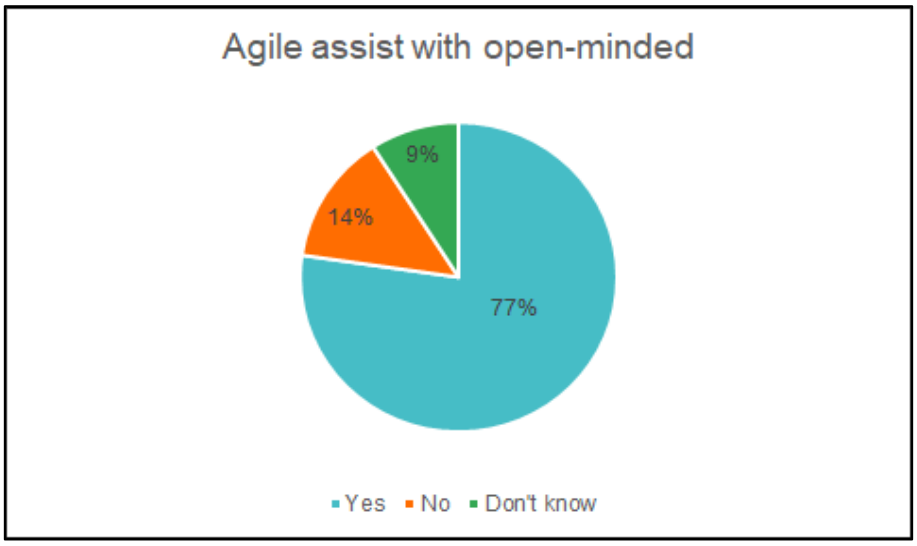



Figure 44: Agile assists with open-mindedness

The key themes related to this section are how Team members are able to adapt when an Agile adoption process seems to be failing and how having an open mind, being able to communicate and take responsibility are essential when participating within an Agile environment.
These themes will be discussed in the next chapter.

### 5..4.2 Organisational functioning

In this section the following questions were asked:

| |
|---|
| 28. What would you change about the current adoption process in your organization and why? (Refer to 3.7) |
| 29. Once given a specification to develop, does being in an Agile environment make you think of better processes/solutions or new ways of designing the deliverable? (Refer to section 3.9.4) |
| 30. Does this type of thinking (Question 29) come naturally because of the Agile environment, or do you have to take time out to focus? |



**What would you change about the current adoption process in your organization and why?**

A majority of the participants indicated that there needs to be more training and upskilling so that each team member understands the goal. Management skills also stood out as a common theme; these aspects can affect the team members who have struggled with direction and have lost sight of the expected outcome.

*"Improved training and an experienced Agilist to provide guidance and ensure quality."*

*"Better planning; Agile skills education; team buy-in; this will lead to successful adoption"*

*"The adoption process should cater to experimenting with the various methodologies."*

*"Include more upskilling or awareness of the process to the upper management to understand the teething process."*

*"Slowly introduce Agile concepts via a hybrid methodology. Once discipline has been established, introduce more flexibility. Ensure business understands terminology being thrown around by developers so as not to confuse them. Not all projects can be done agile. First look at the composition and quality of the team available."*

*"Nothing drastic but just fine tuning here and there. I would resolve the issue of business owner vs product owner, who makes the final call. The business owner understands the market and customer but does not understand the development process, while product owner understands the development process and knows to create customer centric products"*

*"Nothing in particular. Being Agile is being able to constantly change perspective even with how and when to apply Agile methodologies. Choose only what you need and not what is prescribed with the goal of achieving success in the short term and long term. You have to be willing to constantly adapt Agile to a changing business."*

*"Target the management to understand the Agile process and not hinder the rest of the company.'*



**Once given a specification to develop, does being in an Agile environment make you think of better processes/solutions or new ways of designing the deliverable?**

A majority of respondents 77%said that being in an Agile environment does assist with allowing them to think of better processes and solutions or new ways of designing.

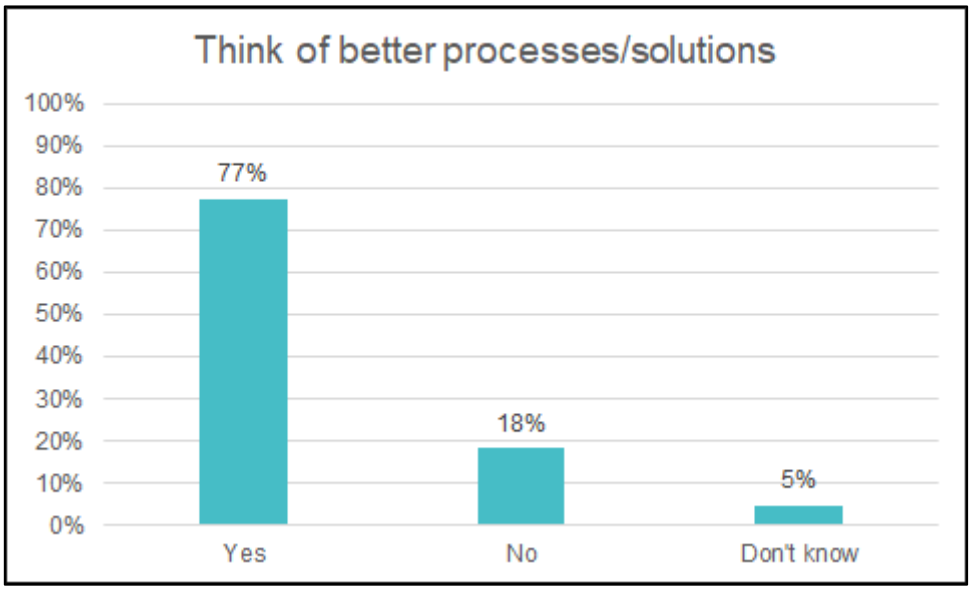



Figure 45: Agile allow for thinking of better processes/solution

**Does this type of thinking (based on the previous question) come naturally because of the Agile environment, or do you have to take time out to focus?**

50% of respondents said that this type of thinking does come naturally because of being in an Agile environment.



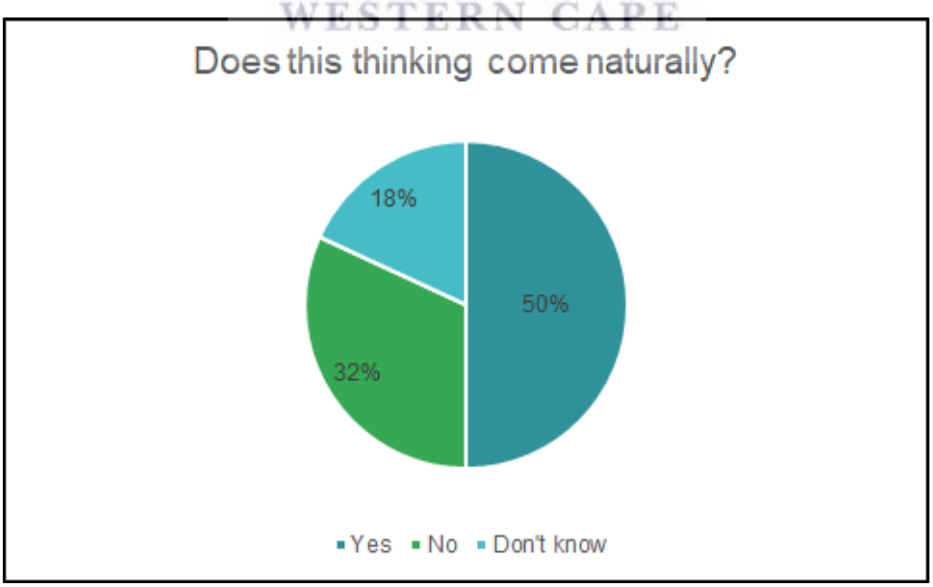



Figure 46: Does this thinking come naturally?

The key themes related to this section are; how changing the adoption process can be assisted with more training and upskilling, how being within an Agile environment allows for out of the box thinking and how this happens naturally.
All these themes will be discussed in the next chapter.

| Themes from Phase 3 – Adoption and Implementation Framework phase |
| --- |
| • Team Dynamics/Communication: The capabilities of the team to ensure that they are able to adapt, assist one another through upskilling and communicate while transitioning over to the new methodology.<br><br>• Agile Training and Upskilling: Agile needs to be fully understood in the organisation to ensure that the benefits of change in methodologies are realised.<br><br>• Organisational principles aligned with methodology (General Adoption framework): The organisations capability to adapt and align their principles with the new methodologies.<br><br>• Analysing processes and practices during transition (General Adoption framework): The organisations processes and practices needs to be measured against previous processes and practices to ensure its more beneficial.<br><br>• Productivity measurement (General Adoption framework): The organisations measurement throughout the process to understand if the new methodology improved output.<br><br>• Project Management (General Adoption framework): During adoption of Agile, additional effort is required from IT project management while implementing the new methodology and ensuring that deadlines are met. This adds additional pressure on the PM function, which must be accounted for. |

- Process Change Management (General Adoption framework): The organisation's management of processes while implementing new processes or adjusting current processes to align with the new software development methodology.

In the next section of the Adoption phases, the Innovation within an Agile Methodology phase will be discussed.

## 5.5 Innovation within an Agile Methodology

In this section the following questions were asked:

| |
|---|
| 11. Have Agile methods allowed for new innovations in the organisation? (refer to section 3.8) |
| 12. If you selected "Agree" in the previous question (Question 11), please mention what new innovations (high-level) resulted from the use of Agile methods? |
| 31. When an idea is rejected to improve a process, does this discourage you and prevent you from trying again or do you keep trying to put forward innovative ideas? (refer to section 3.8) |
| 33. Consider the following question: does Innovation only happen when the team's relationships are going well, or does it happen regardless? |



**Have Agile methods allowed for new innovations in the organisation?**

Almost half of the participants (45%) indicated that working with Agile methodologies have allowed for new innovations within the organisation. The remaining 55% were split between those that did not know (41%) if they have, and those that said they had not (14%). This indicates that there might be some confusion over whether or not Agile methods do have an impact on the development aspect of the projects.

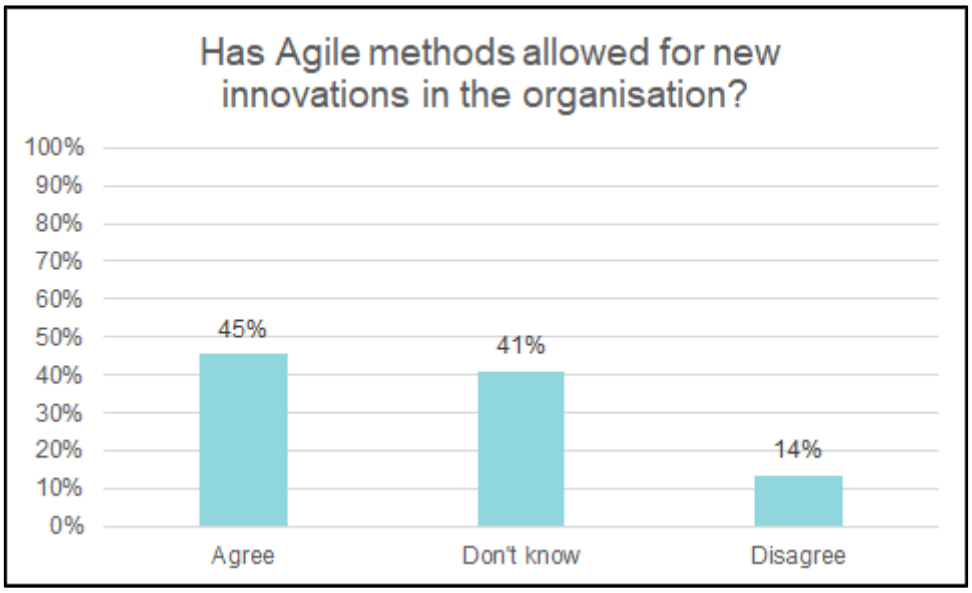



Figure 47: Agile methods allowed for new innovation

**If you selected "Agree" in the previous question (Question 11), please mention what new innovations (high-level) resulted from the use of Agile methods?**

The main themes that stood out from the 9 participants who answered, indicated that Agile methods have assisted by giving freedom to the development. Since there was nothing set in stone, the developments were much faster and there have been new developments.



*"Adhering to a framework which is not too rigid allows more freedom in development and allows the company to shift from service driven interactions to project driven interactions. (Less time fixing bugs and more time understanding and planning solutions)."*

*"Because of Automation and Kanban, as a team went from deploying 50 applications per month to 350 in their respective DEV, QA and Prod. This process improved the reliability in deployments and allowed enhancements and bug fixes to get in the hands of customers a lot quicker."*

*"PoCs and MVPs present a road map for solving a problem"*

*"Adopting new technologies mainly Cloud AWS"*

*"Adopted a hybrid methodology to get the best of traditional and agile approach. Heavy project management approach like Prince2 is too rigid and time consuming."*

*"Financial awareness product called TymeCoach"*

*"Business and Tech has a way of working to react quicker to customers' needs and a constantly changing and competitive landscape. Responses and turnaround times are quicker, and costs of development are reduced as a result."*

**When an idea is rejected to improve a process, does this discourage you and prevent you from trying again or do you keep trying to put forward innovative ideas?**

Working in an Agile environment, allows for encouragement to spread throughout the team, and the majority of the participants (95%) have shown that they keep on trying when an idea is rejected whilst the remaining 5% give up on their ideas. This also shows how free the developers are when they are building a software product for a client. Since there are no boundaries to their thinking, they are able to expand their thinking processes.

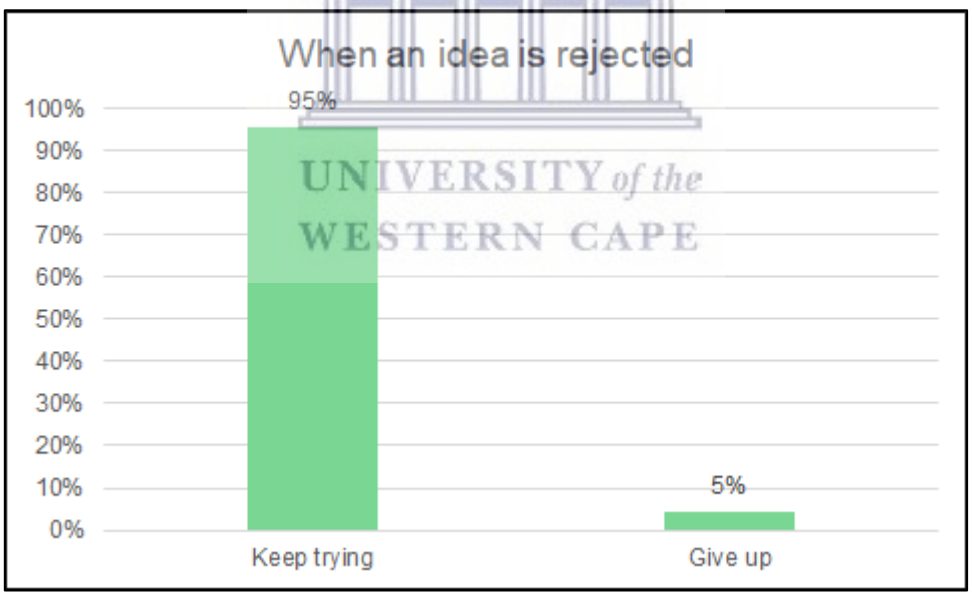



Figure 48: When an idea is rejected with an Agile environment

**Consider the following question: Does innovation only happen when the team's relationships are going well, or does it happen regardless?**

While working in an Agile environment, participants (91%) have indicated that innovation does happen within their organisation whilst the remaining 9% are unsure if it does. Of those who have mentioned that innovation does happen, 45% have mentioned that it happens

regardless whilst the other 45% indicated that it happens only when the relations between the team members are going well.

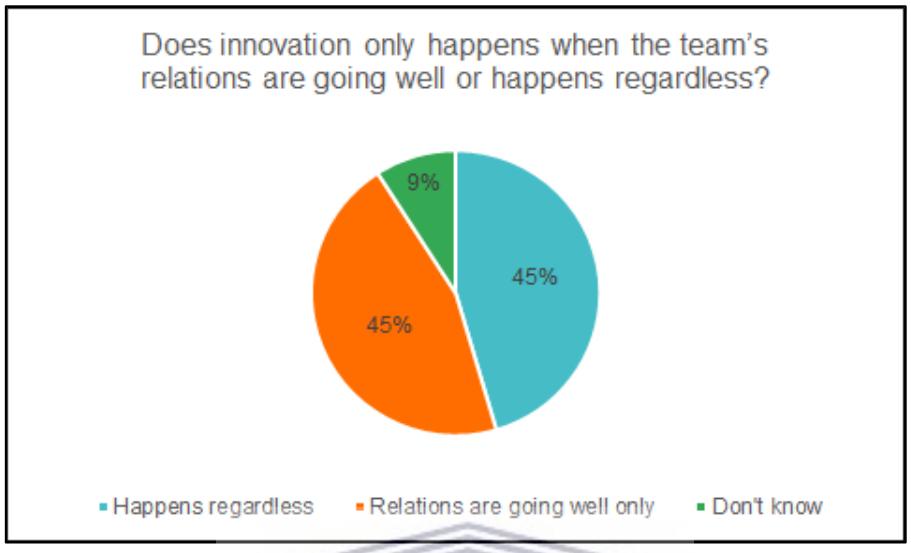



Figure 49: Does innovation happen within the organisation

The key themes related to this section are; that working with Agile methodologies does allow for new innovations, that Agile methods have assisted with being free when developing, that working in an Agile environment allows for encouragement to spread throughout the team and that innovation does happen within their organisation.
All these themes will be discussed in the next chapter.



| Themes from Phase 4 – Innovation within an Agile Methodology |
| --- |
| • Innovation through problem solving: The ability of the team to generate solutions for processes through experimentation and discovery.<br>• Innovation through Team Dynamics: The team's ability to share ideas, creativity and problem-solving through projects and processes.<br>• Innovation through Knowledge sharing: The capability of the team to share knowledge. |

- Less siloed approach to Development: Teams have the ability to work more closely together through team dynamics

## 5.6 Summary

This chapter has presented the results of the online questionnaire which was completed by IT professionals within the Western Cape province of South Africa. This questionnaire found that, innovation within an agile environment does take place, and in order for it to work efficiently the following should be considered within the organisation: communication, teamwork, agile methodology understanding and technical skills. These aspects assist with the use of Agile methodologies to encourage innovation. In the next chapter the research questions are discussed in the light of these results.

# Chapter 6 – Discussion

The previous chapter presented key themes from the questionnaire which was responded to by 22 IT professionals from the Financial Industry in South Africa. These are now discussed in terms of the research questions posed and for each research sub-question, the results of the case studies are discussed in terms of the dominant criteria.

## 6.1 Employee/Employers analysis phase

The key theme related to this section is that having the employees ready for the adoption, which will assist with a fully adopted methodology.

### 6.1.1 Organizational CM capability (General Adoption Framework):

The capabilities of the organisation to manage the change management aspect while introducing new ways of working. The organisation needs to understand what is expected throughout the process and whether it is able to keep up with the changes (refer to Chapter 3.3). The organisation needs to lead the conversations and lead the change through its management style. This will give guidance as to what is expected from each member. These processes need to be aligned and run in parallel to ensure that they fit in with current businesses process. A suggestion for this to work efficiently within the financial industries is by ensuring that everyone is on the same page and understands the steps that will be taken.



### 6.1.2 Employee CM capability (General Adoption Framework):

Chapter 3 explains how the Employees should have the capabilities for dealing with the change management. Each team member should manage their own changes as their current processes will change and these need to be the well managed throughout the process. These changes will require extra efforts from the employee to incorporate the new processes while still maintaining current deadlines. The research suggests that regular check-ins between the manager and the employee should be set up. These meetings will reveal any issues throughout the process that need to get assistance from management to ensure they are resolved.

### 6.1.3 Employee level of experience/training (General Adoption Framework):

The level of an employee's experience does assist with adapting to new ways of working if they are able to see the benefits as discussed in Chapter 3.3. Change is hard for those who are more experienced if they have been doing the same process for a while. However, if they notice that the new process is more beneficial than the older process, they are more likely to adapt than someone with less experience. The experience assists with adapting as they are able to apply their mind and see the benefits of the new processes. The researcher suggests that team members will be aided by incorporating in regular reminders reasons as to why the change is happening and reasons why the improved process is needed.

## 6.2 Base Methodology phase

The key theme related to this section is that having the foundation methodologies in place, will allow for a fully adopted methodology.

### 6.2.1 Selection of the correct Base Methodology

Chapter 3.3 explains the importance of having a selection process in place as it assists with the simplification of the transition to the new methodology. To ensure that the correct methodologies are selected, the pros and cons should be carefully examined to ensure that the methods align closely with what the current process is. The selection process which needs to take place requires the organisation to understand their current ways of working and find a methodology that could potentially align with the culture. This process will determine the complexities that will arise when comparing the methodology and the current culture. This will simplify the adoption and once the transition is complete, the teams are more likely to successfully adopt a more complex methodology. The researcher suggests that there should be reasons written down as to why certain methodologies are selected and how they fit with current culture and way of working, in order to prevent failure.

### 6.2.2 Start the adoption process with the adoption of the correct (most applicable) Agile Methods (Base Methodology)

The process should begin with the most suited methodology, one which aligns closely with current culture, before introducing new methods. The organisation should have the necessary tools and processes in place for the beginning of this adoption process. Starting the adoption using the most applicable methodology will ensure that the chances of

successfully adopt the methodology are high. The new methodology will not require many changes for the team therefore they will not be under pressure, nor will they be likely to fail in the adoption. The researcher suggests keeping track of the new processes which will be adopted to ensure that the team is using the new process. These tracking methods will ensure that the adoption process is happening throughout the team, and it cannot be avoided.

### 6.2.3 Technology preparation/maturity

Literature (refer to Chapter 3.3) explains that the technology infrastructure should be improved or up to date to have the capacity to deal with the new processes. If the infrastructure is not available that will support the successful adoption of a new process, then this will discourage the team from adopting the new processes. The infrastructure should simulate the change to encourage new ways of working. The researcher suggests the organisation should ensure that the technology is able to adapt to the requirements that allows for the Agile adoption to take place. The transition may require changes in the systems, or add-ons to the current systems/applications, which would assist with workload management.



### 6.2.5 Project Management

Project Management will ensure that the current on-going project and new projects are managed through the adoption process as discussed in Chapter 3.3. The current thoughts are that if the projects seem to be falling behind due to taking on new processes through the adoption process, then it is important to manage the deadlines with the client to ensure that projects are completed on time. The researcher suggests that regular updates should be done on how far projects have progresses and if there are any setbacks, the deadlines need to be re-examined for this to work efficiently within the financial industries.

### 6.2.4 Team Dynamics/Communication: support and meetings within teams

Team Dynamics through communication will assist with the transition by team members supporting and guiding one another. Such mutual assistance ensures that there is current knowledge is shared about the topic with different aspects being supported. The support from team members means that everyone is dealing with the same issues and therefore the team members encourage one another to improve their ways of working. The change will demand the team to complete tasks differently and the expectation is that productivity will

have increased. This requires the team to put in more effort and if this puts strain on the team members then they will need to support one another. The researcher suggests that frequent meetings take place on the adoption topic, where members can express what they are dealing with and what challenges they need assistance with. This usually happens to a majority of the team and therefore another team member is able to assist and mitigate the problem.

## 6.3 Adoption and Implementation Framework phase

This process requires the organisation to shift their culture to align with the methodology selected within the Base Methodology phase. The methodology will be running in parallel to their current methods in place and will slowly adjust to fully adopt the new Agile methodology. This phase will be the longest phase of the adoption process as it requires monitoring and measurements in place to track the progress of the methodology.

### 6.3.1 Team Dynamics/Communication: communication within teams

Chapter 3.3 explains how team needs to ensure that there is constant communication amongst the team which will ensure the processes and principles are understood during the adoption and implementation framework process. The staff will be required to use the new methods as the purpose of them is to ensure better management, quality, and faster production. The staff will need to adapt when there are struggles through this process and have an open mind by accepting the new ways of working. Team dynamics plays a big role through an adoption. Ensuring there is constant communication will ensure that everyone is able to adopt the new processes. The researcher suggests that there should be a team buddy system which allows for frequent communication amongst the team members which enables them to suggest and help one another throughout the adoption and implementation phase.



### 6.3.2 Organisation principles aligned with new methodology

The organisation will be functioning differently through new systems and processes which depend on the staff to ensure that they are operating efficiently within the methodology. The organisation will go through change management and new learnings to adapt to the new environment.

### 6.3.3 Agile Training and Upskilling

Training and upskilling of the team on Agile adoption is vital for a successful adoption to take place (refer to Chapter 3.3). This will ensure that benefits of Agile will be understood and make the employees more eager to carry out adoption process. Training and upskilling on Agile can assist with the adoption process since it supports the understanding of how Agile will be beneficial to the organisation. The training and upskilling of staff are essential for the adoption process as it requires the staff to change their ways of working for the

implementation. The researcher suggests that training courses should be compulsory for each team member and these skills that are learnt are used during the implementation of the processes for this to work efficiently within the financial industries.

### 6.3.4 Analysing processes and practices during transition

The measurements in place should be used to compare the new process against the old process to ensure that it is more beneficial as discussed in Chapter 3.3. The measure of the process through Key Performance Indicators (KPIs) will ensure that it is worth having the new process in place and not worth returning to the old process. The realisation that the benefits of the new processes outweigh those of the old process should encourage the adoption. The researcher suggests that measurements should be in place when comparing processes and practices outputs for this to work efficiently within the financial industries.

### 6.3.5 Productivity measurement

The new processes brought into ways of working will affect the productivity, and therefore the productivity needs to be measured using a timeline to ensure the new processes are more efficient. It is essential to measure the productivity output in order to determine if the new methodology adopted has improved ways of working. The productivity measurement also ensures that the project management has been working and has been being adjusted to accommodate the new adoption process. The researcher suggests that the productivity, once the new processes are in place, should be measured to identify the capabilities of these new processes.

### 6.3.6 Project Management

In the transition phase, project management will manage deadlines with stakeholders and clients. The deadlines are either extended or met due to the employees spending more time on the adoption process. The adoption and implementation process will affect the projects taken on and the current projects in progress (refer to chapter 3.3). The management will therefore ensure that these projects are managed with the relevant parties to meet expectations. The researcher suggests project management should be in place to ensure that while the transition is taking place, the projects are meeting current deadlines provided and that the number of new projects taken on is managed according to capacity.

### 6.3.7 Process Change Management

The adoption requires processes within the organisation to change and adapt according to the new methodologies; this needs to be managed and measured to ensured that the correct processes are selected to fit current business practices. Process management should ensure that the processes in place are the most efficient in order to eliminate any unnecessary processes. The researcher suggests that management methods are able to determine the efficiencies and productivity outputs from the processes. The processes that lack any form of productivity should be removed or changed to be able to improve current ways of working.

## 6.4 Innovation within an Agile Methodology phase

The key themes related to this section are that working with Agile methodologies does allow for new innovations, that Agile methods have assisted team members to be freer when developing, that working in an Agile environment allows encouragement to spread throughout the team and that innovation does happen within an organisation.

### 6.4.1 Innovation through problem solving



Chapter 5.5 highlights the ability of the team to generate solutions for processes through experimentation and discovery is innovation through problem solving. Agile methods are able to bring new innovations within the organisations through their adaptiveness and improvisation, which enables the organisation to get to a result as efficiently as possible. The new Agile methods assist with new ways of thinking and reacting to complex business requirements presented by clients. The researcher suggests that brainstorming meetings should be allocated to the team and that the team needs to time to collaborate when dealing with challenges within the process.

### 6.4.2 Innovation through Team Dynamics

Team dynamics along with Agile methods has promoted innovative process improvements within the organisation; these have brought effective communications and improved ways of working as a team as discussed in Chapter 5.5. These innovative ways are presented through the Agile methodology as it encourages idea sharing amongst team members, which in turn produces a more unified team to complete a common goal. In other words, Team Dynamics improves the ways of working through communication and coming together

to achieve a common goal. The participation of each member by giving each one a voice for opinions and suggestions fosters trust and openness within the team which then allows for innovation. The researcher suggests that time is dedicated to activities such as team building to encourage more communication between team members so that relationships can grow. This will improve the communication and willingness to participate within those projects where collaboration is needed.

### 6.4.3 Innovation through Knowledge sharing

The capabilities of the team to share knowledge allows team members to build up their knowledge and experience which will assist with the innovation processes. Through knowledge accessibility and knowledge flow, each team member is able to increase their skill and knowledge; this can improve the quality of innovation throughout the team. Innovation through knowledge sharing is a means of building up current knowledge and upskilling on current ways. The researcher suggests that all members should show willingness to help one another and share their knowledge and experience.

### 6.4.4 Less siloed approach to Development

A team's ability to work more closely together through team dynamics prevents each member from working in their own space, and this situation leads to more shared ideas. This approach assists with the design and productivity elements of the projects where the non-siloed environment sparks more ideas; greater interaction between the team members produces new innovations into projects. The researcher suggests that team members should have the freedom to express their ideas and opinions in order to create an environment of more open-minded team members.

### 6.4.5 Innovation as a result of adopting Agile methods

The use of Agile methods has resulted in innovation through the approaches and techniques which assists with the ways of working. These innovations are generated through the Agile environment, where sharing ideas and implementing changes to the product will result in a more innovative product. The agile environment allows and encourages constant research and development throughout the process which will ensure the highest level of innovation has been established for the product. Innovation has been a part of the journey through the

methodologies use and as stated in Chapter 5.5, more than half of the respondents who completed the questionnaire has confirmed this.

# Chapter 7 – Conclusion and Recommendation

## 7.1 Answering the research questions

In the next section, the Secondary and the Primary questions which were posed in this study, will be answered. These questions will be answered based on what was found in literature, together with the findings presented and discussed in Chapters 5 and 6.

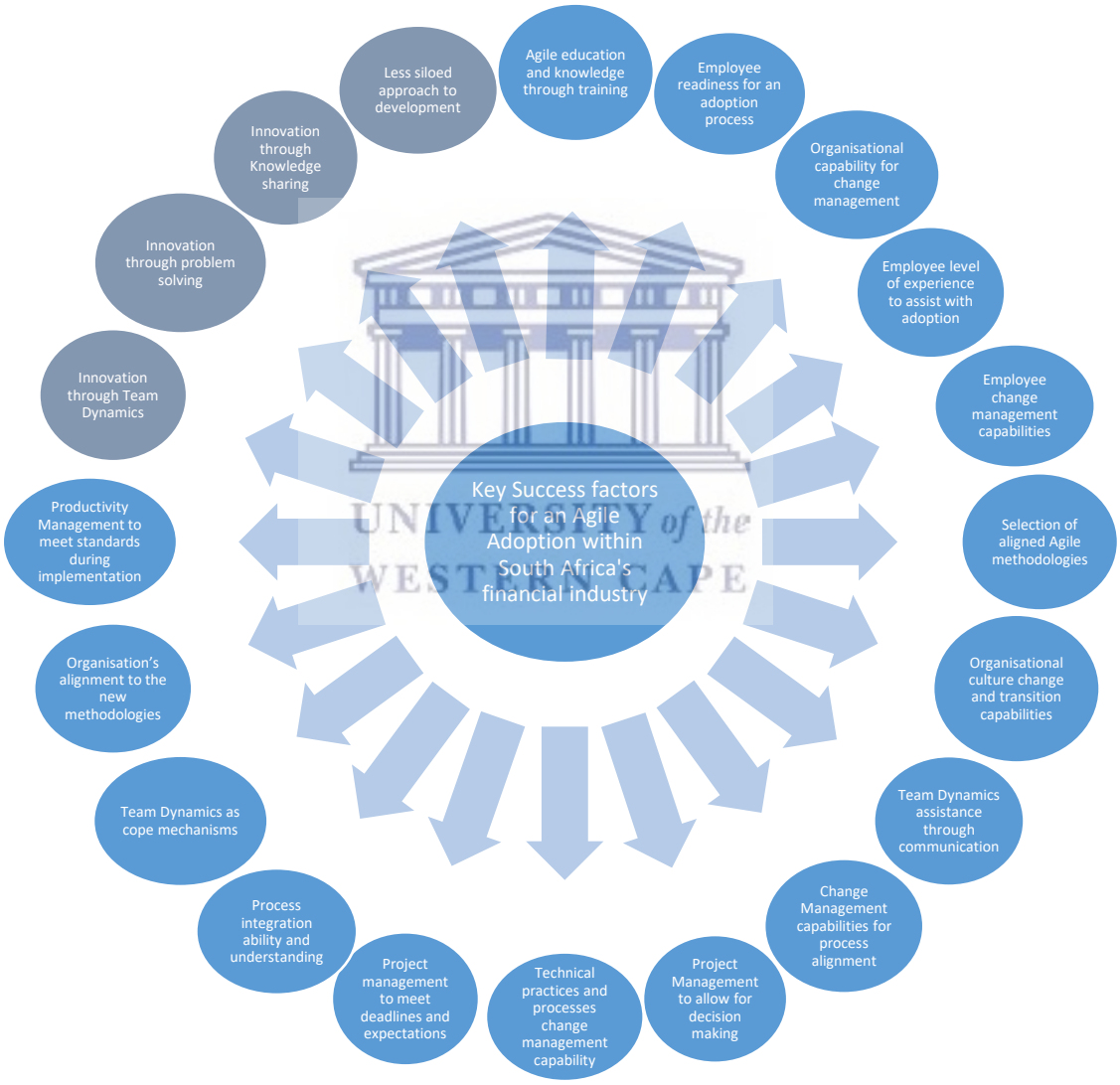



Figure 50: Key Success Factors from literature and questionnaire outcomes

### 7.1.1 Secondary Questions

#### *7.1.1.1 Which Agile Software Development Methodologies are being adopted by financial industry organizations in South Africa?*

It is clear that the most popular Agile Software Development methods are Scrum and Kanban. These are the easiest base methodologies to start the Agile adoption process as these methodologies focus on project management and communication within the team through regular meetings. These methodologies assist with knowledge sharing and with complex projects through meetings.

#### *7.1.1.2 What Agile adoption frameworks were used by these organisations?*

The researcher found that the General Adoption Framework and the Agile Adoption Process framework in literature and after looking at the data, it is clear that components of these Agile Adoption frameworks are implemented but there is no single clear accepted Agile Adoption method that is being used currently in the Financial Industry in South Africa.



##### 7.1.1.2.1 General Adoption Framework

The General Adoption Framework has a step-by-step process for dealing with an Agile Adoption, however, this is not specific to an industry. The general adoption process includes the following steps as the guidelines:

- the identification of the most appropriate methodology
- understanding the organisations requirements
- the adaptation and the implementation

##### 7.1.1.2.2 Agile Adoption Process framework

The Agile Adoption Process framework specifically deals with the preparation for an Agile adoption process; however, it lacks the completion of a full Agile adoption framework. The framework ensures that all segments within the organisation have been investigated in order to reveal their readiness for the Agile methods to be implemented. These investigated variables identify the issues so that guidance and assistance can be provided through the process. The variables are as follows:

- Whether the organisation is ready for agility
- Which practices should the organisation adopt
- The difficulties which could arise potentially when adopting them
- The preparations for the necessary practices

The researcher uses two Agile adoption frameworks found in literature, The General Adoption Framework and The Agile Adoption Process framework, which have been used to structure and identify key phases in the Agile Adoption process.

These key phases are:

- Preparation phase
- Base methodology phase
- Adoption and Implementation phase
- Innovation phase

The survey participants were asked questions pertaining to these phases. these questions and answers have been presented and discussed with reference to these four phases.



#### *7.1.1.3 What challenges were experienced by the industry during the adoption process?*

##### 7.1.1.3.1 Agile understanding (process knowledge/ training)

Based on the questionnaire results, Agile understanding/knowledge was a challenge when adopting Agile methodologies. This challenge led to team members being uninterested in new methodologies and lack a keen involvement in fully adopting Agile. The lack of understanding also meant that more time needed to be spent on learning how being Agile will benefit the organisation. Team members did not understand the process that needed to be followed which meant that other team members had to assist and step up their involvement in the adoption process.

#### 7.1.1.3.2 Employee readiness for an adoption process

Employee readiness was a challenge observed in the adoption process as it requires the employee to acquire the mind-set which allows the adoption process to take place. This requires the employee to allow the change to happen and to be ready through the current ways of working.

#### 7.1.1.3.3 Employee current change management capability

The employee's capability to handle the changing processes and changing environment was a challenge observed in the adoption process. This requires the employee to deal with a changing environment and to be able to approach the change with an optimistic attitude as the changes will benefit the organisation.

#### 7.1.1.3.4 Change Management (System changes, Management, and business alignment)

Change management within the team/organisation was also a challenge when adopting Agile methodologies. The management and the team were not aligned on the processes that needed to be followed when adopting Agile methods. These challenges create unnecessary obstacles that prevent an adoption to have a successful outcome. The management team needs to ensure that there are regular updates and discussions to ensure business alignment.

### 7.1.1.4 What innovations have the users of Agile methodologies brought into the organisation?

As discussed in 6.4, innovations in Problem Solving, Team Dynamics, Knowledge Sharing and less siloed approach in development is often associated with Agile processes.

Evidence found from the questionnaire illustrates that Agile methodologies resulted in improved digital innovation such as cloud services. These innovative ideas have been encouraged through Agile methodologies which does not limit or prevent ideas to be implemented anytime during the process. The Agile methodologies assist and improve the ways of working while maintaining quality and expectations of the end result.

Agile encourages experimentation and not being afraid to fail scenarios which addresses the obstacles quickly and inexpensively to prevent any disruption throughout the process which allows for innovation. The more these experimentations are done, the more comfortable they feel with failing and preventing experimentation. The experimentations allow the team to overcome the fears with failing which improves their idea generation within the Agile environment.

### 7.1.2 Primary Research Question:

*What are the key success factors for Agile Software Development Methodology adoption within the Financial Industries in South Africa?*

The following key success factors were identified from Section 6.1 – Section 6.4:

- Agile education and knowledge through training
- Employee readiness for an adoption process
- Organisational capability for change management
- Employee level of experience to assist with adoption
- Employee current change management capabilities
- Selection of aligned Agile methodologies
- Organisational culture change and transition capabilities
- Team Dynamics assistance through communication
- Change Management capabilities for process alignment
- Project Management to allow for decision making
- Technical practices and processes change management capability
- Project management to meet deadlines and expectations

- Process integration ability and understanding
- Team Dynamics as cope mechanisms
- Organisation's alignment to the new methodologies
- Productivity Management to meet standards during implementation
- Innovation through problem solving
- Innovation through Team Dynamics
- Innovation through Knowledge sharing
- Less siloed approach to development

Below is a summary of the key themes/successful factors for each phase for an Agile adoption within the financial industry in South Africa.

| Adoption Phase | Key Success Factors |
|---|---|
| Preparation and analysis | • Agile education and knowledge through training<br>• Employee readiness for an adoption process<br>• Organisational capability for change management<br>• Employee level of experience to assist with adoption<br>• Employee current change management capabilities |
| Base Methodology | • Selection of aligned Agile methodologies<br>• Organisational culture change and transition capabilities<br>• Team Dynamics assistance through communication<br>• Change Management capabilities for process alignment<br>• Project Management to allow for decision making |
| Adoption and Implementation | • Technical practices and processes change management capability<br>• Project management to meet deadlines and expectations<br>• Process integration ability and understanding<br>• Team Dynamics as cope mechanisms<br>• Organisation's alignment to the new methodologies<br>• Productivity Management to meet standards during implementation |
| Innovation | • Innovation through problem solving<br>• Innovation through Team Dynamics<br>• Innovation through Knowledge sharing<br>• Less siloed approach to development |

Figure 51: An Agile adoption framework for the Financial Industry

## 7.2 Conclusion

### 7.2.1 Validity of this study

The work which was done was in order to answer the research questions: from literature through data collection (questionnaire instrument) and analysis. The phases of the research study were well aligned with the research objectives and correlate with the research questions, resulting in a high level of validity.

### 7.2.2 Reliability of this study

The data collection has shown duplicated answers by the participants which has shown data saturation. Therefore, the researcher confirms that the study is reliable for the financial industry within South Africa. The findings presented may not be applicable to other industries within South Africa or the financial industries in other countries.



### 7.2.3 Contributions of research

This is the first study in the South African Financial Industries context that presents a comprehensive list of factors to consider when adopting Agile software methodologies.

### 7.2.4 Limitations of this study

The data collection had a limited scope, and it was completed within a single industry. As a result of the lockdown restrictions the data collection tool, which was originality meant to be an interview tool, had to be adjusted to become an online survey instrument, which may have negatively impacted the richness and quality of the qualitative data that was gathered.

### 7.2.5 Recommendations for future research

Now that adoption within the financial industry, which is traditionally a slow-moving industry when it comes to technological change, has been investigated and a list of 12 key success factors has been presented, a deeper understanding of the impact on innovation of using the correct or incorrect software development approach can be investigated.

### 7.2.6 Summary

Agile adoption is not an easy task for an organisation as there are so many factors to consider. The factors have an impact on the outcome of the adoption process and the main key success factors to focus on should be identified in order to produce a straightforward process. This research has shown those key success factors for an Agile adoption and has provided an understanding of how they should be attended to for a successful adoption process.

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# Appendix A: Ethical Clearance Form

UNIVERSITY of the WESTERN CAPE

60 YEARS of hope, action & knowledge

27 November 2020

Mr N Norman
Information Systems
**Faculty of Economic and Management Sciences**

**Ethics Reference Number:** HS20/9/32

**Project Title:** An agile software development adoption framework for the South African financial industry.

**Approval Period:** 25 November 2020 – 25 November 2023

I hereby certify that the Humanities and Social Science Research Ethics Committee of the University of the Western Cape approved the methodology and ethics of the above mentioned research project.

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

**Please remember to submit a progress report by 30 November each year for the duration of the project.**

*The permission to conduct the study must be submitted to HSSREC for record keeping purposes.*

The Committee must be informed of any serious adverse event and/or termination of the study.

*Ms Patricia Josias*
*Research Ethics Committee Officer*
*University of the Western Cape*

Director: Research Development
University of the Western Cape
Private Bag X 17
Bellville 7535
Republic of South Africa
Tel: +27 21 959 4111
Email: research-ethics@uwc.ac.za

*NHREC Registration Number: HSSREC-130416-049*

FROM HOPE TO ACTION THROUGH KNOWLEDGE.

## Appendix B: Research Project Information Sheet

| | |
|---|---|
| Project Title: | An Agile software development adoption framework for the South African financial industry |

**What is this study about?**

My name is Nicholas Norman, a student at the University of the Western Cape (South Africa) pursuing a Master's Degree in Information Management. The objective of this research is to get a holistic view of understanding the ways in which the Agile Methodology has been adopted and to what extent it has brought innovation into the organization. This study is solely for academic purposes.

**What will I be asked to do if I agree to participate?**

If you agree to participate in this research project, you will be asked to respond to a number of structured questions. This should take approximately 20 minutes. If you do not want to answer any question, you do not have to.

**Would my participation in this study be kept confidential?**

You are not required to provide any personal details, such as your name, address or identity number. All other details such as your age, education, employment status etc is therefore anonymous.



**What are the risks of this research?**

There are no known risks associated with participating in this research process. This research will not expose you to any harm as a result of your participation.

**What are the benefits of this research?**

The feedback would either confirm the adoption of methods or introduce new adoption ways when using Agile Methodologies. It will also show if there has been any new innovations (e.g. software products) due to the Agile Methodologies being used.

**Do I have to be in this research and may I stop participating at any time?**

Your participation in this questionnaire is completely and entirely voluntary. You may choose not to take partat all. If you decide to participate in this survey, you may stop participating at any time.

**What if I have questions?**

If you have any questions feel free to contact the study leader:


Contact details of project leader (study supervisor)

Name: Johan Breytenbach

University of the Western Cape, Department of Information Systems

Telephone: 021 959 2162

Email: Jbreytenbach@uwc.ac.za

Contact details of student

Name: Nicholas Norman

Telephone: 0727404663

Email: 3122458@myuwc.ac.za




NOTE: *This research project has received ethical approval from the Humanities & Social Sciences Research Ethics Committee of the University of the Western Cape, Tel. 021 959 2988, email: research-ethics@uwc.ac.za*

Research Participant Consent Form: Questionnaire

| | |
|---|---|
| Project Title: | An Agile software development adoption framework for the South African financial industry |

Please tick Yes or No to each of the following

| | Yes | No |
|---|---|---|
| 1. I confirm that I have read and understand the information sheet explaining the above research<br>project and I have had the opportunity to ask questions about the project. | | |

| | | |
|---|---|---|
| 2. I understand that my participation is voluntary and that I am free to withdraw at any time without<br>giving any reason and without there being any negative consequences. | | |
| 3. I understand that should I not wish to answer any particular question or questions, I am free todecline. | | |
| 4. I understand my responses and personal data will be kept strictly confidential. I give permission for members of the research team to have access to my anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified or<br>identifiable in the reports or publications that result for the research. | | |
| 5. I agree for the data collected from me to be used in future research. | | |
| 6. I agree to take part in the above research project. | | |

| | | |
|---|---|---|
| Name of Participant<br>(*or legal representative*) | Date | Signature |
| Name of person taking consent | Date | Signature |



Contact details of study supervisor:

Name: Johan Breytenbach

University of the Western Cape, Department of Information SystemsTelephone: 021 959 2162

Email: Jbreytenbach@uwc.ac.za

NOTE: *This research project has received ethical approval from the Humanities & Social Sciences Research Ethics Committee of the University of the Western Cape, Tel. 021 959 2988, email: research-ethics@uwc.ac.za*

# Appendix C: Questionnaire

An Agile software development adoption framework for the SouthAfrican financial industry

There has been multiple developments and growth within the software development methodologies in the Financial Industries in South Africa. These developments and growth was for constant process improvement to maximize the outcome with the shortest lead time possible. Agile software development methodologies has been the most popular in recent years. The methodologies is flexible to adapt to any type of process requirements because it has multitude variations for process improvements. Quality tends to be compromised whenrushing to meet deadlines. However, with adaptive Agile methodologies, quality is not compromised when being rushed with shortened process time. Agile methodologies are not only beneficial to the organisation but also to the developers as it provides them with individual benefits, which opens the gateway for more productivity.



The adoption of the Agile software development methodologies will be investigated. Having a smooth transition into a new method of completing software development processes alongchange management, the more likely the organisation would accept it. To understand this view, we investigated the Agile software development adoption methods and look at how innovation has been used to implement it. We examined the structure of the methods, and how the organisation has been affected by the adaptation of the methodologies.

**Background Information**

1. What gender are you?
    a. Male
    b. Female

2. What is your age?
    a. < 20 years
    b. 20 – 29 years
    c. 30 – 39 years
    d. 40 – 49 years
    e. >50 years

3. Language
    a. English
    b. Afrikaans
    c. Xhosa
    d. Other

4. What is your job title (or similar to):
    a. Software Developer
    b. Software Engineer
    c. Web Developer
    d. Computer Programmer
    e. Team Leader
    f. QA – Tester
    g. Development Manager
    h. Scrum Master
    i. Other: _____



5. How long have you been involved with software development?
    a. <1 year
    b. 1 – 3 years
    c. 4 – 8 years
    d. >= 9 years

6. How many people employed in your organisation?
    a. < 500
    b. 500 – 2000
    c. 2000 – 5000
    d. 5000 – 10 000
    e. > 10 000

7. How many people are engaged in your software development team?
    a. < 5
    b. 5 – 10
    c. 10 – 20
    d. 20 – 30
    e. > 30

8. How long have you been involved with Agile Methods?
    a. < 1 year
    b. 1 – 3 years
    c. 3 – 5 years
    d. > 5 years

**Current Agile information:**

9. What current Agile Development Methodology is being used?
    a. Scrum
    b. Waterfall
    c. Extreme programming
    d. Scaled Agile Framework (SAFe)
    e. Lean
    f. Feature Driven Development (FDD)
    g. Large-Scale Scrum
    h. Dynamic Systems Development Method (IDSDM)
    i. Other

10. What were the key reasons to start using Agile Methods?
    a. Quality, Productivity, Predictability, Team
    b. Culture, Early Risk Reduction, Build Right Products, Cost Control
    c. Creativity, Manage Priorities, IT/Business alignment, Customer/Stakeholder Satisfaction
    d. Discipline, Revenue, Visibility, Organizational Transparency

11. Has Agile methods allowed for new innovations in the organisation?
    a. Agree
    b. Disagree
    c. Don't know

12. If you selected "Agree" in the previous question (Question 11), please mention what innovations (high-level) resulted from the use of Agile methods?

_____

**Adoption Process**

13. Was there an adoption method (process) used when implementing the Agile methodology?
    a. Yes
    b. No
    c. Don't know

14. If you selected "Yes" in the previous question (Question 13), on a scale, please rate the difficulty level per process when adopting the methodology (1=easy, 5= very difficult):
    a. 1
    b. 2
    c. 3
    d. 4

15. (A). When adopting the methodology, rank the efforts of your organisation invested in for the adoption for "Team"

| Less Effort | More Effort | Most Effort |
|---|---|---|
| 1 | 2 | 3 |



15. (B). When adopting the methodology, rank the efforts of your organisation invested in for the adoption for "Productivity"

| Less Effort | More Effort | Most Effort |
|---|---|---|
| 1 | 2 | 3 |

15. (C). When adopting the methodology, rank the efforts of your organisation invested in for the adoption for "Quality"

| Less Effort | More Effort | Most Effort |
|---|---|---|
| 1 | 2 | 3 |

16. What was the outcome of using the adoption methodology for the Agile method(s) implemented?

    a. Successful
    b. Unsuccessful
    c. Don't know

17. What has worked in the current adoption process and how does it help with having a positive attitude to being more innovative?

18. What does the adoption process lack in terms of dealing with complex Agile methods which prevents flexibility to "think out of the box"?

19. If any, what types of challenges has arisen when adopting the methodology and how were these challenges dealt with?

**Team Dynamics**

20. How does team members' roles change when the adoption process seems to be failing?

21. What skills and experience do the team members need in order to participate in an Agile environment?

22. What skills and experience does the Agile leader need when giving guidance to team members to ensure for an innovative mind set?



**Software Development**

23. What was the length of the last project iteration and how did using Agile assist?

24. Would you suggest that having an adoption method would improve the quality of the product using Agile methods?
    a. Yes
    b. No

25. Does being Agile assist with the development by providing an open-minded state (thinking out of the "box")?
    a. Yes
    b. No

**Agile adoption process**

26. When implementing an Agile process, what is the biggest risk when not following an adoption process?
    a. Time
    b. Money
    c. Other: _____

27. What would the outcome be of a failed adoption process in terms of costs to the organization and what would the impact be?

28. What would you change about the current adoption process and why?

**Innovation**

29. Once given a specification to develop, does being in an Agile environment, make you think of better processes/solutions or new ways of designing?
    a. Yes
    b. No
    c. Don't know

30. Does this type of thinking (in question 29) come naturally because of the Agile environment, or do you have to take time out to focus?
    a. Yes
    b. No
    c. Don't know



31. When an idea is rejected to improve a process, does this discourage you and prevent you from trying again or do you keep trying?
    a. Keep trying
    b. Give up
    c. Don't know

32. Consider the following statement: Is the Agile methodology working in the organisation?
    a. Strongly Agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly Disagree

33. Consider the following statement: Innovation only happens when the team's relations are going well or happens regardless?
    a. Relations are going well only
    b. Happens regardless
    c. Don't know

34. Any general comments you want to make about the adoption method or any of the above answers you wish to expand/discuss.