

https://dspace.org/

The influence of Agile methodology on digital transformation: the case of the South African bank

Daya, Mayur

2021
https://hdl.handle.net/10539/32631

Downloaded from a DSpace repository. https://dspace.org/

THE INFLUENCE OF AGILE METHODOLOGY ON DIGITAL TRANSFORMATION: THE CASE OF A SOUTH AFRICAN BANK

Mayur Daya

0201608E

Mayur.Daya@gmail.com I 078 802 8803

A research report submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Management in the field of Digital Business

Johannesburg, 2021

(Version 2019–2020)

ABSTRACT

This study aimed to analyse the digital maturity level and understand the influence the Agile methodology has on digital transformation at Bank X.

A quantitative study was conducted using primary data with a sample of 123 respondents that attempted the survey. Only 82 respondents successfully completed all four sections of the research instrument. An online survey, consisting of 165 questions, adopted a Likert scoring scale to capture the respondents' feedback. Linear regression, Spearman's Rho, descriptive statistical analysis, the Mann-Whitney test, the correlation test, and the Wilcoxon Signed-Rank test were used to analyse the data.

The study found that no statistical differences were observed in the view of the impact of agile on digital transformation between the management and non-management groups. A positive correlation between Agile and digital transformation indicated that an increase in the Agile construct has an increasing effect on the digital transformation construct, confirming that Agile influences digital transformation. A further finding was that both Agile and digital maturity statistically significantly predicted the department's digital transformation. Finally, the Wilcoxon Signed-Ranks test indicated that respondents felt that the department's digital maturity level was higher than the hypothesised maturity level, Stage 3. Based on the digital maturity matrix in Appendix B, the maturity level was less than Stage 4; hence, a maturity level of Stage 3 has been assumed.

The study verified that the department has adopted an Agile methodology; however, to attain an elevated digital maturity level, it is recommended that data still needs to be used efficiently to obtain valuable insights for targeted marketing, decision making and the generation of new value streams. It is further recommended that business processes are continuously reviewed, and management needs to be encouraged to take risks that do not have any associated reputational risks.

The study's results are significant as they could assist the leadership team to achieve an enhanced digital maturity level with each Agile iteration.

KEY WORDS

Agile, digital transformation, digital maturity

DECLARATION

I, Mayur Daya, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Management in the field of Digital Business at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

Name: Mayur Daya Signature: 

Signed at Johannesburg

On the 01 day of July 2021

DEDICATION

This report is dedicated to my family, mentors, colleagues and friends who have supported me through my journey.

A special dedication to my mother, brother and maternal uncles, who have guided and supported me in all aspects of my life.

This report is also dedicated to my family and friends who have departed and who have played a major role in guiding and inspiring me.

ACKNOWLEDGEMENTS

This report would not have been possible without the support of my family, friends, classmates and colleagues at work.

I am indebted to my supervisor, Dr Tebogo Sethibe, for keeping me focused and supporting and mentoring me during this research project. I thank you.

To my study group: we have developed a life-long bond beyond both the academic and the corporate arenas. I am thankful for the time we spent together.

To Wits Business School, thank you for creating a virtual platform that enabled learning to continue during the COVID-19 pandemic.

To my employer, thank you for allowing me to perform my study. Lastly, to my colleagues, who took time to participate in the survey and distributed the survey to other respondents, thank you.

TABLE OF CONTENTS

ABSTRACT ii

DECLARATION iv

DEDICATION v

ACKNOWLEDGEMENTS vi

TABLE OF CONTENTS vii

LIST OF TABLES x

LIST OF FIGURES xi

LIST OF ACRONYMS AND ABBREVIATIONS xii

CHAPTER 1: INTRODUCTION 1

1.1 Purpose of the Study 1

1.2 Context of the Study 1

1.3 Research Problem 2

1.4 Research Objectives 2

1.5 Significance of the Study 3

1.6 Delimitations of the Study 3

1.7 Definition of Terms 3

1.8 Assumptions 4

1.9 Chapter Outline 4

CHAPTER 2: LITERATURE REVIEW 6

2.1 Introduction 6

2.2 Theoretical Framework 6

2.3 Definition of Topic or Background Discussion 7

2.3.1 Digital transformation concept 7

2.3.2 Digital transformation framework 8

2.3.3 Agile methodology 11

2.4 Prior Studies 12

2.4.1 Earlier Studies on digital transformation 13

2.4.2 Earlier studies on Agile 19

2.4.3 Earlier studies on digital transformation and Agile 22

2.4.4 Hypothesis 1 ..... *26*
2.4.5 Hypothesis 2 ..... *27*
2.4.6 Hypothesis 3 ..... *27*
2.5 Conclusion of the Literature Review 28
2.5.1 Hypothesis 1 ..... *28*
2.5.2 Hypothesis 2 ..... *28*
2.5.3 Hypothesis 3 ..... *28*
CHAPTER 3: RESEARCH METHODOLOGY 29
3.1 Research Approach 29
3.2 Research Design 29
3.3 Data Collection Methods 30
3.4 Population and Sample 30
3.4.1 Population *30*
3.4.2 Sample and sampling method *31*
3.5 The Research Instrument 31
3.6 Procedure for Data Collection 32
3.7 Data Analysis and Interpretation 32
3.8 Limitations of the Study 33
3.9 Validity and Reliability 33
3.9.1 External validity *34*
3.9.2 Internal validity *34*
3.9.3 Reliability *34*
3.10 Demographic Profile of Respondents 35
3.11 Ethical Considerations 35
CHAPTER 4: PRESENTATION OF RESULTS 36
4.1 Introduction 36
4.2 Demographics 36
4.3 Reliability and Descriptive Statistics 42
4.3.1 Agile *42*
4.3.2 Digital maturity *43*
4.3.3 Digital transformation *44*
4.4 Inferential Statistics 45
4.4.1 Mann-Whitney test: management and non-management *45*
4.4.2 Correlation results *47*
4.4.3 Digital maturity assessment *47*
4.4.4 Regression results *52*

4.5 Summary of Results 54
CHAPTER 5: DISCUSSION OF RESULTS 56
5.1 Introduction 56
5.2 Demographics 56
5.3 Objective 1: To Analyse the Digital Transformation Maturity Level of Bank X ... 57
5.4 Objective 2: To Analyse the Impact of Agile Methodology on Digital Transformation at Bank X. 61
5.5 Objective 3: To analyse the view of the management / non-management groups on the impact of agile on digital transformation 63
5.6 Conclusion 63
CHAPTER 6: CONCLUSION AND RECOMMENDATIONS 64
6.1 Introduction 64
6.2 Research Objective 1 Conclusion 64
6.3 Research Objective 2 Conclusion 65
6.4 Research Objective 3 Conclusion 66
6.5 Recommendations 66
6.6 Limitations 67
6.7 Suggestions for Further Work 68
REFERENCES 69
APPENDIX A: RESEARCH INSTRUMENT 76
APPENDIX B: DIGITAL MATURITY MATRIX 90
APPENDIX C: CONSISTENCY MATRIX 91
APPENDIX D: ETHICS CLEARANCE cERTIFICATE 92
APPENDIX E: LETTER TO RESPONDENTS 93
APPENDIX F: CONSENT FORM 94

LIST OF TABLES

Table 1: Profile of respondents 30
Table 2: Respondents' departments.....37
Table 3: Respondents' age 37
Table 4: Respondents' gender 37
Table 5: Years worked at the organisation.....38
Table 6: Role held by the respondents.....38
Table 7: Project length 39
Table 8: Level of Agile experience (in years) 39
Table 9: Agile project involvement.....39
Table 10: Agile method adopted 40
Table 11: Team (squad) size.....40
Table 12: Agile – reliability and descriptive statistics.....42
Table 13: Digital maturity – reliability and descriptive statistics.....43
Table 14: Digital transformation – reliability and descriptive statistics.....44
Table 15: Mann-Whitney test on management and non-management.....45
Table 16: Test statistics – grouping variable (management).....46
Table 17: Correlation results 47
Table 18: Digital maturity descriptive results summary 48
Table 19: Wilcoxon Signed-Rank test – ranks table.....49
Table 20: Test statistics.....51
Table 21: Model summary.....52
Table 22: ANOVA table.....53
Table 23: Coefficient table.....53
Table 24: Collinearity statistics.....54

LIST OF FIGURES

Figure 1: Agile Questions 1–10 76

Figure 2: Agile Questions 11–22 77

Figure 3: Agile Questions 23–33 78

Figure 4: Agile Questions 34–47 79

Figure 5: Agile Questions 48–53 80

Figure 6: Digital Maturity Questions 1–9 81

Figure 7: Digital Maturity Questions 10–23 82

Figure 8: Digital Maturity Questions 14–36 83

Figure 9: Digital Maturity Questions 37– 50 84

Figure 10: Digital Maturity Questions 51–62 85

Figure 11: Digital Transformation Questions 1–5.3 86

Figure 12: Digital Transformation Questions 5.4–7.4 87

Figure 13: Digital Transformation Questions 7.5–11 88

Figure 14: Digital Transformation Question 11 89

Figure 15: Digital Maturity Matrix – adopted from Berghaus and Back (2016) 90

Figure 16: Ethics Clearance Certificate 92

Figure 17: Letter to Respondents 93

LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Term
TOC	Theory of Constraints
360DMA	360 Digital Maturity Assessment

CHAPTER 1: INTRODUCTION

1.1 Purpose of the Study

The purpose of the study was to understand the role of Agile methodology has on digital transformation in a South African Bank. A quantitative research approach was used, and online surveys were used to collect data. The surveys were sent to individuals working in Agile teams in the identified organisation.

1.2 Context of the Study

Clients are changing the way they bank and no longer favour visiting branch outlets. Moreover, to remain relevant in a highly competitive digital era, banks in South Africa need to react rapidly to changes in their environment or face the threat of extinction. This, however, is only possible by the adoption of the agile methodology. Guinan et al. (2019) argued that Agile facilitates the digital transformation process.

The identified organisation (Bank X) is legacy South African bank that not only strives to deliver valuable products and services to clients but also aims at providing delightful client experiences. This confirms a statement by Sajić et al. (2018) that banks need to ensure that the new digital channels are efficient, fast and provide a high level of customer experience.

Bank X has leadership capabilities but lacks digital capabilities; therefore, based on Westerman et al. (2014), the classification of digital mastery could be classified as being conservative. The organisation is risk-averse and cautious in taking drastic steps; however, it needs to transform to become digital masters so that they are not threatened by new digital entrants. Dreischmeier et al. (2015) stated that digital transformation needs to be an essential item on management's agenda.

Being a legacy bank, the leadership team prefers long-term planning and a view of the full scope, which is not sustainable in a digital era. Flexibility and the ability to react

rapidly to changes, in both environmental conditions and customer requirements, is critical for the survival of the organisation in the digital era.

Banks need to review their business processes and operating models and adopt new ways of working. By assessing the organisation's digital maturity using a digital maturity model, this can be achieved.

1.3 Research Problem

Ochoa-Urrego and Peña (2020) stated that digital transformation is a continuous process, and on completion of each iteration, the level of digital maturity is increased. The adoption of an Agile methodology enables teams to be flexible so that they are able to respond to changes quicky and iteratively deliver working software in short intervals. These characteristics complement the iterative requirements of digital transformation.

Although there is abundant siloed literature on Agile methodologies, digital transformation and digital maturity models, there is no study that integrates the three concepts within the context of South African banks.

1.4 Research Objectives

Main Objective: To analyse the influence of Agile methodology on digital transformation at a South African Bank (Bank X).

Sub-Objective 1: To analyse the digital transformation maturity level of Bank X.

Sub-Objective 2: To analyse the impact of Agile methodology on digital transformation at Bank X.

Sub-Objective 3: To analyse the view of the management / non-management groups on the impact of agile on digital transformation.

1.5 Significance of the Study

There are currently limited noteworthy studies addressing a combination of the concepts of Agile methodology, digital transformation and digital maturity within the context of South African Banks.

There are studies conducted on foreign organisations on the Agile Methodology((Barton et al. (2018); McAvoy and Sammon, (2005); Sommer (2019)), Digital transformation (Sebastian et al. (2017); Sajić et al. (2018)) and Digital maturity(Eremina et al. (2019)).

The study aims to assist digital leaders in the banking sector to understand the influence of Agile methodologies on their digital transformation journey, taking into consideration that digitally mature organisations are more profitable and can attain a competitive advantage faster. The speed and flexibility aspects refer to the Agile methodology.

From a theoretical perspective, the study will contribute to the limited literature about Agile and digital transformation from a South African banking perspective.

1.6 Delimitations of the Study

1. The study excludes investments and other departments.
2. The study is limited to the head office; other outlets and divisions outside Gauteng are excluded.
3. The study is limited to retail banking departments.

1.7 Definition of Terms

Terms	Definition
Agile	“Agile Methodology for software development refers to a group of software development methods in which resolutions emerge through the collaboration between

	cross-functional teams, thereby facilitating adaptive planning, ongoing improvement, and evolutionary developments that contribute to a rapid and flexible response to the changes" (Alami, 2015).
Digital Transformation	"A process of major change to enhance customer experience and to innovate on business models by leveraging digital technologies" (Fitzgerald et al., 2013).
Digital Transformation Framework (Digital Maturity Model)	"A Digital Maturity Model can assist management and employees in developing a clear roadmap for their transformation activities in order to improve the level of Digital Maturity" (Teichert, 2019).
Researcher	The student conducting the study.

1.8 Assumptions

The first assumption made in the study is that the identified organisation previously used traditional methodologies, such as Waterfall, and it is currently adopting the Agile Methodology. A further assumption is that this organisation strategically selects projects that can be delivered using Agile methodologies. A subsequent assumption is that the centre of excellence in the organisation creates a working model best suited for the organisation by using learnings from various methodologies. The final assumption is that the sample of respondents may choose not to complete the survey.

1.9 Chapter Outline

Chapter 1 presented the purpose of the study, the context of the research, the research problem, the research objectives, the significance of the study and the delimitations. The chapter also defined the terms used in the report and discussed the assumptions made regarding the study.

The theoretical review is presented in Chapter 2, as well as the concepts of digital transformation, Agile and the digital transformation framework. Prior studies by other researchers are reviewed.

Chapter 3 details the process to conduct the research. The research approach, the research design, data collection methods, population and sample and research instrument are discussed. The data collection procedure, data analysis and interpretation, limitations of the study, validity and reliability, demographics of the respondents and ethical considerations are also outlined.

Chapter 4 presents the research findings. The findings are discussed in Chapter 5. A conclusion is derived in Chapter 6 to prove the objectives, and recommendations are made for possible future research.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The study evaluates the influence of the Agile methodology on digital transformation at a South African Bank. The literature review provides insights into digital transformation, digital maturity models, and Agile by examining prior research.

2.2 Theoretical Framework

The theory of constraints (TOC) has been identified as the theoretical lens adopted in the study. Şimşit et al. (2014) stated that the theory is a sector independent management philosophy that enables system improvements by iteratively identifying weaknesses and resolving them. In agreement with Şimşit et al. (2014), that in every system, there is a problem or a requirement that requires a solution that will enable the organisation to be more profitable and ultimately acquire a competitive advantage over their competitors. By adopting the TOC, organisations can measure and enhance their financial and operational performance because resolving every problem puts the organisation in a better position.

Zandi (2014) held that there is always one problem or constraint that requires resolution that could restructure the organisation or the organisational processes. Because digital transformation requires an organisation to change various aspects in the way it operates and review its business models, this is an appropriate view.

Chou et al. (2016) stated that constraints could be either tangible or intangible aspects that could limit the system or application. A finding noted by Chou et al. (2016) was that organisations that successfully adopted the TOC have decreased their production lead times, increased customer satisfaction and improved their profit margins. These are also the benefits of adopting the Agile methodology.

In a study performed by Rhee et al. (2010) to enhance the efficiency of business processes based on the TOC, it was found that the TOC-based business process

management enabled process efficiency. The approach adopted was to identify critical resources, use them to solve a particular problem, and then solve the next one.

In India, Sheshasaayee and Vijaykumar (2015) performed a study to identify bottlenecks in the Agile methodology using the TOC. Feature driven deployment (FDD), Lean software development, Extreme programming (XP) and Scrum were evaluated. Sheshasaayee and Vijaykumar (2015) stated that bottlenecks reduce throughput and ultimately reduce revenue. TOC was adopted to adopted to discover bottlenecks. The research was conducted in three phases. The first phase uncovered bottlenecks in agile software development; the second phase looked at the Lean framework and the third phase interrogated the Agile methodology within the context of the case study. The bottlenecks discovered in the Lean framework were the lack of motivation; lack of a method for interacting with stakeholders and the lack of simplicity. Two bottlenecks surfaced for XP which were that XP only focused on customer interactions and there was no guiding principle for teams on the concept of process improvement. Scrum on the other hand, does not require the customer's presence which is a bottleneck as it inhibits decision making and increases the time to deliver working software. In FDD, success is considered by the implementation of requirements and not those that are accepted by customers. Face-to-face communication is decreased in FDD which may introduce communication bottlenecks.

Ifandoudas and Chapman (2009) posited that the iterative nature of the TOC enables identifying, exploiting and resolving bottlenecks. The iterative nature of TOC resembles the iterative nature of the Agile methodology in delivering solutions in small sub-products, therefore, this theory was chosen.

2.3 Definition of Topic or Background Discussion

2.3.1 Digital transformation concept

Westerman et al. (2014) defined digital transformation as "the use of technology to radically improve the performance or reach of enterprises". Fitzgerald et al. (2013) define the concept as a "process of major change to enhance customer experience

and to innovate on business models by leveraging digital technologies". On the other hand, Kazim (2019) described digital transformation as a digitisation process with organisational implications.

Digital transformation, although feared by many leaders, is a journey that needs to be taken. According to Teichert (2019), digital transformation is a topic that is being escalated on management agendas. With the adoption of digital technology increasing, and clients changing the way they bank, the need for traditional banking outlets is diminishing. Therefore, there is an urgent need for banking products and services to be digitised. Barton et al. (2018) held this view.

Digitally mature organisations, according to Baculard et al. (2017), outperform their laggard competitors. Baculard et al. (2017) state that real benefits from digital transformation are only achieved when digital leaders focus on both strategy and the organisation's pain points.

A sound strategy is vital for the success of digital transformation. Štemberger et al. (2019) stated that organisational structures, business processes and business models must be reviewed, so that a roadmap can be formulated to provide direction for achieving a higher digital maturity level.

Dreischmeier et al. (2015) stated that existing organisations have an advantage over new entrants as they have operating experience and, most importantly, data. The use of data is an essential aspect of digital transformation.

The journey is an iterative process that requires constant organisational and environmental assessments to ensure that the actions to be taken enable the organisation to attain a competitive advantage.

2.3.2 Digital transformation framework

Teichert (2019) mentioned that the organisation must establish its digital maturity levels and identify weaknesses to establish a roadmap to achieve an elevated digital maturity level. According to Colli et al. (2019), this is achieved by adopting a digital

maturity model that most suits the organisation. Some of the models include Acatech, Dreamy, Impulse, Capability Maturity Model (CMM), Forrester's model, Westerman et al. (2014), Eswaran (2017), the 360 digital maturity assessment (360DMA), Berghaus and Back (2016), e-Gov-MM, Buvat, et al. (2017).

Colli et al. (2019) stated that Acatech was developed to model company information and can be adapted to different context-specific information. This model focuses on maturity stages and dimensions. Colli et al. (2019) posited that maturity stages apply to data generation, adaptability and transmission, while dimensions refer to organisational strategy, resources and culture. It was further stated by Colli et al. (2019) that the organisational structure dimension assesses the organisational structure and strategy aspects. The resources dimension assesses the tangible, intangible and physical resources. The information systems dimension assesses the availability of the information technology infrastructure where information received from individuals is required for decision making. The last dimension is culture, which assesses organisational culture, skills and the employee mindset.

The 360DMA was derived by Colli et al. (2019) and assesses the following dimensions: value creation, governance, technology, competence and connectivity. The governance dimension deals with assessing the strategy, organisational structure, digital awareness and resource allocation.

Technology refers to the hardware and software aspects that enable the transformational process. Connectivity deals with the infrastructure required to transfer data inside and outside the organisation. Value creation aims at adopting models that generate value, and lastly, competence refers to the skills required to achieve digital maturity.

According to Štemberger et al. (2019), Forrester's model assesses technology adoption, organisational alignment and culture, while aspects such as technology adoption, process, human roles, systems and information are emphasised in the digital asset management model.

Another digital maturity model that examined nine dimensions was proposed by Berghaus and Back (2016). The dimensions were strategy, product innovation, organisation, customer experience, collaboration, information technology, process digitisation, transformation management, culture and expertise.

According to Williams et al. (2019), the CMM assessed the dimensions of process and institutional aspects. Culture, collaboration, organisational structure and the human resource functions form part of the institutional aspects. The process dimension examines aspects relating to systems and technology, performance management and business processes. Business processes are activities such as resource planning and budgeting for the required resources.

Westerman et al. (2014) presented a digital maturity model that examined the following dimensions: operations, customer experience, digital vision, business models, engaging the organisation, building technology leadership capability and governing the transformation.

Eswaran (2017) proposed a digital maturity model that examines the following dimensions: organisational culture, strategy and leadership, empowerment of employees through constant learning, business operation optimisation, customer engagement and product transformation.

The e-Gov-MM formulated by Valdés et al. (2011) focuses on assessing strategy, process management, IT governance and the organisational people dimensions.

The model proposed by Ertan (2018) assesses the dimensions of technology, culture, insights and organisation.

The model proposed by Buvat et al. (2017) shares common dimensions with some of the other models presented. The dimensions investigated are culture and engagement, workforce enablement, vision, business and technology, customer experience, governance, operations, business model innovation and talent management. Business model innovation and culture are essential aspects for the organisation to remain relevant in a constantly changing digital ecosystem.

Aslanova and Kulichkina (2020) performed a study to define a digital maturity model. The study was based on an analysis of a clothing factory and an oil and gas manufacturing company. The model presented had three scales and four levels of maturity. The scales were the digital transformation strategy, digitisation readiness and the level of digitisation. The levels of digital maturity were represented as beginners, catching-up, leaders and off-track.

Organisational culture, systems and processes are common dimensions across multiple digital maturity models. Organisational culture includes collaboration, agility, flexibility, risk tolerance and customer-centricity.

2.3.3 Agile methodology

The Waterfall methodology, as defined by Gharajeh (2019), is a linear methodology requiring each step to be completed before moving to the next step in the process. The model is appropriate for projects requiring long-term planning and minimal changes to requirements during a Waterfall iteration. Gharajeh (2019) explained that a typical Waterfall model starts with requirements gathering, a process of understanding and documenting the solution requirements, followed by system analysis. The solution is then developed and given to the testing team for vigorous software testing. Once sign-off is received from the testing team, the product is then deployed to the production environment for consumption by the targeted user group. Post-implementation and after the warranty period has passed, the product then moves into operations and maintenance. Gharajeh (2019) stated that Waterfall provides little flexibility as requirements are signed off before development can start: no changes are considered mid-iteration.

The previous paragraph aligns with Highsmith and Cockburn's (2001) definition of the Agile methodology as 'a response to the inability of traditional methodologies to embrace change in a turbulent business environment'. The traditional methodologies referred to by Highsmith and Cockburn (2001) are Waterfall methodologies that require the scope of the project to be finalised at the start of the Waterfall iteration. There is no room for changes during the iteration.

Based on an article by Guinan et al. (2019), the Agile methodology enables squads to be formed with chapter members from cross-functional areas. Agile enables flexibility so that teams can accept requirements at any stage of the project, cater for customer feedback and respond to environmental changes. Guinan et al. (2019) stated that sprints (a defined period during which deliverables need to be completed) are two weeks long and enable the team to deliver solutions rapidly. Collaboration ensures that the team has a common understanding of the deliverables and eliminates bottlenecks.

Collaboration is essential for the success of an Agile squad and the organisation. Alami's (2015) definition of an Agile methodology is, therefore, relevant. Alami (2015) defines Agile as a collection of software development methods founded through the collaboration of team members from various cross-functional areas. These Agile squad members constantly improve their product by accepting customer feedback and new requirements, which are implemented in upcoming sprints. The flexibility and rapid response qualities of the Agile methodology are supported, which confirms Zaitsev, Gal and Tan's (2020) idea of an Agile methodology as “collaborative social interactions and fast-paced and iterative changes in project requirements”.

2.4 Prior Studies

Although there are earlier studies on Agile, digital maturity models, and digital transformation, there are fewer studies conducted in the South African retail banking sector framework on Agile methodologies in conjunction with digital transformation. The literature reviewed presents aspects of digital transformation, digital maturity models and Agile. Works include Buvat et al., 2017; McAvoy and Sammon, 2005; Sommer, 2019; Sebastian et al., 2017; Kettunen and Laanti, 2017; Guinan et al., 2019; Sánchez, 2017; Fuchs and Hess, 2018; Gerster, 2017; Barton et al., 2018; Dreischmeier et al., 2015; De Smet et al., 2018; Baculard et al., 2017; Tratkowska, 2019; Mugge et al., 2020; Zaitsev et al., 2020; Eremina et al., 2019; Ochoa-Urrego and Peña, 2020; Kazim, 2019; Williams et al., 2019; Teichert, 2019; Valdés et al., 2011; Štemberger et al., 2019; Stankovic et al., 2013; Misra et al., 2009; Maruping et

al., 2009; Ertan, 2018; Colli et al., 2019; Berghaus and Back, 2016; Westerman et al., 2014.

2.4.1 Earlier Studies on digital transformation

Qualitative research was performed in Argentina by Sánchez (2017) to formulate a framework that explains the resources, management choices and capabilities required for organisations embarking on a digital transformation journey. It was found that digital transformation brings about challenges in various areas, such as leadership and data governance. Traditional business models are challenged, and the drivers for digital transformation need to be understood. A subsequent finding by Sánchez (2017) revealed that digital transformation is driven by strategy; hence, IT adoption needs to align with the organisation's strategy. Competitive advantage is attained through a company's intangible assets, such as skills. Sánchez (2017) proposed a digital transformation framework that assessed the following dimensions: Strategy definition, Digital products or services, Platform and partners, Resource and capabilities, and barriers to digital technology adoption.

In a study conducted by Stoianova et al. (2020) to design a framework that enables the evaluation of the readiness and identification of barriers for digital transformation. The framework considers both the organisation’s current state and prior developments. Stoianova et al. (2020) found that digital transformation affected all areas of the organisation and required business models and processes to be revised as existing business models and processes did not cater for new developments. The formulated framework assesses the following dimensions, known as domains; Enterprise architecture, Maturity of business processes, Systematic management, Corporate culture and Using data.

Nylén and Holmström (2015) performed a study to formulate a managerial framework that supported an organisation’s Digital Transformation journey. The framework aimed at supporting incremental enhancements in digital innovation management and assessed five dimensions: User experience, Value proposition, Digital evolution scanning, Skills, and Improvisation.

Further, organisations that have adopted Agile methodologies can react to changes quickly and are generally successful. The lack of resources impedes the digital transformation journey. Sánchez (2017) stated that leaders need to be proactive visionaries who have a sound understanding of the goal and drive the organisation towards attaining the goal. These leaders need to identify opportunities proactively and capitalise on opportunities while on the digital transformation journey.

Meanwhile, in London and Paris, Dreischmeier et al. (2015) performed a systematic analysis to understand whether organisations face extinction if they do not embrace a digital transformation journey. It was evident that new digital entrants pose a threat to existing companies, and existing companies will face extinction should they not embrace a digital transformation journey. Dreischmeier et al. (2015) stated that digital transformation and innovation should be essential items on senior managements' agenda. Management needs to work with the idea of the organisation being its own digital disrupter. First, management needs to focus on digitising the core business, then continuously look for innovative revenue generation opportunities. Constantly changing consumer requirements and an intensely competitive operating ecosystem require forward-looking measures. Due to rapid changes and volatility, leaders can no longer plan for the long-term because responses need to be rapid. Therefore, Agile is the recommended methodology. Agile enables rapid delivery and flexibility; hence, client-centric solutions are delivered to market quickly, and operational costs are lowered.

A final finding by Dreischmeier et al. (2015) was that organisational culture needs to support digital transformation by promoting continuous learning, risk-taking and experimentation. Further, although large companies have broad insights, business models still need to be constantly reviewed to ensure that they are relevant. Agile can be used to bring about flexibility in the strategy and increase execution rates. The use of client data can provide insights into generating new revenue streams. These revenue streams can aid in attaining competitive advantage and ultimately result in an organisation being profitable.

Quantitative research was performed on 100 companies by Baculard et al. (2017) to understand their levels of digital readiness. The study involved conducting surveys on the companies. Baculard et al. (2017) stated that revenue generated by digital firms was almost double that of digital laggards. However, the journey requires changes to the business model and organisational culture to cater for continuous learning, speed of delivery and ultimately organisational agility. It was found by Baculard et al. (2017) that short-term benefits are reaped when organisations begin their digital journey by first identifying and resolving pain points.

Baculard et al. (2017) confirmed that these organisations operate as 'two-speed' organisations as part of the solution operates on legacy systems. Successful digital leaders need to look at the pain points and work towards a digital strategy, which is then converted into an easily understandable vision understood by all employees. Teams need to be deadline-driven, enabling Guinan et al.'s (2019) rapid solution delivery requirement. Lastly, digital teams are most successful when they 'recruit' personnel that deal directly with the customer. Client buy-in can then be achieved earlier, and resistance to the transformation process decreases.

In Switzerland, Tratkowska (2019) performed a qualitative report to review definitions of digital transformation and its implications on structuring new business models and implementation activities. Tratkowska (2019) found that organisations need to grow sustainably in an ambiguous, volatile, complex and uncertain environment. Volatility is the high velocity of change, and uncertainty is the uncertainty and unpredictability in the operating environment; complexity is the variety of information and the relationships that interplay, while ambiguity refers to the lack of clarity for examining events. Tratkowska (2019) further confirmed that business models, processes and operations need to be reviewed when introducing technology to ensure organisational relevance in a digital ecosystem. Tratkowska (2019) proposed two digital maturity models: the digital maturity Model and the Ernst & Young Digital Readiness Assessment model. The digital maturity model consists of five aspects, while the latter model is significantly granular. The model provides a current view of the organisation's

digital maturity levels and enables management to attain insights so that actions can be taken to move the organisation to the desired level.

In a qualitative study by Kazim (2019), it was found that the success of digital transformation is dependent on the leadership mindset, strategy, vision and the ability to continue experimenting with innovation. The purpose was to address the inability of managers to meet the challenges encountered during their digital transformation journey. The study was conducted among French organisations and noted a further finding that operational leaders must change their leadership styles.

Meanwhile, a study was conducted by Eremina et al. (2019) to detect trends originating from digital maturity and how Baltic companies are adapting to digitisation and continuously enhancing their competitive advantage. An examination of twenty-eight companies listed on the Nasdaq was conducted. The survey found that improvements in an organisation in terms of digitisation were shown to increase revenue because there is a correlation between sales and profitability. It was also noted that digital maturity contributes to the profitability of the invested capital. Besides, it was discovered that there is a relationship between digital maturity and the organisation's financial and market performance.

Research was presented by Ochoa-Urrego and Peña (2020) on building a maturity model to assess service providers' maturity levels in Colombia. The study was conducted using a literature review, and reference was made to the CMM and the Control Objectives for Information and Related Technologies (COBIT) model. The most important learning was that the digital transformation strategy must align with the overarching organisational strategy. Most of the frameworks studied suggested that an assessment must be done on both application and technology levels and that exclusive use of technology will not achieve a high level of digital maturity. Lastly, action-oriented models would be beneficial as they consider both strategic and business models.

Research presented by Williams et al. (2019) aimed at providing a digital maturity model for small- to medium-sized enterprises. The study was performed by reviewing

six models. Some of the findings were that the model and maturity level need to fit the organisational requirements, and there is a general lack of digital transformational knowledge in the organisation. References to the CMM are made, stating that it is the most cited generic model. Williams et al. (2019) stated that there is a lack of evidence that digital maturity models are beneficial; hence, digital leaders are reluctant to embark on a digital journey, although it is an essential process for the survival of the organisation.

Further, Teichert (2019) performed a study to identify characteristics from twenty-two models, focusing on the dimensions of measuring digital maturity. It was found that organisational culture can be a catalyst or a stumbling block for digital transformation. The adoption of a maturity model provides an organisation with direction during the transformation process. Moreover, digital change is disruptive and needs to happen iteratively. Teichert (2019) stated that 59% of the models studied require a self-assessment of the organisation, with each model proposing different assessments. The general model accounts for innovation, strategy, vision and organisational culture.

Štemberger et al. (2019) conducted a study that surveyed 181 Slovenian companies. The companies varied in size from large to medium. The aim was to discover successful patterns of digital transformation. It was found that the Business-IT partnership pattern brought about the highest digital maturity. This pattern required the responsibility of the journey to lie with management and the information technology department.

A mixed-method study based on global companies such as Air France, Caesar's Entertainment and Burberry was undertaken by Westerman et al. (2014) to determine areas where companies are building new digital capabilities. A digital maturity model was derived that assessed the following dimensions: processes, business models and customer experience.

Eswaran (2017) performed a quantitative study on 783 respondents from organisations with more than 100 employees in different sectors. The respondents were from Asia, Europe, North America, Middle East, Africa, and South America. The

study revealed that digital disruption would impact almost every sector, with many organisations changing their business models. With the demand for digital products increasing, Eswaran (2017) recommended that organisations must change the way they work, review their business models and upskill the workforce; this can only be done with a revised strategy guided by a vision. Flexibility and speed to respond to changes are the key factors that organisations need to adopt to succeed. Lastly, organisational culture needs to cater for cross-functional collaboration.

A quantitative study was performed in Chile by Valdés et al. (2011) on thirty public agents to formulate a digital maturity model to understand e-Government readiness. The model was benchmarked against international best practice. The model was continuously adjusted, proving that the model is flexible enough to respond to requirement changes. It proved to be a useful tool.

Ertan (2018) undertook a quantitative study to investigate the level of digital maturity in 21 Swedish organisations. Ertan (2018) used online surveys and targeted organisations in multiple industrial sectors. It was found that Swedish companies, similar to any other global organisations, are impacted by digital transformation and showed a lower level of digital maturity.

Digital transformation is an iterative process and will prove unsuccessful if there is a lack of momentum. Buvat et al. (2017) indicated this in a quantitative study of 1300 executives from 750 global organisations involved in their organisation's digital transformation journey. It is essential to note that only a few organisations have leadership and digital capabilities.

Colli et al. (2019) performed a study to understand the impact of the Fourth Industrial Revolution on the production industry. It was found that digital transformation is a multi-disciplinary organisational activity that begins with a digital maturity assessment. The results of the assessment are then used to guide the organisation on its digital journey. The outcome of the article was to define a new digital maturity model based on fifteen chosen models, such as Acatech, Impuls and Problem-Based Learning. The new model was called the 360 digital maturity Assessment (360DMA).

A qualitative study was conducted by Berghaus and Back (2016) to derive the stages in digital transformation that organisations encounter. The study was conducted using a survey of 547 individuals in 417 organisations based in Germany and Switzerland. The first finding was that there are many items related to employee commitment and digital affinity. A further finding was that a workforce that has adopted digital ways of working in their daily tasks is open-minded towards digital transformation. Berghaus and Back (2016) stated that innovation is retarded in environments where digital transformation is faced with resistance and is slow in adoption. Management support is essential when embarking on the digital transformation journey; therefore, managers need to adopt openness in their leadership style. Servant leadership is advised. Further, Berghaus and Back (2016) stated that data, and its appropriate use, is an essential factor enabling organisations to attain a competitive advantage.

2.4.2 Earlier studies on Agile

An action study was performed by Sommer (2019) at the Lego group to understand how Agile was orchestrated and implemented. Some of the findings were that employee buy-in is essential; every employee must understand the eventual goal, and an increase in employee morale and satisfaction resulted in faster delivery of work items. Sommer (2019) confirmed that a year after Agile was adopted, positive results were noticed. The adoption of new models was evident, including pop-up store formats and digital inventory management in these stores. Software teams were able to deliver a financial application and a planning tool because Agile allowed teams the flexibility and the ability to prioritise work. The financial application, originally estimated to be delivered in 8000 hours, was completed in two sprints.

Sommer (2019) pointed out that teams that struggled with working in an Agile method had multiple responsibilities and found it challenging to adhere to Agile processes and ceremonies. The strategy, vision and mission must be communicated clearly to employees to ensure commitment. Agile enables companies to respond to change faster, enables transformation, and brings about a competitive advantage, as Sommer (2019) stated. Communication needs to be open to ensure employee commitment,

satisfaction and continued motivation. Further, when an entire organisation works in an Agile framework, teams work efficiently together.

A design science research was performed in the private sector by Kettunen and Laanti (2017) to construct actionable artefacts to be used by organisations embarking on their digital transformation journey. Some of the findings were that digital transformation causes fast, disruptive change. Therefore, organisations need to change the ways they work and review their business models. Goals need to be restated to ensure employee buy-in and commitment. Kettunen and Laanti (2017) confirmed that digital transformation must be achieved iteratively using resource and competency-based views. Agile enables constant changes in a software system; therefore, methodologies such as SAFe and LeSS are adopted when Agile needs to be adopted across the organisation. Rapid decision making is essential as delays hamper agility and have ripple effects on flexibility and solution delivery.

According to Kettunen and Laanti (2017), open communication between product owners and product managers is vital, and the product must provide the customer with value or the team with valuable insights. Organisations must see themselves as software organisations because digital transformation is a continuous process. The most important finding by Kettunen and Laanti (2017) was that delivery must be quick and timeous as a missed deadline is an opportunity lost.

Barton et al. (2018) performed a study in the Netherlands on a bank's Agile transformation. It was found that by 2014 40% of their clients had embraced digital channels. Volumes received by the contact centre had decreased, and with clients migrating to digital channels, a superior customer-centric digital experience needed to be created. A subsequent finding by Barton et al. (2018) was that client-centricity was critical, and the rate of deployment of Minimal Viable Products was equally important. Further, leadership requires a thorough understanding of Agile principles and processes. The concept of tribes, squads and chapters must be applied when teams are structured. Agile team (squad) sizes must be limited to enable rapid product delivery. Chapter members are allocated to squads to enable the removal of informational silos.

An explanatory study was conducted in Southern California by De Smet et al. (2018) to guide managers embarking on an organisational transformation. Some of the notable findings by De Smet et al. (2018) were that organisations need to adopt the Agile methodology to allow deployment of solutions faster than organisations operating with a traditional method. De Smet et al. (2018) mentioned that many sectors are approaching the tipping point; therefore, organisations need to react to changes quickly. It was also found that mature Agile organisations favour unpredictability and fast-changing environments, with customer-centricity being the primary focus. Further, to enable quicker responses and foster a culture of collaboration, organisations need to adopt a backbone reporting structure instead of a hierarchical one. Work is divided into smaller work items so that it can be completed in a shorter time. De Smet et al. (2018) also advised that leaders need to foster innovation and creativity and promote the concept of failing fast to attain faster learnings. It was also stated by De Smet et al. (2018) that teams need to be strategically selected.

Meanwhile, at the University College Cork in Ireland, McAvoy and Sammon (2005) performed a study to provide an innovative teaching and learning technique in Agile software development. The researchers' approach was a mixture of action and quantitative research, where the research was conducted in two phases. The first phase was with 24 students broken up into groups of six, and the second phase was with employees from two consulting companies. Both phases were provided with two case studies of firms from different sectors, both in the top 10 in their sectors. The cases were studied, and surveys were then conducted. McAvoy and Sammon (2005) found that the decisions organisations considered when adopting the Agile methodology were based on eleven adoption factors. These factors ranged from the duration of the project to customer involvement, for example, and they were grouped into four groups: project, team, customer and organisation.

A finding by Maruping et al. (2009) noted that constant changes in requirements negatively impacted software quality. The adoption of Agile methodologies remedied this, and high project quality was enforced. The study was performed by conducting a field study on a United States-based firm with employees working in various sectors

comprising 862 developers working in 110 teams. The study aimed to investigate the management of Agile software development teams. Data was collected at the beginning, the middle and at the end of the project.

An empirical study was conducted by Stankovic et al. (2013) on project managers and senior developers working in Yugoslavian IT companies. The purpose of the study was to determine the critical success factors that determine the success of Agile software projects. Data collection was accomplished over one month using an online survey. The respondents belonged to twenty-three companies. Stankovic et al. (2013) confirmed that quality did not have a statistical impact, while the project nature was dependant on the project's completion time. Stankovic et al. (2013) further stated that the project schedule and the project nature impacted the costing. A final finding was that some of the assumed prerequisites for the success of Agile projects, such as executive support and organisational environments, are critical success factors for Agile.

A further quantitative online survey-based study was performed by Misra et al. (2009) to detect elements that lead to the success of software projects that adopt the methodology. Open- and closed-ended questions were used; however, closed-ended questions formed the core of the study. It was found that customer satisfaction, collaboration, corporate culture and learning and development influenced the project's success. A second finding by Misra et al. (2009) was that team aspects such as distribution, size, and technical competency did not significantly impact success. Other success factors included the use of tools and learning from failure.

2.4.3 Earlier studies on digital transformation and Agile

A quantitative study was performed by Sebastian et al. (2017) aimed at discovering findings of 25 global companies that embarked on digital transformation. The companies were 104 years of age, with 82 297 employees. One of the findings was that the companies' digital transformation journeys were in their early stages, and they still generated revenue from traditional services and products. This threatened their value propositions as born digital companies are powerful in a digital era. Sebastian

et al. (2017) stated that three factors enable successful digital transformation. These are the digital strategy defined by value propositions, an operational backbone that enables operational excellence and a platform that enables agility and innovation. Most companies need to be successful and attain a competitive advantage. Formulating a digital strategy will enable leaders to establish new value propositions using existing and new capabilities. Sebastian et al. (2017) stated that customer engagement strategy entails creating an omni-channel experience using data to understand the client's needs, while the digital strategy aims to reformulate the value proposition using products, services and data. Further, a strategy is only valuable if it drives capital investments.

In a global qualitative study conducted by Guinan et al. (2019) with 130 senior-level IT managers from 60 organisations, data was collected by arranging semi-structured interviews to study the IT function and identify the levers for digital transformation. It was found that existing organisations are reviewing client engagement models and their business models, which may disrupt products and services. Guinan et al. (2019) confirmed that Agile methodologies enable the digital transformation journey by promoting flexibility, enabling client feedback to be considered earlier. Agile also decreases development times.

A further recommendation by Guinan et al. (2019) that the adoption of tribes, chapters and squads, with members all co-located, promotes rapid delivery and removes information silos. The four levers for a successful team, according to Guinan et al. (2019), are a diverse and targeted team composition; iterative setting of goals; constant learning is the third lever, enabling teams to experiment so that decisions on whether to continue or to pivot can be taken; and talent management is done through the centres of excellence with the knowledge and experience to support team members.

In Munich, Fuchs and Hess (2018) performed a qualitative study to conceptualise the Agile transformation process using the lens of a socio-technical system. The study was conducted by interviewing staff in two multi-national companies whose divisions are in Munich. First, the findings were that large-scale Agile transformation could be

performed in multiple iteration phases of Agile transformation. A second finding by Fuchs and Hess (2018) was that with increasing digital demand, organisations need to continuously release innovative customer-centric solutions, which prompts for Agile to be adopted. Third, large-scale Agile transformation can occur in two ways: first, the transformation of an entire department or, second, the transformation of areas in a department

In large Agile organisations, practitioners recommend the adoption of a Scaled Agile Framework (SAFe), Large-Scale Scrum (LeSS) or Disciplined Agile Delivery (DAD). Fuchs and Hess (2018) further stated that some firms do not understand the Agile practices and organisational structures are not suited for Agile adoption. The biggest challenge in large-scale Agile is coordination between Agile and non-Agile teams. Seven categories of challenge were identified. Fuchs and Hess (2018) provided two types of action: coping and scaling action. Coping actions deal with centres of excellences that derive recommendations for dealing with challenges that arise while scaling actions deal with scaling up Agile adoption in the organisation. A further finding was that there are multiple steps in Agile adoption that require various iterations. These are the transition from plan-based to Agile, coping and addressing challenges to the digital hubs in the organisation and expanding the team. Scaling happens in the second stage. The last key finding was that skills are an essential part of Agile adoption.

A bibliometric study conducted by Gerster (2017) analysed 2833 articles between 2007 and 2017 to understand the extent of digital innovation that was already a subject of mainstream research. The first finding stipulates that digital transformation impacts both business and information technology. Practitioners see Agile as a methodology to increase flexibility and enable rapid response to changing requirements and environmental conditions. Gerster (2017) confirmed that a trend was noted whereby software companies moved from on-premise to on-demand operating models, showing an inevitable change in operating models. Lastly, the ability to manage both digital and traditional paradigms favours an organisation's agility.

Mugge et al. (2020) performed a study for practitioners and management based on the results of the disruption survey patterns. The study was based on 352 digitally developing companies and 145 digitally mature organisations. The study aimed to highlight actions that digitally mature organisations have taken so that digital laggards can use the learnings on their journeys. The first finding was that companies need to review the role and value of data in their business models, which requires changes to the organisation relating to mindset, tools, systems and methods of revenue generation. The second finding was that many companies are cautiously on digital transformation and are therefore lagging. Mugge et al. (2020) stated that executives were concerned about remaining competitive in a digital future. Digital leaders were concerned about whether their organisations were flexible enough to respond to changes quickly and that the organisation could face detrimental consequences if the organisational culture was not reviewed. The digital leader needs to be a visionary, as a sound strategy coupled with a future business system vision is essential for a successful digital transformation.

A Digital Maturity Assessment must be performed before an organisation embarks on a digital transformation journey. The journey brings about challenges in various areas, like management and data governance however according to Baculard et al. (2017) digitally mature firms generate more revenue than their digitally laggard competitors. A digital transformation framework that is relevant to the organisation must be adopted to assess the organisation's current state. Attaining an elevated level of digital maturity is an iterative process hence the agile methodology most suited. The agile methodology enables teams to be flexible and promotes collaboration within teams to ensure rapid delivery of working software. The rapid delivery of working software enables the organisation to attain a competitive advantage. The success of the adoption of the agile methodology requires buy-in from the workforce therefore, the leadership team must ensure that the goal, vision and mission are communicated unambiguously. Lastly, the efficient use of data is essential for the organisation to be successful in the digital era.

2.4.4 Hypothesis 1

The digital maturity level of Bank X is on Stage 3.

To remain relevant in a digital era, retail banks need to embark on a digital transformation journey. Aslanova and Kulichkina (2020) stated that digital maturity is an iterative process that is achieved gradually, guided by a digital transformation strategy. Progress is measured by pre-defined goals and key performance indicators. Aslanova and Kulichkina (2020) further stated that digital maturity is the basis for digital transformation.

Digital maturity is achieved by integrating digital technology with organisational processes, business models and human capital. The human factor is an important aspect of digital maturity, as staff and management buy-in is critical for the success of the transformation and for the organisation to reach a higher maturity level. Aslanova and Kulichkina (2020) stated that skills are an essential aspect.

Eremina et al. (2019) stated that digital maturity contributes to an organisation's revenue and, ultimately, profitability. In terms of Bank X, clients are changing the way they bank and no longer want to visit a banking outlet for their daily banking needs. By becoming more digitally mature, clients have the freedom to complete their banking needs at their leisure. By digitising the products, services and processes, clients could bank anywhere and at any time.

Based on the digital maturity matrix by Berghaus and Back (2016) in Appendix B, the retail department has been hypothesised to be on Stage 3. The organisation already prioritises digital projects and has strategically partnered with the relevant vendors to transform successfully to digital. Teams exhibited a level of flexibility as new requirements are encouraged, even at a late stage. However, teams still delivered high priority requirements in short intervals. Learnings from past failures are made available to other teams. The use of data is apparent.

2.4.5 Hypothesis 2

The adoption of Agile at Bank X significantly enables digital transformation.

Retail banks need to embark on a digital transformation journey, a process that is found difficult but essential for survival; therefore, digital leaders are sceptical about the journey. This sentiment is shared by Kettunen and Laanti (2017) and Baculard et al. (2017). For the journey to be successful, Baculard et al. (2017) mentioned that both client-facing and internal processes need to be digitally transformed.

Digital transformation is an iterative process requiring multiple Agile iterations. Client feedback and learnings from the previous sprint must be taken into consideration in a future sprint. To ensure a competitive advantage is attained, customer-centric solutions need to be deployed rapidly to the market. Delivery teams need to be flexible enough to accept new requirements at any stage of the project and have the ability to respond rapidly to environmental changes. Therefore, Guinan et al. (2019) and Gerster (2017) agree that Agile methodologies enable digital transformation as the journey requires flexibility, decreased development times and efficient collaboration in the teams.

2.4.6 Hypothesis 3

There is no significant difference in the view of the impact of agile on digital transformation between the management and non-management groups.

According to Sommer (2019) employee buy-in is essential to reap the benefits of the Agile methodology. Employee buy-in is achieved through an unambiguous understanding of the organisational goals, mission and vision. According to Aslanova and Kulichkina (2020), the human factor, being both the management and non-management groups, has a critical role to play for the organisation to be successful in its digital transformation journey.

2.5 Conclusion of the Literature Review

Based on the literature review, banks need to adopt Agile methodologies to remain relevant in a volatile and highly competitive operating ecosystem. Although traditional banks have the insights, customer requirements are continuously changing; hence, these organisations also need to transform to remain relevant. Digital leaders need to cater for the high volatility levels in the ecosystem in the short term. Agile favours this. Digital transformation requires a quick response to organisational and environmental changes. Teams need to exhibit a high level of flexibility to react to pressing issues that arise mid-sprint. Leaders require direction to achieve a higher level of digital maturity, and this is only possible by assessing the organisational digital maturity level using a digital maturity model.

Agile methodologies enable iterative implementation and cater to flexibility; digital transformation thrives on Agile adoption.

2.5.1 Hypothesis 1

The digital maturity level of Bank X is on Stage 3.

2.5.2 Hypothesis 2

The adoption of Agile at Bank X significantly enables digital transformation.

2.5.3 Hypothesis 3

There is no significant difference in the view of the impact of agile on digital transformation between the management and non-management groups

CHAPTER 3: RESEARCH METHODOLOGY

The research approach, research design, data collection and population sampling are discussed in this chapter. The data collection process, research instrument, research limitations and analysis are also discussed.

3.1 Research Approach

Barnes (2001) stated that there is no one correct approach to conducting research and each research method has its own pros and cons.

The researcher adopted a quantitative approach as the study required variables to be identified, which influenced an outcome.

The positivism paradigm was adopted as a population from Bank X's employees that work on Agile projects was approached to participate in the study. The reason for approaching these employees was that they have a sound understand of the agile practices. This paradigm was chosen as these employees have extensive experience in working on Agile projects and therefore, their responses to the questionnaire would be accurate and trustworthy. A deductive approach was adopted in the study as the hypotheses were empirically tested.

The assumption by the researcher was that the identified employees that currently work on Agile projects have sufficient agile working experience and that the accuracy of the study would not be compromised.

Literature reviews that provided insights into the constructs and variables(dimensions) relating to the influence of Agile on digital transformation are – to an extent – available. An assumption was made that relationships between dependent and independent variables can be tested using empirical approaches.

3.2 Research Design

The research utilised questionnaires from existing studies and was provided to individuals from the chosen organisation who work in Agile teams and follow Agile

practices. Data collection occurred during the last quarter of 2020, therefore, a cross-sectional research design using quantitative techniques was identified by the researcher. The researcher agrees with Creswell (2014) that surveys allow a vast amount of data to be collected and generalised. For analysis purposes, the responses were converted into a numerical structure.

The gathered data was then analysed using a statistical tool. A digital maturity model in Appendix B was adopted to identify the organisation's current digital maturity level.

3.3 Data Collection Methods

Data was collected via online surveys. The link to the survey was provided to relevant individuals via email. In the event of non-responses, measures such as follow-up emails and telephone calls were conducted to ensure that essential data was collected. The survey adopted a Likert Scale type response format where respondents were able to provide their feedback.

3.4 Population and Sample

3.4.1 Population

The identified research population consisted of individuals that worked on Agile projects at the organisation. The reason these individuals were approached was that they have sound exposure to the Agile principles and practices, which enabled the findings to be accurate.

For adequate statistical analysis to be performed, the study aimed to attain 80–120 responses in the identified organisation.

Table 1: Profile of respondents

Description of respondent type	Number to be sampled
Chapter Managers	5
Project Sponsors	5
Product Owners	20

Description of respondent type	Number to be sampled
Scrum Masters	10
Agile Squad Members	80
Total Number Of Respondents	120

3.4.2 Sample and sampling method.

The respondents were profiled based on Table 1 therefore, a stratified method was adopted, and the targeted population sample was limited to individuals that worked on Agile projects. The purposive sampling method was also adopted as the study targeted individual working on agile projects and the data gathering needed to be completed quickly. The questionnaire was anonymous, hence to an extent convenient sampling was also adopted as the survey was shared with co-workers who met the criteria in Table 1.

3.5 The Research Instrument

An online survey hosted in Qualtrics was used for data collection. A Likert Scale was used to obtain an understanding of perceptions. Responses were measured using ordinal, interval and nominal scales.

The layout of the questionnaire will be as follows:

- Part A: Agile – Survey Instrument
    - The questionnaire was adopted from Stankovic et al. (2013) and examined the following dimensions: Demographics, Organisational, People, Process, Technical project and lastly, Organisational success.
- Part B: Digital maturity
    - The questionnaire was adopted from Berghaus (2016), which corresponds to the Digital Maturity matrix listed in Appendix B. The following dimensions were examined: Customer experience, Product innovation, Strategy, Organisation, Process digitisation, Cooperation,

Information technology, Culture and expertise and lastly, Transformation management.

- Part C: Digital transformation
    - The questionnaire was adopted from the article presented by Sánchez (2017) and examined the following dimensions: Strategy definition, Platform and partners, Digital products and service, Resource and capabilities and lastly, Barriers to adopt digital technologies.

3.6 Procedure for Data Collection

Primary data was used for the study. The researcher approached the identified individuals who work in the roles identified in Table 1. A link to the survey was sent to the identified population; this was administrated by the researcher. To ensure non-responses are minimised, a maximum of two bi-weekly reminders followed by a telephone call was actioned by the researcher.

3.7 Data Analysis and Interpretation

Data collected from Qualtrics was exported to Microsoft Excel. The data was then sanitised to ensure dirty data was removed, there after it was exported to a statistical package for further analysis. SPSS was utilised for this task. The hypotheses were examined using the Cronbach's alpha reliability test, correlation, regression, Mann-Whitney test, Wilcoxon Signed-Rank test and descriptive statistical procedures.

Spearman's Rho was the statistical tool adopted to measure the association's strength between pairs of combinations of the three constructs. The Spearman's Rho values range between -1 and 1. The absence of a linear correlation depicted by 0,1 indicated perfect positive correlations and -1 indicated a perfectly negative correlation. Perfect correlations imply that an increase or decrease in one variable has a similar effect on the other.

The correlation coefficients were tested using the guide provided by Owen et al. (n.d.):

- Coefficients between 0.00 and 0.19 imply a very weak correlation.

- Coefficients between 0.20 and 0.39 imply a weak correlation.
- Coefficients between 0.40 and 0.59 imply a moderate correlation.
- Coefficients between 0.60 and 0.79 imply a strong correlation.
- Coefficients between 0.80 and 1.00 imply a very strong correlation.

The regression statistic tool was adopted to determine the relationship between the dependent variable, digital transformation, and the Agile and digital maturity predictors. The regression equation illustrates the relationship between the predictor variables and dependent variables and has the form of:

$y = b_0 + b_1x_1 + b_2x_2$.

In the case of this study:

- y = digital transformation
- x_1 = Agile
- x_2 = Digital maturity
- b_0 = The intercept or the constant
- b_1 = The Agile regression coefficient
- b_2 = The digital maturity regression coefficient

3.8 Limitations of the Study

The researcher has identified the following limitations:

- The willingness of respondents to complete the survey once it has been published.
- Not all departments in the identified organisation have adopted an Agile delivery methodology, forcing the organisation to work as a 'two-speed' organisation.

3.9 Validity and Reliability

According to Heale and Twycross (2015), reliability and validity will be assessed against the scope of the study before the publication of the survey. The research instrument was reviewed after the pilot survey, which incorporated the feedback. The

pilot survey was scheduled for October 2020. Cronbach's Alpha was adopted to test consistency and, ultimately, reliability. The Cronbach's Alpha ranges between 0 and 1.0. The Cronbach Alpha values were tested using a scale provided by George and Mallery (2003) as follows:

- $\alpha < 0.5$ were taken as unacceptable internal consistency
- $0.5 \leq \alpha < 0.6$ were taken as poor internal consistency
- $0.6 \leq \alpha < 0.7$ were taken as questionable internal consistency
- $0.7 \leq \alpha < 0.8$ were taken as acceptable internal consistency
- $0.8 \leq \alpha < 0.9$ were taken as good internal consistency
- $0.9 \leq \alpha$ were taken as excellent internal consistency

3.9.1 External validity

External validity, defined by Andrade (2018), aims to understand whether the results of a study can be generalised. The data was collected from respondents working at the identified South African Bank who work on Agile projects aimed at digitising functionality in the bank. The case study is only generalisable to similar organisations with similar processes, culture, systems and skills.

3.9.2 Internal validity

This concept refers to the research instrument being able to continue to measure its intended measure if it was repeatedly applied. Providing the same questionnaire to all respondents that work on Agile projects at the identified bank achieved this.

3.9.3 Reliability

As defined by Heale and Twycross (2015), reliability is the accuracy of the instrument to perform the study. The only variation to the questions was that the questionnaire was posed to individuals employed by the identified organisation. To ensure reliability is not jeopardised; the survey adopted questions from past studies and the same survey was provided to all respondents.

3.10 Demographic Profile of Respondents

Considering the study is focused on the influence of Agile on digital transformation at an identified South African Bank, the primary criterion is that the respondents must be working in Agile teams delivering digital solutions.

3.11 Ethical Considerations

In line with ethical compliance for the study, the following was considered:

- The identity of the organisation and associated respondents was anonymised.
- Data was only collected after the University provided clearance.
- Respondents' personal information was not disclosed.
- Organisational information that was deemed confidential relating to strategy and could have introduced reputational risk was not disclosed in the study.
- Confidential banking information and digital roadmaps was not disclosed in this study.

CHAPTER 4: PRESENTATION OF RESULTS

4.1 Introduction

The results are based on the survey published to a targeted population who work on Agile projects in the identified organisation's retail banking space. At the time, the organisation underwent a restructure; hence, most of the targeted individuals' reporting lines were moved to the Group Technology Department, although they were still working on projects in the retail space. This chapter proceeds by first presenting the demographics, then the reliability and descriptive statistics and finally, the inferential statistics will be presented. The inferential statistics comprise the correlation test for all three constructs: a Wilcoxon Signed-Rank test, a regression test, and a Mann-Whitney test.

4.2 Demographics

A total of 123 respondents participated, of which 33% abandoned the survey. The remaining 67% (n=82) of the responses were usable. Tables 2–11 present the respondents' departments, age, gender, the number of years worked at the organisation, the respondents' role, the project length, the respondents' Agile experience, their involvement in Agile projects, the Agile methodology used by the respondents and the size of the teams.

Table 2: Respondents' departments

Department	Percentage (%)
Retail and Business Banking	24.4
Group Technology	70.7
Wealth	4.9
Total	100.0

In Table 2, the majority (70%) of the respondents were from Group Technology, working on retail-related projects.

Table 3: Respondents' age

Age	Percentage (%)
21–30 years	4.9
31–40 years	40.2
41–50 years	39.0
51–60 years	13.4
Over 60 years	2.4
Total	100.0

Table 3 shows that the majority (45%) of the respondents were young (between 21–40 years).

Table 4: Respondents' gender

Gender	Percentage (%)
Male	69.5
Female	30.5
Total	100.0

As depicted in Table 4 and in line with the banking sector demographics, the majority (69%) of the respondents were male.

Table 5: Years worked at the organisation

Years worked at the organisation	Percentage (%)
Less than 2 years	9.8
2–5 years	40.2
6–10 years	18.3
More than 10 years	31.7
Total	100.0

Based on Table 5, most (40%) of the respondents were employed for between 2–5 years, while 31% worked for the organisation for more than 10 years.

Table 6: Role held by the respondents

Respondents' Role	Percentage (%)
Top Management	4.9
Middle Management	20.7
Supervisor	3.7
Professional	63.4
Administration	6.1
Total	100.0

Table 6 shows that the majority (63%) of the respondents were professionals. The management grouping consisted of top management, middle management. Supervisors comprised a small (29%) percentage.

Table 7: Project length

Project length (in months)	Percentage (%)
0–3 months	13.4
4–6 months	11.0
71–2 months	14.6
More than 12 months	61.0
Total	100.0

Table 7 illustrates that the majority (61%) of the respondents indicated that projects were more than 12 months in length.

Table 8: Level of Agile experience (in years)

Level of Agile Experience (in years)	Percentage (%)
Less than 2 years	25.6
2–5 years	53.7
6–10 years	15.9
More than 10 years	4.9
Total	100.0

The respondents' Agile experience is presented in Table 8. Half (53%) of the respondents have between 2–5 years of Agile working experience.

Table 9: Agile project involvement

Number of Agile projects you have been involved in	Percentage (%)
1–10	80.5
11–20	13.4
21–30	3.7
More than 30	2.4

Number of Agile projects you have been involved in	Percentage (%)
Total	100.0

In Table 9, a majority (80%) of the respondents have not been involved in more than 10 Agile projects.

Table 10: Agile method adopted

Agile method used	Percentage (%)
Scrum	48.8
Agile Modelling	3.7
DAD	1.2
Kanban	14.6
Scaled Agile Framework (SAFe)	25.6
Other	6.1
Total	100.0

Table 10 shows that most (48%) of the respondents adopted Scrum, while a quarter (25%) indicated that SAFe was adopted.

Table 11: Team (squad) size

Team (Squad) Size	Percentage (%)
2–7 Members	15.9
8–12 Members	45.1
13–20 Members	25.6
More than 21 members	13.4
Total	100.0

Per Table 11, the majority (45%) of the respondents indicated that team size ranges between 8–12 members, although the second-highest percentage (25%) indicated that teams had 13–20 members.

4.3 Reliability and Descriptive Statistics

The research instrument had three sections; Agile, digital maturity and digital transformation, each assessing various dimensions. The results for each section will be presented individually as follows.

4.3.1 Agile

Table 12: Agile – Survey Instrument: reliability and descriptive statistics

Dimension	Cronbach's Alpha	Minimum	Maximum	Mean	Standard Deviation
Organisational Dimension	0.857	1	7	5.03	1.121
People Dimension	0.909	1	7	5.56	1.118
Process Dimension	0.892	1	7	5.18	1.073
Technical Dimension	0.926	1	7	5.20	1.138
Project Dimension	0.764	1	7	5.11	1.006
Organisational Dimension Success	0.857	1	7	5.28	1.233
Agile	0.971	1	7	5.21	0.997

Table 12 illustrates the reliability and descriptive statistical results for the Agile construct. The Cronbach Alpha value for the Agile construct is greater than 0.9, indicating an excellent level of internal consistency and a high level of reliability in the results. The Cronbach Alpha values for the Agile dimensions range between 0.764

and 0.926, indicating acceptable, good and excellent internal consistency for the respective dimensions.

4.3.2 Digital maturity

Table 13: Digital maturity – reliability and descriptive statistics

Dimension	Cronbach's Alpha	Minimum	Maximum	Mean	Standard Deviation
Customer Experience	0.859	1.00	5.00	3.72	0.715
Product Innovation	0.904	1.00	5.00	3.67	0.774
Strategy	0.893	1.00	5.00	4.13	0.639
Organisation	0.878	1.00	5.00	3.65	0.724
Process Digitisation	0.915	1.00	5.00	3.73	0.706
Corporation	0.939	1.00	5.00	3.76	0.809
Information Technology	0.934	1.00	5.00	3.70	0.746
Culture and Expertise	0.932	1.00	5.00	3.51	0.845
Transformation Management	0.951	1.00	5.00	3.85	0.795
Digital Maturity	0.984	1.00	4.95	3.75	0.655

Table 13 illustrates the reliability and descriptive statistical results for the digital maturity construct. The Cronbach Alpha value for the digital maturity construct is greater than 0.9, indicating an excellent level of internal consistency and a high level of reliability in the results. The Cronbach Alpha values for the digital maturity

dimensions range between 0.859 and 0.951, indicating good and excellent internal consistency for the respective dimensions.

4.3.3 Digital transformation

Table 14: Digital transformation – reliability and descriptive statistics

Dimension	Cronbach's Alpha	Minimum	Maximum	Mean	Standard Deviation
Platform and Partners	0.798	1.00	4.00	3.20	0.606
Digital Products Or Services	0,907	1.00	4.00	3.24	0.602
Resource and Capabilities	0,896	1.00	4.00	3.26	0.607
Digital Transformation	0,946	1.00	4.00	3.24	0.558

Table 14 illustrates the reliability and descriptive statistical results for the digital transformation construct. The Cronbach Alpha value for the digital transformation construct is greater than 0.9, indicating an excellent level of internal consistency and a high level of reliability in the results. The Cronbach Alpha values for the Digital transformation dimensions range between 0.798 and 0.907 indicates acceptable, good and excellent internal consistency for the respective dimensions.

4.4 Inferential Statistics

4.4.1 Mann-Whitney test: management and non-management

The management grouping consisted of top management, middle management and supervisors, while the non-management group comprised professionals and administration staff.

The Mann-Whitney test replaces scores with ranking numbers starting at one and going through to the maximum for each construct. The higher the score, the higher the construct is ranked. This test was conducted on management/non-management grouping across the three constructs. The hypothesis is formulated as:

H_0: There is no significant difference in the view of the impact of agile on digital transformation between the management and non-management groups.

H_1: There is a significant difference in the view of the impact of agile on digital transformation between the management and non-management groups.

Table 15: Mann-Whitney test on management and non-management

Construct	Management	N	Mean Rank	Sum of Ranks
Agile	Management	24	38.00	912.00
	Non-Management	58	42.95	2491.00
	Total	82		
Digital Maturity	Management	24	43.79	1051.00
	Non-Management	58	40.55	2352.00
	Total	82		
Digital Transformation	Management	24	43.19	1036.50
	Non-Management	58	40.80	2366.50
	Total	82		

Table 16: Test statistics – grouping variable (management)

Variable	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
Agile	612.000	912.000	-0.856	0.392
Digital Maturity	641.000	2352.000	-0.561	0.575
Digital Transformation	655.500	2366.500	-0.414	0.679

Based on the results from Table 16, the null hypothesis cannot be rejected as:

- The significance is greater than 0,05 for all three constructs.
- The U-value for all three constructs are approximately half of the product of the management and non-management group sizes.
- At p = 0.05, the z-critical value is 1.6449, which is greater than the calculated z-values for each of the three constructs.

Therefore, hypothesis 3 is valid as there is no significant difference in the view of the impact of agile on digital transformation between the management and non-management groups.

4.4.2 Correlation results

Table 17: Correlation results

Construct		Agile	Digital Maturity
Digital Maturity	Spearman's Rho	0.646	
	Sig. (2 tailed)	0,000	
	N	82	
Digital Transformation	Spearman's Rho	0.546	0.627
	Sig. (2 tailed)	0.000	0.000
	N	82	82

Table 17 presents the pairwise correlations between the constructs. The correlation coefficients are positive and range between moderate and strong. The correlation was significant at the 0.01 level (2-tailed).

Table 17 indicates the strong positive correlations between Agile and digital maturity (0.646) and digital maturity and digital transformation (0.627). A positive but moderate correlation is revealed between Agile and digital transformation (0.546).

A positive correlation exists in each pair, which indicates that an increase in one of the paired constructs has a similar effect on the other. Based on Table 17, should Agile increase, then digital maturity increases. A similar effect would be noticed on digital transformation should Agile increase. Similarly, if digital maturity increases, digital transformation will increase.

4.4.3 Digital maturity assessment

It is hypothesised that the digital maturity of the organisation is at Stage 3. Stage 3 in the digital maturity matrix proposed by Berghaus and Back (2016) in Appendix B translates to 'Commit and Transform'. Table 18 illustrates that the mean values for each of the digital maturity dimensions range between 3.4991 and 4.1043. The overall mean for the construct is 3.7535.

The hypothesis is formulated as:

H_0: The retail department's maturity level is at Commit and Transform (Stage 3).

H_1: The retail department's maturity level is not at Commit and Transform (Stage 3).

Table 18: Digital maturity descriptive results summary

Digital Maturity	N	Minimum	Maximum	Mean	Standard Deviation
Customer Experience	82	1.00	5.00	3.72	0.715
Product Innovation	82	1.00	5.00	3.67	0.774
Strategy	82	1.00	5.00	4.13	0.639
Organisation	82	1.00	5.00	3.65	0.724
Process Digitisation	82	1.00	5.00	3.73	0.706
Cooperation	82	1.00	5.00	3.76	0.809
Information Technology	82	1.00	5.00	3.70	0.746
Culture And Expertise	82	1.00	5.00	3.51	0.845
Transformation Management	82	1.00	5.00	3.85	0.795
DIGITAL MATURITY	82	1.00	5.00	3.75	0.655
TEST VALUE = 3	82	3.0000	0.00000	3.00	3.00

Table 18 illustrates the digital maturity descriptive results. Each of the digital maturity dimensions will be compared to a fixed value of three; therefore, the homogeneity of variance is not required.

Table 19: Wilcoxon Signed-Rank test – ranks table

Digital Maturity Dimension	Ranks, ties and totals	N	Mean Rank	Sum of Ranks
Customer Experience	Negative Rank	66	41.16	2716.50
	Positive Ranks	10	20.95	209.50
	Ties	6		
	Total	82		
Product Innovation	Negative Rank	64	44.27	2833.50
	Positive Ranks	15	21.77	326.50
	Ties	3		
	Total	82		
Strategy	Negative Rank	79	41.89	3309.50
	Positive Ranks	3	31.17	93.50
	Ties	0		
	Total	82		
Organisation	Negative Rank	68	40.15	2730.00
	Positive Ranks	9	30.33	273.00
	Ties	5		
	Total	82		
Process Digitisation	Negative Rank	67	39.41	2640.50
	Positive Ranks	8	26.19	209.50
	Ties	7		
	Total	82		
Cooperation	Negative Rank	64	38.61	2471.00
	Positive Ranks	9	25.56	230.00

Digital Maturity Dimension	Ranks, ties and totals	N	Mean Rank	Sum of Ranks
	Ties	9		
	Total	82		
Information Technology	Negative Rank	66	40.64	2682.00
	Positive Ranks	10	24.40	244.00
	Ties	6		
	Total	8		
Culture And Expertise	Negative Rank	58	42.02	2437.00
	Positive Ranks	18	27.17	489.00
	Ties	6		
	Total	82		
Transformation Management	Negative Rank	69	36.27	2502.50
	Positive Ranks	4	49.63	198.50
	Ties	9		
	Total	82		
DIGITAL MATURITY	Negative Rank	58	42.02	2437.00
	Positive Ranks	18	27.17	489.00
	Ties	6		
	Total	82		

The results in Table 19 indicate that the negative ranks are greater than the positive ranks, indicating that each dimension's mean values were greater than the test value (Stage 3). Moreover, the sum of ranks for the negative ranks is far greater than the sum of ranks for the positive ranks, indicating a larger difference between the maturity levels, favouring a stage greater than 3.

Table 20: Test statistics

Digital Maturity Dimension	Z	Asymp. Sig. (2-tailed)
Customer Experience	-6.501	0.000
Product Innovation	-6.135	0.000
Strategy	-7.444	0.000
Organisation	-6.249	0.000
Process Digitisation	-6.436	0.000
Corporation	-6.167	0.000
Information Technology	-6.316	0.000
Culture And Expertise	-5.052	0.000
Transformation Management	-6.344	0.000
Digital Maturity	-7.036	0.000

Note. The Z-values are based on positive ranks.

In Table 20, the null hypothesis can be rejected as the *p*-values (Asymp. Sig. [2-tailed]) for each of the dimensions, including the digital maturity construct, is less than 0.05. It is concluded that there is a difference between the department's digital maturity level and the hypothesised maturity Stage of 3.

A Wilcoxon Signed-Rank test indicated that the digital maturity dimensions were statistically significantly higher than the hypothesised maturity Stage of 3.

4.4.4 Regression results

Linear regression was conducted to determine if a relationship existed between the dependent variable digital transformation and the predictor variables, Agile and digital maturity.

The hypothesis is formulated as:

H_0: Agile and digital maturity do not influence digital transformation.

H_1: Agile and digital maturity influence digital transformation.

Table 21: Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.673	0.454	0.440	0.418

In Table 21, the coefficient of correlation (R-value = 0.673) indicates a correlation relationship between digital transformation and the predictors. The predictors are the constant, Agile and digital maturity.

The coefficient of determination (R^2 value) in Table 21 indicates the extent of the variance the predictors have on the variance on the dependent variable, digital transformation. Based on the R^2 value in Table 21, 45.4% of the variance in digital transformation can be predicted from the predictors. The Adjusted R^2 attempts to provide a more realistic R^2 estimate value for the sampled population, which is 0.014 less than the R^2 value. The values of R^2 and adjusted R^2 are small (close to 1), indicating a large number of observations and a small number of predictors.

Table 22: ANOVA table

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.439	2	5.720	32.780	0.000
	Residual	13.784	79	0.174		
	Total	25.223	81			

In the ANOVA table (Table 22), the $p < 0.05$ signifies that the regression model statistically significantly predicts the outcome variable, digital transformation. Agile and digital maturity can predict the department's digital transformation. The calculated F-value (32.780) is greater than the F-critical (2,79) = 3,112 and $p < 0.05$, implying that the null hypothesis can be rejected.

In Table 23, the results for the coefficients are depicted. The coefficients were calculated to enable the relationship between the dependent and independent variables to be derived.

Table 23: Coefficient table

Model		Unstandardised Coefficients		Standardised Coefficients Beta	t	Sig.
		B	Standard Error			
1	(Constant)	1.056	0.280		3.767	0.000
	Agile	0.261	0.066	0.466	3.938	0.000
	Digital Maturity	0.220	0.101	0.258	2.179	0.032

Table 24: Collinearity statistics

Model		Collinearity Statistics	
		Tolerance	**VIF**
1	(Constant)		
	Agile	0.495	2.021
	Digital Maturity	0.495	2.021

Table 24 indicates no multicollinearity as the VIF values are less than 10, and tolerance is greater than 0.1 for both Agile and digital maturity.

In Table 23, $p < 0.05$ (Sig. column) for both Agile and digital maturity indicates that both variables contribute statistically significantly to the model; therefore, the unstandardised coefficients will be used for the regression equation:

Digital transformation = 1.056 + 0.261 (Agile) + 0.220 (digital maturity)

Although both constructs influence digital transformation, the Agile coefficient is greater than the Digital Maturity coefficient, indicating that Agile has a more significant influence on digital transformation.

In summary, the model has successfully predicted the digital transformation score ($F(2,79) = 32.780$; $p < 0.05$). A 45.4% variance is explained in digital transformation. Digital transformation was predicted by both Agile ($\beta = 0{,}261$, $t = 3.938$, $p < 0.05$) and Digital Maturity ($\beta = 0.220$, $t = 2.179$, $p < 0.05$) predictors. This means that an increase in Agile increases digital transformation by 0.261 and an increase in Digital Maturity increases digital transformation by 0.220.

4.5 Summary of Results

The data was analysed using various statistical tests that aided in attaining a better understanding of the various dimensions of Agile, Digital Maturity and digital transformation. All three constructs proved to have good reliability.

The descriptive results for each of the constructs are close to the mean values with a small standard deviation.

The Mann-Whitney test revealed that the management and non-management grouping had no statistical differences observed between them.

Spearman's Rho correlation revealed a moderate to strong positive correlation between the constructs.

A comparison between the Digital Maturity dimensions and the maturity Stage 3, Commit and Transform shows that respondents consider the maturity level to be closer to 4 (User-Centred and Collaborated Process). This comparison was conducted using the non-parametric Wilcoxon Signed-Rank test.

The regression test indicated a correlation between the dependent and independent variables, indicating an increase in Agile and digital maturity has the same effect on digital transformation. Agile and digital transformation has an approximately 45% explained variance on digital transformation. A linear relationship exists between the dependent and independent variables indicating that both Agile and digital maturity influence digital transformation.

CHAPTER 5: DISCUSSION OF RESULTS

5.1 Introduction

This chapter focuses on discussing the results. The demographic will be discussed, followed by an understanding of the management and non-management groups. After that, the two objectives will be discussed individually before concluding the chapter.

5.2 Demographics

In Table 2, most of the respondents (70%) working on retail projects reported into the Group Technology reporting line. These individuals included business analysis, testing, solution architects, user experience, product owners, Scrum masters and user interface designers, while 24% of the respondents were from retail and business banking. The minority of the respondents were from the wealth department; they were assisting on projects in the retail and business banking space. Based on Table 3, the majority (79%) of the respondents were between 31–50 years. Table 4 indicates that approximately two-thirds (69%) of the respondents were males, and the remainder (30%) were female.

Table 5 indicates that almost half of the sampled population (40%) had worked for the organisation for between 2–5 years, while 31% of the population were employed by the organisation for more than 10 years. A small sample (18%) have been employed by the organisation between 6–10 years. A minority (9%) have worked for the organisation for less than two years.

Table 6 depicts that close to two-thirds (63%) of the respondents were professionals, while about a third (35%) of the population comprised top management, middle management, supervisors, and administrators. The professionals comprise the squad members from the various cross-functional areas.

Based on Table 7, most (61%) of the projects were active for more than 12 months. The remaining respondents (39%) confirmed that their projects were active for either 0–3 months, 4–6 months, or 7–12 months.

In terms of Agile working experience, Table 8 indicated that most (53%) of the respondents had 2–5 years of Agile working experience, while a quarter (25%) of the respondents indicated less than two years' Agile experience. A minority (20%) had an excess of six years of Agile working experience.

Based on Table 9, the majority (80%) of the respondents were involved in 10 or fewer Agile projects, while a minority (19%) of respondents worked on eleven or more projects. It is apparent from Table 10 that Scrum is the most used methodology (48%), followed by SAFe (25%) and Kanban (14%). SAFe is in second place as it is being adopted by the department.

Team sizes depicted in Table 11 confirm that most (45%) of the teams had between 8–12 members. A small percentage (15%) of the population indicated that their teams have between 2–7 members; however, more than a third (39%) of the respondents confirmed that teams had thirteen or more members.

5.3 Objective 1: To Analyse the Digital Transformation Maturity Level of Bank X

To interpret the data, the researcher investigated the digital maturity levels according to the nine dimensions. A 5-point Likert Scale scoring system was adopted to record the present level of digital maturity. The scale was as follows:

1. Promote and support;
2. Create and build;
3. Commit and transform;
4. User-centred and collaborated process;
5. Data-driven enterprise.

The purpose of the customer experience dimension was to understand the customer experience aspect and the presentation of information on both digital and traditional channels, the personalisation of customer interactions with the aid of data and the use of data for marketing purposes. Table 18 indicates that the mean for this dimension is 3.72, greater than maturity Stage 3, closer to maturity Stage 4, user-centred and

collaborated process. The higher value is probably due to the use of data from various systems for marketing and customer insights and the ability for interactions to be carried out on digital and traditional channels. Delivery of channel-appropriate content may have produced a higher score. According to Berghaus and Back (2016), data and its appropriate use is a critical factor that enables an organisation to attain a competitive advantage. The use of data for personalised communication and marketing confirms a statement by Dreischmeier et al. (2015) that the use of data allows the organisation to understand the client better and generate new revenue streams. The generation of new revenue streams would also indicate that the organisation would be more profitable, as stated by Eremina et al. (2019). Based on the mean of this dimension, it is evident that the department uses data. However, projects are underway to merge customer data across channels so that insights can be achieved more efficiently. Further work still needs to take place, so the maturity stage of this dimension would remain on Stage 3.

The product innovation mean value (3.67) in Table 18 is greater than maturity Stage 3, leaning towards Stage 4. The probable reason for this is the increase in digital product offerings due to frequent innovative product releases coupled with revised business models. This dimension remains on Stage 3 as the process for registering innovative ideas needs to be revised and published so that staff can easily share their ideas. Failure to revise this process would hamper new ideas from being explored and experimented, leading to a loss of opportunities to attain a competitive advantage. According to Kazim (2019), digital transformation is dependent on innovative experimentation. A lack of ideas from employees hampers experimentation and innovation, which retards the organisation's ambition to become digitally mature.

The strategy dimension's mean value in Table 18 was 4.13, which exceeds Stage 4. The possible reason for this could be that digital business is an important aspect of the strategy, as digital projects are highly prioritised, and digital transformation is acknowledged as a continuous journey. The results align with Kazim (2019), who averred that strategy is one of the elements that promotes successful digital transformation. The prioritisation of digital initiatives indicates that the digital strategy

aligns with the organisational strategy, confirming Ochoa-Urrego and Peña (2020)'s statement. The maturity stage will remain on Stage 4 as the department needs to focus on core competencies, and when compared to competitors, the organisation is not perceived as a driver of innovation. More focus is required on innovation and the digital strategy.

The process digitisation dimension mean value was 3.73, as depicted in Table 18, exceeds Stage 3. A possible reason for this could be the integration of digital channels to provide clients with a choice of channels to contact the organisation. There is a second possibility aligning to Dreischmeier et al. (2015) that could be the constant review of business models and processes. These reviews will aid in identifying repetitive tasks that could be automated using technology so that staff can focus on identifying innovative revenue generation opportunities. It can be agreed with Berghaus and Back (2016) that the organisation understands the importance of data and uses data-driven decision making; however, the data can be more efficiently used to derive valuable insights and generate new revenue streams. Stage 3 maturity level is, therefore, assumed for this dimension.

The cooperation dimension's mean value was 3.73 (Table 18), closer to Stage 4. A possible reason for higher value could be using tools for collaboration, remote working practices with secured access to the required platforms to enable work to continue even if the employee is working remotely. Table 11 indicated that the majority (45%) of the teams had between 8–12 members, which confirms that teams were small to medium in size; this promotes efficient collaboration. According to Misra et al. (2009), efficient collaboration allows teams to deliver working software iterations successfully. Stage 3 is explained for this level as, in some cases, the digital experts have limited capacity and work across teams. Working across teams hampers the team's collaboration by creating bottlenecks and ultimately stifles its ability to deliver rapidly. Access to digital experts is an example of a constraint as stipulated by the TOC. This constraint needs to be exploited, all other items need to be subordinated to the constraint and finally elevated by ensuring other digital experts are trained or new individuals with the required skills are recruited. This is to ensure teams have sufficient

access to these experts so that bottlenecks are removed, and work items are delivered quicker.

The information technology mean value (3.70) in Table 18 also leans towards Stage 4. Possible reasons for the high value may be due to the ability to modify digital assets on short notice to complement changing business requirements and regular disaster-recovery testing exercises performed to ensure the uptime of critical applications and data. Although the organisation may have the ability to react to and modify digital assets quickly, confirming an argument by Gerster (2017) that flexibility enables rapid response to changing requirements and environmental conditions, the changes must be tested thoroughly to minimise reputational risk and downtime, which is time-consuming. The process to deploy software to the production environment is lengthy, which inhibits rapid deployments. This may result in a loss of critical opportunities, which may have enabled the organisation to attain a competitive advantage, hence an agreement with Štemberger et al. (2019) that business processes need to be reviewed. For this reason, Stage 3 is assumed for this dimension.

The culture and expertise mean (Table 18) also exceeded maturity Stage 3. The possible reasons for a higher value could relate to the organisation encouraging individuals to develop their digital expertise to deliver high-quality innovative solutions. This aligns with Colli et al. (2019), who argue that skills are essential to attain digital maturity, while Sánchez (2017) confirmed that competitive advantage is achieved with the aid of intangible assets, skills being one of them. Finally, management teams are risk-aversive for using digital products in their business units due to concerns about reputational risk should the digital offerings not fulfil their needs. Dreischmeier et al. (2015) stated that risk-taking is essential in digital transformation; therefore, where minimal reputational risk is envisaged, leaders should be encouraged to take risks. Maturity Stage 3 is assumed for this dimension.

The transformation management mean value (3.85) in Table 18 is closer to Stage 4. Possible reasons might be that digital transformation is strategically planned with defined goals that are regularly monitored. Although digital projects are prioritised, top management still needs to recognise that innovation, digital maturity, and digital

transformation is an iterative process. According to Kettunen and Laanti (2017), this is a continuous journey; hence, Stage 3 is assumed for this dimension.

A Wilcoxon Signed-Rank test proved the digital maturity level for each of the dimensions, and the overall digital maturity construct was not at Stage 3 as the negative ranks were greater. Strategy was the only dimension that exceeded Stage 4. However, the rest of the dimensions, including the overall digital maturity construct's mean value, exceeded Stage 3. Based on the explanation earlier, the overall digital maturity level is at Stage 3, Commit and Transform. Therefore, an understanding of the digital maturity level has been uncovered, implying that Sub-objective 1 has been met and Hypothesis 1 is true.

5.4 Objective 2: To Analyse the Impact of Agile Methodology on Digital Transformation at Bank X.

The descriptive statistical results for the Agile construct are presented in Table 12. It is indicative that the organisation has adopted the Agile methodology to deliver working software iteratively. Table 11 indicates that most of the teams have 8–12 members, which, according to Guinan et al. (2019), not only reduces information silos and bottlenecks but enables rapid application delivery.

Guinan et al. (2019) stated that Agile methodologies enable digital transformation. The correlation test results presented in Table 17 indicate that correlation is significant ($p < 0.05$) at the 0.01 level and that Agile and digital transformation exhibit a positive, moderate correlation. Thus, an increase in Agile will have an increasing effect on digital transformation. Moreover, with each iterative Agile implementation, the organisation digitally transforms, confirming a statement by Teichert (2019) that digital transformation is a repetitive process.

The regression test results, presented in Table 21, confirm a correlation relationship between the digital transformation and the predictors. In Table 23, it was found that the significance, $p < 0.05$ for both predictors, implying that both Agile and digital maturity contributed statistically significantly to the model. The equation produced from

Table 23 indicates that a linear relationship existed between digital transformation and the predictor constructs Agile and digital maturity.

The regression equation is of the form:

Digital transformation = 1,056 + 0,261 (Agile) + 0,220 (digital maturity).

The equation indicates that an increase in Agile increases digital transformation by 0.261, and an increase in digital maturity increases digital transformation by 0.220. The implication is that with each Agile iteration, the organisation iteratively digitally transforms, confirming the statements by Buvat et al. (2017) and Teichert (2019) that digital transformation is an iterative process. Agile provides teams with the flexibility to accept requirements at any stage of the project and react to changing environmental conditions. By delivering prioritised working software in short periods, the organisation can achieve a competitive advantage earlier. The team can attain valuable customer insight so that rectifications can be made in upcoming sprints.

The Agile methodology works at all levels of the digital maturity model presented by Berghaus and Back (2016). This is primarily due to the identification strategic objectives at each maturity level that must be broken down into smaller work items. Teams then iteratively deliver smaller work items at a rapid rate, enabling the organisation to progress in digital maturity. The iterative delivery of work items requires teams to constantly identify and fully understand the constraints, sub-ordinate the constraint and elevate the constraint which aligns to the TOC as digital transformation is an iterative process.

By applying the TOC and the practices of the agile methodology, teams within the organisation iteratively deliver working software rapidly, allowing the organisation to attain a competitive advantage quicker. Moreover, the teams are able to identify learnings from past implementations and take the necessary remedial actions sooner.

In summary, Sub-objective 2 has been met, and with each Agile incremental deployment, digital transformation increases and proves Hypothesis 2 to be true.

5.5 Objective 3: To analyse the view of the management / non-management groups on the impact of agile on digital transformation

Although Table 6 indicated that most of the respondents were non-managers, the Mann-Whitney test was used to determine if there was a difference between the view of two groups on the impact of agile on digital transformation. Table 15 revealed that the mean ranks for the management grouping were marginally higher for the Agile construct, while the non-management ranks were higher for digital maturity and digital transformation.

The U-values for Agile, digital maturity and digital transformation depicted in Table 16 are: (U= 612.000, $p > 0.05$), (U= 641.000, $p > 0.05$) and (U= 655.500, $p > 0.05$). The $p > 0.05$, for all three constructs, is the first indication that there is no statistical difference observed between the management and non-management groups. Secondly, the U-values for all the constructs are approximately half of the product of the management and non-management group size. Lastly, at p=0.05, the z-critical (1.6449) is greater than the calculated z-values for all three constructs, confirming that there was no statistical significant difference in the view of the impact of agile on digital transformation between the management and non-management groups

In summary, Sub-objective 3 has been met therefore, Hypothesis 3 is true.

5.6 Conclusion

The main purpose of the study was to understand the influence of Agile methodology on digital transformation in a South African Bank. The research results have been achieved through a departmental survey comprising Agile, digital maturity and digital transformation-related instruments.

The findings of the study demonstrate that in the retail department, Agile influences digital transformation. Staff perceive the organisation’s retail department to be close to maturity Stage 4, which is a user-centred and collaborated process. However, Stage 3 is assumed.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This chapter will conclude by integrating the findings of the hypotheses with the research objectives.

6.2 Research Objective 1 Conclusion

It was hypothesised that Bank X exhibits a digital maturity level of 3. The Wilcoxon Signed-Ranks test results indicated that the digital maturity dimensions were statistically significantly higher than the hypothesised maturity Stage of 3. This was due to the higher negative ranks for each dimension and the overall digital maturity construct. Further, the descriptive test results (Table 18) indicated that, except for the strategic dimension's mean value that was greater than Stage 4, the remaining eight dimensions and the overall digital maturity's mean value exceeds Level 3 but less than Stage 4. Maturity Level 3 was, therefore, assumed.

Project work to merge customer data is still underway, which inhibits the valuable insights that could be achieved and new revenue streams that could be generated. The process to log ideas needs to be reviewed and published so that new ideas can be gleaned from employees. Limited access to critical resources may stifle the team's ability to deliver working software, and the business processes need to be constantly reviewed to complement the organisation's vision to become digitally mature.

It was also found that management is risk aversive. For organisations to increase their digital maturity level when risks are low, management needs to encourage risk-taking. The organisation understands that skills are an essential aspect of digital transformation and encourages staff to develop their digital skills. In cases where specialised skills are not available in the organisation, strategic partnerships are created with relevant vendors to deliver the required feature.

The correlation statistical test depicts a positive correlation between the Agile and digital maturity constructs, implying that with each successful Agile deployment, the

organisation’s digital maturity is increased. Attaining an increased level of digital maturity is a long-term iterative process. At each iteration, the impacting business models and business processes must be reviewed to complement the changes that the application deployment will bring.

The essential difference between this study and other studies is that the researcher found a lack of academic material relating to retail banking in the South African context. There was an abundance of literature relating independently to Agile, digital transformation and digital maturity. To maintain validity and reliability, therefore, the researcher adopted research questions from existing studies. The literature review and results were concise, and no known shortcomings were encountered.

It is, therefore, concluded that the organisation exhibits a Stage 3 maturity level based on Berghaus and Back (2016), which proves Hypothesis 1 to be true and fulfils Sub-objective 1: that an understanding of Bank X’s Digital Maturity level has been achieved.

6.3 Research Objective 2 Conclusion

The correlation test indicates a positive relationship between Agile and digital transformation: this indicates that with each Agile iteration, digital transformation increases.

The regression equation indicated that both Agile and digital maturity influence digital transformation. The Agile coefficient value (Table 23) is higher than the digital maturity coefficient, which is indicative that both constructs have a positive impact on digital transformation. Agile, however, has a more substantial impact.

The difference between this study and other studies is that this study is based in a South African context, intending to understand the influence of Agile on digital transformation. The second difference is that a limited amount of research has been carried out in the field of South African retail banking. Although the study is limited to one financial organisation, it provides some insight and aims to add to the body of knowledge relating to the subject.

Therefore, it is concluded that Agile enables digital transformation in retail banks, which proves Hypothesis 2 to be true and fulfils Sub-objective 2, the impact of Agile methodology on digital transformation at Bank X is understood.

6.4 Research Objective 3 Conclusion

Although the results of the study indicated that was no difference in the view of the impact of agile on digital transformation between the management and non-management groups, however, employee buy-in and motivation are important aspects for an organisation to be successful in their digital transformation journey.

6.5 Recommendations

The results of the study indicate that the retail department needs to continue on the digital transformation journey in order to become more digitally mature.

Digital leaders within Bank X must ensure that client and interaction data is utilised more efficiently to enable powerful insights to be achieved; therefore, focus must be provided to amalgamate the data into a single source.

Focus needs to be placed on process automation, as this will enable routine tasks to be completed quickly, enabling the workforce to focus on innovation and activities that require logic to be completed.

The use of Application Programming Interfaces and web services are evident in the organisation. Priority must be given to expanding the Application Programming Interfaces and the web service layer to enable a quick response to changes and rapid deployments of new software applications.

The digital leadership team must create an environment that fosters innovation so that Bank X can achieve a competitive advantage through successful innovation. Moreover, the process for registering innovative ideas needs to be revised and published so that employees can log ideas efficiently. These ideas will enable experimentation and innovation.

Inter-team dependencies need to be identified early in the project so that the relevant actions can be taken to minimise delays during project execution. Moreover, resources should be made available to ensure that high priority projects are delivered in the agreed timelines to achieve a competitive advantage.

The vision, strategy and agreed goals must be communicated unambiguously to ensure continued employee motivation so that that the workforce has a common understanding.

Bank X needs to strive to be its own competitor. Decades into the future, the digital environment in its current form will be near obsolete however, with the aid of insights from data analysis combined with the adoption of an agile methodology, customer centric solutions will be delivered and the digital environment will remain relevant. A culture of learning needs to be instilled in the staff as skills are an important intangible asset that can aid in attaining a competitive advantage.

6.6 Limitations

The research population was limited to individuals who worked on Agile projects in the retail banking department at the identified organisation. All other departments were excluded. The study was limited to the head office; all other office locations were excluded from the study.

The timing of publishing the survey might have been the reason for either the abandoned responses or individuals not responding at all. The survey was published towards the end of 2020, and respondents might have been occupied with project-related commitments.

Some of the respondents might have experienced a loss of interest due to the length of the survey which may have resulted in inaccurate response. This might have impacted the true reflection of the organisation.

The number of abandoned responses may have had an impact on the results of the study.

6.7 Suggestions for Further Work

To fully understand the influence that Agile has on digital transformation and digital maturity on the organisation as a whole, the study should be repeated in other departments. It is also recommended that the locus of the study be extended to include offices where development work for these departments occurs.

If the study is repeated, a larger management population should be approached to complete the survey. A better understanding of the view that the management and non-management roles have on the topic will be achieved. In this case, responses from the management grouping were small and turned out to be statistically insignificant. Future researchers may be advised to adopt shorter questionnaires from other existing studies to minimise the number of abandoned responses.

Considering the risk-aversive nature of the organisation, should the study be repeated, future researchers may consider the adoption of more appropriate digital maturity models. Such models need to cater for the low risk appetite of similar organisations due to their complex processes and reputation risk that may be encountered.

A similar study could be conducted to discover the influence that Agile has on digital transformation on other legacy banks operating in the retail space. It is recommended that the relevant permission be obtained from the concerned organisation before commencing the study.

REFERENCES

Alami, A. (2015). Measuring Agile benefits realization. *PM World Journal*, *4*(12), 1–11.

Andrade, C. (2018). Internal, external, and ecological validity in research design, conduct and evaluation. *Indian Journal of Psychological Medicine*, 40(5), 498–499. https://doi.org/10.4103/IJPSYM.IJPSYM_334_18

Aslanova, I. V., & Kulichkina, A. I. (2020). Digital maturity: Definition and model. *In 2nd International Scientific and Practical Conference "Modern Management Trends and the Digital Economy: from Regional Development to Global Economic Growth" (MTDE 2020)* (pp. 443–449). Atlantis Press. https://doi.org/10.2991/aebmr.k.200502.073

Baculard, L.P., Colombani, L., Flam, V., Lancry, O., & Spaulding, E. (2017). Orchestrating a successful digital transformation. *Bain & Company, 9*(23), 1–8.

Barnes, D. (2001) Research methods for the empirical investigation of the process of formation of operations strategy. *International Journal of Operations & Production Management, 21*(8), 1076-1095.

Barton, D., Carey, D., & Charan, R. (2018). One bank's Agile team experiment. *Harvard Business Review, 96*(2), 59–61.

Berghaus, S. (2016). *Survey for the digital maturity & transformation check 2016–2017*. Unversitat St.Gallen. https://sabineberghaus.files.wordpress.com/2018/05/digital-maturity-check_en.pdf

Berghaus, S., & Back, A. (2016). Stages in digital business transformation: Results of an empirical maturity study. *In MCIS* (p. 22). https://doi.org/10.1016/j.bushor.2019.07.005

Buvat, J., Slatter, M., Puttur, R. K., Westerman, G., Bonnet, D., & Crummenerl, C. (2017). Understanding digital mastery today. *Capgemini Research Institute*, 80, 1–32.

Ifandoudas, P., & Chapman, R. L. (2009). A practical approach to achieving agility–a theory of constraints perspective. *Production Planning & Control*, *20*(8) 691–702. https://doi.org/10.1080/09537280903107473

Chou, H. H., Wang, C. T., & Sheu, R. S. (2016). A practical multiple-tool-set approach for increasing agile response in overhaul production with limited resource requirement visibility*. International Journal of Industrial Engineering, 23*(2), 119–136.

Colli, M., Berger, U., Madsen, O., Moller, C., & Wæhrens, B. V. (2019). A maturity assessment approach for conceiving context-specific roadmaps in the Industry 4.0 era. *Annual Reviews in Control*, *48*, 165–177. https://doi.org/10.1016/j.arcontrol.2019.06.001

Creswell, J. (2014). *Research Design* (4th ed.). United States of America: SAGE Publications Inc.

De Smet, A., Lurie, M., & St George, A. (2018). Leading agile transformation: The new capabilities leaders need to build in 21st-century organisations. *McKinsey & Company, 15*, 1–27.

Dreischmeier, R., Close, K., & Trichet, P. (2015). *The Digital Imperative*. BCG Perspectives.

Eremina, Y., Lace, N., & Bistrova, J. (2019). Digital maturity and corporate performance: The case of Baltic States. *Journal of Open Innovation: Technology, Market and Complexity, 5*(3), 1–13. https://doi.org/10.3390/joitmc5030054.

Ertan, J. (2018). Digital readiness of Swedish organizations. *KTH Industrial Engineering and Management*, 1–45.

Eswaran, A (2017). Competing in 2020: winners and losers in the digital economy. *Harvard Business Review Analytic Services Report*, 1–20.

Fitzgerald, M., Kruschwitz, N., Bonnet, D., & Welch, M. (2013). Embracing digital technology: A new strategic imperative. *MIT Sloan Management Review, 55*(2), 116.

Fuchs, C., & Hess, T. (2018). Becoming agile in the digital transformation: The process of a large-scale agile transformation. 1–17.

George, D., & Mallery, P. (2003). *SPSS for Windows step by step: A simple guide and reference. 11.0 update* (4th ed.). Boston: Allyn & Bacon.

Gerster, D. (2017). Research, digital transformation and IT: Current state of research. *In PACIS* (pp.133). https://aisel.aisnet.org/pacis2017/133

Gharajeh, M. S. (2019). Waterative Model: an integration of the Waterfall and iterative software development paradigms. *Database Systems Journal, 10*, 75–81. http://www.dbjournal.ro/archive/30/30.pdf#page=75

Guinan, P. J., Parise, S., & Langowitz, N. (2019). Creating an innovative digital project: Levers to enable digital transformation. *Business Horizons*, *62*(6), 717–727. http://doi.org/10.1016/j.bushor.2019.07.005.

Heale, R., & Twycross, A. (2015). Validity and reliability in quantitative studies. *Evidence-based nursing, 18*(3), 66–67. http://dx.doi.org/10.1136/eb-2015-102129.

Highsmith, J., & Cockburn, A. (2001). Agile software development: The business of Innovation. *Computer, 34*(9) 120–127. http://doi.org/10.1109/2.947100.

Kazim, F. A. (2019). Digital transformation and leadership style: A multiple case study. *ISM Journal of International business, 3*(1), 24–34.

Kettunen, P., & Laanti, M. (2017). Future software organizations – agile goals and roles. *European Journal of Futures Research, 5*(1), 1–15. http://doi.org/10.1007/s40309-017-0123-7

Maruping, L. M., Venkatesh, V., & Agarwal, R. (2009). A control theory perspective on agile methodology. *Information Systems Research*, *20*(3), 377–399. https://doi.org/10.1287/isre.1090.0238

McAvoy, J., & Sammon, D. (2005). Agile methodology adoption decisions: An innovative approach to teaching and learning. *Journal of Information Systems Education, 16*(4), 409–420.

Misra, S. C., Kumar, V., & Kumar, U. (2009). Identifying some important success factors in adopting agile software development practices. *Journal of Systems and Software, 82*(11), 1869–1890. https://doi.org/10.1016/j.jss.2009.05.052

Mugge, P., Abbu, H., Michaelis, T. L., Kwiatkowski, A., & Gudergan, G. (2020). Patterns of digitization: A practical guide to digital transformation. *Research-Technology Management, 63*(2), 27–35. http://doi.org/10.1080/08956308.2020.1707003

Nylén, D., & Holmström, J. (2015). Digital innovation strategy: A framework for diagnosing and improving digital product and service innovation. *Business Horizons, 58*(1), 57-67. https://doi.org/10.1016/j.bushor.2014.09.001

Ochoa-Urrego, R. L., & Peña, J. I. (2020). Digital Maturity Models: a systematic literature review. In *ISPIM Conference Proceedings* (pp. 1–15). The International Society for Professional Innovation Management (ISPIM).

Owen, A., Marshall, E., Green, D., Croft, T., & Davis, S. (n.d.). Spearman's correlation. Statstutor. https://www.statstutor.ac.uk/resources/uploaded/spearmans.pdf

Rhee, S. H., Cho, N. W., & Bae, H. (2010). Increasing the efficiency of business processes using a theory of constraints. *Information Systems Frontiers, 12*(4), 443–455. http://doi.org/10.1007/s10796-008-9145-9

Sajić, M., Bundalo, D., Bundalo, Z., & Pašalić, D. (2018). Digital technologies in transformation of classical retail banking into a digital bank. In *2017 25th Telecommunication Forum (TELFOR)* (pp. 1–4). IEEE. http://doi.org/10.1109/TELFOR.2017.8249404

Sánchez, M. A. (2017). A framework to assess organizational readiness the digital transformation. *Dimensión Empresarial, 15*(2), 27–40. http://dx.doi.org/10.15665/rde.v15i2.976

Sebastian, I. M., Ross, J. W., Beath, C., Mocker, M., Moloney, K. G., & Fonstad, N. O. (2017). How big old companies navigate digital. *MIS Quarterly Executive*, *16*(3), 197–213.

Sheshasaayee, A., & Vijaykumar, H. (2015). Identifying bottlenecks in agile software development using Theory of Constraints Principles. *Indian Journal of Science and Technology, 8*(29), 1-10.

Şimşit, Z. T., Günay, N. S., & Vayvay, Ö. (2014). Theory of constraints: A literature review. *Procedia – Social and Behavioral Sciences*, *150*, 930–936. https://doi.org/10.1016/j.sbspro.2014.09.104

Sommer, A. F. (2019). Agile Transformation at LEGO Group: Implementing Agile methods in multiple departments changed not only processes but also employees' behavior and mindset. *Research-Technology Management, 62*(5), 20–29. http://doi.org/10.1080/08956308.2019.1638486

Stankovic, D., Nikolic, V., Djordjevic, M., & Cao, D. B. (2013). A survey study of critical success factors in agile software projects in former Yugoslavia IT companies. *The Journal of Systems and Software*, *86*(6), 1663–1678. http://doi.org/10.1016/j.jss.2013.02.027

Štemberger, M. I., Erjavec, J., Manfreda, A., & Jaklič, J. (2019). Patterns of approaches to digital transformation: An institutional arrangements perspective. *Economics and Business Review, 21*(3), 467–492. http://doi.org/10.15458/ebr.93

Stoianova O. V., Lezina T. A., Ivanova V. V. (2020). The framework for assessing company's digital transformation readiness. *St Petersburg University Journal of Economic Studies*, 36(2), 243–265. https://doi.org/10.21638/spbu05.2020.204

Teichert, R. (2019). Digital transformation maturity: A systematic review. *Acta universitatis agriculturae* et *silviculturae mendelianae brunensis, 67*(6), 1673–1687. https://doi.org/10.11118/actaun201967061673

Tratkowska, K. (2019). Digital transformation: theoretical backgrounds for digital change. *Nauki o Zarzadzaniu, 24*(4), 32–37. http://doi.org/10.15611/ms.2019.4.05

Valdés, G., Solar, M., Astudillo, H., Iribarren, M., Concha, G., & Visconti, M. (2011). Conception, development and implementation of an e-Government maturity model in public agencies. *Government Information Quarterly*, *28*(2), 176–187. http://doi.org/10.1016/j.giq.2010.04.007

Westerman, G., Bonnet, D., & McAfee, A. (2014). *Leading digital*. Boston: Harvard Business Review Press.

Williams, C. A., Lang, K., & Schallmo, D. (2019). Digital maturity models for small and medium-sized enterprises: A systematic literature review. In *ISPIM Conference Proceedings* (pp. 1–15). The International Society for Professional Innovation Management (ISPIM).

Zaitsev, A., Gal, U., & Tan, B. (2020). Coordination artifacts in agile software development. *Information and Organization, 30*(2), 100288. https://doi.org/10.1016/j.infoandorg.2020.100288.

Zandi, F. (2014). A bi-level constraint-oriented outsourcing framework for orchestration of an ERP system. *International Journal of Production Research, 52*(1), 130–148. https://doi.org/10.1080/00207543.2013.828178

APPENDIX A: RESEARCH INSTRUMENT

Part A: Agile Methodology (adopted from Stankovic et al. [2013])

Figure 1: Agile Questions 1–10

Section 1 – Demographics

Question Number	Question	Response
1	Please indicate the department you work for	_____
2	Please indicate your age	_____
3	Please indicate your gender	_____
4	Please indicate the number of years worked at the organisation	_____
5	Your job or role in the organisation	_____
6	Length of the project (in months):	_____
7	Your level of experience with Agile projects (in years):	_____
8	Number of Agile projects you have been involved with	_____
9	Agile method used:	_____
10	Please indicate the number of people working in your Agile team	_____

Section 2 – Success factors of the Agile project

This section includes all the possible success factors of software development projects using Agile methods, compiled and consolidated from the academic and professional literature. Responses to each of the following statements range from 1 to 7 as follows:

1. Strongly disagree
2. Disagree
3. Somewhat disagree
4. Neutral
5. Somewhat agree
6. Agree
7. Strongly Agree

Figure 2: Agile Questions 11–22

Question Number	Question	Response
	Organisational Dimension	
11	The project received strong executive support. "Executive" may mean the whole Board of Directors or the CEO, CFO, CIO, etc. who influenced the decision making:	_____
12	The project had a committed sponsor or a committed organisation manager. An example of a committed sponsor/manager would be one who would stand up to critics and vouch for the Agile method in a non-Agile organisational environment:	_____
13	The organisation had a cooperative culture instead of hierarchal. A cooperative culture fosters ad-hoc teams driven by the needs of the job at hand (e.g. start-up organisations) while a hierarchal culture has clear divisions of responsibility and authority (e.g. established, large organisations):	_____
14	The organisation had an oral culture placing high value on fluid, face-to-face communication style:	_____
15	Agile methodology was universally accepted in the organisation:	_____
16	The organisation had a reward system that was appropriate for Agile behaviour. An example of such a reward system would be one that recognises both individual and team contributions and that rewards results of the Agile pilot projects:	_____
17	The project team was collocated, i.e. all team members worked in the same location for ease of communication and casual, constant contact:	_____
18	The project team worked in a facility with proper Agile-style work environment, e.g. a dedicated office with pair programming workstations, communal area, ample wall spaces for postings, no separate cubicles, or offices, etc.:	_____
	People Dimension	
19	The selected project team members had high technical competence and expertise (problem-solving, programming, subject matter):	_____
20	Project team members had great motivation and were committed to the project success:	_____
21	Project management was knowledgeable in Agile principles and processes:	_____
22	Project management had light-touch and/or adaptive management style, e.g. encouraging creative, flexible working	_____

Figure 3: Agile Questions 23–33

Question Number	Question	Response
	environment while taking advantage of mutual interactions among the project's various parts and steering them toward continuous learning and adaptation:	
23	The project team worked in a coherent, self-organising teamwork manner, i.e. relying on the collective ability of an autonomous team to solve problems and adapt to changing conditions:	_____
24	Project management had a good relationship with the customer:	_____
	Process Dimension	
25	The project scope and objectives were well-defined	_____
26	The project followed an Agile-oriented requirement process, e.g. specifying initial requirements at a very high level, leaving much room for interpretation and adaptation as the project progressed:	_____
27	The project followed Agile project management style, e.g. plans generally not being documented in great detail, and deviations and changes being readily accepted and incorporated into the project plan:	_____
28	The project followed Agile-oriented configuration management process, e.g. employing good version control or source code management to accommodate the refactoring efforts and frequent builds:	_____
29	The project manager followed an Agile-friendly progress tracking mechanism, e.g. using flexible time-boxing or rapid-pace progress measurement techniques instead of document milestones or work breakdown structure:	_____
30	The project had strong communication focus and rigorous communication schedule, i.e. face-to-face and instant communication channels (between team members, between team and management, and between team and customers), daily stand-up meetings, build-cycle meetings, etc.	_____
31	The project honoured regular working schedule, i.e. 40-hour work week, no overtime:	_____
32	The project had strong customer commitment and presence, i.e. having at least one customer representative on-site working hard and full-time as a member of the project team:	_____
33	The customer representative on the project had full authority and knowledge to make decisions on-site, such as approving, disapproving, and prioritising project requirements and changes	_____

Figure 4: Agile Questions 34–47

Question Number	Question	Response
	Technical Dimension	
34	The project imposed well-defined coding standards upfront:	_____
35	The project pursued simple design, e.g. programmers used the simplest possible design for each module to avoid waste and to facilitate cooperative work:	_____
36	The project pursued vigorous refactoring activities to ensure the results are optimal and to accommodate well all changes in requirements:	_____
37	The project maintained the right amount of documentation for Agile purpose, i.e. not too focused on producing elaborate documentation as milestones but not ignoring documentation altogether either:	_____
38	The project followed continuous and rigorous unit and integration testing strategy for every iteration:	_____
39	The project delivered working software regularly within short periods:	_____
40	The project delivered the most important features first:	_____
41	The project employed proper platforms, technologies, and tool suitable for Agile practice, e.g. object-oriented development techniques, tools supporting rapid iterative development, processes supporting refactoring, etc.:	_____
42	The project provided appropriate technical training to the team, including training on subject matter and Agile processes:	_____
	Project Dimension	
43	The project nature was a non-life-critical software project, although it could be a business mission-critical software. (Examples of life-critical projects are certain advanced weapons programs or air traffic control programs):	_____
44	The project type was of variable scope with emergent requirements:	_____
45	The project had a dynamic, accelerated schedule:	_____
46	The project had a small team size (20 members or less):	_____
47	The project had no multiple, independent teams working together:	_____

Figure 5: Agile Questions 48–53

Question Number	Question	Response
48	The project had up-front, detailed cost evaluation done and approved:	
49	The project had up-front risk analysis done and evaluated for using the Agile method:	_____

Section 3 – Perception of success of the Agile project

This section includes aspects of your perceived level of success of the Agile software development project at hand. Responses to each of the following statements range from 1–7 as follows:

1. Very Unsuccessful
2. Unsuccessful
3. Somewhat Unsuccessful
4. Neutral
5. Somewhat Successful
6. Successful
7. Strongly Successful

Question Number	Question	Response
	Organisational Dimension	
50	The project was successful in terms of quality of the project outcome or the resulting software product:	_____
51	The project was successful in terms of scope and requirements of the project being met:	_____
52	The project was successful in terms of timeliness of project completion:	_____
53	The project was successful in terms of costs and efforts being under budget or within estimates:	_____

Part B – Digital Maturity (adopted from Berghaus (2016))

Figure 6: Digital Maturity Questions 1–9

Responses to each of the following statements range from 1–5 as follows:

1. Not at all
2. Little
3. Partially
4. Mostly
5. Completely

Question Number	Question	Response
	Customer Experience	
1	We ensure a content-wise consistent and channel-appropriate customer experience on all digital and non-digital channels.	_____
2	Interactions with our customers can take place via both traditional and digital channels (e.g. advice, purchase, customer service).	_____
3	We personalise our digital customer communication (e.g. concerning content and frequency) according to user behaviour and existing Customer Relationship Management (CRM) data	_____
4	We take into account the individual user situation (e.g. time of day, current location, device used) when designing digital content. We merge customer and interaction data across channels.	_____
5	We derive insights from customer and interaction data that influence our marketing and communication activities.	_____
6	Both the evaluation of customer data and the triggering of relevant actions take place automatically in real-time	_____
	Product Innovation	
7	We have supplemented our products and services with digital innovations.	_____
8	We have successfully implemented new digital business ideas or business models in recent years.	_____
9	We have created suitable framework conditions for developing digital innovations (e.g. goals, financial/human resources, free time).	_____

Figure 7: Digital Maturity Questions 10–23

Question Number	Question	Response
10	We have a clearly defined innovation process for developing, evaluating, and implementing new ideas by employees and customers.	_____
11	We actively involve customers in the development of new digital innovations.	_____
12	We systematically survey our customers in order to improve our existing digital offering	_____
	Strategy	
13	"Digital business" has a central role in our overall strategy.	_____
14	We know which core competencies are the basis of our business success in an increasingly digital future.	_____
15	We drive digital projects with high priority.	_____
16	We see digital transformation as the continuous strategic development of our company.	_____
17	We are perceived by competitors and specialist groups as a driver of digital innovations.	_____
18	We drive digital innovations systematically and in a targeted manner.	_____
19	We systematically evaluate new technologies and changes in customer behaviour in order to identify potential for digital innovations	_____
	Organisation	
20	Digital projects are planned and implemented across departments and functions.	_____
21	Business areas with a high customer focus (e.g. marketing, sales, customer service) have cross-channel operational management.	_____
22	We have a systematic "early warning" to identify new, relevant technologies or business models. We can react quickly to changes in the technology or market environment.	_____
23	In normal business operations, we have enough resources to simultaneously drive digital innovations.	_____

Figure 8: Digital Maturity Questions 14–36

Question Number	Question	Response
24	In the field of digitisation, we maintain a partner network with external service providers, start-ups or research institutions.	_____
25	When working with external partners, we rely on standardised, efficient processes.	_____
	Process Digitisation	
26	We have consistently integrated digital channels (including mobile and social media) into communication and service processes.	_____
27	We have defined quality features and goals for digital channels that are regularly checked.	_____
28	We base our spending planning for digital communication on how intensively customers use individual media.	_____
29	We regularly review our core processes for the potential for improvement through digital technologies.	_____
30	We exploit the latest digital possibilities to automate our routine processes.	_____
31	We use knowledge from data analysis as a basis for decisions (e.g. to improve communication).	_____
32	We actively use our expertise in the field of big data, for example, when designing new products or business models.	_____
	Cooperation	
33	The use of digital collaboration platforms (e.g. SharePoint, Jive) improves the cross-departmental exchange of information and collaboration in our company.	_____
34	Digital collaboration platforms are used in our company in such a way that they reduce complexity and redundancies in communication.	_____
35	Our employees share relevant knowledge proactively and in a structured manner in digital collaboration platforms.	_____
36	We use the exchange with external experts to develop additional knowledge in the field of digitisation.	_____

Figure 9: Digital Maturity Questions 37– 50

Question Number	Question	Response
37	We have defined internal experts for digital topics who are available as contact persons for employees or external parties.	_____
38	Our mobile infrastructure with full data access allows employees to be fully capable of working and collaborating on the go.	_____
39	Our company specifically uses new forms of work (e.g. coworking, mobile office) to promote creativity and exchange between employees.	_____
	Information Technology	
40	We can adapt our digital offerings at short notice if our business requires it.	_____
41	We can quickly test and modify new digital products and services using prototypes.	_____
42	Thanks to open interfaces, we can quickly and easily connect our systems to new, own or third-party offers.	_____
43	We regularly update our IT infrastructure to meet changing requirements.	_____
44	Our internal IT can ensure the use of digital technologies that are relevant to our company.	_____
45	Our internal IT advises the specialist departments proactively and competently on technological innovations.	_____
46	The employees are familiar with important rules of conduct for IT security, and compliance with them is checked regularly (e.g. external audits).	_____
47	To ensure IT operations and the availability of data, we have planned and tested measures for various threat scenarios.	_____
48	We explain to customers proactively and clearly how we use their data.	_____
	Culture and expertise	
49	The development of digital expertise is a central component in employee development.	_____
50	Function-related digital skills are an important selection criterion when recruiting new employees.	_____

Figure 10: Digital Maturity Questions 51–62

Question Number	Question	Response
51	Our employees are familiar with our own digital products and use them themselves.	_____
52	Our managers are ready to take risks for the existing business by using innovative digital solutions.	_____
53	Despite investment risks, our managers encourage the development of innovative digital solutions.	_____
54	Errors and lessons learned from failed digital projects are proactively communicated within the company.	_____
55	We evaluate mistakes made in order to improve our digital processes and solutions	_____
	Transformation Management	
56	The digital transformation of our company follows a defined strategic plan.	_____
57	The digital transformation is controlled based on defined roles, responsibilities and decision-making processes.	_____
58	The goals of the digital transformation are measurably defined and known in the company.	_____
59	The achievement of goals for all activities in connection with the digital transformation is checked periodically.	_____
60	The top management level (management/board of directors/board of directors, etc.) recognises the importance of digital business and makes appropriate resources available.	_____
61	Middle management actively drives the change processes in the company that are necessary for digitisation.	_____
62	All managers encourage personal responsibility and willingness to change among employees in the context of digital transformation	_____

Part C – Digital Transformation (adopted from Sánchez (2017))

Figure 11: Digital Transformation Questions 1–5.3

Two scales were adopted by section. The scales are depicted in the table below.

Score	Scale 1	Scale 2
1	Strongly agree	Great extent
2	Agree	Medium extent
3	Disagree	Low extent
4	Strongly disagree	Not at all

Question Number	Question	Response
	Strategy definition (Please use Scale 1 to Answer)	
1	To what extent do you agree that the following are part of your organisation's strategy? • Improve customer experience • Innovation • Decision making • Efficiency	_____
	Platform and partners (Please use Scale 2 to Answer)	
2	To what extent your value proposition depends on new ways of collaboration with stakeholders (e.g. partners, suppliers, consumers, competitors)?	_____
3	To what extent your organisation is vertically integrated with suppliers and customers?	_____
4	To what extent does your company know about their end customer's goals?	_____
	Digital products or services (Please use Scale 2 to Answer)	
5.1	Consider one of your product or service. To what extent is this product or service electronically specifiable and searchable	_____
5.2	Consider one of your product or service. To what extent is this product or service provided digitally?	_____
5.3	Consider one of your product or service. To what extent is this product or service delivered digitally?	_____

Figure 12: Digital Transformation Questions 5.4–7.4

Question Number	Question	Response
5.4	Consider one of your product or service. To what extent is this product or service augmented (or can be) with valuable information?	_____
5.5	Consider one of your product or service. To what extent is this product or service threatened by enterprises in other industries that have relationships with your customers – offering competitive services to yours and disrupting our business?	_____
5.6	Consider one of your product or service. To what extent is this product or service at risk of being replaced with an alternative digital offering?	_____
5.7	Consider one of your product or service. To what extent is this product or service going to be delivered digitally in five years?	_____
	Resource and Capabilities (Please use Scale 1 to Answer)	
6.1	My organisation is using digital technologies (social networks, mobile, analytics and cloud computing).	_____
6.2	My organisation integrates digital technologies (social networks, mobile, analytics and cloud computing).	_____
6.3	My organisation Monitors customer needs and behaviour	_____
6.4	My organisation can respond to threats and opportunities better than our competitors.	_____
	Data Management (Please use Scale 1 to Answer)	
7.1	In my organisation our senior executives regularly consider the opportunities that data analytics (data mining, OLAP, Big Data) might bring to our business.	_____
7.2	In my organisation we integrate data from multiple internal sources into a data warehouse for easy access.	_____
7.3	In my organisation we integrate external data with internal to facilitate high-value analysis of our business environment. We collaborate with channel partners, customers, and other members of our business ecosystem to share big data and applications.	_____
7.4	In my organisation we identify internal opportunities for big data and analytics by evaluating our processes, strategies, and marketplace.	_____

Figure 13: Digital Transformation Questions 7.5–11

Question Number	Question	Response
7.5	In my organisation our data scientists, quantitative analysts, and data management professionals operate effectively in teams to address big data and analytics projects.	_____
7.6	In my organisation we have explored or adopted tools to process unstructured data such as text, video, or images.	_____
8	Project management and Agile expertise) How project success is defined? Project success depends on traditional iron triangle criteria on time, within budget, and to specification.	_____

Select the appropriate response for the next three questions.

9 (Project management and Agile expertise) Stakeholder involvement:

Not involved		Involved without influence		Involved with influence	

10 (Project management and Agile expertise) Multi-disciplinary project teams:

Not multi-functional		Some key departments		Most Departments	

11 Which barriers are impeding your organisation to adopt or develop digital technologies? Select the appropriate options

Lack of organisational strategy.	
Lack of ecosystem strategy.	
Lack of collaborative culture.	
Lack of leadership/CEO-level understanding.	
CEO-level satisfaction with status quo.	

Figure 14: Digital Transformation Question 11

	Employees' lack of ability to use digital technologies (cloud, social, mobile, and analytics). Legal/regulations restrictions.	
	Bestselling product/service dependency on the current commercial context.	

APPENDIX B: DIGITAL MATURITY MATRIX

Maturity Stage	Description
1 – Promote and Support	The items clustered in this stage are mainly related to strategic prioritization, flexible work, and management support of digital transformation. Basic digital services for existing products and a consistent customer experience across multiple channels were initiated. Employees are familiar with existing digital products. The internal IT ensures the availability of relevant digital technologies and keeps the infrastructure up-to-date. Digitization has become a priority on the strategic agenda. Digital transformation projects are supported and prioritized by top, senior, and middle management. Also, flexible and mobile work that is enabled by digital technology has already been established.
2 – Create and Build	In this stage, digital innovation plays a more prominent role, both at the strategic level and within product innovation. The strategic importance of innovation is stressed by explicitly promoting digital innovation, and systematically evaluating potential in new technologies. This also includes evaluating internal communication or service processes, in terms of whether they can be improved by digital technologies. Suitable conditions for innovation are created by strengthening digital competencies, collaborating more strongly with the internal IT department, liaising with external partners, such as start-ups or universities, and also by allocating dedicated resources, time, and budget to digital innovation.
3 – Commit to Transform	The items in this cluster belong mainly to the dimension of culture & expertise, but also to organization and transformation management. While in stage 2, the focus appears to be on experimenting with digital innovations, in stage 3, the digital transformation affects the internal culture and organizational structure more profoundly. Important capabilities within the company culture are a proactive error management and the communication of learning from failed projects, as well as willingness to take risks. Items related to the dimension "organization" describe a flexible organization that collaborates with partners and that is able to react quickly to changes. A company that is willing to perceive digitization as more radical change to their organization, needs to define roles and responsibilities for all processes related to the digital transformation, as well as creating a strategic plan for the transformation process that the company is willing to follow.
4 – User centred and collaborated processes.	The items in the fourth cluster are related to a variety of dimensions. One common ground appears to be user-centeredness. This is revealed by the involvement of users in innovation processes, the personalization of customer experiences, and the focus on customer data when designing interaction. Another commonality is that digital transformation has progressed and shown results. The company is known as a digital innovator within the respective industry, and transformation goals, as well as KPIs for digital channels, are determined and reviewed periodically. Another indicator is digital ambidexterity.
5 – Data driven enterprise	The items with the highest difficulty metric are clustered in stage 5. These items are related to the use of advanced data analytics technologies for expenditure planning, collating customer data across multiple channels, real-time analysis, and personalizing customer interactions accordingly. This data is often available; however, only advanced companies use it appropriately for decision support or product development. Preconditions for the implementation of a data-driven business are internal expertise for data utilization, appropriate technological infrastructure, and data governance across different business units.

Figure 15: Digital Maturity Matrix – adopted from Berghaus and Back (2016)

APPENDIX C: CONSISTENCY MATRIX

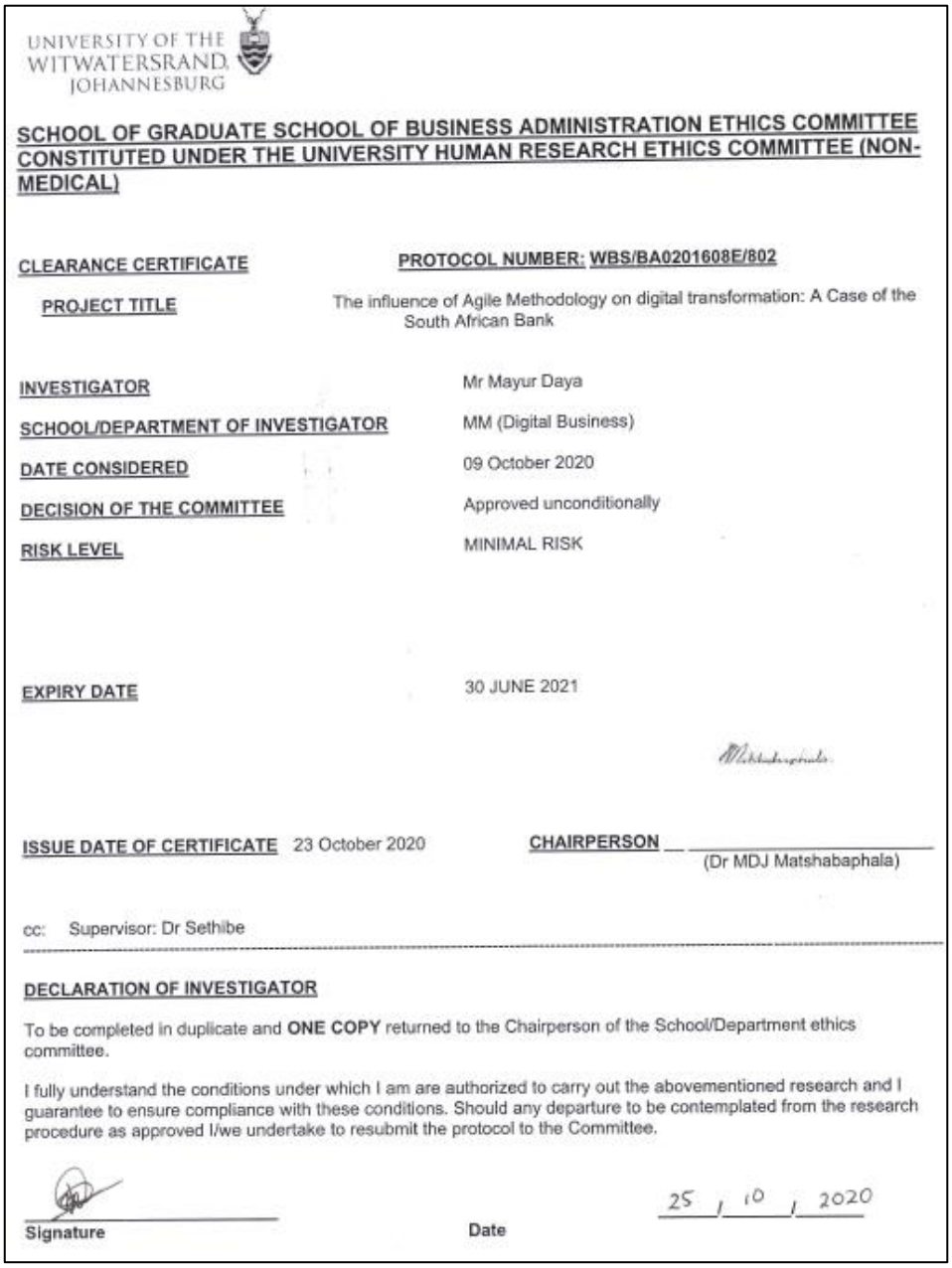
Purpose: To determine the influence of Agile Methodology on digital transformation: The Case of a South African Bank.

Aims/ Objectives	Literature Review	Hypothesis	Research Questions	Variables Dependant / Independent	Source of Data	Type of Data	Analysis
To analyse the digital transformation maturity level of Bank X.	Eremina et al. (2019); Teichert (2019); Colli et al. (2019); Berghaus and Back (2016); Buvat et al. (2017);	Bank X exhibits a Digital Maturity level of Stage 3.	Is Bank X at maturity Level 3?	IV1 = Maturity Level 3 DV1 = Bank X's Digital Maturity level	Questionnaire	Original (Survey Data)	Reliability and validity, Descriptive, Mann-Whitney test, Wilcoxon Signed-Rank Test, Correlation, and Regression
To analyse the impact of Agile methodology on digital transformation at Bank X.	Sánchez (2017), Baculard et al. (2017); Dreischmeier et al. (2015) ; Tratkowska (2019); Guinan et al. (2019); Fuchs and Hess (2018); Gerster (2017); Mugge et al. (2020)	Agile enables digital transformation in Retail Banks.	Does Agile have an impact on digital transforma-tion at Bank X?	IV1 = Agile Adoption DV2 = Digital Transformation	Questionnaire Statistical	Original (Survey Data)	

Method: Quantitative Study

APPENDIX D: ETHICS CLEARANCE CERTIFICATE

Figure 16: Ethics Clearance Certificate



UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

SCHOOL OF GRADUATE SCHOOL OF BUSINESS ADMINISTRATION ETHICS COMMITTEE CONSTITUTED UNDER THE UNIVERSITY HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)

CLEARANCE CERTIFICATE **PROTOCOL NUMBER: WBS/BA0201608E/802**

PROJECT TITLE The influence of Agile Methodology on digital transformation: A Case of the South African Bank

INVESTIGATOR	Mr Mayur Daya
SCHOOL/DEPARTMENT OF INVESTIGATOR	MM (Digital Business)
DATE CONSIDERED	09 October 2020
DECISION OF THE COMMITTEE	Approved unconditionally
RISK LEVEL	MINIMAL RISK
EXPIRY DATE	30 JUNE 2021

ISSUE DATE OF CERTIFICATE 23 October 2020 **CHAIRPERSON** _____ (Dr MDJ Matshabaphala)

cc: Supervisor: Dr Sethibe

DECLARATION OF INVESTIGATOR

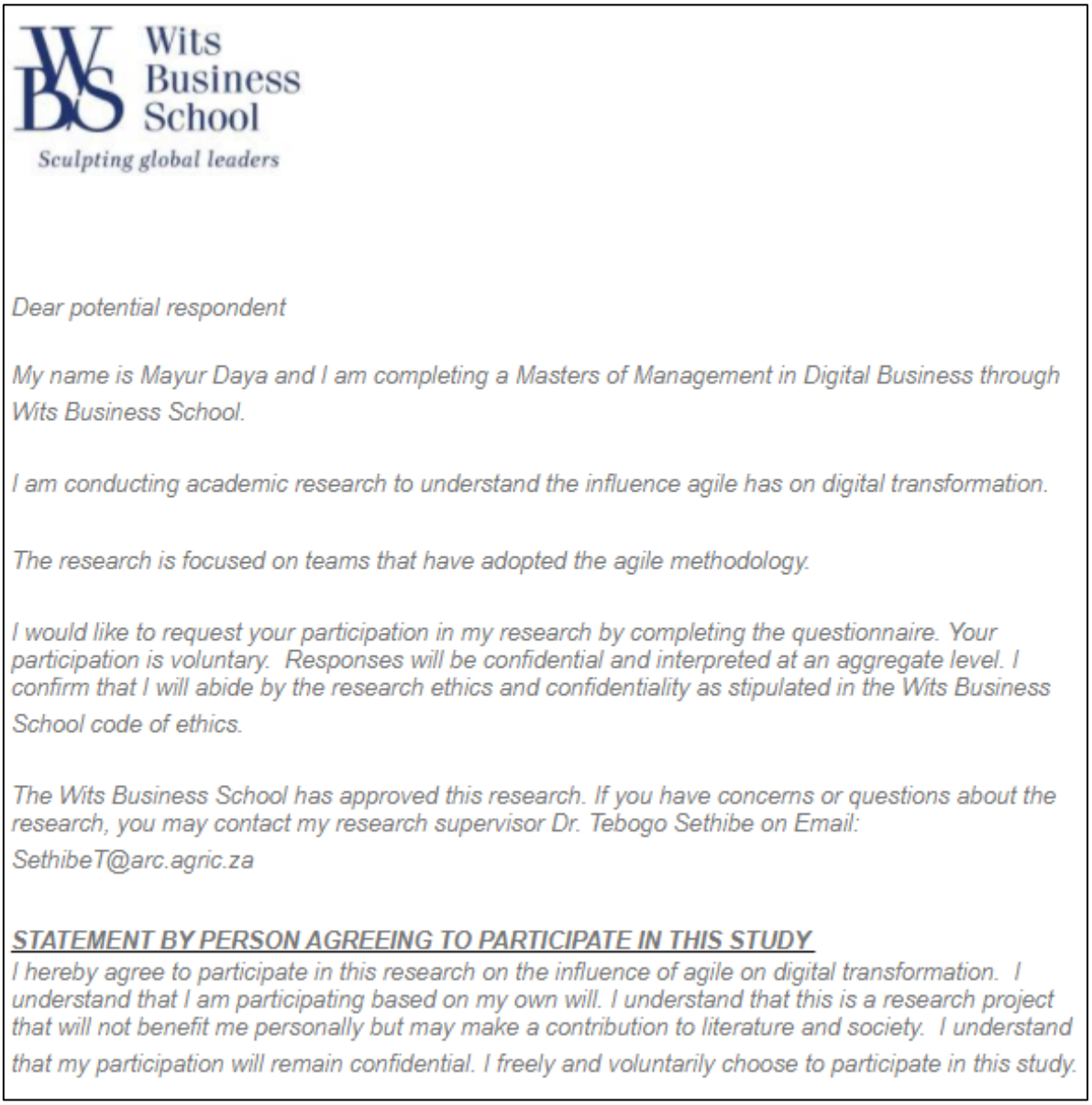
To be completed in duplicate and **ONE COPY** returned to the Chairperson of the School/Department ethics committee.

I fully understand the conditions under which I am are authorized to carry out the abovementioned research and I guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee.

Signature **Date** 25 / 10 / 2020

APPENDIX E: LETTER TO RESPONDENTS

Figure 17: Letter to Respondents



Wits Business School

Sculpting global leaders

Dear potential respondent

My name is Mayur Daya and I am completing a Masters of Management in Digital Business through Wits Business School.

I am conducting academic research to understand the influence agile has on digital transformation.

The research is focused on teams that have adopted the agile methodology.

I would like to request your participation in my research by completing the questionnaire. Your participation is voluntary. Responses will be confidential and interpreted at an aggregate level. I confirm that I will abide by the research ethics and confidentiality as stipulated in the Wits Business School code of ethics.

The Wits Business School has approved this research. If you have concerns or questions about the research, you may contact my research supervisor Dr. Tebogo Sethibe on Email: SethibeT@arc.agric.za

STATEMENT BY PERSON AGREEING TO PARTICIPATE IN THIS STUDY

I hereby agree to participate in this research on the influence of agile on digital transformation. I understand that I am participating based on my own will. I understand that this is a research project that will not benefit me personally but may make a contribution to literature and society. I understand that my participation will remain confidential. I freely and voluntarily choose to participate in this study.

APPENDIX F: CONSENT FORM

Dear Examiner,

A consent form/letter was not utilised and permission was granted via internal processes.

Regards,
Mayur Daya