

https://dspace.org/

Banking 4.0 -The impact of Industry 4.0 on current Business Banking Business models in a big South African Bank

Böhmer, Helena M

2020
https://hdl.handle.net/10539/31226

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



Title

Banking 4.0 - The impact of Industry 4.0 on current Business Banking Business models in a big South African Bank

Student Name: Helena M Böhmer

(Student number: 1761521)

School of Mechanical, Industrial and Aeronautical Engineering

University of the Witwatersrand

Johannesburg, South Africa.

Supervisor:

Bernadette Sunjka

A research report submitted to the Faculty of Engineering and the Built Environment, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Science in Engineering(50/50).

August 2020

Candidate's declaration

I declare that this dissertation is my own unaided work. It is being submitted to the Degree of Master of Science to the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination to any other University.



……

(Signature of Candidate)

26th day of August 2020

Abstract

Industry 4.0 is inevitable. Banks need to ensure that business models enable them to adapt the way they do business and be ready scale their product offerings in line with the rapid changing technology. Financial technology (known as Fintech) is also a reality. Fintech seeks to improve and automate the delivery and use of financial services. This also introduces competition of new entrants to the market. With the dawn of Fintech, banking will have to adopt and ensure they are on par with this technology. But how will banks adapt to this change and are they ready to change?

For this study a theoretical framework was used to measure the readiness of a big South African bank. This framework includes, gamification, blockchain technology, biometric technology, digital investment and process optimization. A qualitative approach, using semi-structured interviews with subject matter experts, was done. This was followed by thematic content analysis using coding as the research method. New pillars emerged from the research. These are human resources, big data and security and were identified as important items for this transformation. These were some of the main findings that were included in the updated framework.

Dedication and acknowledgements

I thank God for giving me the ability and opportunity and enabling me to complete this dissertation.

This paper is dedicated to my husband, Horst, for his incredible support while completing this challenging task, to my children, Minkè, Nika and Waldo for their love and support - I trust this will motivate you to follow your dreams. And to my parents whom has always been supportive of me in all my endeavours.

Contents

Candidate's declaration 2
Abstract 3
Dedication and acknowledgements 4
List of figures 9
List of tables 10
1 Chapter 1 – Introduction 11
1.1 Research Background and Context 11
1.2 Problem Statement and Motivation 13
1.3 Research Question 13
1.4 Research Objectives 13
1.5 Summary of Research Design and Method 14
1.6 Delimitations (of the research) 14
1.7 Outline of chapters 15
2 Chapter 2 – Literature review 16
2.1 This literature review 16
2.2 Business model background and definition 16
2.2.1 Triggers to change a business model 17
2.2.2 Traditional business banking business models 18
2.3 Defining Industry 4.0 21
2.4 Impact of Industry 4.0 on the banking industry 23
2.5 Impact of Industry 4.0 on banking business models 24
2.6 Enabling Banking 4.0 26
2.6.1 The Conceptual framework 27
2.6.2 Mapping from literature to framework 32
2.6.3 Data analytics or big data 40

2.6.4 Enabling Technologies 40
2.6.5 Competition 43
3 Chapter 3 – Research Design and Method 45
3.1 Research Design 45
3.1.1 Research instrument 45
3.1.2 Research environment 48
3.1.3 Sampling design 49
3.1.4 Data Collection and ethics considerations 50
3.1.5 Data analysis 51
3.1.6 Validity and Reliability 55
3.2 Research Methods 57
4 Chapter 4 – Results and Analysis 60
4.1 Pillar 1 – Gamification 60
4.1.1 Themes identified 61
4.1.2 Pillar 1 - Implementation: 63
4.1.3 Pillar 1 - Relevance: 65
4.1.4 Pillar 1 - Timing: 66
4.2 Pillar 2 - Blockchain technology 68
4.2.1 Themes: 68
4.2.2 Pillar 2 - Implementation: 70
4.2.3 Pillar 2 - Relevance: 71
4.2.4 Pillar 2 - Timing: 72
4.2.5 Pillar 2 - Future focus 73
4.3 Pillar 3 - Biometric Technology 74
4.3.1 Themes 74
4.3.2 Pillar 3 - Implementation: 76
4.3.3 Pillar 3 - Relevance: 77

4.3.4 Pillar 3 - Timing: 78
4.4 Pillar 4 - Digital investment 79
4.4.1 Themes: 80
4.4.2 Pillar 4 - Implemented: 83
4.4.3 Pillar 4 - Relevance: 84
4.4.4 Pillar 4 - Timing: 85
4.5 Pillar 5 - Process automation 86
4.5.1 Themes: 86
4.5.2 Pillar 5 - Implemented: 89
4.5.3 Pillar 5 - Relevance: 90
4.5.4 Pillar 5 - Timing: 90
4.6 Other 91
4.6.1 Themes: 91
4.7 Impact of each pillar on traditional banking models: 94
5 Chapter 5 – Discussion of results 95
5.1 Pillar 1 - Gamification 95
5.2 Pillar 2 - Blockchain Technology 99
5.3 Pillar 3 - Biometric Technology 103
5.4 Pillar 4 - Digital investment 107
5.5 Pillar 5 - Process automation 112
5.6 Other 116
5.6.1 Summary: 120
6 Chapter 6 – Developing a Conceptual Framework for Industry 4.0 in Banking 121
This chapter proposes a revised framework for Industry 4.0 in Banking 121
6.1.1 Order of framework 121
6.1.2 Timing of framework 124
6.1.3 Supporting pillars to the framework 125

6.1.4 New framework 127
6.2 Evaluating the implementation of Industry 4.0 128
6.3 Identifying the impact of the changes due to Industry 4.0, (2015 to 2019). 130
7 Chapter 7 Conclusions and Recommendations 133
7.1 Recommendations 135
8 References 136
9 Appendix A – Respondents invitation letter 145
10 Appendix B – Letter of Consent 146
11 Appendix C – Research Instrument - Interview questionnaire 147
12 Appendix D - Interviews transcribed 150
13 Appendix E – Coding: In vivo and hypothesis 224
14 Appendix F – Second level of coding continued: Pattern coding 243
15 Appendix G - Ethical clearance 256

List of figures

Figure 2.1: Banking Business Models of the future (Kolber et al., 2016) 27
Figure 3.1: Analysis as a Spiral (Ormrod et al.,2016) 51
Figure 3.2: Visual representation of coding used as per Saldana. (Saldana, 2009) 53
Figure 4.1: Maturity of Gamification 61
Figure 4.2: Priority of gamification 62
Figure 4.3: Implemented - Gamification 63
Figure 4.4: Gamification Implemented (Grouped) 64
Figure 4.5: Relevance - Gamification 65
Figure 4.6: Timing of usage - Gamification 66
Figure 4.7: Timing of usage - Gamification Grouped 67
Figure 4.8: Implemented - Blockchain Technology 70
Figure 4.9: Relevance - Blockchain Technology 71
Figure 4.10: Timing of usage - Blockchain Technology 72
Figure 14.11: Future focus - Blockchain Technology 73
Figure 4.12: Implemented - Biometric Technologies 76
Figure 4.13: Relevance - Biometric Technologies 77
Figure 4.14: Timing of usage - Biometric Technology 78
Figure 4.15: Implemented - Digital investment 83
Figure 4.16: Relevance - Digital investment 84
Figure 4.17: Timing of usage - Digital investment 85
Figure 4.18: Implemented - Process Automation 89
Figure 4.19: Relevance - Process Automation 90
Figure 4.20: Timing of usage - Process Automation 90
Figure 6.1: Industry 4.0 Readiness Framework (HM Bohmer, 2020 ©) 127

List of tables

Table 2.1: First mapping to the conceptual framework *32*
Table 2.2: Second mapping to the conceptual framework *33*
Table 2.3:Third mapping to the conceptual framework *34*
Table 2.4:Fourth mapping to the conceptual framework *35*
Table 2.5: Fifth mapping to the conceptual framework *36*
Table 2.6: Sixth mapping to the conceptual framework *37*
Table 2.7: Combined table *38*
Table 3.18: Number of codes identified per level *59*
Table 4.19: Summary of the impact of each pillar on traditional banking models *94*

1 Chapter 1 – Introduction

1.1 Research Background and Context

This research explores the impact of Industry 4.0 on the banking industry and more specifically on the business models that banks use to do their business.

For this research the banking industry is defined as financial institutions that accept deposits from the public and create credit from this. The emphasis of this research is specifically on a large established financial institution and it focusus on a particular bank within South Africa.

According the Schwab (2018), the term, Industry 4.0 was coined at the Hannover Fair in 2011. The author added the previous three industrial revolutions all created major social change and opportunity, but today's revolution is unique in the velocity at which the new ideas and technology spread around the world. In this fourth industrial revolution, also known as the digital revolution or mostly referred to as Industry 4.0, the lines between physical, digital and biological spheres are blurred. According the Schwab (2018), Industry 4.0 is characterised by rapid development and advances in technology and can not only change industries, but entire systems, countries and society. This is the combination of internet of technologies and future-orient technologies which leads to a paradigm shift in industrial production (Lasi et al., 2014), and it is the revolution in the underlying technology. (Liang, 2016). Industry 4.0 will change the design, manufacture, operation and service of products and services and that connectivity and interaction between parts, machines and people will make production systems 30% faster and 25% more efficient and enable mass customization. (Ganzarain & Errasti, 2016). Disruption is imminent yet Industry 4.0 enable companies to venture into other industries at amazing speeds. (Moreno et al., 2015).

Although there are themes around rapid development in technology, speed and velocity of change, digitization and inevitable change, there is no one formal definition or understanding around Industry 4.0. For the purpose of this study Industry 4.0 is defined as the rapid advances in technology and how these impact the current ways of work. The

focus of this study is then how these rapid advances are impacting the business models in the banking industry.

This is the back drop of the banking industry facing multiple challenges and pressures to improve their business models.

A business model is a company's plan for making a profit and it identifies the products or services the business will sell, the target market it has identified, and the expenses it anticipates. This is the strategy of the business. (Investopedia, 2019). Thompson et.al. (2017), describes strategy as the things that managers and organizations do. In addition, this source proposes that “this is how organizations cope with the world, which is dynamic and emergent. Technologies, fashion and competition all change consistently and simultaneously. They (companies) sometimes have to deal with legislation and other constraints and often they have to out-manoeuvre competitors.” (Thompson, 2017:p33).

Banking is no exception and is also driven by the strategic framework the executives put in place and drive. From Thompson’s (2017), definition of strategy, one can conclude that business models are a basis of how business is done and how this adapts to the changing business environment to ensure relevance and sustainability. In the light of the change that comes with the development of Industry 4.0, it would seem feasible that banking business models would need to incorporate these anticipated and inevitable changes. (Thompson, 2017).

In summary, research thus, investigates the impact of Industry 4.0 on traditional banking business models using a framework and semi-structured interviews to understand how Industry 4.0 impacts the bank and its business models or strategy.

1.2 Problem Statement and Motivation

Industry 4.0 is inevitable. Banks need to ensure that business models enable them to adapt the way they do business and be ready to scale their product offerings in line with the rapid changing technology. Financial technology (known as Fintech) is also a reality. According to Investopedia, Fintech is used to describe new technology that seeks to improve and automate the delivery and use of financial services. (Investopedia.com, 2019). It further describes this will mostly include general monetary transactions without the assistance of an employee of the bank. Fintech thus, seeks to improve and automate the delivery and use of financial services. (Investopedia.com, 2019). This technology helps companies to manage their business and processes better. With the dawn of Fintech, banking will have to adopt this technology. But how will banks adapt to this change and are they ready?

1.3 Research Question

The above leads to the critical research question:
What is the impact of Industry 4.0 on Traditional Business Banking Business models in a large South African Bank?

1.4 Research Objectives

The main objective of this research is, to investigate the impact of Industry 4.0 on Business Banking Business models in a South African Bank

This will be achieved by,

1. Developing a Conceptual Framework for Industry 4.0 in Business Banking based on the research from a framework employed by Deloitte.
2. Evaluating the implementation of Industry 4.0 in the Business Banking Environment of a South African Bank.
3. Identifying the impact of the changes due to Industry 4.0, in the Business Baking environment of a South African Bank between 2015 to 2019.

1.5 Summary of Research Design and Method

Qualitative research was done. This research is exploratory as the phenomenon of Industry 4.0 is still relatively new world wide, as will be described in detail later.

The instrument used was semi-structured interviews. The research environment was mostly meeting rooms in the working environment, except for two Skype interviews. Purposive sampling, a non-probability sampling technique was used, to choose the participants. The ethics process, as prescribed by the University of the Witwatersrand Ethics Committee, was followed for the data collection for this research. Ethics clearance number: MIAEC 223/19. Confidential interviews were conducted. The analysis was done using thematic content analysis using coding. The following steps were followed for the analysis:

- Organizing
- Perusal
- Classification
- Synthesis

More on this in the 3.1.5 Data analysis.

From the above the conclusions and recommendations were drawn.

1.6 Delimitations (of the research).

The research was focused on one of the major banks in South Africa which bring limitations to the research. It would be ideal to do this study using various banks, either within the country or even worldwide, to understand in depth how ready the banking industry is for Industry 4.0. As only one bank was investigated, this introduces some bias as the participants are all from the same company. To minimise this, all questions asked were open-ended and participants were assured that information would be confidential and not shared or used for any other purpose but the analysis for this study.

1.7 Outline of chapters

The structure of the thesis is as follows:

- The first chapter starts with the research background, problem statement, research question, objectives, methods summary and limitations. (Chapter 1)
- The second part of the thesis is Literature Review (Chapter 2). This part introduces existing knowledge and theories that were chosen based on their relevance to Industry 4.0, banking industry and business models.
- The third part is Research Method (Chapter 3). This part describes research design, instruments, sampling, data collection and ethics considerations
- The fourth part is analysis and results (Chapter 4) and analyses the research findings obtained from the interviews.
- The fifth part is discussion of results (Chapter 5) and details on the research findings obtained from the interviews.
- The sixth part is developing a conceptual framework (Chapter 6).
- The final part is the conclusion and recommendations (Chapter 7) and provides the conclusions and answers to the research questions.

2 Chapter 2 – Literature review

2.1 This literature review

The literature review covers the background and definition of a business model, what it consists of and the design and what would prompt the change of a business model in the business life cycle. It also looks at current and traditional business models of banks and how these models are implemented and used still today. Next, the background on what Industry 4.0 entails, why it is important and how this impacts the world around us in the banking industry is explored. Finally, the framework used to evaluate the readiness of the bank, is described and how this will be used to evaluate the impact of Industry 4.0 in banking. This includes the conceptual framework and the reason why this framework is chosen, impact of big data and other enabling technologies and how competition plays a role in the further design for business models in this ever-changing environment.

2.2 Business model background and definition

Thompson et al., (2017) explains the business model enables a company to have a very clear picture concerning the organization. He calls this the “why” of company existence. He further elaborates the key components of a business models are the products (or services), the market and as he calls it, the “compelling reason to buy”. (Thompson et al., 2017: p55). One can conclude from this statement that a business model describes the rationale of how an organization creates, captures and delivers value. This is in the economic, social and cultural contexts.

Thompson et al., (2017) continues to explain that, an effective organization has a clear vision of the future and can identify opportunities and threats in the market place that require change in the current business models of the company. (Thompson, 2017).

This is supported by Mintzberg's work that proposes strategy and business model creation comprises of:

- "Learning from the past"
- "Understanding the present"
- "Imagining the future", and
- "Competing and innovating to stay ahead of rivals and seize new opportunities." (Thompson, 2017: p39)

According to Bocken (2018), value is the focus of a business model, the connections that a business model provides between a firm's potential and the realisation of economic value. (Bocken et al., 2018). He also adds that few comprehensive frameworks have been developed for sustainable business models, except perhaps in grey literature. Grey literature are documents produced in print and electronic formats that are protected by intellectual property rights and of sufficient quality to be collected and preserved by libraries but not controlled by traditional commercial publishers.

2.2.1 Triggers to change a business model

Disruptive technological innovations are the main causes, that force companies to adapt their business models. (Christensen, 1997; Picot A, 2008). According to Saebi (2017) firms are more likely to adapt their business models under conditions of perceived threats rather than opportunities. (Saebi, 2017).

Less than 20% of large and dominant companies that were listed on the Standard and Poor index in the USA in 1954 were still listed 53 years later in 2007. (Jetter et al, 2009). The authors attribute this mainly to the pace of innovation and that these failed companies, simply hold on too long to established business models and strategies, failing to innovate due to inadequate strategic foresight for fear of cannibalism of existing business. A phenomenon described by the authors as an example, is that electronic communication was virtually unknown about 20 years ago, yet today we can not imagine the world without it. (Jetter et al., 2009).

In a study on the transition from traditional banking to mobile banking, Chen et al., (2017), emphasises that traditional banking models will have to change as FinTechs are expected to overturn the traditional banking business model, forcing banks to upgrade and transform or create their own demise. (Chen et al., 2017).

As defined by Schwab (2018), Industry 4.0, enables new ideas and technology to spread around the world at a great velocity. This is a trigger for the change to a business model. Industry 4.0 is a threat to a business that is not innovating their business model.

Jetter et al., (2009), found that significant changes in the business models of companies must be accompanied by radical changes in the company's corporate culture to support the model through change management. (Jetter et al., 2009). This is supported by Jorgensen et al., (2007), where project managers were interviewed and claimed that changing the mindsets and attitudes was the most serious obstacle to implementation (Jorgensen et al., 2007).

From the above, it's clear that current developments and future aspirations must be taken into consideration when creating and changing a business model. Further it is also important that a business model must be revisited often to ensure that one not only look at the past as a means of understanding the present, but also continuously look at the future whilst innovating and stay ahead of rivals. Impact of change in business models does impact employees and change management and the expectation of employees must be managed appropriately.

2.2.2 Traditional business banking business models

Stephan Bird, CEO of Global Banking at Citigroup, a worldwide organization in more than 160 countries, described the current traditional banking models at a stage of extinction and added that banks should either swiftly adapt and create new competitive positioning or gradually perish. (Chen et al., 2017). He added that internet based financial enterprises are cutting directly into the traditional financial industry.

New business models and internet-based finance companies have the following characteristics: flexible organizational structures, they are formed by joint ventures or small equity investments, financial products are innovated through the mobile internet, and new products can be introduced quickly and processes are evolving continuously. (Chen et al., 2017). The author added that in traditional business models all financial transactions had to occur over the counter, in fixed places or fixed facilities. In the new models, trade can be conducted anytime and anywhere through online transactions. The same idea is also stated in an article on digital banking and how to make business models fit for the future. Here it is mentioned that traditional business banking models are confined by branch banking, maintaining legacy systems and complex structures. (Itonics, 2019).

As concluded from the above, customers were expected to go to the branch to execute their banking. This was further complicated by complex processes and structures and thus time consuming. These included even simple transactions like, cash withdrawals, deposits, balance enquiries, to name a few. Legacy systems are also a problem to most large organizations and the bank is no exception. As described by Bennett (1995), “Migrating and updating this baggage (referring to legacy systems) from our past has technical and nontechnical challenges, ranging from justifying the expense in dealing with outside contractors to using program understanding and visualization techniques.” (Bennett, 1995:p19). This then increases time and effort that must be spent to get historic legacy systems on par with current technologies to enable integration to new systems and does not enable companies to focus on their core business execution.

Banks should be every day banks according to Accenture PLC, thus not only catering for financial needs but also nonfinancial needs, delivering complete customer solutions using digital levers. (Moreno et al., 2015). The author added that these levers suggested is currently only offered in limited amounts by traditional banks. Traditional business models are thus cumbersome to many customers.

2.2.2.1 Established vs new business

Established businesses have greater customer confidence than new innovative businesses. According to the Data Investor (2019), when comparing start-ups with established banks, the latter has the advantages of excellent market access, reliable and established products, established brands and customer confidence. (Itonics, 2019). An example of this is African Bank, that was placed under curatorship in 2014. One may expect they had lost customer confidence, yet after the necessary was done to obtain a new banking licence, their customer advances grew at 9% and group profit after tax was up by 19% according to the 2018 annual financial statements. (Annual Financials African Bank, 2018). One can conclude that established banks have an advantage over new entrants to the market when it comes to customer confidence and new business of customers. These established major banks still have the ability to grow in an unfavourable economic climate. This is demonstrated by the combined headline earnings for the four major banks in South Africa being up by 8.7% from 2017 to 2018 according to a PwC report. (Natsas and Roopnarain, 2019).

When expenditures are considered, however, the major banks have a few concerns they need to address. The combined cost-to-income ratio of the top four banks in South Africa, Nedbank, FNB, Absa and Standard Bank is 55.1% (Temkin, 2018), in comparison with a newer entrant, Capitec, who's ratio is 39%. (Annual Financials Capitec, 2019). While the actual numbers are not available at the time of this publication, the expected cost-to-income ratios for the new digital banks are expected to be between 25% and 30%. (Withers, 2019). This is due to the fact that they have fewer employees, less administrative costs and no legacy systems to maintain which leads to lower back office technology costs. (Withers, 2019). Therefore, with the dawn of Industry 4.0, major banks will need to carefully consider how they will be doing business differently going forward and continuously improving processes.

2.3 Defining Industry 4.0

According the Schwab (2018), the term, Industry 4.0 was coined at the Hannover Fair in 2011 (Schwab, 2018). The author added the previous three industrial revolutions all created major societal changes and opportunities, but today's revolution is unique in the velocity at which the new ideas and technology spread around the world. In this fourth industrial revolution, also known as the digital revolution, the lines between physical, digital and biological spheres are blurred. It can, thus, not only change industries, but entire systems, countries and society.

According to Schwab, Industry 4.0, encompasses various technology breakthroughs, including artificial intelligence, internet of things, robotics, 3D printing, to name a few. (Schwab, 2018). This is supported by Lasi et al., (2014), who mention the first industrial revolution to be characterised mechanization, the second the intense use of electricity, the third industrial revolution was widespread digitization and Industry 4.0 as the combination of internet of technologies (Internet of things) and future-orient technologies which leads to a paradigm shift in industrial production. (Lasi et al., 2014).

Ganzarain & Errasti (2016), add that Industry 4.0 will change the design, manufacture, operation and service of products and services and that connectivity and interaction between parts, machines and people will make production systems 30% faster and 25% more efficient and enable mass customization. (Ganzarain & Errasti, 2016).

There are the three major technological drivers for Industry 4.0. As described by Guoping et al, (2017), the world is marching into a new development period when digital technology, physical technology, and biological technology have achieved an unprecedented development, and at the same time their applications are converging greatly. (Guoping et al, 2017).

According to Moreno (2015), the digital revolution is re-shaping every aspect of banking and it is enabling companies to venture into other industries at amazing speeds. (Moreno et al., 2015).

It may thus be concluded, that change is inevitable, and the speed of this change is significant in various industries, including the service industry.

The main principals of the previous industrial revolutions should be remembered when looking at industry 4.0. The first industrial revolution was based on stream and mechanization. The second electricity and mass production (“Hard automation”), the third by computers and “flexibility” automation. The basic of industry 4.0 is where internet of things are connected to ensure that different machines and process work together for the output required. This is also referred to as smart factories. Basl (2017), define it well in that he mentioned that the basic principles of Industry 4.0 are connection of machines, work pieces, and systems and business are creating intelligent networks along entire value chain that can control each other autonomously. (Basl,2017)

In summary, the following is said about Industry 4.0:

- Industry 4.0 is characterised by rapid development and advances in technology, (Schwab, 2018).
- Industry 4.0 is the revolution in the underlying technology. (Liang, 2016).
- Industry 4.0 can not only change industries, but entire systems, countries and society. (Schwab, 2018).
- Industry 4.0 as the combination of interaction of technologies and future-orient technologies which leads to a paradigm shift in industrial production. (Lasi et al., 2014).
- Industry 4.0 will change the design, manufacture, operation and service of products and services and that connectivity and interaction between parts, machines and people will make production systems 30% faster and 25% more efficient and enable mass customization. (Ganzarain & Errasti, 2016).
- Disruption of business models which enable companies to venture into other industries at amazing speeds. (Moreno et al., 2015).

2.4 Impact of Industry 4.0 on the banking industry

The impact on the banking industry of Industry 4.0 is significant. Laing (2016), in his study about Blockchain application and Outlook in the Banking Industry, he discusses the multiple pressures that is facing the banking industry in China which include a decline in profits, an increase in risk and a new state of change and development. (Liang, 2016). Liang (2016), states the sudden internet finance boom has also led to numerous challenges in the traditional banking business. As a result, commercial banks need to rely on new technological growth to accelerate product and service innovations, thereby adapting to new customer demands and competitive environments. (Liang, 2016). He continues to explain there is a downward trend for banks from a growth perspective and that new sources and methods of growth must be explored. He explains that FinTech 1.0 is internet finance, characterized by its revolution in application scenarios and that we are in FinTech 2.0, which emphasizes the revolution in the underlying technology.

This again underlines the impact of Industry 4.0 is in the technology space. But how does this then impact banking? Is banking not about deposits and credit? What impact does technology have on banks?

Josephs et al., (1999), found that technology is used widely, in the banking industry and is continually driven to be rolled out, as this assists to reduce costs and eliminate uncertainties. (Joseph et al., 1999). This is supported by a study done ten years later that concludes that investment in information technologies (IT) in the financial services sector has proliferated in the last decade. (Davamanirajan et al., 2009).

The fact that technology plays a major role in banking is further supported by statistics, for example Mastercard alone processes 38 000 plus transactions per second world wide. (Benmlih-Taya, 2018), and that every day more than R 350 billion is settled through the National Payment System (PASA, 2018). Both these are technology driven systems.

Banks also realise this, as about 20% of their operating expenses are related to IT. (Annual Financial Statements First Rand, 2019). This applies at a group level of a large bank in South Africa, First Rand. If the staff costs are excluded, this IT investment number

goes up to a staggering 30% of the total yearly budget. Other banks in South Africa show similar numbers.

It may be concluded from the literature that the banking industry is mainly a technology driven sector as all processes are supported by some form of technology. Additionally, banks do realise this and continue to invest in technology. As described above, Industry 4.0 main impact is on technology and systems and will, therefore, impact banking, on systems and processes and the flexibility thereof, hence, putting pressure on existing systems.

2.5 Impact of Industry 4.0 on banking business models

As mentioned above, Mastercard alone processes 38 000 plus transactions per second world wide. (Benmlih-Taya, 2018). This, as well as, all the other transactions by mainstream banks contribute to vast transaction volumes, and it may be concluded these IT systems need complex system integrations to ensure all transactions are monitored and are securely executed.
The result of this is that these transactions then produce big data i.e. large quantities of information are produced by these transactions. Big data is large-volume, complex, growing data sets with multiple, autonomous sources. (Wu et al., 2014). The three defining characteristics of big data are volume, variety (including complexity), and velocity. (Eaton et al., 2011). This is a huge change for traditional banking and banks need to effectively use and manage this data.

Wu et al., (2014), explains that data-driven models involve demand-driven aggregation of information sources, data mining and analysis, user interest modelling, and security and privacy considerations. (Wu et al., 2014). Thus, user interest modelling and how this is used in banks to interact with their customers is becoming increasingly important in ensuring the banking industry is relevant going forward. Liang (2016), adds that the greatest disruption of internet finance for the traditional banking industry lies in enriching application scenarios and using big data analytics as a foundation, in order to provide more personalized and convenient services to attract more customers. (Liang, 2016). How big data is used has a huge impact on the business banking models of the future.

Another consideration is security. According to the South Africa Banking and Risk Information Centre, South Africa (SABRIC), South Africa, has the third highest number of cybercrime victims worldwide, losing R2.2 billion a year to cyber-attacks. (SABRIC,2018) These attacks include identity theft, phishing and ransomeware. IT Systems and advances in IT systems must ensure that security is of the highest standard to ensure that banks keep their credibility.

These two points, big data and security, are supported by the findings of Mekjnjjc (2019). Mekinjic (2019), describes that Industry 4.0 has forced banks to extensively re-examine traditional business models as they now have to respond quickly and efficiently to the demands of their clients, while offering safe and simple services for use. (Mekinjić, 2019). This quick response translates not only to effective processes and structures, but also to how big data is used to assist customers.

According to Liang (2016), the banking industry requires transformation and needs to seek new growth opportunities due to continuous regulation changes and prospects of revenue cuts due to interest rate liberation. (Liang, 2016). Business models are impacted by the change in regulations and must be revisited to ensure the growth opportunities are identified.

Ślusarczyk (2018) states that “the objective of Industry 4.0 is to achieve a higher level of operational effectiveness and productivity and also a higher level of automation. The most prominent characteristics of the concept are: digitization, optimization and personalization of production; automation and adaptation; human-machine interaction (HMI); value-added services as well as automated data exchange and communication.” (Ślusarczyk, 2018:p232-p248). Banks will have to ensure that operational effectiveness and increased productivity and higher levels of automation are met.

2.6 Enabling Banking 4.0

In the extensive research undertaken regarding Industry 4.0 and banking business model frameworks, only one services industry and banking specific conceptual framework for Industry 4.0 was found to be suitable. This is the conceptual framework from Deloitte in their article on Banking Business Models of the future. (Kobler et al., 2016). This is described in detail in 2.6.1 The Conceptual framework.

In the review of literature, most studies on Industry 4.0 were done in a production environment and within the context of lean manufacturing. Limited information is available in the service industry regarding Industry 4.0. This is supported by Rennung (2016), who undertook a study on Industry 4.0 for the services industry and found the research focus was on the production environment when the concept of Industry 4.0 is studied. (Rennunga, 2016).

To ensure the validity of this framework used in this research, it was verified against literature relating to Industry 4.0 in general. This assisted in confirming the main characteristics of the framework used. The next section describes the framework and how it was validated.

2.6.1 The Conceptual framework

The conceptual framework from Deloitte in their article on Banking Business Models of the future, (Kobler et al., 2016), is used for an examination into the readiness of the Big Bank to embrace Industry 4.0 and its application to banking services.

This article identified 5 pillars that banking must incorporate in their business models to be ready for Industry 4.0. These pillars are gamification, blockchain technology, biometric technologies, digital investment and process automation. This framework was used as the basis for the interview questions. See Figure 2.1 for the framework.

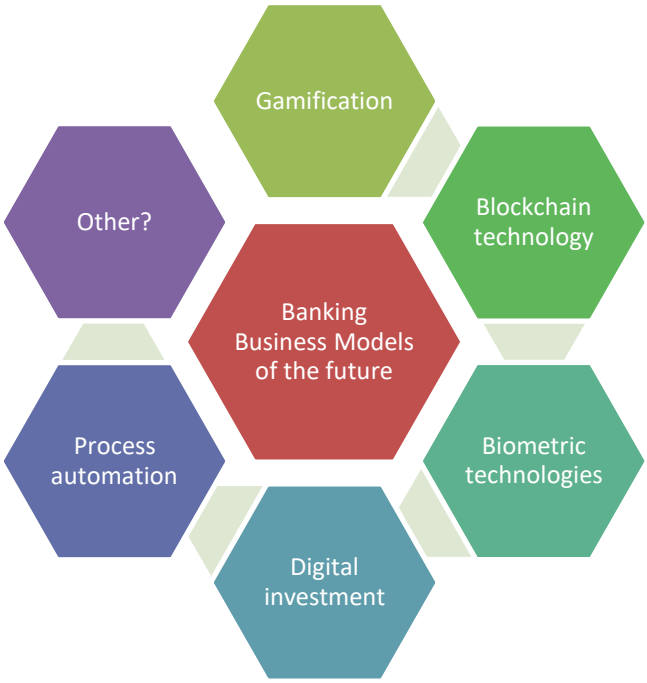


Figure 2.1: Banking Business Models of the future (Kolber et al., 2016)

Each pillar is described on the next page.

Pillar descriptions:

- **Gamification** – According to the article, gamification is defined: “To ensure a more enjoyable experience for the customers.” (Kobler et al., 2016).

  According to Yazdanfard et al., (2014), gamification is defined as the use of game mechanics (or game theory) in non-game environments. (Yazdanifard et al., 2014). This includes reward levels and a competition element.

  According to deCos (2015), who did an in-depth study of gamification in banking, the term “gamification” was first introduced in 2000 but didn’t draw much attention until 2010. She further explains the term became a trending topic and was discussed at various conferences, blog posts and books. In a wide sense gamification is understood as a way to support user engagement, enhance user activity, encourage social interaction and improve overall user experience. The desired effect is achieved through activating intrinsic motivation and incorporating game theory design elements. (deCos, 2015).

  According to research done by Baptista (2015), there is a direct and strong relationship between gamification and interaction to use banking services, and when implemented properly consumer interaction with banking services is more enjoyable and this increases customer acceptance, engagement and satisfaction. (Baptista, 2015). According to Yazdanifard et al., (2014), gamification is still in its infancy stages and it is hard to predict its effectiveness in the long run. (Yazdanifard et al., 2014). The author adds that currently gamification strategies mainly focus on reward systems to engage customers. Marketers are only beginning to scratch the surface of the potential gamification has to offer in the service industry and particularly within the banking sector.

From the above one can summarise that gamification:

- Ensures a more enjoyable customer experience
- Is enabled by the use of game mechanics (game theory) for non-gaming environments
- Supports user engagements
- Includes rewards
- Is still in infancy stage

- **Blockchain technology** - Blockchain is a real time global payment network enabling payment to anyone, anywhere. This will simplify payments and transaction flows. According to an article on blockchain technology and banking by Accenture (2016), the adoption of Blockchain technology will enable banks to process payments more quickly and more accurately, reducing transaction processing costs. (Meszaros et al., 2016). The article adds that the main reason for resistance to blockchain technology is regulatory, compliance and security. According to Liang et.al, Blockchain is currently a concept that has received significant attention in financial technology (including FinTech). The authors add that it combines several computer technologies, including distributed data storage, end-to-end transmission, consensus mechanisms, and encryption algorithms and that it is a disruptive innovation of the Internet era. However, as blockchain is a major breakthrough in data storage and information transmission, it might fundamentally transform the existing operating models of finance and economy, which might lead to a new round of technological innovations and industrial transformation within the FinTech industry, (Liang, 2016).

  From the above one can summarise that blockchain technology:

  - Enables payments everywhere and simplifies payments
  - Speeds up payments and financial transactions
  - Is a cost effective way to make payments as transaction costs are lower
  - Needs to still prove security and regulatory compliance

- **Biometric technologies** - This allows for seamless and secure digital authentication and reduces identify theft. These are voice recognition and touch ID fingerprint sensors technologies and will enable the move away from passwords. (Grant, 2016). The definition of biometric technology according to John Vacca is automated methods for identifying a person's identity based on the person's physiological or behavioural characteristics. (Vacca, 2007). The author adds these are crucial components of security of personal identification and verification systems, which controls access to valuable information to economic assets as parts of the national infrastructure. There are three types of verification:
    - Something that you know, e.g. password
    - Something you have, e.g. smart phone
    - Something you are, e.g. fingerprint or face

  From the above one can summarise that biometric technology:
    - Can decrease identity theft
    - Speed up transactions by "automating" verification
    - Has three types of verification

- **Digital investment** – Digital investment is described as robo-advisors, that enable automated investment advisory services. (Kobler et al., 2016). According to an article in Forbes, these investment services promise to make investing easy, inexpensive and even fun. (Berger, 2019). Throughout the interviews it became apparent the description should change slightly to include more than robo-advice only. Advanced machine interfaces, including machine learning and AI were also included as part of the definition. The idea of platform thinking was also included. The latter entails a collection of capabilities (or services/functions), to enable the brands, segments and product houses to create and deliver contextual solutions. This is also an interface for banking's customers, partners and employees to interact and communicate.

From the above one can summarise that digital investment:

- Enables automation
- Makes investments easier
- Enables platform, artificial intelligence (AI) and machine learning.

- **Process automation** – offers large scale cost reduction in combination with increased flexibility and accuracy of back office tasks. (Kobler et al., 2016). Business process automation is the use of technology to execute recurring tasks or processes in a business where manual effort can be replaced. It is done to achieve cost minimization, greater efficiency, and streamlined processes. (Kissflow, 2019).

  From the above one can summarise that process automation:

  - Relates to cost reduction
  - Relates to the automation of “back office tasks” or recurring tasks
  - Improves efficiency and reduce costs.

This framework from Deloitte is used to establish what is required for big South African banks to ensure that they are ready for the impact of Industry 4.0. In this research, this framework was used to evaluate how far the business banking in a specific big South African bank is adapting to this, new way of doing business. The outcome is discussed in Chapter 4 and 5.

2.6.2 Mapping from literature to framework

The conceptual framework in the Deloitte model used consists of 5 pillars which are gamification, blockchain technology, biometric technology, digital investment and process automation. These pillars are depicted in the tables below on the left hand side and the related themes defined by other literature are mapped on the right of the tables.

In an extensive study on Service Provision in the Framework of Industry 4.0, Rennunga (2016), describes the 3 themes relevant for Industry 4.0 are, dealing with complexity, capacity for innovation and flexibility. (Rennunga, 2016). This is mapped back to the conceptual framework below in Table 2.1.

Table 2.1: First mapping to the conceptual framework

Framework used for research	**Related themes defined by Rennunga (2016)**
Gamification	Capacity for innovation
Blockchain technology	No item mapped against this framework item
Biometric technology	No item mapped against this framework item
Digital investment	Dealing with complexity Capacity for innovation Flexibility
Process automation	Dealing with complexity Capacity for innovation Flexibility
Other	No item mapped against this framework item

Another author, Mekinjić (2019), defines in his study on the impact of Industry 4.0 on the transformation of the banking sector, the components of Industry 4.0 for banking as blockchain networks, artificial intelligence, internet of things, biometrics, cooperation of banks with fintech company's preparation of the platform and other services. (Mekinjić, 2019). This is mapped to the conceptual framework in Table 2.2 below.

Table 2.2: Second mapping to the conceptual framework

Framework used for research	**Related components by Mekinjić, (2019).**
Gamification	No item mapped against this framework item
Blockchain technology	Blockchain networks
Biometric technology	Biometrics
Digital investment	Internet of things Artificial intelligence
Process automation	Preparation of the platform
Other	Cooperation of banks with Fintech companies; Other services.

According to Bocken (2018) who did an in-depth study of sustainable business models for banking, the following were identified as important:

- Technological:
    - Maximize material and energy efficiency
    - Substitute with digital processes
- Social
    - Encourage sufficiency
    - Adopt a stewardship role
    - Inclusive value creation
- Organisational
    - Repurpose for society/environment
    - Resilience in loan granting
    - Sustainable financial products

(Bocken et al., 2018).

This is mapped to the conceptual framework Table 2.3 below

Table 2.3:Third mapping to the conceptual framework

Framework used for research	**Related components by Bocken et al., (2018).**
Gamification	No item mapped against this framework item.
Blockchain technology	Sustainable financial products.
Biometric technology	Sustainable financial products.
Digital investment	*Maximize material and energy efficiency* Substitute with digital processes Inclusive value creation Sustainable financial products
Process automation	*Maximize material and energy efficiency* Substitute with digital processes Resilience in loan granting
Other	Encourage sufficiency Adopt a stewardship role Repurpose for society/environment

According to Chem (2017), who did a study on the transition from traditional banking to mobile internet finance, there are five things to consider to ensure that banks are ready for Industry 4.0. These are mobile Internet, cloud computing, big data, search engines, and blockchain technology. (Chen et al., 2017).

This is mapped to the conceptual framework in Table 2.4 below:

Table 2.4:Fourth mapping to the conceptual framework

Framework used for research	**Related components by Chem (2017)**
Gamification	No item mapped against this framework item
Blockchain technology	Blockchain technology
Biometric technology	No item mapped against this framework item
Digital investment	Mobile Internet Cloud computing Search engines
Process automation	Mobile Internet
Other	Big data

In a study about The Everyday Bank: A New Vision for the Digital Age, the authors describe the core considerations for the bank of the future. (Moreno et al., 2015). They add that aspects of banking going forward should include highly industrialised, back and front-end process automation and must be well integrated, efficient and scalable, coping with complex partnerships and exponential growth. The author also adds there are four core aspects to consider making that a reality. These are:

- Extending the Ecosystem
    - This entails creating partnerships with service providers
- Mastering analytics
    - Use vast amounts of customer data to anticipate customers needs and deliver timely offers
- Embracing omnichannel
    - Seamless integration of the customer experience
- Creating a digital core
    - Have IT infrastructure that is highly flexible and scalable, enabling customer single views and dynamic product bundling.

This is mapped to the conceptual framework in Table 2.5.

Table 2.5: Fifth mapping to the conceptual framework

Themes in framework used for research	**Related components by Moreno (2015)**
Gamification	Embracing omnichannel
Blockchain technology	Extending the Ecosystem
Biometric technology	No item mapped against this framework item
Digital investment	Creating a digital core Embracing omnichannel
Process automation	Creating a digital core
Other	Extending the Ecosystem Mastering analytics

In a study on “A model for assessing Maturity of Industry 4.0 in the Banking sector” (Bandara et al., 2019), the authors identified five dimensions to consider for maturity of Industry 4.0 in banking. These are customised products, digitised products, data driver services, digital marking approaches and service-oriented architecture.

This is mapped to the conceptual framework in Table 2.6 below

Table 2.6: Sixth mapping to the conceptual framework

Themes in framework used for research	**Related components by Bandara et al., (2019)**
Gamification	Customised products
Blockchain technology	Digitised products
Biometric technology	Digitized products
Digital investment	Service oriented architecture Data driver services, Digital marking approaches Digitised products
Process automation	Digitised products
Other	No item mapped against this framework item

Combined Table

Please see Table 2.7: Combined table for the combined matrix. The number in brackets indicate from which mapping the item originates, e.g. (1) refers to tables from the first mapping, (2) from the second mapping and so on.

Table 2.7: Combined table

Themes in framework used for research	**Combined matrix**	
Gamification	Capacity for innovation*(1)* Embracing omnichannel*(5)*	*Customised products(6)*
Blockchain technology	Blockchain networks*(2)* Sustainable financial products*(3)*	Blockchain technology*(4)* Extending the Ecosystem*(5)* *Digitised products(6)*
Biometric technology	Biometrics*(2)* Sustainable financial products*(3)*	*Digitised products(6)*
Digital investment	Dealing with complexity*(1)* Capacity for innovation*(1)* Flexibility*(1)* Internet of things*(2)* Artificial intelligence*(2)* *Maximize material and energy efficiency (3)* Substitute with digital processes*(3)* Inclusive value creation*(3)*	Sustainable financial products*(3)* Mobile Internet*(4)* Cloud computing*(4)* Search engines*(4)* Creating a digital core*(5)* Embracing omnichannel*(5)* *Service oriented architecture(6)* *Data driver services, (6)* *Digital marking approaches(6)* *Digitised products(6)*

Themes in framework used for research	**Combined matrix**	
Process automation	Dealing with complexity*(1)* Capacity for innovation*(1)* Flexibility*(1)* Preparation of the platform*(2)* *Maximize material and energy efficiency (3)*	Substitute with digital processes*(3)* Resilience in loan granting*(3)* Mobile Internet*(4)* Creating a digital core*(5)* *Digitised products (6)*
Other	Cooperation of banks with Fintech companies; *(2)* Other services*(2)* Encourage sufficiency*(3)* Adopt a stewardship role*(3)*	Repurpose for society/environment*(3)* Big data*(4)* Extending the Ecosystem*(5)* Mastering analytics*(5)*

It is evident from Table 2.7 above, the framework used, does address the various themes and elements defined by other sources. These exceptions were grouped in the “other” grouping, as depicted above.

Since the framework from Deloitte is addressing the bulk of the information described in Table 2.7: Combined table , it was decided to use this model as the base for the study to understand the relevance and maturity of the pillars identified in the model within the bank investigated.

2.6.3 Data analytics or big data

According to van Dyk (2019), the way analytics will work for Industry 4.0 include automated analytics and robotic processes for digital tasks. (van Dyk, 2019). Digital investment and process optimization are thus very important to be considered and the impact this has on business banking modes.

According to a PwC article, digital solutions, low-cost operating models and supply-chain integration should be the top priorities for banks. (Kobler et al., 2016). It is mentioned that big banks in South Africa are finding new ways to enable themselves to stay relevant in the digital market. They also mention that big banks in South Africa have an advantage over new entrants in that they already serve a sizable number of South Africa's Business banking customers. Data analytical capabilities are the top priority for most of these big banks. (Camarate, 2017).

2.6.4 Enabling Technologies

How will Industry 4.0 be enabled in banking? What must be considered for Banking 4.0. According to Dewa et al., (2019), there are enabling technologies for Industry 4.0. (Dewa et al., 2019). These enabling technologies are:

- **Location detection technologies:** An example of this is Global Positioning System (GPS) technology to track of object's position. To enable Banking 4.0 these technologies have been deployed to track locations of mobile ATM's. It is also used for GEO payments using smart devices.

- **Authentication and fraud detection technologies:** The high rate of cybercriminal activities and need for security in specific fields make authentication and fraud detection technologies critical. Security is the number one selling point for any bank. Customers must trust the bank enough to deposit their monies. A major consideration for Banking 4.0 is to ensure that various initiatives are enabled to ensure that banking can be done safely and securely.

- **Internet of Things platforms:** The Internet of Things (IoT) is a network of physical objects – vehicles, machines, home appliances, and more – that use sensors and Application Programming Interface (APIs) to connect and exchange data over the Internet. (SAPTeams, 2019). Banking 4.0 is impacted as this enables various devices to work together to ensure that capabilities are working as required, this enables data transfer and enables customers to use various devices to do their banking instead of been limited to one device, as before.

- **Mobile devices:** These devices have an ability to access nearly any form of data and connect to any network. The programmable devices can access various applications and can be accessed anywhere and at any time. To enable Banking 4.0 and the rapid change it brings, mobile and other smart devices can now be used in the business banking world due to software to protect the sensitivity of Business banking transactions sufficiently. Not only can customers interact with their banking account, but staff members can also interact with their daily work load using the smart device.

- **Cloud computing platforms**: According to Microsoft, cloud computing is delivery of computer services over the internet to enable and offer faster innovation, economies of scale and flexible resources (Microsoft, 2019). Information is basically available anywhere at any time, through the use of cloud computing platforms. To enable Banking 4.0 secure cloud computing ability is very important. These platforms enable collaboration of teams that are in different locations. The “work anywhere” concept makes baking an attractive work environment.

- **Communication technologies:** There are various technologies available for communication today. To name a few, email, telephone, texting and video conferencing. Video conferencing can be done via various platforms. One example is Skype. Communication technologies are an important part to enable Banking 4.0. Employees need to communicate on a daily basis to ensure that

projects are completed, and job specifications are met. Enabling Skype for business, on all staff's laptops, ensure that staff can communicate with an internet connection. This is widely available in urban areas in South Africa.

- **Multilevel customer interaction and customer profiling technology:** Various technologies are available today to enhance the interaction of customers with products and services that companies offer. These solutions allow customers to define the product design during the conceptualisation stage as well as order items online without having to visit a firm or branch. Application areas for this class of technology include the use of self-service technologies (SSTs), such as telephone banking and online investment trading, whereby customers produce services for themselves without assistance from firm employees. For Banking 4.0 these technologies are becoming more and more relevant, as customers want to interact with the bank as and when they are available. Going to the branch to do transactions takes a lot of time and effort. Banks are enabling these technologies across their product base. Telephone banking, cell phone banking (also referred to as USSD application type banking), App type banking and online banking are becoming the channels of the future.

- **Big data analytics technology:** With the volume and speed of data generated by computers and the internet growing exponentially each year, the field of big data has grown and attracted much attention. The field involves the use of data streams for inferential decision-making. A major drawback in the wide adoption of big data analytics technologies is the issue of data security. To enable Banking 4.0, business banking is investing heavily in big data technologies and the security thereof. These, for example, enable the bank to collect the required information from customers on their banking behaviour to enable the bank to provide value adding services to the customers. An example of this is pre-scored credit, or credit on demand. With big data analytics and technology, the bank is able to provide the customer with various services and products which in traditional banking models required lots of paper work and days, sometimes weeks of processing and approvals.

- **Smart sensors:** These devices can make decisions based on the data they obtain through instrumental recording. Smart sensors have been used widely in academia and research with applications in the transportation and logistics industry, manufacturing, security and healthcare amongst many other examples. This technology is used more in the transportation and logistics sector but to enable Banking 4.0, suppliers of ATM's etc may use these technologies in future.

- **Advanced human-machine interfaces**: With the growth of embedded sensors in industrial equipment, human-machine interfaces for the real-time analytics of machinery performance have become a present day reality. Advanced human - machine interfaces are common on current industrial machines with numerous applications, which include motion study and manufacturing. The machine human interfaces are becoming more relevant to enable Banking 4.0. These "robot" type applications are used to relay information to customers via smart screens and talking to humans through advanced technologies, i.e. chat-bots technology.

Traditional banks should be using these technologies to enable Banking 4.0.

2.6.5 Competition

There are new trends that are developing in the market. According to Camarate (2017), these are low-cost models, e.g. Discovery Bank, sector or industry specific banking, e.g. South African Post Office and ongoing transformation of the four universal banks in South Africa. (Camarate, 2017). Big banks in South Africa need to continue to work on new ways of working to ensure they remain relevant in the ever-changing environment. In the last few years South Africa has seen the launch of six new banks. At the time of publication, Discovery Bank, Bank Zero, African Bank (re-launch), Postbank, Tyme Digital and the nice Young Women in Business Network Cooperative Financial Institution were identified by Businesstech as new entrants to the market. (Businesstech, 2019). Big banks in South African should use the dawn on Industry 4.0 to ensure they are aligned

with the best solutions to enable them to compete with these new market entrants, whom have an advantage, as they have no technical debt and legacy systems to solve for.

3 Chapter 3 – Research Design and Method

3.1 Research Design

The research design addresses the methods and procedures used to collecting and analysing data to enable the research question to be answered. A qualitative or quantitative methodology can be followed. Qualitative approaches are more subjective and is used to gain insights and explore complex, ill-defined phenomenon's and exploratory topics. (Market research, 2019; University Of Missouri, 2019). The authors add that characteristics of these topics are normally broad, subjective, and data is required, e.g. interviews or surveys are used. Qualitative research is used for exploration, description, verification, problem identification and evaluation. (Ormrod and Leedy, 2016). On the other hand, quantitative research is structured data with statistical analysis and experiments and surveys are used to obtain this data. (Ormrod and Leedy, 2016).

For this research, qualitative research was done using semi-structured interviews. Please see a detailed description below.

3.1.1 Research instrument

3.1.1.1 Choice of semi-structured interviews

To address the research question and objectives of this research, an appropriate research model was identified and adopted to form the basis of this research report. A "what" question is posed for this research with regards to a contemporary phenomenon, namely Industry 4.0 in business banking in South Africa. (Yin, 2009).

This research is also exploratory as the phenomenon of Industry 4.0 is still relatively new world wide, according to Schwab (2018), that mentioned that this is only tracked from 2011. (Schwab, 2018). Thus, because a relatively unexplored phenomenon is being investigated, and exploratory research was proposed, a qualitative approach is most appropriate. (Ormrod and Leedy, 2016). The authors add that qualitative approaches that are available include survey research, action research, case study, interviews content analysis and design-based research to name a few.

Semi-structured interviews were used for this research. According to Cohen et.al. (2006), characteristics of semi-structured interviews are that the interviewer and participant engage in a formal interview, the interviewer can prepare an interview guide ahead of time to list the questions and topics to be covered in a particular order if required and that the interviewer can stray from the guide when appropriate. (Cohen, 2006). The author adds these types of interviews are best done when there may only be one chance to interview and several interviews are required, open-ended questions can be asked and discussed when required to understand the underlying topic described by the participant. The author further elaborates the benefits of semi-structured interviews is the questions can be prepared ahead of time which allow the interviewer to prepare, participants have the freedom to express their views on their own terms and these interviews provide reliable, comparable qualitative data.

This is supported by Drever (1995). According to Drever (1995), semi-structured interviews are done by setting up a general structure of the interview guide but decide in advance what topics will be covered and main questions to be asked. (Drever, 1995). The author adds that details transpires during the interview, and the person been interviewed have a fair degree of freedom and can express themselves. Ormrod et al., (2016), also supports this in their book, Practical Research: Planning and design 11ed. The authors say that an advantage of semi-structured interviews are the high response rate and questions can be explained and be discussed. (Ormrod and Leedy, 2016).

In summary, semi-structured interviews were chosen as the concepts tested from the framework that is used as the base for this research, needed explanation and the oral testimony of subject matter experts were required. This fitted in with the instrument in that preparation was crucial, to be able to stray away from the guide and ask the open-ended questions as required. Freedom of expression of participants to ask if they are unsure and also relay their expertise could be done. This also ensured reliable, comparable qualitative data.

3.1.1.2 Development of interview questions:

The interview questions were developed based on the pyramid model as presented by Wengraf (2001). The description below is from his book, Qualitative Research Interviewing. (Wengraf, 2001).

The interview questions progressed from the critical research question to theoretical questions and then to the particular interview questions. To explain this further, one example will be explained end to end.

The critical research question is what the impact is of Industry 4.0 on banking business models of a big South African bank. From the conceptual framework described in section 2.6.1 The Conceptual framework, the theory questions were identified. These were around the readiness of the bank according to this framework. An example is “Are we ready for gamification”. This question based on the theory was then further refined to the relevance, timing and implementation of gamification and the impact on the current business model used. The same process was done for each pillar investigated. The final interview questionnaire can be seen in Appendix C – Research Instrument - Interview questionnaire.

One can thus see that the starting point was the larger research question and the literature assisted to identify the major areas within this question. This then assisted in developing the interview questions to enable the answering of the original research question. Word choice were chosen carefully and adapted slightly depending on the person interviewed to encourage complete and honest answers. Questions were mainly “how”, “what” or “where” questions, steering away from “why”. Each major topic was also explained to ensure uniform understanding of the topics and concepts. The interview structure was also in a logical flow, starting with a more general question to get the interviewee at ease with the process and ensuring the questions can be answered as accurately and comprehensively as possible.

The final question provided closure for the interviewee in that they can express what they see as relevant.

3.1.1.3 Testing and changing of interview questions

To test these interview questions, a few non-formal interviews were held with trusted colleagues. The way the questions were posed were tested and slightly adapted. For example, “why” questions were changed to “how” or “what” questions. This ensured that interviewees doesn’t feel threatened.

Questions around legacy systems were also removed as this is not relevant in each area. This was rather changed to a more general question under the digital transformation pillar. Questions on what projects are running in their areas were also slightly adjusted to ensure that they understand the concepts first before trying to provide answers. Questions on relevancy, timing and implementation were also asked per pillar considered as per the framwork.

The number of questions changed from the original interview to subsequent interviews. This is attributed to the learning from the practice interviews as well as the learning after each interview, based on answers given or clarity sought from the interviewee. This ensured that subsequent interviews were quicker and easier for the interviewee to understand.

The final interview questionnaire is in section Appendix C – Research Instrument - Interview questionnaire and the transcribed interviews are in section Appendix D - Interviews transcribed.

3.1.2 Research environment

The research environment is limited to one big bank within South Africa. The interviews were conducted within the meeting rooms of the company. Meeting rooms were booked at the location convenient for the participant. Only two of the interviews were Skype interviews. The other interviews were face to face.

3.1.3 Sampling design

Purposive sampling, a non-probability sampling technique, was used. As described in the International Journal of applied research the author stated that there are seven types of purposive sampling methods. (Sharma, 2017). According to the author, to name a few, these are maximum variation sampling, typical case sampling, critical case sampling and expert sampling. One typical use of purposive sampling is to test a theoretical framework and where deliberate choices of a participant is done based on the qualities the participant possesses. (Etikan, 2016). According to the author, no set number of participants were required, and the researcher decided what needed to be known and set out to find people who are willing to provide information from their knowledge or expertise. This type of sampling is used when expert option is required from subject matter experts. (Etikan, 2016). For this study, purposive, non-probability expert sampling was used as Industry 4.0 and banking is a relative new area of study and expert opinion are required to draw conclusions.

According to an in-depth study on how many interviews are enough for saturation, it was found that saturation is reached at nine interviews. (Hennink et al., 2017). For this study it was decided that at least one person per business unit working actively on the topics in the theoretical framework will be interviewed. Originally, eleven respondents were identified for interviews. It did, however became apparent that more participants would be required to interview and to validate certain findings and obtain clarity for some pillars. Clarifications and impact on risk and current implementation were searched. For the five pillars investigated, thirteen subject matter experts were interviewed. Gamification was the exception. For the gamification pillar, an additional participant was interviewed, making it fourteen respondents for this pillar.

The reasoning for the above was that after the eleven respondents were interviewed, there were a few themes that were not clear. Yet, once the extra two participants were interviewed, it became apparent that the information and themes identified were recurring. After transcribing the interviews and doing the first and second level of coding, themes and statements started repeating. Saturation was reached for each pillar, except for the gamification pillar. Saturation is defined as the point where no new or relevant data is collected any more. (Dworkin, 2012). Another subject matter expert was then interviewed

for gamification. She expanded on gamification. It was clear the gamification is a new and immature topic within the services and banking industry. No other interviews regarding gamification was required.

3.1.4 Data Collection and ethics considerations

The ethics process as prescribed by the University of the Witwatersrand Ethics Committee, was followed for the data collection for this research. The process described below was followed. This is a summary of the presentation by Knight (2019).

Ethics is a vital part of research practice and is driven by moral principles to influence behaviours. Research ethics is the ethical practices of collecting and analysing data that involve people as research subjects or participants. Since interviews are the method of data collecting for this research, ethical clearance was required.

During the research no one was forced or pressured to participate in the interviews. Data was collected objectively, and consent was asked from each individual with the approved consent letter. Each participant needed to complete this form. See Appendix B – Letter of Consent for the approved example. The planning of what the research entailed as well as the questionnaire, letter for participation and consent forms were submitted to the university ethics committee to evaluate. See Appendix A – Respondents invitation letter for the invitation letter and Appendix C – Research Instrument - Interview questionnaire for the questionnaire. Part of the application for ethics clearance was to identify risk categories, explaining whom the participants will be, instruments to be used, how informed consent will be obtained and protection of data, anonymity and confidentiality and the researcher details. These were also explained to each individual before the interviews. The explanation included what the project is about, what was expected from each individual and the terms and conditions of their participation. (Knight, 2019).

Please see 15 Appendix G - Ethical clearance for application submitted and approved. Data analysis.

3.1.5 Data analysis

Analysis as a spiral are presented in the Practical Research: Planning and design 11ed from Ormrod et al., (2016). Please see the visual representation below in figure 3.1:

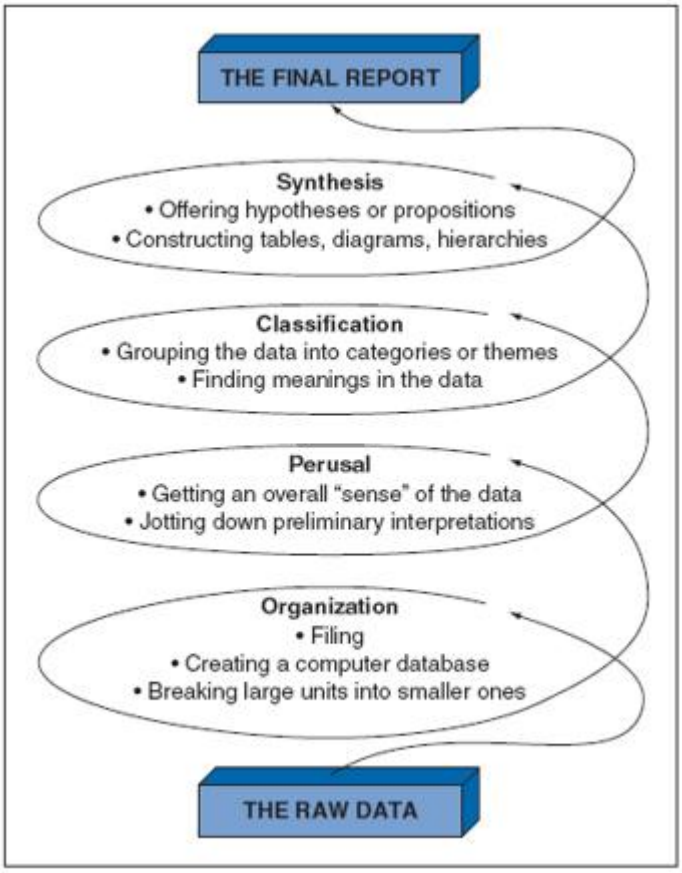


Figure 3.1 : Analysis as a Spiral (Ormrod et al.,2016)

For this research the raw data is in interview recordings, "organization" was achieved by organizing the data by means of transcribing the interviews and creating a computer data base for this information. Transcribed interviews can be seen in section Appendix D - Interviews transcribed. "Perusal" was done by reading and rereading through the transcripts and jot down thoughts and interpretations. "Classification" was done as a first and second level of coding. This can be viewed in Appendix E – Coding and Appendix F – Second level of coding continued: Pattern coding. The "synthesis" was done by analysing and interpreting the data. This is done in Chapters 4 to 6.

3.1.5.1 Coding

Coding was used to search through the data to identify recurrent themes. According to Huberman et al., (2014), “codes are labels that assign symbolic meaning to the descriptive or inferential information compiled during study. Codes usually are attached to data “chunks” of varying size.” (Huberman et al., 2014:p71). The authors further define code as a short phrase or word that capture the attribute and meaning. The data studied are for example interview transcripts.

According to Saldana (2009), coding is a qualitative inquiry, like a short phrase or word that describes the idea of what is presented in the sentence/paragraph. (Saldana, 2009). He adds the raw data used is, for example, interview transcripts, then patterns are identified, and coding filters are applied to rationalise the code. The code is then categorised, and these will then form themes or concepts that can be brought back to the theory. (Saldana, 2009).

The author goes further and describes that the first cycle of coding can be a single word, phrase or even a paragraph and that only in the second part of the coding process, “the portions coded can be exact same units, longer passages of text and even a reconfiguration of the codes themselves developed thus far.” (Saldana, 2009:p4). He then describes that one should code for patterns, thus looking for things that are alike, much alike or have something in common. The author also describes that coding is to arrange things in systematic order and make something part of the system. Code should be applied and re applied a few times until patterns are explained and categories and themes are identified. The outcome is thus themes and categories. Please see figure 3.2 below to explain this visually:

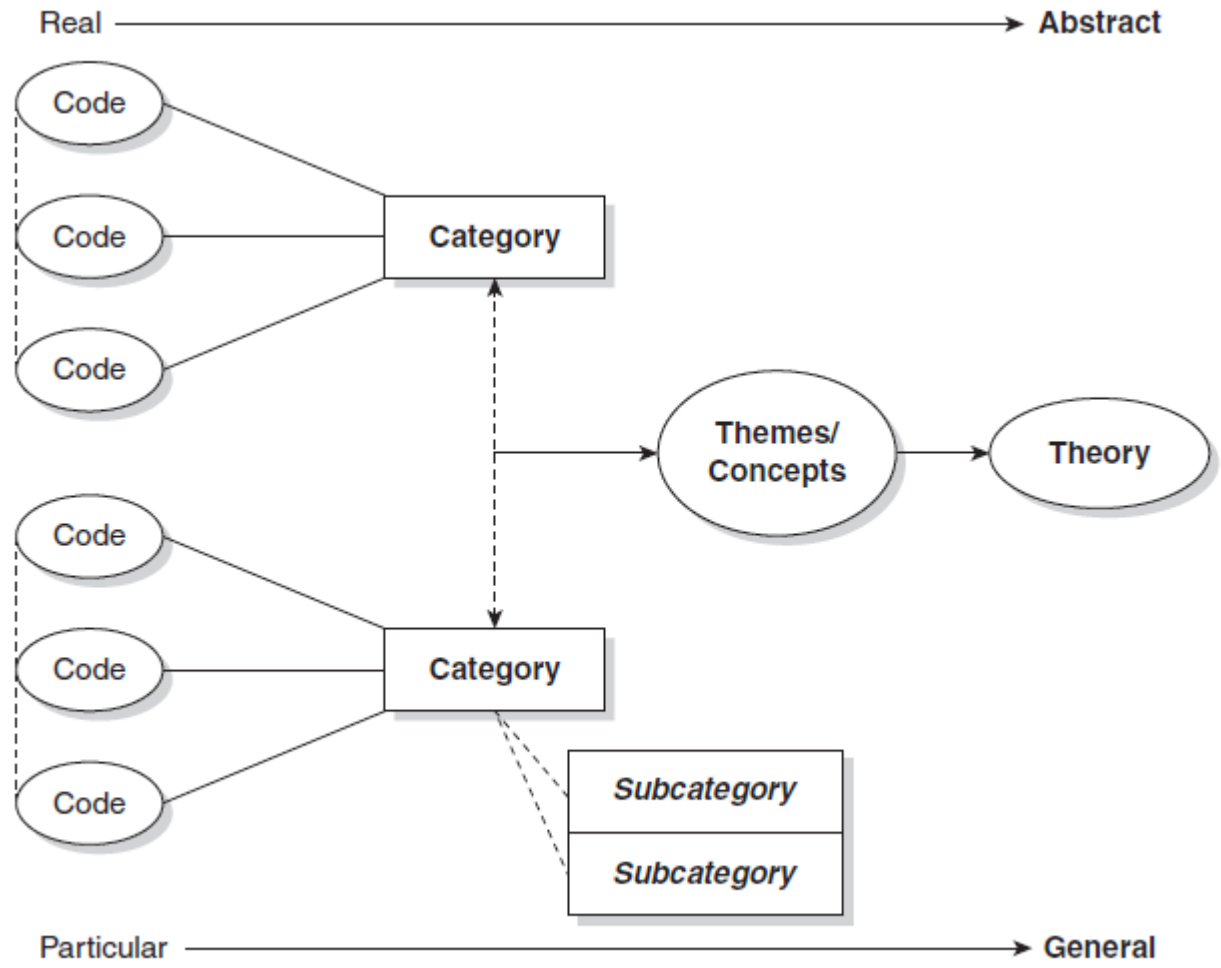


FIGURE 1.1 A streamlined codes-to-theory model for qualitative inquiry

Figure 3.2: Visual representation of coding used as per Saldana. (Saldana, 2009)

The follow is taken from the Qualitative Data Analysis: A Methods Sourcebook from Hubbermann et al., (2014). (Huberman et al., 2014).

Coding is analysis so researchers can quickly find clusters or themes within data. It is also a heuristic method of discovery, ideal for topics that are new and require exportation.

Two levels of coding were suggested in the literature, first and second cycle of coding. There are 25 different approaches for the first cycle of coding. For this research, the first level of coding that was used was a combination of in vivo and hypothesis coding.

In vivo coding words or short phrases from the participant's language is used to record codes. Phrases or ideas that are repeated are good leads for the basic topic in the passage. This then provides an inventory of topics for indexing or categorizing. This coding was used to determine the progress made for each pillar and help identifies what is missing from the framework.

Hypothesis coding is used for researcher-generated predetermined list of codes, generated by the researcher before data is collected based on the theory. A count was done based on the codes. For this research hypothesis coding was used to determine the relevant, implementation and timing of the specific pillars. To develop the start list of codes, deductive coding was used, as the theoretical framework were used to create these. This list was revised as themes became more apparent within the coding.

The second cycle of coding is searching to identify patterns to help with the emerging of themes or causes configuration or explanation. This assists to condense large amounts of data into smaller analytical units. According to Saldana (2009), there are six methods of doing second cycle coding. (Saldana, 2009). For this research, the second level of coding used was pattern coding with a narrative description, which outlines the ideas identified by the participants. According to the author, a meta code is developed by pulling various smaller codes together in meaningful units. This is ideal for theme development. (Saldana, 2009).

3.1.5.2 Thematic content analysis

Qualitative research designs includes, to name a few, case study, ethnography, phenomenological study, ground theory study and content analysis. (Ormrod and Leedy, 2016). For this research, content analysis was chosen.

Thematic content analysis is used as an analysis technique to identify topics and themes in qualitative data, mainly from interviews. (Anderson, 2007). Anderson (2007), further adds the purpose of this analysis is to search through the data and list common themes that represent the overall inputs from each participant. Clusters of data that conveyed similar meaning were identified as it emerged through this deductive analytical process. The method as proposed by this author is described in more detail below:

- Make multiple copies of interview transcripts.
- Mark/highlight all units of meaning – ensure relevant information is retained to not have a disconnect from source as thematic content analysis continues.
- Put similar units together (copy and paste or cut out if hard copies are used).
- Label plies (similar unit groupings) as initial categories, using the words of participants and revise if required.
- Identify categories that are missing.
- Go through the transcript again and group units that are similar and identify dissimilar units.
- Read through the meaning of each unit and category again and re-label where appropriate.
- After a few days, read through the original transcripts.
- Revise the units where necessary – collapse, re-label, subdivide and redistribute units.
- Look over all categories and consider the number of categories -are there too few or too many. If so, revise similar units.
- Do the same for each transcript.
- Once all transcripts are completed, combine categories/themes from all interviews and collapse or subdivide categories where appropriate.
- Re-read all categories as a whole and consider if there are too many or too few and if it makes sense overall.
- Redo above until you are satisfied with the categories that the transcripts as a whole are addressed.

Data was analysed in MS Excel and Word where applicable.

3.1.6 Validity and Reliability

To ensure the research is valid and reliable, construct validity and reliability judging criteria was used.

According to Yin (2019), construct validity is done by comparing two or more sources of evidence with each other. (Yin, 2019). For this study, subject matter experts (experts and executive managers) were interviewed to help establish a chain of evidence and validate

and expand on the existing conceptual framework from Kobler (2016). Interview answers were then validated against the conceptual framework and the available literature. This then established a chain of evidence to validate the framework and expand on this framework.

According the Yin (2019), to establish reliability of research the objective is that a later investigator can follow the same procedure as described and be able to conduct the same research and be able to come to the similar findings and conclusion. (Yin, 2019). To ensure the research is reliable and repeatable, everything was well documented. This includes literature, interview questions, sampling methods, interview transcripts, detailed research design, and conclusions.

As mentioned previously, Industry 4.0 in the service industry is relatively unexplored (Rennunga, 2016), and there are limited studies done on Industry 4.0 as well as changing of business models due to technological changes that Industry 4.0 brings. From the research it was clear that some of the concepts were not clear to all participants and the interviewer had to define various concepts at times and ensure the participants understand what was required. It was apparent that the framework's five pillars were not actively implemented or used in their current business. Some pillars also needed more explanation to some of the interviewees.

In total, 14 respondents were interviewed. Originally only 11 would be interviewed, but more information was required after these interviews were done. For all five pillars investigated, there were 13 participants interviewed. Once this was completed it became apparent that for the gamification pillar limited information was available and as this is a specialised field. For this pillar another participant was then interviewed to obtain expert knowledge on this topic. No other subject matter expert on gamification were available at the time of the data collection and although literature was used to obtain more information on gamification, the researcher needed to draw conclusions from limited raw data.

Two interviews were conducted using a Skype call. All the other interviews were done in person within a boardroom at the company premises. Every effort was made to ensure

that the respondents were comfortable and that they understood the expectation from the interview and questions posed.

3.2 Research Methods

3.2.1.1 Interviews

Interviews were done within a big South African bank. Permission was obtained from the business unit manager of our area to conduct the interviews. Once this was received the ethics approved letter of participation were send to participants identified. This email was to invite them to participate. This letter can be viewed in Appendix A – Respondents invitation letter. Once the participant accepted, a meeting was set-up at a convenient time and place for the participant. The interviews were mostly conducted at work in meeting rooms and were 40 minutes on average. All participants were informed on what will be required of them and were given a chance to not participate. Once they were comfortable to proceed, the letter of consent was signed, and the interview started using the interview guide. The letter of consent can be viewed in Appendix B – Letter of Consent. The research purpose and objective were discussed and explained, and the questions then started as per the interview guide. The guide was developed to ensure the questions are asked in sequence and per topic. As mentioned in 3.1 Research Design, practice interviews were done to ensure the questions were clear and easy to understand.

The interviews were recorded and then transcribed. These transcripts are available in Appendix D - Interviews transcribed. To ensure confidentiality of these interviews, the raw data is stored on a password protected computer.

As a result of the framework mapping done in 2.6.2 Mapping from literature to framework there was an “other” section identified that was not addressed in the framework, but made visible as these were identified by other authors and studies. To ensure that these are also tested, the participants were asked if there is anything missing from the framework. Please refer to sections 4.6 Other and 5.6 Other for more details on this.

3.2.1.2 Coding

Coding was done in three main stages. First pre-coding was done and then first and second level of coding. This ensured the raw data was ready for analysis. These are described further below.

a) Pre-coding

Interview transcripts were pre-coded. As described by Saldana (2009), this is to highlight, jot down and underline things and ideas that strike you, (Saldana, 2009). It also included reading the transcripts from different perspectives. For this research, all interviews were conducted recorded and then transcribed by the researcher. This ensured the interview was listened to when conducted, then listened to again while transcribing and then captured. Once this was done these transcribed interviews were read again a few times to ensure there was understanding of what was presented.

b) First level of coding

Coding were done with the first participant's data but identifying words and phrases that represents the main idea or ideas presented by the participant. It then progressed to the second participants data and etc. It was found that as coding progressed, the subsequent sets of data influenced and affected the recordings from the previous participant's data. Saldana calls this "Coding contrasting data" (Saldana, 2009:p18) and say this maximises the potential for variety. In vivo and hypothesis coding was done on the data. In vivo coding was done on the data where descriptions and explanations were given and hypothesis coding was done on inputs of numbers based on the Likert scale, for implementation, relevance and timing.

c) Second level of coding

After the first very granular level of coding, pattern coding was done, to lump the data together into clusters and meta-data, which lead to the themes identified. This is in line with the recommendation made by Saldana (2009), to first split the data in more granular code in the first cycle and then in the second cycle lump the relevant data together. (Saldana, 2009). The author adds that to lump data together gets the essence of categorizing a phenomenon represented in the data.

See Table 3.18: Number of codes identified per level. This table represents a summary of the number of codes (phrased and key words) that were identified in the first and second level of coding.

Table 3.1 : Number of codes identified per level

Number of groupings	Gamification	Block-chain	Biometric technologies	Digital investment	Process automation	Other
Number of codes for 1st level	45	52	42	58	51	102
Number of codes (Meta-codes) for 2nd level	4	7	6	8	9	10

d) Analysis

Once the first and second levels of coding were completed, the data was ready for analysis. Themes were identified and pie charts and histograms of the data collected were drawn. This assisted in understanding the effect of the implementation, relevance and timing of the topics researched as well as the themes that emerged from the data. At this stage, while the analysis was interpreted some anomalies were identified. Reviewing the source documents again - the transcribed interviews - these anomalies were mostly addressed, and some coding and phrases were updated throughout the various stages. This was done in line with the recommendation by Saldana (2009) that all anomalies must be investigated and corrected if required.

The results from the above method were then compared with the theoretical framework from Kobler (2016), as discussed in section 2.6.1 The Conceptual framework. Findings and conclusions are discussed further in Chapter 4 – Results and Analysis.

4 Chapter 4 – Results and Analysis

This chapter contains the results and analysis for the research. Each pillar of the conceptual framework was analysed and are reported below. The order is as follows:

- Pillar 1 – Gamification
- Pillar 2 – Blockchain technology
- Pillar 3 – Biometric technology
- Pillar 4 – Digital investment
- Pillar 5 – Process automation
- Other.

For each of these pillars, the themes that transpired form the coding is described and then the result from the hypothesis coding is presented. These are the implementation, relevance and timing of each pillar.

Coding details can be seen in Appendix E – Coding: In vivo and hypothesis and Appendix F – Second level of coding continued: Pattern coding.

4.1 Pillar 1 – Gamification

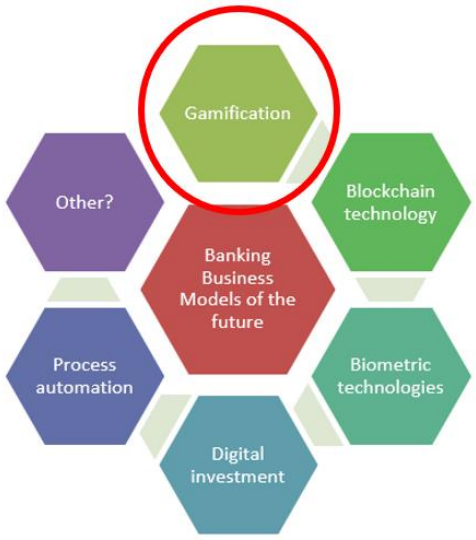


Figure 2.1: Banking Business Models of the future

The definition given in the framework for gamification is to ensure a more enjoyable experience for the customers.

4.1.1 Themes identified

Four themes were identified through the coding. They are described below:

4.1.1.1 Maturity

Respondents 1, 6 ,8, 9, 13 and 14 agreed this is a relevant pillar (or capability) that needs to mature before it will gain priority in the organization. Respondents 6 and 13 said they do not see the value of this as a priority currently.

This is depicted in the chart below, Figure 4.1: Maturity of Gamification.

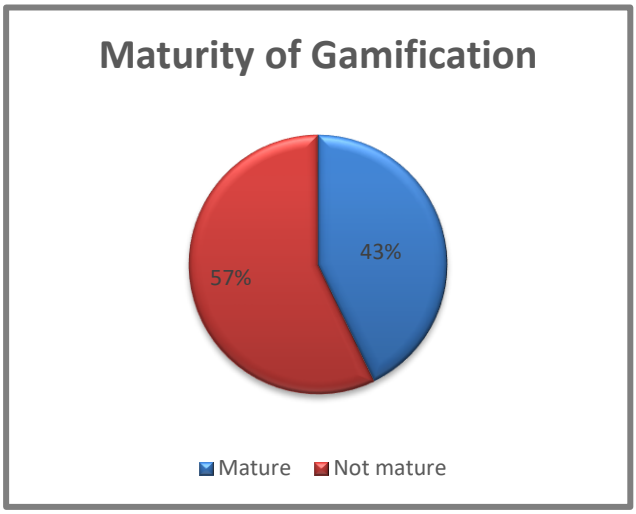


Figure 4.1: Maturity of Gamification

4.1.1.2 Priority

Respondents 1, 2, 3, 4, 5, 7, 8, 10, 11, 12 and 14 said this is relevant in their business units although only in an exploratory phase and that other priorities are currently driven. This is depicted in the chart below, Figure 4.25: Priority of gamification.

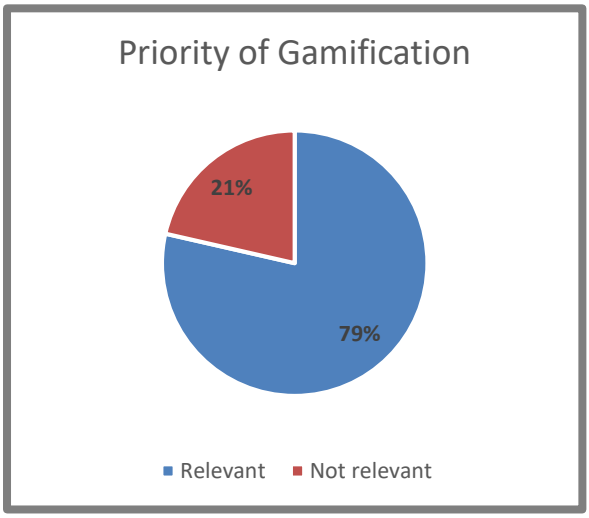


Figure 4.2 : Priority of gamification

4.1.1.3 Learning and development

Respondents 4 and 14 mentioned the best use case and implementation for gamification is for learning and development and to be used as a training tool. Respondent 5 agreed and added this can drive product adoption if customers are educated on what is available. Respondent 2, 10 and 11 added if employees are trained that they can drive a better customer experience. Respondent 14 added this can drive customer engagement. Respondent 12 added that customer's behaviour changes through implementing game-based principles.

4.1.1.4 User Experience improvement

Respondents 2 said the user experience will improve significantly with the implementation of gamification as the back bone of the design. An example of straight through processing will assist the customer to get to their need met sooner and more efficient. Respondent 5 agreed that customer enjoyment will modify the customer behaviours and if something is done easier and quicker customers will use this more. Respondent 9 agreed that it will be possible for customer offers to be available 24/7 and respondent 11 added the turnaround time will be much quicker ensuring a better customer experience. Respondent 14 said that game-based design thinking is important to ensure a better customer experience.

4.1.2 Pillar 1 - Implementation:

This is a measure to understand to what degree the pillar investigated, are currently been implemented in the business unit. A question was posed to the respondents to understand if this technology is implemented and used in the business unit. Figure 4.3 6: Implemented - Gamification depicts the results.

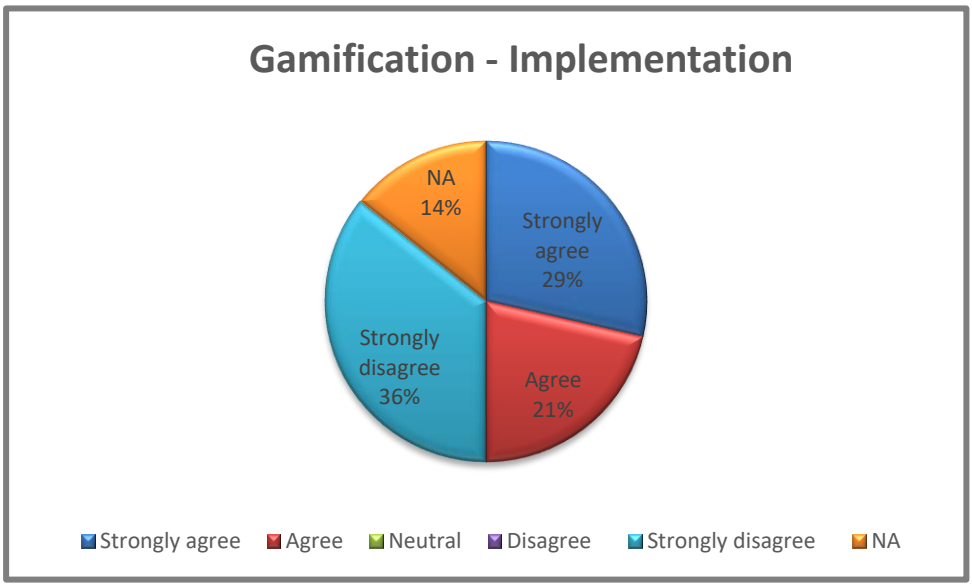


Figure 4.3 : Implemented - Gamification

The results indicate slightly more respondents as the other pillars. This is due to interviewing more respondents for this pillar, as more subject matter expert information was required due to the fact the gamification is still in infancy stages as described in section 2.6.1 The Conceptual framework.

36% (Strongly Disagree) said that gamification is not implemented but they are investigating this, while 29% (Strongly Agree) said that gamification is highly relevant and actively implemented in their business unit with an additional 21% (Agree) indicating that gamification is relevant and implemented in parts of their business unit.14% (NA) of respondents said that gamification is not implemented in their business unit and is not applicable.

The responses ranged for the implemented gamification is spread widely across the spectrum. These were then grouped to get a better understanding of this range.
This is depicted in the graph below, Figure 4.47: Gamification Implemented (Grouped).

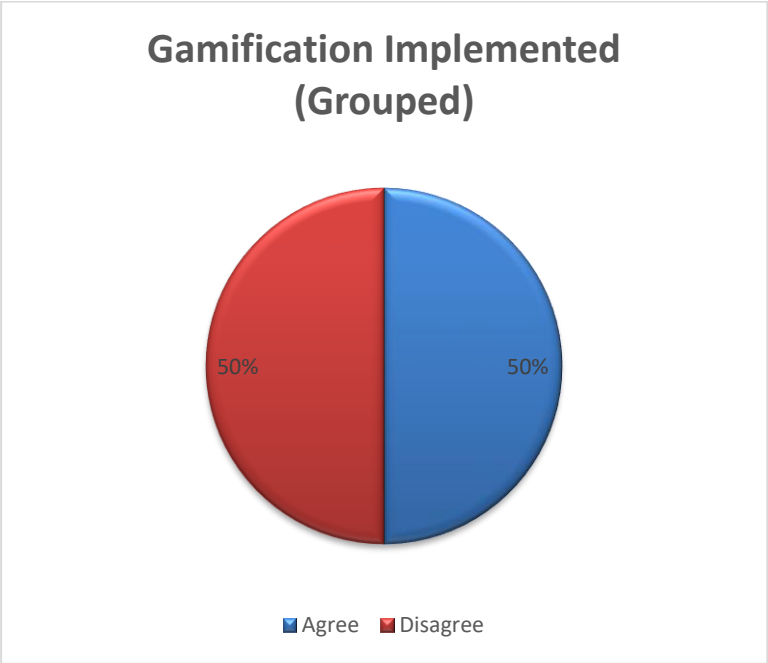


Figure 4.4 : Gamification Implemented (Grouped)

50% of respondents said gamification is not implemented in their business units, but they might investigate this, and 50% said it is implemented in their business unit and could identify more than one use case (application). The reason for the diverse split is because some areas are more likely to use this tool than others, as this is more relevant to their business model and focus within the business unit. Learning and development has tested as the largest use case for gamification. Hence, if the specific business unit's core function is not learning and development, for either staff or customers in the form of education of various products and services, it is not used in that unit currently.

4.1.3 Pillar 1 - Relevance:

This is a measure to understand if the pillar investigated are relevant to the business unit. Figure 4.58: Relevance - Gamification depicts the results.

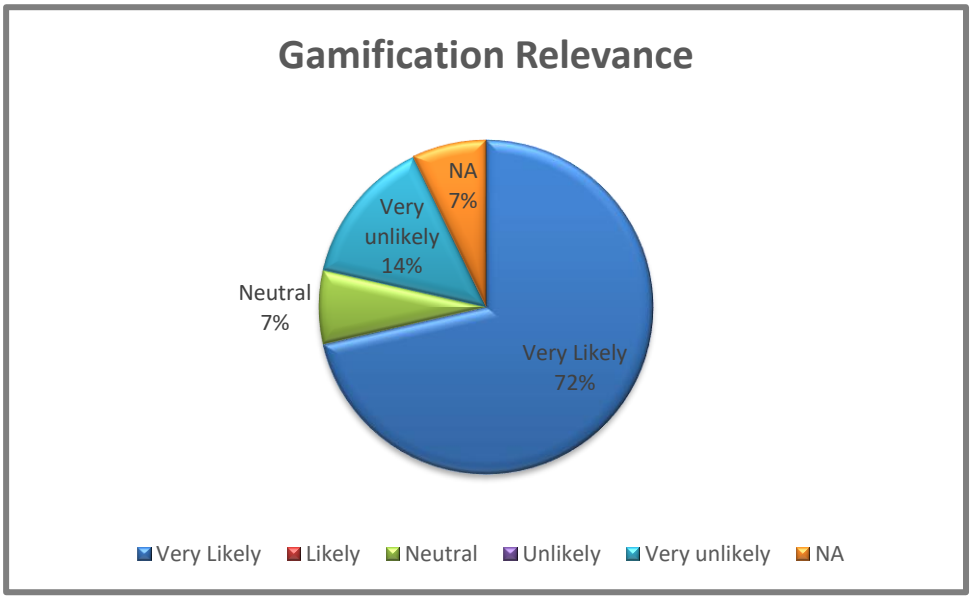


Figure 4.5 : Relevance - Gamification

72% (very unlikely) said gamification is relevant their business unit and could identify more than 1 use case while 7% (neutral) said that gamification is relevant in their business unit and in the investigation phase. 14% (very unlikely) of respondents said that gamification is somewhat relevant in their business unit but could not identify a use case and additional 7% (NA) of respondents said that gamification is not relevant in their business unit and is not applicable.

4.1.4 Pillar 1 - Timing:

This is a measure of the time frame that the pillar investigated has been implemented or investigated in the business unit. Figure 4.69: Timing of usage - Gamification depicts the results.

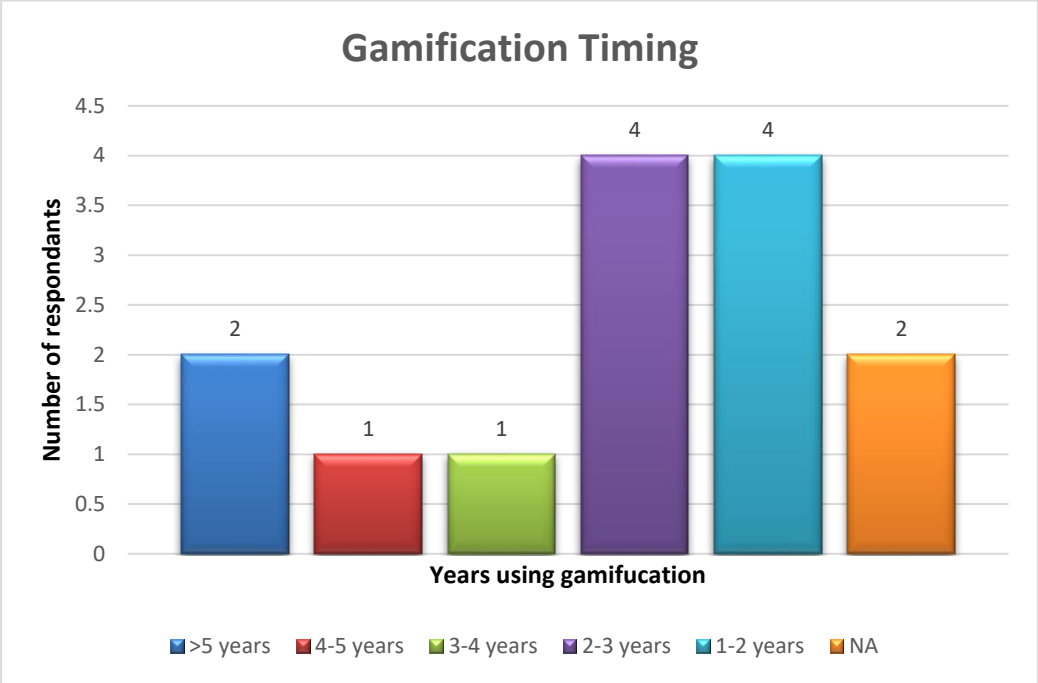


Figure 4.6 : Timing of usage - Gamification

2 (<5 years) said gamification is investigating gamification for 5 or more years, while 1 (4-5 years) said they are investigating gamification for 4-5 years. 1 (3-4 years) said they are investigating gamification for 3-4 years and 4 (2-3 years) said they are investigating gamification for 2-3 years. 4 (1-2 years) said they are investigating gamification for 1-2 years. 2 (NA) said gamification is not investigated or applicable in their area.

In summary, most business units that invest in gamification are only doing it for a short period of time. Figure 4.69: Timing of usage - Gamification depict this.

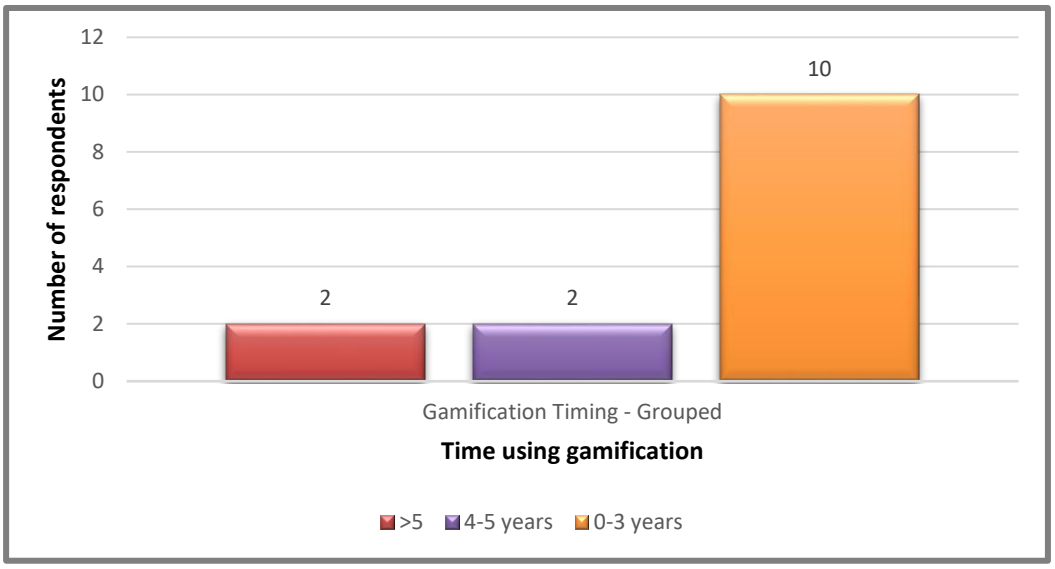


Figure 4.7 : Timing of usage - Gamification Grouped

4.2 Pillar 2 - Blockchain technology



Figure 2.1: Banking Business Models of the future

The description given by the framework regarding Blockchain technology which could radically simplify the payments and transactions world.

4.2.1 Themes:

Four themes were identified for blockchain technology. There are as follows:

4.2.1.1 Limited use cases and experimental/immature technology:

Respondent 1 said there are limited use cases to use this technology. Respondents 2, 3, 4, 5, 8, 12 and 13 said there are still a lot of regulatory issues and frameworks must be considered and be bedded down for this technology can be implemented. These include for example tax considerations and how disputes are handled, to name a few. Respondent 10 and 12 mentioned this is still an immature industry as it is in the experimental phase. Respondents 1,3,5,7,12 agreed and added this can be a future solution and still need to be proven as a trusted partner. Respondent 3 added there is no wide spread use case and that reliability is still an issue. The volumes that is used for

payments in banking, no blockchain technology can handle at the moment. Respondents 1, 2, 5, 9 agreed the problem is lack of priority and focus to drive this forward. The bank is currently focusing on other areas of development.

4.2.1.2 Feasible in a closed eco system:

Respondent 13 said the distributed leger part of the Blockchain technology is relevant in banking. Swift transactions (across border) can also benefit from this. Respondent 2, 3, 4 and 5 agreed and added a trusted exchange will be possible when doing contracting, specifically cross border for example settlements of cars. This might mean a closed eco system is required between relevant parties that the transaction is done to ensure security. This is also referred to as a single trusted source and are required for interbank transactions.

4.2.1.3 Possible future solution:

Although only 3 respondents agreed this is not relevant most said that there is still a journey ahead and a future solution may be possible.

4.2.1.4 Not relevant:

Respondents 6, 10 and 11 said blockchain technology is not relevant in their business unit.

4.2.2 Pillar 2 - Implementation:

This is a measure to understand to what degree the pillar investigated are currently been implemented in the business unit. A question was posed to the respondents to understand if this technology is implemented and used in the business unit. Figure 4.811: Implemented - Blockchain Technology depicts the results.

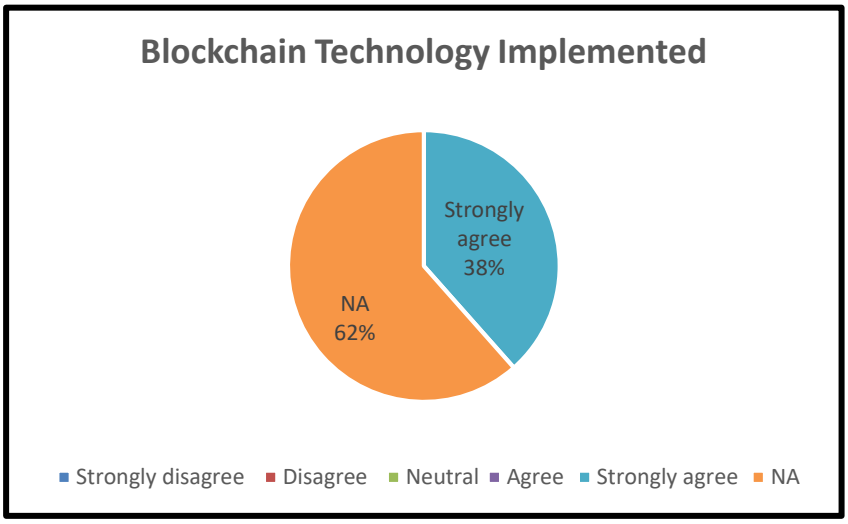


Figure 4.8 : Implemented - Blockchain Technology

38% indicating blockchain technology is not implemented but they are investigating this. 62% of respondents said blockchain technology is not implemented in their business unit and is not applicable.

4.2.3 Pillar 2 - Relevance:

This is a measure to understand if the pillar investigated is relevant to the business unit. Figure 4.912: Relevance - Blockchain Technology depicts the results.

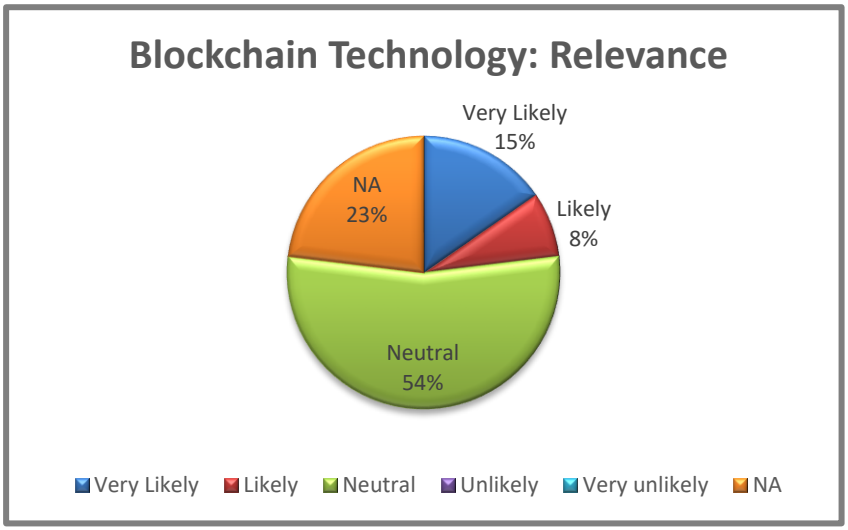


Figure 4.9 : Relevance - Blockchain Technology

15% said blockchain technology is relevant in their business unit and could identify more than 1 use case, while 8% said blockchain technology is relevant in their business unit and could identify a use case. 54% said blockchain technology is relevant in their business unit and in the investigation phase and additional 23% of respondents said blockchain technology is not relevant in their business unit and is not applicable.

4.2.4 Pillar 2 - Timing:

This is a measure of the time frame that the pillar investigated has been implemented or investigated in the business unit. Figure 4.1013: Timing of usage - Blockchain Technology depicts the results.

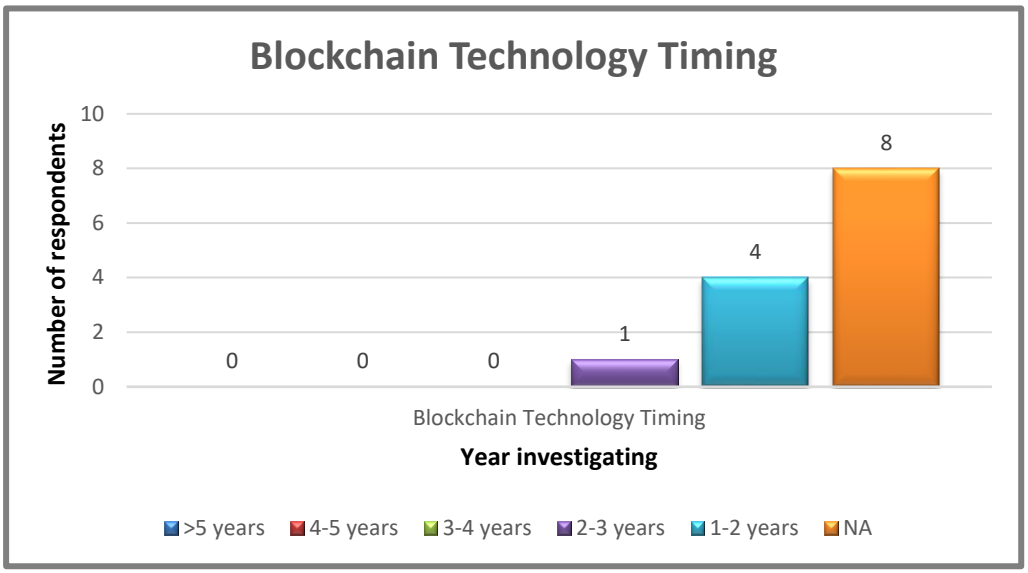


Figure 4.10 : Timing of usage - Blockchain Technology

1 (2-3 years) said they are investigating blockchain technology for 2-3 years. 4 (1-2 years) said they are investigating blockchain technology for 1-2 years. 8 (NA) said blockchain technology is not investigated or applicable in their area.

4.2.5 Pillar 2 - Future focus

This is a measure of the time frame to understand if this is a possible future implementation. The results are depicted in Figure 14.11: Future focus - Blockchain Technology.

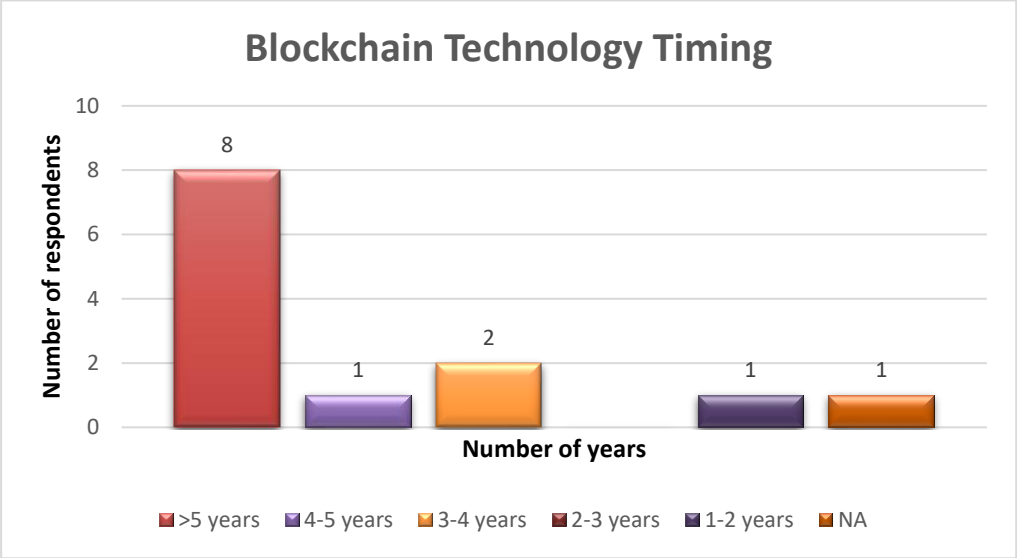


Figure 14.11: Future focus - Blockchain Technology

8 (<5 years) said they are investigating blockchain technology for future use 5 or more years, while 1 (4-5 years) said they are investigating blockchain technology for future use 4 - 5 years. 2 (3-4 years said that they are investigating blockchain technology for future use 3 - 4 years and 1 (1-2 years) said they are investigating blockchain technology for future use1 -2 years. 1 (NA) said they are not investigating blockchain technology for future use.

4.3 Pillar 3 - Biometric Technology



Figure 2.1: Banking Business Models of the future

The description given by the framework for biometric technology is that this could allow for seamless and secure digital authentication

4.3.1 Themes

Six themes were identified. These are as follows:

4.3.1.1 Verify customers and give them a richer user experience:

Respondents 1 and 2 agreed that biometric technology will give the customer a richer user experience. Respondent 6 and 9 agreed and added that in addition, this can also be used to verify customers automatically. Respondents 5, 11 and 13 extended this idea and added that in call centres this can be used to identify customers using voice recognition and natural language processing which ensure a richer customer experience. This was further extended by respondent 10 who said that this is an effective way to identify customers

4.3.1.2 Limitation – Single member entities only

Respondent 8 said there are limits to this technology currently and that it is only used for single member entities and not for larger companies with more than one director.

4.3.1.3 Drive efficiencies

Respondent 1 said this is an enabler that drives efficiencies for the bank and the customers and that authorizations can be done using biometric technology. Respondents 3, 4 and 11 agreed and added that authorizations, approvals and verifications of customers are done and this will increase going forward. If this can be done using biometrics it will drive efficiencies. Respondent 13 added this will enable us to move away from signatures and respondent 3 agreed we can do contracting using biometrics going forward. Respondent 7 agreed this will unlock value and business opportunities. Respondent 10 underlined this idea by adding that we will be able to more effectively collect data about our customers and help enhance their customer experience. We will be able to identify their demographic and with which channel they interacted (call centre/branch etc.) and assist them more effectively according to their preferences.

4.3.1.4 Security enabler

From a security and risk/fraud perspective respondents 3, 5, 7 and 9 agreed that more than 1 biometric must be used, example, finger print and password/voice/face recognition. This will ensure that fake identification is not done.

4.3.1.5 New banking product offering

Respondents 6 and 9 mentioned that this capability must be so robust and well defined that this service to verify customers must be able to be used by other companies as well. For example, if government want to verify their customers, they must be able to call this service as another product offering from the bank. This is another advisory service from the bank.

4.3.1.6 Used currently

Respondents 7,12 and 13 highlighted we are already using biometrics to assist customers to log into their online banking using the App and to verify customers at branches.

4.3.2 Pillar 3 - Implementation:

This is a measure to understand to what degree the pillar investigated has currently been implemented in the business unit. A question was posed to the respondents to understand if this technology is implemented and used in the business unit. Figure 4.1215: Implemented - Biometric Technologies depicts the results.

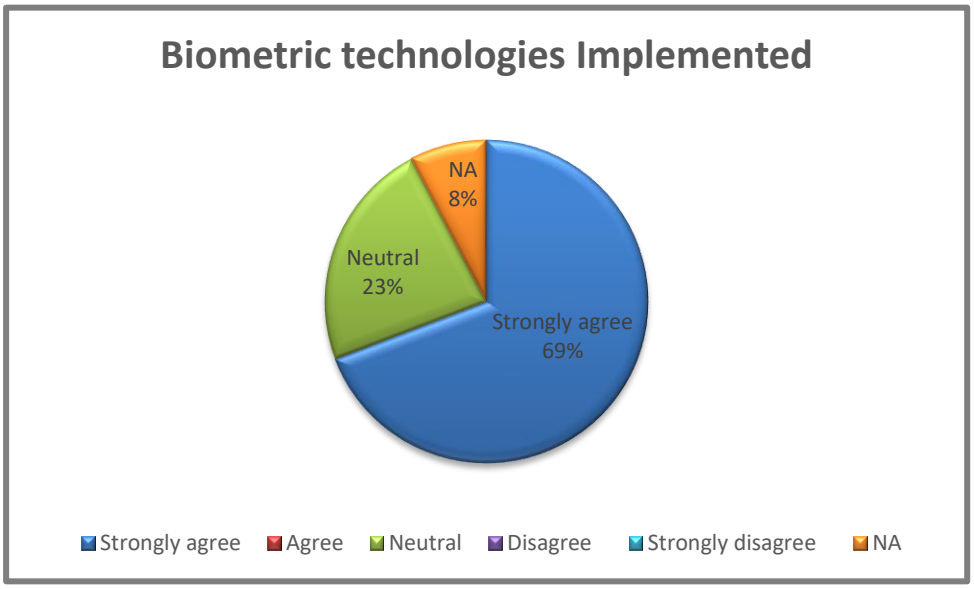


Figure 4.12 : Implemented - Biometric Technologies

69% (Strongly agree) said biometric technologies are actively implemented in their business unit, while 23% (neutral) said they are in advanced stages of investigating and investing in biometric technologies within their business unit. 8% (NA) of respondents said biometric technology is not implemented in their business unit and is not applicable.

4.3.3 Pillar 3 - Relevance:

This is a measure to understand if the pillar investigated is relevant to the business unit. The results are depicted in Figure 4.1316: Relevance - Biometric Technologies.

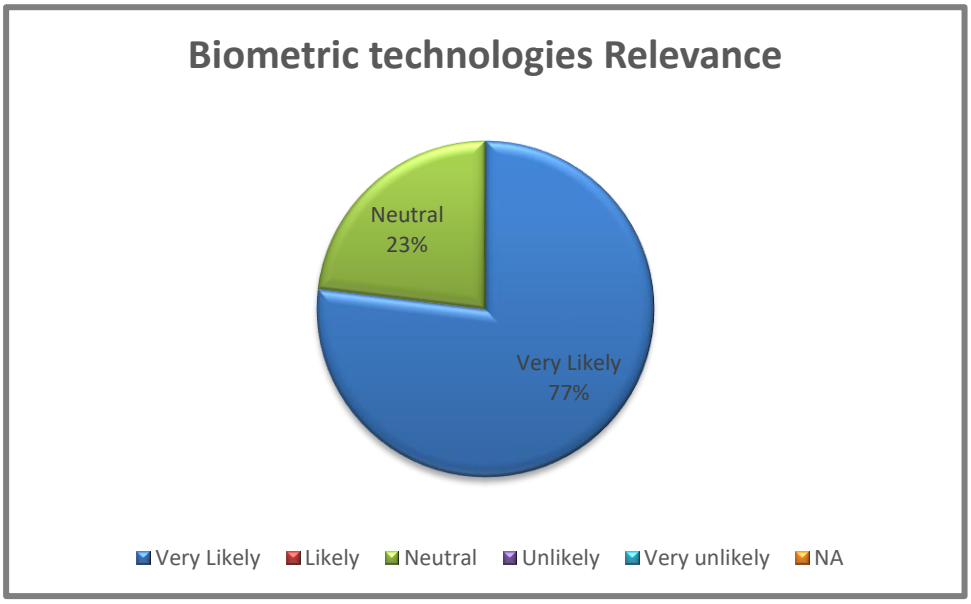


Figure 4.13 : Relevance - Biometric Technologies

77% (very likely) said that biometric technologies are relevant their business unit and could identify more than 1 use case. 23% (neutral) said that biometric technologies are relevant in their business unit and in the investigation phase.

4.3.4 Pillar 3 - Timing:

This is a measure of the time frame that the pillar investigated has been implemented or investigated in the business unit. The results are depicted in Figure 4.1417: Timing of usage - Biometric Technology.

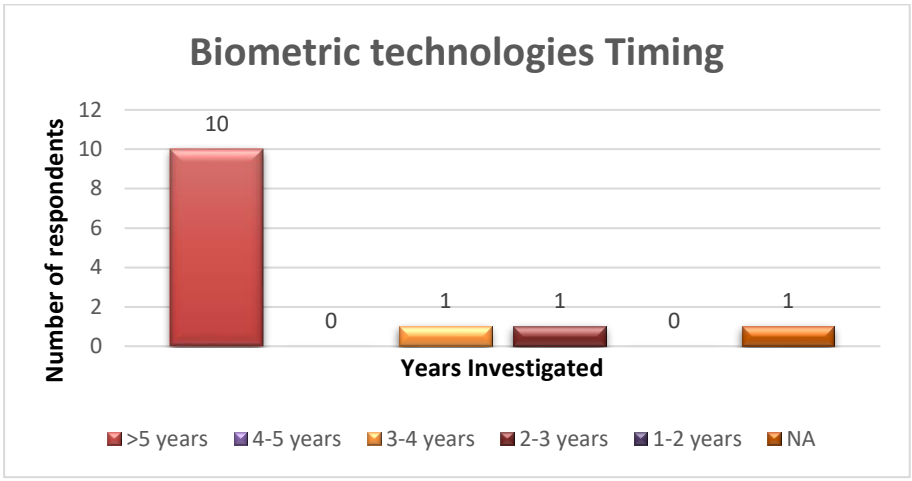


Figure 4.14 : Timing of usage - Biometric Technology

10 respondents said they are implementing biometric technologies for 5 or more years, while 1 respondent said they are implementing biometric technologies for 3 - 4 years and 1 respondent said they are implementing biometric technologies for 2 - 3 years. 1 respondent said they are not implementing biometric technologies, and this is not applicable.

4.4 Pillar 4 - Digital investment

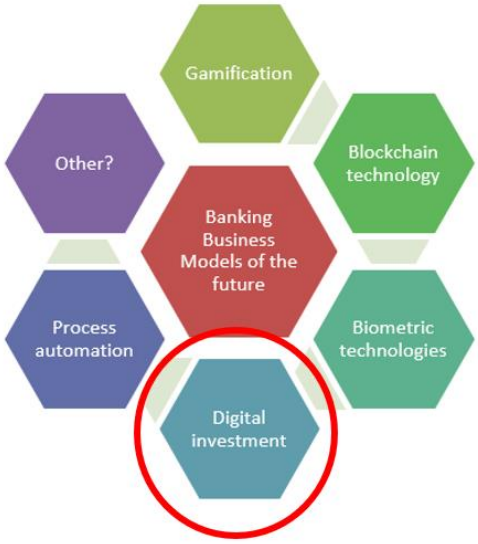


Figure 2.1: Banking Business Models of the future

According to the framework, digital investment is described as robot advisors, that enable automated investment advisory services. Throughout the interviews, the concept was expanded to include digital investing as a slightly broader definition. This is not limited to only robo-advice but also include investments to enable the robo-advice, including AI, machine learning and platform thinking. The latter entails a collection of capabilities (or services/functions), to enable the brands, segments and product houses to create and deliver contextual solutions. This is also an interface for our customers, partners and employees to interact and communicate.

4.4.1 Themes:

Ten themes were identified. These were as follows:

4.4.1.1 Efficiencies for volume and scaling of products and services:

Respondent 1 said that digital investment will drive efficiencies. Respondent 2 agreed digitization is the better and faster option to get results, respondent 4 said for volumes this is the way to go and can drive efficiencies. Respondent 5 agreed and added to analyse a lot of data and make recommendations based on specific rules is where robots and systems beat humans hands down. Respondent 8 said this is for volumes of scoring and agreed with respondents 4 and 5 on this topic. Respondent 9 said it is difficult to scale financial advisors and much more expensive. Digital investment can be scaling much faster to drive efficiencies and help do data crunching. Respondent 11 said straignt through processing (STPs) will be done for credit applications and drive a quicker customer experience and less handoff points. Respondent 12 said that data is required to assist customers and that digital investment will drive efficiencies. Respondent 13 is also of the opinion that digital investment is key for efficiencies and scaling for the bank.

4.4.1.2 Data analysis:

Respondent 1 said a prerequisite for this to work is to have clean data. Respondent 2 mentioned a lot of data crunching is required to make this work. Respondent 11 mentioned real-time information and data is required to ensure that robo-advisors can work efficiently.

4.4.1.3 Platform thinking

Respondent 7 said that platform is required. This means that the bank needs to be able to use and leverage off any system and capability to assist a customer effectively. Respondent 2 and 8 said that priority is required and more focus to ensure that this is implemented efficiently throughout the bank.

4.4.1.4 Maturity

Respondent 12 said that robo-advice is the end game, but the framework is not mature as yet for this to be implemented effectively. These things take time to put in place, at least

15 years. Building blocks are put in place to be more digital. Respondent 5 mentioned that self-aware robots are 50 to 100 years away and that robots are good at giving a specific answer to a specific question well. They can do one thing well and give specific outputs to specific inputs.

4.4.1.5 Data enrichment:

Respondent 6 said they are collecting data and enrich this to ensure they are able to give customers accurate advice. Giving the banker context on the customer's experience from the last visit as an example, enables the bank to interact with their customers more efficiently.

4.4.1.6 Legal framework:

Respondent 3 said the legal framework under which digital investment and robo-advisors work must still mature. Respondents 4,8, 12 and 13 agreed the current legal landscape does not allow for full on robo-advice. The governance and legal considerations are important for robots.

4.4.1.7 Advice available to all customers

Respondent 2 said we are currently not giving advice to our customers using robots. Going forward this will be a great additional service to our customers. It will enable the bank to advise them to choose the right product. Respondent 1 agreed that information to customers is banking of the future. This information will enable them to make decisions. Respondents 5 and 6 agreed and said that advisory services of money management for customers are the future of the bank. Respondent 9 took this idea a step further and said that the robo-advise will be a tool kit that bankers can use to advise their customers. Respondent 12 added that for now the bank only have a high-level decision tree that is used to choose a product. This is one step forward toward giving advice and a capability of the future.

4.4.1.8 Self service

Respondent 13 said the future is self-service - assisted self-service or un assisted self-service. Respondent 2 said an advantage of robo-advice is that the bank are able to give advice to more customers. From individuals to small and medium businesses.

Respondent 3 agreed this service would be a great addition for low end customers as well as customers whom do passive investments. He added this can also work in the asset management space. Respondent 5 agreed this will work well in the entry level as well as the high-end wealth customers' space. Respondent 9 said advice will differentiate us from the future and that we need to roll-out our available advice as wide as possible and that robo-advice is a solution for this. He also added that assisted and unassisted self-service is required for this.

4.4.1.9 No conflict of interest:

Respondents 3 and 4 said that a major advantage is there is no conflict of interest using a robo-advisor. This is because the robot is programmed making the best decision with vast lake of information, i.e. big data, available.

4.4.1.10 Not relevant in current form

Respondent 10 said this tool is not relevant for business in its current form, but that digitization is imminent, and the digital investment is relevant. Respondent 4 said this is not for judgemental credit as this is too complex and must be considered case by case by an informed person. She also added that in South Africa with the various languages and low levels of education in robo-advice will be difficult to implement.

4.4.2 Pillar 4 - Implemented:

This is a measure to understand to what degree the pillars investigated are currently being implemented in the business unit. A question was posed to the respondents to understand if this technology is implemented and used in the business unit. Figure 4.1518: Implemented - Digital investment depict the results.

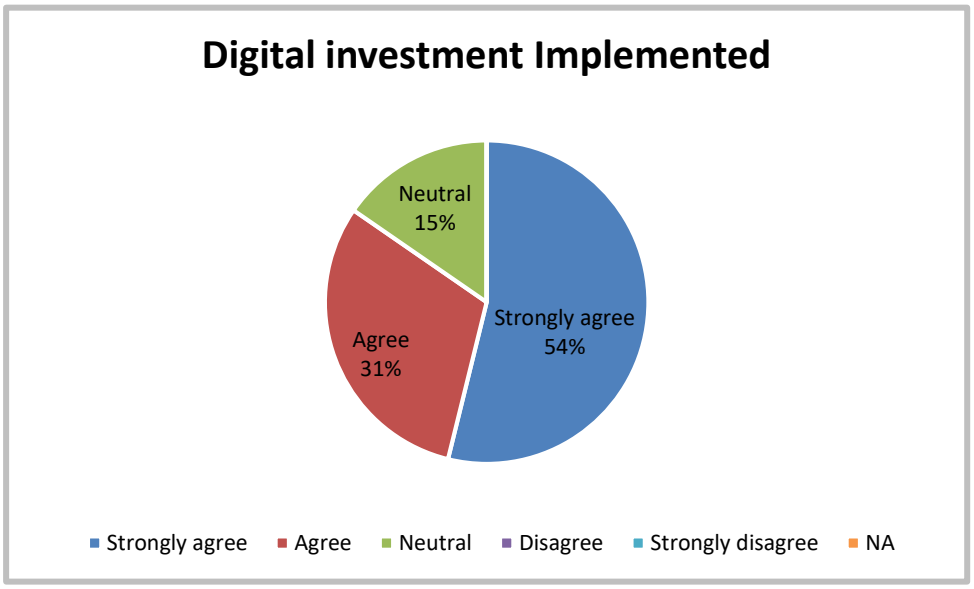


Figure 4.15 : Implemented - Digital investment

54% strongly agreed and said digital investment is actively implemented in their business unit, with an additional 31% who agreed that digital investment is implemented in parts of their business unit while 15% were neutral and said they are in advanced stages of investigating and investing in digital investment within their business unit.

4.4.3 Pillar 4 - Relevance:

This is a measure to understand if the pillars investigated are relevant to the business unit. Figure 4.1619: Relevance - Digital investment depicts the results.

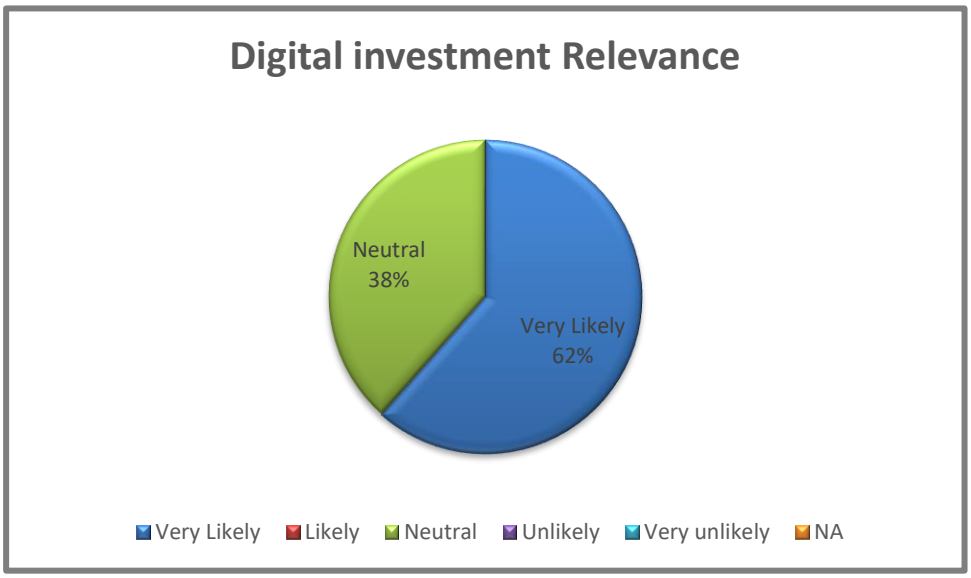


Figure 4.16 : Relevance - Digital investment

62% responded very likely and said digital investment is relevant in their business unit and could identify more than one use case. 38% were neutral and said digital investment is relevant in their business unit and in the investigation phase.

4.4.4 Pillar 4 - Timing:

This is a measure of the time frame the pillar investigated has been implemented or investigated in the business unit. The results are depicted in Figure 4.20 23: Timing of usage - Process Automation investment.

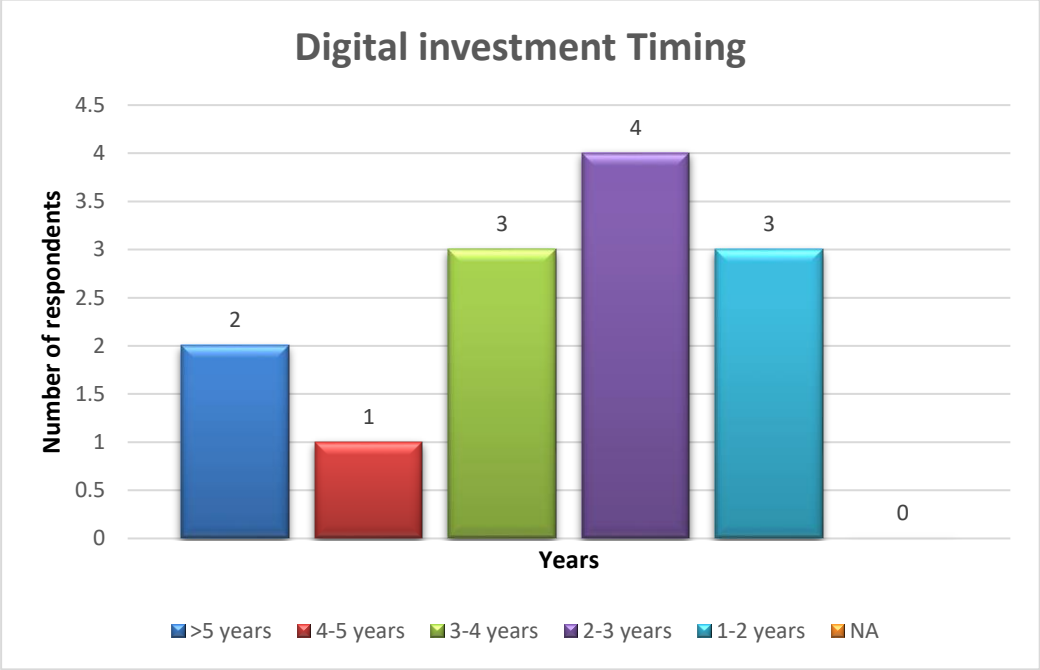


Figure 4.17 : Timing of usage - Digital investment

Two respondents said digital investment is investigated five or more years, while one respondent said they are investigating digital investment for four to five years. Three respondents said that they are investigating digital investment for three to four years and four respondents said they are investigating digital investment for two to three years. Three respondents said they are investigating digital investment for one to two years.

4.5 Pillar 5 - Process automation

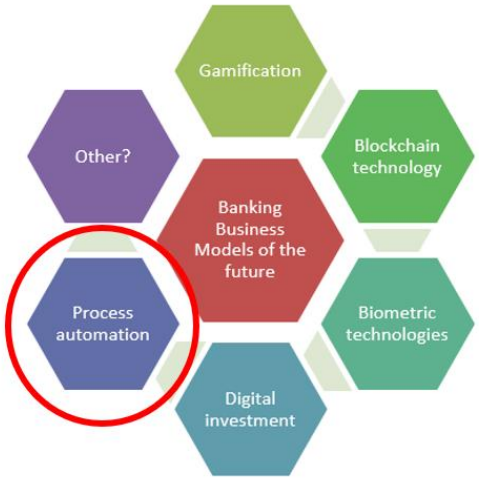


Figure 2.1: Banking Business Models of the future

The definition given by the framework is that process automation offers large scale cost reduction in combination with increased flexibility and accuracy of back office tasks.

4.5.1 Themes:

Seven themes were identified. These were as follows:

4.5.1.1 Future relevance

All thirteen respondents said that process automation was something that was implemented in their area, that it is highly relevant and has been worked on in the last five years.

All respondents confirmed that process automation is key for the relevance of the bank of the future.

4.5.1.2 Optimization sometimes lacks

Respondents 1 to 11 raised that optimization is as important as automation. Respondent 1 and 2 said many times optimization is missing when a process is automated. Respondent 3 said they do not optimise currently, and that automation is more their focus. Respondent 4 said they automate first and then optimise. Respondent 5 mentioned they are looking at the people vs the eco system and how they interact in the most efficient or optimised way. Respondent 6 said they are actively re-engineering processes to ensure optimization before automation is done. Respondent 7 said efficiencies are important. Respondents 8 and 10 said the bank is not currently looking at efficiencies but just to automate processes. Respondent 9 said process optimization is done before automation and that only relevant processes should be optimised. (An example - don't optimise cheque process as we are not using this going forward). Respondent 12 said they are actively involved in process optimization and influencing this although they are not always the executors.

4.5.1.3 Applicable to mundane yet relevant processes

Respondents 1 and 3 agreed that process automation should be done for mundane or processes with high repetition rate. Respondent 5 mentioned it is important to identity the correct processes to optimise and automate. Respondents 2 and 9 agreed only relevant processes must be automated. Respondent 3 mentioned that before a process can be automated it must be well defined.

4.5.1.4 Paper based and integration

Respondents 4, 10 and 12 mentioned process automation is important and paper-based processes must be replaced. Respondent 11 agreed and added system integration is important. This will eliminate finger error. Respondent 13 agreed that straight through processing is required and focus on minimal human intervention is required. Humans can be used monitor and integration errors.

4.5.1.5 Efficiencies

Most respondents agreed with the benefits of process optimization and automation. Respondent 1 mentioned time efficiencies will result. Respondent 2 mentioned that going forward limited resources will be used to assist with capture between systems. Respondent 6 added that real-time data is required and the only way to do this is system integration and process optimization. Respondent 12 added this will increase sales volumes. Respondent 11 mentioned there are still a lot of paper-based processes. This is time consuming. Online processes for credit approval are still in the infancy stages. Once this is on the automated platform, there will be more alignment of processes and less integration errors.

Respondent 2 mentioned there is a lot of work done currently on ensuring current processes are on systems. This is the first building block for more integration and opportunities for optimization.

4.5.1.6 Problem with integration and process optimization

Respondent 4 highlighted two issues with process optimization. These are integration failures and high-quality data, which is required to give insight.

4.5.1.7 Large amount of work required to change a process

Responded 8 added there is a lot of work required to change a process. This includes regulatory frameworks and governance paper work. This is a time-consuming process. Buy-in of relevant stakeholders is required. Respondent 8 also mentioned that gaps must be identified before processes can be automated. Respondents 5, 9 and 11 highlighted that new ways of thinking are required as "platforms" are the way of the future. This means one process for a function/capability and only customise where necessary.

4.5.2 Pillar 5 - Implemented:

This is a measure to understand to what degree the pillars investigated are currently being implemented in the business unit. A question was posed to the respondents to understand if this technology is implemented and used in the business unit. Results are depicted in Figure 4.18 21: Implemented - Process Automation.

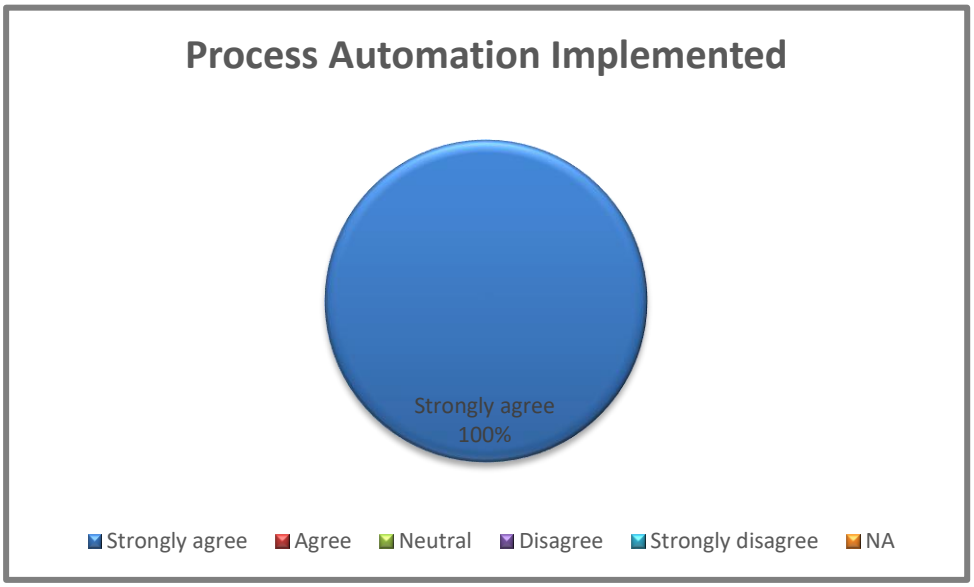


Figure 4.18 : Implemented - Process Automation

For process automation and optimization pillar – 100% strongly agree and said this is implemented actively in their area.

4.5.3 Pillar 5 - Relevance:

This is a measure to understand if the pillars investigated are relevant to the business unit. The results are depicted in Figure 4.19 22: Relevance - Process Automation.

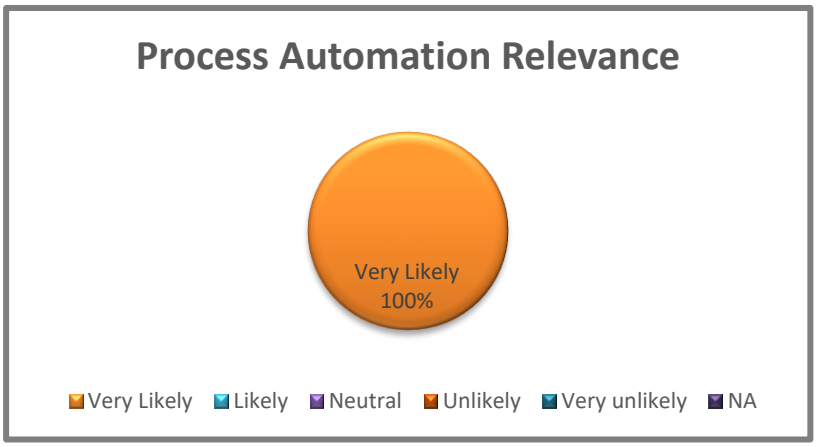


Figure 4.19 : Relevance - Process Automation

For process automation and optimization pillar - all areas say this is highly relevant in their area.

4.5.4 Pillar 5 - Timing:

This is a measure of the time frame that the pillar investigated has been implemented or investigated in the business unit. The results are depicted in Figure 4.20 23: Timing of usage - Process Automation.

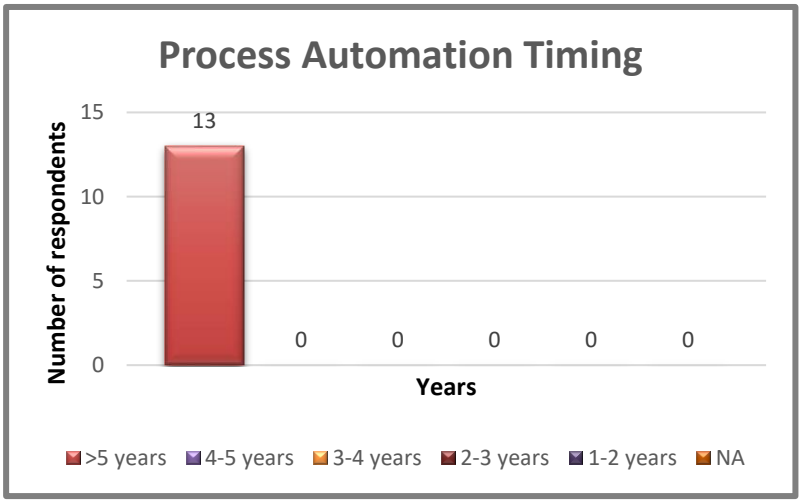


Figure 4.20 : Timing of usage - Process Automation

For process automation and optimization pillar - all areas have been doing process automation and optimization for 5 years or more.

4.6 Other

For this category the question posed was what is missing from the framework or how will they change this?

4.6.1 Themes:

Various themes were identified. These were as follows:

4.6.1.1 Human element

All respondents agreed the impact on the human element must be considered to a larger extent. Respondent 1 said the current employees will have different jobs in a few years' time. Respondent 2 agreed and added we need to focus on people change management and that diverse skills will be required. The same number of people will execute higher volume of transactions. Respondent 3 added that the 4IR will extend human capabilities. He added that in the past a skill was developed and then handed over to the next generation to continue to implement this. With the pace of 4IR, skills that are developed will only last a short period of time before they change. Respondent 4 added the human impact and change management is a huge element to consider. Respondents 5 and 7 also mentioned the human element and said we need to upskill our employees as jobs will change, change management is important. Respondent 5 added that the way we assess skill will have to change. Responded 8 talked about people and execution and how this will change, people must be upskilled. Respondent 6 and 9 talked about a transformative purpose. What will make people want to change their behaviour? To change the hearts and minds of people to embrace the change. Respondent 10 added there will be a change in the employee, employer relationship. Respondent 11 mentioned the HR processes will have to be updated and change to cater for this change. Respondent 12 said that people's roles will change. Respondent 13 agreed that jobs will change, and human intervention will be a minimum. Respondent 9 also mentioned that change management is important.

4.6.1.2 Data and analytics

Many respondents agreed that data must be considered a pillar. Respondent 1 called it a data centric customer experience. Respondent 3 said that data is required to effectively

understand our customers. Respondent 4 said that data is key to understand our customers effectively and anticipate what they will require. Responds 4 and 10 also added that natural language processing and self-learning robots require data to be designed and monitored. Respondent 5 also added data analytics are very important for process design and redesign. Responded 6 talked about common data share, to be able to relate data on a common platform. Respondent 9 talked about machine learning. This is also a data element as machine learning requires data to enable it to function properly. Respondent 10 added we must focus on data models and predictive analytics. Respondent 12 added we need to use data across themes - not silo a approach. To further explain an example is described. Clients may be renting currently. As the bank have this data available, they will be able to establish if the customer can afford a home loan and can propose properties in the area, they currently live, with the option to change of course. Behaviour of customers is thus used to determine affordability of credit instead of traditional methods. Respondent 13 added the platform must understand the customer need and life-cycle and this will use data for contextual sales. Respondent 5 added call centres for example can use data to handle the bulk of the calls that come through and the remainder can be handed off to the call centre agents.

4.6.1.3 Legacy systems

Respondents 5 and 11 said that legacy systems and how one maintains or decommissions these, has a huge impact and cost associated with it. Yet, if not done the future of the bank is in jeopardy.

4.6.1.4 Eco system to be created

Respondent 6 said that value must be created for your business as well as other businesses. The need to create an eco-system that is not always profit driven, but customer centricity driven. User experience is important, what is the customer science to use something? If it is easy to use customers will use it. if not, they will use something else.

4.6.1.5 Risk involvement

Respondents 6 and 8 mentioned that risk must be involved up front to ensure change happens efficiently. We are going into the unknown and it is important that risks are identified and addressed upfront.

4.6.1.6 Empathy

Respondent 12 said customer empathy is something that cannot be replaced with a machine. Customers does not always want to adapt and go digital with their processes. There must be a way that we as a bank can identify this to assist customers according to their need. In a customer interviews, the respondent realised that money management is emotional for many people. Banks need to support their customers in this regard. Respondent 13 added going forward banks will be more advisory in their capacity. The advice must include empathy.

4.6.1.7 Maturity of the 3rd industrial revolution

Respondent 3 said that we are only now at the maturity of the impact of the 3rd industrial revolution and that is why process automation is implemented everywhere.

4.6.1.8 Security

Respondents 5 and 7 placed emphasis all of the pillars are underpinned by security. Everything must be built with maximum security in mind. Respondent 8 added that one must build on what can go wrong. This will ensure that risks are taken into consideration and maximum security is used.

4.7 Impact of each pillar on traditional banking models:

A summary of the analysis above is depicted in Table 4.19: Summary of the impact of each pillar on traditional banking models. In this table one can see all pillars identified in the framework, as well as the new or “other” pillars that have an impact on branch banking, maintaining legacy systems and complex structures, except for gamification and biometric technology. Gamification and biometric technology do not have an impact on the maintenance of legacy systems as both these are new technologies in comparison with the current banking infrastructure.

Table 4.1 : Summary of the impact of each pillar on traditional banking models

Impact of pillar on traditional banking models	Branch Banking	Maintaining legacy systems	Complex structures
Gamification	Yes	No	Yes
Biometric technology	Yes	No	Yes
Blockchain technology	Yes	Yes	Yes
Digital investing	Yes	Yes	Yes
Process optimization and automation	Yes	Yes	Yes
Human resources management	Yes	Yes	Yes
Big data	Yes	Yes	Yes
Security and risk	Yes	Yes	Yes

5 Chapter 5 – Discussion of results

In chapter 4 the results were depicted and analysed. In this chapter, the results are discussed, and conclusions are made. The order of this chapter is done per pillar of the framework.

5.1 Pillar 1 - Gamification

There were four main themes identified from the gamification pillar, namely, maturity, priority, learning and development and user experience improvement.

Maturity of gamification was explored with the respondents. Six of the fourteen respondents said this is not a mature capability, of which two said that this will add no value to their business unit

Gamification is not a mature capability in South Africa or internationally. Yazdanifard et al., (2014), did a study that investigated gamification in the service industry to understand how this can be used to gain customers. One of the findings was that gamification is in infancy stages and that it is hard to predict the efficiencies in the long run for services. (Yazdanifard et al., 2014). Since this capability is still in development stages, more work should be done to understand the implementation and benefit that gamification will have. As mentioned by one respondent that had experience with gamification implementation before, she mentioned that it takes a lot of effort to develop and release a concept for gamification, yet the benefits are mostly short term. This was a conclusion from a product that was launched and then gamification was used to drive adoption of the product.

Eleven of the fourteen respondents could identify use cases and said that gamification is relevant in their area. As mentioned, gamification is still immature and in an exploratory phase. Although most respondents said this is relevant in their business unit, priority and benefits are mostly used to drive deliverables. Depending on an organization strategy, projects are pushed. Currently gamification is not the number one priority and thus not implemented widely, yet it is relevant and should gain more traction in the near future. Seven of the fourteen respondents agreed that learning and development is a great use case for gamification. According to deCos (2015), one of the main reasons for low

performance in students is boredom and lack of engagement, yet the use of gamification, i.e. to use gaming as a learning process, encourage engagement and raises motivation. (deCos, 2015).

Muntean (2011), conducted research, based on Fogg's Behavioural model, which consists of three main elements, motivation, ability and trigger. This model suggests that motivation (willingness) and ability is not enough to determine specific behaviour. There must be a call for action. The conclusion was that mechanics used in gamification can trigger and motivate desired behaviour among students. (deCos, 2015; Muntean, 2011). This was supported by Simoes et al., (2013), who developed a gamification framework for a K-6 learning platform which increased the results for children. K-6 is an abbreviation used for schooling up to grade six. (deCos, 2015).

Taking the above into consideration, gamification can be used efficiently for learning and development. In the banking environment employees must be trained on a regular basis with the newest regulation and security related issues that is relevant in banking. Gamification can be used effectively to do training for large number of employees.

For customers, this tool can also be used to train customers on various products offered and train them how to use these as well as drive adoption of new products and services.

Five respondents agreed that gamification will drive a better user experience, when game-based design is used. An example is to show the customer how far they are with the credit application. This is supported by empirical research done by DeCos, 2015. She created and experiment by creating an e-platform, using future game mechanics. In conclusion the topics such as usability, usefulness, motivation and fun are helpful to meet the training goal. (DeCos, 2015).

Gamification will improve the user experience as the customer is informed of the end goal. For banking a relevant use case is straight through processing. This will significantly improve the user experience.

Furthermore, three areas were measured per pillar. These are implementation, relevance and timing.

Implementation measures to what degree gamification is currently implemented in various business units. 50% of respondents said gamification is not implemented in their business unit but they might investigate this, and 50% said that it is implemented in their business unit and could identify more than one use case. The reason for the diverse split is because some areas are more likely to use this tool than others, as this is more relevant to their business model and focus within the business unit. Learning and development has tested as the largest use case for gamification. Hence, if the specific business unit's core function is not learning and development, for either staff or customers in the form of education of various products and services, it is not used in that unit currently, and will test as not implemented.

From this the conclusion can be drawn that the gamification pillar form Industry 4.0 is implemented in pockets and smaller areas within the larger bank. This is relevant for the business banking models of the future and should be explored more.

Relevance measures how relevant gamification is to the various business units. In total only 21% of participants said that gamification is not relevant or somewhat relevant in their business units. The bulk of participants (79%) agreed that gamification is relevant in their business unit and could identify more than one use case. This use cases were mostly in learning and development but include elements of an improved customer experience.

From this it is clear that the gamification pillar for Industry 4.0 is relevant and has an impact on the business banking models of the future for the bank.

The third measure is timing which measures the time frame that gamification has been implemented or investigated in the business unit. 2 respondents said they are not investigating gamification and it is not applicable. 9 respondents said they have been investigating/implementing gamification for 1 - 4 years. 3 respondents said they have been investigating/implementing gamification for 4 or more years.

In light of these results, it can be concluded that gamification is relevant, although this is not implemented widely in the bank or investigated for an extended period.

The maturity of gamification was mentioned various times. The reason this pillar is not widely implemented and accepted in banking, is because banking is a conservative industry and this is a pillar that is not investigated widely yet. The issues of time, effort and investment required for implementation will have to be solved first to ensure there is a business benefit to do gamification. Quick development tools and methods will be required to implement this efficiently and effectively.

Respondents mostly agreed this pillar is relevant. Learning and development came up as the most relevant use case for gamification. Customers and employees of the bank are trained using this tool. For employees on the latest regulation and for customers to drive product adoption. Since banking is a highly regulated industry, employees are required to be trained on the latest regulation and changes. Gamification is used as a tool to develop training programmes to make this type of training more enjoyable. For customers the example will be to drive adoption of a new product. Customers are currently able to open an account by taking a “selfie” (photo of themselves, using their cell phones). This information is then used to identify the customer and obtain the relevant personal information from home affairs and the customer is verified. User experience improves as customers know what the end goal is, using the levels as a gamification tool.

It is clear that although gamification is implemented in pockets currently, this is relevant for Industry 4.0 business models and that the bank is starting to investigate this as a pillar to consider future growth and implementation of business models.

5.2 Pillar 2 - Blockchain Technology

The next pillar for discussion is blockchain technology. See the discussions of the themes below.

Three themes will be discussed in this section namely limited use cases and experimental/immature technology, feasible in a closed eco system (Permissioned blockchains) and why some participants see this as not relevant:

One participant said there are limited use cases to use this technology. Seven respondets said there are a lot that must be considered from a regulatory perspective on tax issues and disputes. Another two participants agreed the industry is immature, and five participants agreed this may be a future solution as the relatability and trusted partner idea must still be proven.

The above is supported by an international study done by the Vermont secretary of state, it was concluded that existing frameworks, for example the Uniform Electronic Transactional Act, does already cover the anticipated usage of blockchain. There are however gaps in these frameworks. These include for example implications for systems with no controller, the fact that this technology is still in infancy and the implementations are still not all defined. The validity of information within these bock chain records can also not be verified. In short, there are still a lot of unanswered questions, which only time will be able to solve. (Condos, 2016).

More limitations identified by a participant was the transaction volumes that is used for payments in banking, no blockchain technology can handle now. According to Blockgeeks (2020), Paypal manages 193 transactions per second and Visa manages 1667 transactions per second while Blockchain technologies, Ethereum and Bitcoin only does 20 and 7 transactions per second respectively. Scalability is still a problem to make this a mainstream technology. (Blockgeeks, 2020).

It was concluded that blockchain technology had limited applications and is a technology that must still be developed to a more mature stage before banking can consider this.

Five participants agreed blockchain can be used successfully for cross border transactions and added that a trusted exchange will be possible when doing contracting, specifically cross border, for example settlements of cars. This might mean that a closed eco system is required between relevant parties that the transaction is done to ensure security. These are referred to closed blockchains or permissioned blockchains and are private networks of shared records for transactions, thus only those with permission can access and transactions can be edited by administrators. (Vaughan, 2015).

Blockchain technology has applications within a permissioned blockchain for settlements of transactions. Three of the thirteen participants said that Blockchain technology is not relevant in their business unit. They could not identify any uses cases and mentioned regulation and priority as blockers. According to a study done by Accenture, reasons for internal resistance to blockchain were identified. 63% said regulatory, 56% compliance and 31% security. (Meszaros, 2016). These are the main reason that Blockchain technology is not as relevant within the bank, with the addition that this is an eco-system. Thus everyone needs to adapt this technology in order to integrate and make this relevant and successful.

Should these stumbling blocks be overcome, blockchain technology may indeed be relevant for banking going forward.

Implementation is a measure to understand to what degree the pillars investigated are currently been implemented in the business unit. A question was posed to the participants to understand if this technology is implemented and used in the business units. All participants said that blockchain technology is not applicable or it is very unlikely this will be implemented. The main reason that was given was the maturity of this technology. There are still a lot to be confirmed and implemented to ensure that this is a feasibly technology for banking.

Relevance is a measure to understand if the blockchain technologies are relevant to the business unit. From the participants it was clear that although blockchain technology is not implemented yet, most participants see this technology as relevant. 15% said that blockchain is relevant in their business unit and could identify more than 1 use case for

future use. 8% could identify 1 use case and 54% of participants are investigating this technology in their business unit. Only 23% of participants said this technology is not applicable in their business unit.

Blockchain technology will become more and more relevant as this is adopted more widely within the banking landscape. Regulation and security must mature in order to adapt this technology fully. Once more trust is established, this technology will flourish.

Timing is a measure of the time frame that blockchain technology has been implemented or investigated in the business unit. It is clear that most of the participants said they are not actively investigating or implementing blockchain technology. Eight of the thirteen participants said that blockchain technology is not applicable in their business unit. Only four said they are looking at and investigating blockchain technology. One participant said that they have been looking at some of the advantages and implementations for blockchain technology for 2-3 years, although this is still in infancy.

Once this technology is more mature and adopted more widely, this will gain the priority required to be implemented within the banking space.

Timing of future focus is a measure of the time frame to understand if this is a possible future implementation. Most of the participants said they can foresee blockchain technology play a role in future. Eight of the participants foresee implementation is still far off, longer than 5 years.

This is in line with the fact that blockchain technology is not mature as yet. This can only be matured with time. Blockchain technology is not implemented in the bank currently. Security and regulatory frameworks were questioned and confirmed by international research as the main reasons for resistance, as mentioned above. Most participants did however agree that although they are not actively implementing blockchain technology now, it is relevant and priority should be given to this.

Although blockchain technology is a pillar for Industry 4.0, the banking industry may not adopt this now. The main reasons are trust (security and regulatory included) and maturity

of this technology. Once this is more stable, banking will be interested in this. Another reason is the adoption of this technology. Once this is more widely adopted and appropriate networks can be built for integration, open and closed networks, traction and priority will be greater.

Change management will also be very important here. The human element of how this works and is implemented may take some time to settle. Systems will have to change in line with ways of thinking and working. This may be the biggest obstacle for implementation of this technology.

5.3 Pillar 3 - Biometric Technology

Five themes were identified for biometric technology namely verify customers and give them a richer user experience, limitation – single member entities only, drive efficiencies, security enabler and current uses.

Seven participants agreed that biometric technology will give the customer a richer customer experience and that this can also be used to verify customers automatically, using for example voice recognition and natural language processing. A participant also added this is an effective way to identify customers.

There are however limitations with the current technology. Currently this technology can only be used effectively for individuals or single member entities and not for larger companies.

Seven participants said that biometric technology is an enabler that drives efficiencies for the bank and the customers. The type of efficiencies includes verification and authorizations and can be done using biometrics as well as approvals and verifications and this will increase going forward. This will enable moving away from signatures and contracting can be done using biometrics going forward. It was also underlined that through the implementation this idea we will enable more effective data collection about our customers and help enhance their customer experience and assist them more effectively. This links to a theme identified in the “Other” section, where items were identified that were missing from the framework. This is discussed in section 5.6 Other, but it makes sense here to mention that with proper data interfaces, biometric technology will not get to its full potential, as clean and accurate data is required to ensure reliable biometric verification and authentication.

Biometric technology is also a security enabler. Four participants mentioned that from a security and risk/fraud perspective, more than one biometric must be used, example, finger print and password or voice/face recognition. If this service can be robust enough, it can be a product the bank offers to customers.

Three participants highlighted that the bank is already using biometrics to assist customers to log into their online banking using the banking app for online banking and within branches to verify customers.

The five themes are all underlined by an article written by Thakkar (2019), a senior product manager has implemented biometric technology for more than 10 years. He talks about the rise in identity fraud and that biometric technology can be used as weapons against this. This is the key technology to verify customers and includes a higher degree of security. Pins and passwords can be lost or hacked. Biometrics are used world-wide to identify customers on mobile devices, e.g. smartphones etc. it is also used for payments and to log into ATM's. Biometrics are helping people to perform multiple banking transactions. This is also an important aspect of security and assists to safeguard against spoofing and hacking of personal information. Customers are also assisted more efficiently as the speed at which they can be helped increases with Touch ID fingerprint sensors. Customers don't need to carry their identity documents with them and boimentric requirements are convenient and easy to use. Biometrics can also be used by banking employees to log into systems. The concept of single sign-on, having one sign of credential for various systems accessed, is becoming more popular, as only one password has to be used. This password can now be a biometric and no passwords will have to be remembered. (Thakkar, 2019).

According to a study done by Mane et al., (2011), it is important to use multimodal biometrics to minimize system error rates and increase security. This implies mutli-sources for biometric verification to ensure more accurate data. (Mane et al., 2011)

Implementation is a measure to understand to what degree the pillars investigated are currently been implemented in the business unit. A question was posed to the participants to understand if this technology is implemented and used in the business unit. The bulk of the participants agreed that biometric technology is actively implemented in their business units. 23% agreed that they are in advanced stages of the implementation. Only 8% said that this is not applicable to their business unit, this was in response for a support structure that only use this technology but does not actively develop this.

Relevance is a measure to understand if the blockchain technologies are relevant to the business unit. All participants agreed that biometric technology is relevant. Although not investigated in some units, this type of technology is an enabler for the usage of other services, e.g. access to online banking using finger print technology. Most participants, 77% said that biometric technology is relevant and could identify use cases. This is relevant technology.

Timing is a measure of the time frame that biometric technology has been implemented or investigated in the business unit.

The bulk of the participants indicated they are using and implementing biometric technologies for more than 5 years. Two more participants indicated that they are using this for more than 2 years and only one participant said this is not applicable for their area.

Biometric technology is a security enabler. From the themes discussed and measurement results above, it can be concluded that biometric technology is important to drive efficiencies for banking. With the digitization that is happening all around, there is an increasing demand for electronic verification of customers. Biometric technology is the answer and can be used in conjunction with passwords and devices or tags to ensure a higher level of security.

From the measurements done within the organization, it is clear that over 90% of participants agreed that biometric technology is actively implemented in their areas. Some agreed to a greater and some to a lesser extent, but it is clear this is a relevant technology. From a timing perspective the bank has been implementing biometric technologies for the past few years and this is on a medium to large scale of maturity.

There is however a draw back with biometric technology. To solve for multi member entities and corporate companies there is still some work that must be done.

To ensure longevity, it is imperative that banking models of the future implement biometric technology, not only to ensure advanced security but also be ensure customers are

served more efficiently. This is in-line with the Industry 4.0 implementation for business models.

5.4 Pillar 4 - Digital investment

Six themes were identified namely efficiencies, data and data enrichment, complex process and environment, platform, legal and the same advice available to all customers.

Eight participants agreed efficiencies are driven by digitising the investment process. The types of efficiencies mentioned included that digitization is the better and faster option to get results, volumes can be handled better, a lot of data can be analysed quickly to make recommendations and assist the customers in decision making. Bayon (2018) also mentioned in his research that the main competitive advantage of robo-advisors is their ability to manage massive amounts of data. (Bayón, 2018).

It is difficult to scale financial advisors to ensure all have the desired training. It is easier to scale digital investments and they are quicker to do data crunching. In addition, another use case was identified. This is for credit applications. With digital investment there can be straight through processing with less handoff points. This in turn drives a better customer experience.

To drive efficiencies, branches will have to become sales centres and not transaction centres. As Skinner (2014) states, tellers should become sellers. (Skinner, 2014). Machines can do most transactions much better and faster than humans can. Another success factor mentioned by Markovitoh et al., (2014), is that end to end customer experience is important. (Markovitch et al., 2014). This underlines the fact the straight through processing, looking at the end to end process can not only drive efficiencies, but also a better customer experience.

Various considerations were identified with digitization. These include that clean data is required and that a lot of data crunching is required. A participant also mentioned that real-time data is required for effective use of digitization. One participant said their business unit is already collecting data and enrich this to ensure they are able to give customers accurate advice. This includes giving the banker context on the customer's experience from the last visit as an example. This enables the bank to interact with their customers more efficiently. Banks of the future will need to ensure they are able to

differentiate themselves. Advice will be a differentiator if done properly. Data enrichment will provide the tools for this.

In his book, “strategies” to launch or become a digital bank, Skinner (2014) said the future of banking is all about data. Compared with 40 years ago, we have a data explosion currently. He said that data is like new oil. (Skinner, 2014). He added that complex process cannot be digitised completely. This includes for example judgemental credit, which need human intervention to complete the process. These processes must be considered case by case. The fact than South Africa have various languages and low levels of education in some areas, make it difficult to implement robo-advise with a high level of confidence. The output that we can expect currently is also limited. Most participants said that a decision tree is used to make recommendations as self-aware robots are 50 to 100 years away. Currently, robots are good at giving a specific answer to a specific question. Another consideration is that the bank requires a platform, thus the bank need to be able to use and leverage any system and capability to assist a customer effectively, taking all the information into consideration. Two participants also mentioned that priority must be given to projects to enable robo-advice. Another participant said that robo-advice is definitely the end game, but maturity is required for successful implementation. He mentioned that this can take up to at least 15 years and we are busy putting the building blocks in place to do this now.

In an article by Markovitoh et al., (2014), they discuss the demand that customers put on companies. Due to disrupting companies like Amazon and Apple, customers expect all companies to have a quick and seamless digital experience, intuitive interfaces, around the clock availability, real time fulfilment and zero errors. Customers are demanding companies to radically overhaul business processes. Success factors identified are to build inhouse capabilities or a centre of excellence. (Markovitch et al., 2014). In the bank investigated, this is called this platform.

Five participants said the legal framework under which digital investment and robo-advisors operate must still mature. The current legal landscape does not allow for full end to end robo-advice. The governance and legal considerations are important for robots.

From a study done by Bayón (2018), on the legal framework for robo-advisors the researcher agreed that it is clear there are some risks that arises from algorithmic training i.e. robo-advice. More control and supervision are required to strengthen resilience of markets in light of the technology developments. The researcher also mentioned that what he terms as “robolaw” should be developed to solve current and potential legal conflicts. This includes for example that liability should be transferred to the accountable party, whether the programmer in the case of software design issues or the owners in the case of operational failure. (Bayón, 2018).

Eight participants said that advisory is a key part of banking going forward. Using robo-advisors can be a great addition for customers to enable the bank to give them advice on the right products and enable them to make decisions on this information. The robo-advice can be used for self-service or it can be used by an employee of the bank to assist when advising customers. This is then the banker’s tool kit. Another advantage is that this will enable the bank to give advice to more customers, high- and low-end customers, or individuals to small and medium business. This can even include passive investment. Two participants added that this type of advice ensures there is no conflict of interest or bias advice given by financial advisors in his journal article, Maume (2019), describes a situation where small to medium income individuals currently do not have access to professional financial advice due to the cost and attractiveness of such an individual to the financial advisors. He suggests that with robo-advice, rich and poor will have access to the same advice. (Maume, 2019).

According to an article by Willmott et al., (2014), digitization is rewriting the rules of competition. Digitization lowers the entry barriers. Sectors that was long established become irrelevant. New entrants can scale up quickly at a lower cost than legacy banks can. (Willmott et al., 2014).

Implementation is a measure to understand to what degree the pillars investigated are currently being implemented in the business unit. 85% of participants agreed that digital investment is implemented in parts or actively in their business unit. The other 15% mentioned they are in advanced stages of investigating and investing in digital technologies.

Relevance is a measure to understand if the digital investment are relevant to the business unit. 62% of participants said digital investment is relevant to their business unit and could identify more than one use case. The other 38% said that digital investment is relevant and that they are in the investigation phase.

Timing measures the time frame that digital investment has been implemented or investigated in the business unit. All participants are busy with digital investment in their business units. Most participants are implementing digital technologies between 3 and 4 years.

Due to the sheer volumes of data and the demand that customers place on companies, digital investment is unavoidable. The original definition given by the framework mentioned the digitization of the investment process. There is a great benefit to do this for customers, so that all will have access to the same tools to invest. This will help the bank to serve more customers with investment advice, digital investment definition must include more. For the sake of differentiating it is termed digital investing. Digital investing is defined by not only automating of the investment process but also includes updating or decommissioning of legacy systems, to ensure that a “platform” is built with capabilities or centres of excellence to provide services for consumption. Investment is imperative to future proof the bank.

Using this definition, the bank is currently actively investing in various business units. All the participants agreed that digital investments are relevant and are actively implemented. Business units see the value in investing in digital platforms. About 50% of participants said they are busy with digital investing for at least 3 or more years.

Data enrichment is an important factor to consider when investments are made. Validated and high-quality data with tested and proven integrations will ensure that digital investment is successful. The correct and relevant information can be drawn from this enriched data.

Complex processes and legal considerations are however areas where digital investing must still mature. There are always exceptions to rules and what-if scenarios that cannot always be fully catered for in systems, either due to the cost and effort associated with it or that some decisions are judgemental in nature, i.e. a person with the correct knowledge and mandate must make these decisions. From a legal and regulatory point of view, legislation must be clear on the processes and accountability, specifically when things go wrong.

Digital investment is required to ensure biometric technologies can be implemented successfully. This is not only from a data perspective but also hardware and software development is required. The same goes for the other pillars investigated in this framework. To effectively and efficiently optimise and automate processes, digital investing is required in systems for the bulk of the processes. Gamification can also only be successful with large scale roll-outs, which require digital investing. It goes without saying the back bone and fundamentals that blockchain technology is built on, requires digital investing.

From the above it can be concluded that digital investing is not a pillar on its own, but rather a supporting layer that underpins the other pillars and essential for the Industry 4.0 readiness framework.

5.5 Pillar 5 - Process automation

Six themes were identified under the process automation pillar namely implemented and relevant, optimization sometimes lacks, applicable to mundane/relevant processes, paper based and integration, efficiencies and problems with integration and process optimization.

All thirteen participants said that process automation was something that was implemented in their area, that it is highly relevant and has been worked on in the last 5 years.

All participants confirmed that process automation is key for the relevance of the bank of the future. According to Jämsä-Jounela (2007), the importance of automation of processes has increased dramatically in the last few years. Process automation serves to enhance product quality and efficiently use resources. (Jämsä-Jounela, 2007). To ensure sustainability, banks must continue to automate processes.

Eleven participants raised that optimization is as important and sometimes a missing step. Many processes are not optimised currently, and automation is more their focus. Only three participants said they are actively optimising and re-engineering processes before automation is considered. This is concerning as optimization and relevant processes is the first step before automation. A process must be well defined to be optimised. Regarding relevant processes, these are processes that have longevity in the bank. This means that if a product for example will be phased out, we may not spend time to optimise this.

According to an article by Kelley (2010), the purpose of optimization is to achieve the “best” design relative to a set of prioritized criteria or constraints. It’s doing the most with the least. He further elaborates that in the traditional standards for technological literacy design process, optimization lacks many times. (Kelley, 2010).

Companies must accelerate the digitization of their business processes, going beyond automating existing systems and reinvent their entire process. This can be done by

starting with the end in mind. What is the required future state or future objective? (Markovitch et al., 2014).

A basic question: “Is this activity required?”, must be asked first as part of the process optimization journey. Process automation just implements the current process, and there is not improvement or examination of the current process. This process may be complex with unnecessary steps.

From the above it can be concluded that optimization must be considered as part of the analysis phase of projects implementations.

Six participants agreed that process automation should be done for mundane or processes with high repetition rate. This include well defined and relevant processes as mentioned in the previous paragraph. An article by PwC supports this and said that automation must be used to efficiently carry out manual, repeatable tasks and time-consuming tasks that are normally performed by people. (Killick, 2019).

It can be concluded form the above the bank should identify these types of processes for automation.

Five participants mentioned that paper-based processes must be eliminated. This is to ensure that information is readily available on the system. System integration between various systems is also a key consideration for process automation. Straight through processing goes hand in hand with system integration, i.e. for the various systems to integrate with each other to ensure a process without or minimal human intervention is required. This eliminates finger error and mundane data capturing. The human role should be monitoring and handling of integration errors.

This idea is supported by Dewa et al., (2019), that mentioned that Multilevel customer interaction and customer profiling technology is an enabling technology for Industry 4.0. (Dewa et al., 2019). This enables customers to take products and services up without assistance from employees of the bank. Customers interact with the bank when they are available and not necessarily within operating hours of the branch.

Most participants agreed with the benefits of process optimization and automation. Time efficiencies will improve, limited capturing between systems, real time data will be available, elimination of time-consuming paper-based processes and online processes for credit approval. The first building blocks are currently built for more integration and opportunities for optimization.

This idea is supported by Skinner (2014), as he mentions that banks are where they are today as a result of revolutions of computing power. Automation is imperative to take banks to the next level. Compared with 40 years ago, banks have automated their back office processes significantly. (Skinner, 2014). This leads not only to a better customer experience but also to more efficient and effective processes.

Process automation and system integration is not without challenges. System integration failures must be controlled and monitored to ensure that information is accurate, and the correct data is transferred between systems. The correct data must be defined to ensure the desired result are obtained. Process change is time-consuming as governance and regulatory frameworks play a large role to update and change processes.

Implementation is a measure to understand to what degree the pillars investigated are currently being implemented in the business unit. A question was posed to the participants to understand if this technology is implemented and used in the business unit. All participants agreed that processes are automated in their business unit. All see this as a very important aspect of the journey to be relevant for the future.

Relevance is a measure to understand if the pillars investigated are relevant to the business unit. All participants agree that process automation is relevant and could identify various use cases in their business unit. Process automation has enjoyed a lot of focus the last few years and this is embedded in the organization.

Timing is a measure of the time frame that the pillar investigated has been implemented or investigated in the business unit. All participants agreed they are investigating and implementing process automation for more than 5 years.

All participants agreed process automation is implemented, relevant and has been implemented for more than 5 years in their business unit. One participant mentioned that the reason for this is that process automation, as it is done currently in the bank, is due to the maturity of Industry 3.0. Another conclusion could be that banking has a lot of legacy systems that must be updated and expanded in a changing world. Systems and processes must be updated on a regular basis.

In this digital world where things move fast real time data is required to make decisions. Realtime information and reports are not possible without process automation and system driven approaches. This is an important consideration for effective Industry 4.0.

One concern to be raised is that optimization is sometimes lacking. To automate a manual process without optimizing and clearly review the business need, expensive resources are wasted. Banks must focus on doing the most with the least. This can be achieved to start with the end in mind. This pillar must be expanded to include optimization as an important factor for sustainable change. If this is done, efficiencies are driven and mundane processes are identified, optimised and automated. Irrelevant paper-based processes are cut out of the system automatically, as this is very seldom required.

Systems and process integration is a final important factor to consider. Experience is required to ensure that these implementations are done correctly and efficiently to minimise or eliminate integration errors.

Industry 4.0. core definition is embedded in fast change. The focus on process automation throughout the organization is required to ensure the bank is relevant in the future.

5.6 Other

A question was posed to the participants to determine what is missing from the framework. The main themes are discussed below.

Eight themes were identified for other or “missing” namely human element, big data, security, legacy systems, eco system to be created, risk-based approach, empathy and maturity of the 3rd industrial revolution.

Human element

All participants agreed the impact on the human element must be incorporated to ensure success for Industry 4.0 in banking. The motivation for this included that jobs, as we know it today, will be different in a few years’ time.

It is alarming to think that according to Manyika (2017), Director of McKinsey, educational systems have not kept up with the pace of the changing work environment. These include science, technology, engineering and mathematics (STEM) skills and critical, systems thinking skills, with creativity. These skills of the future include soft skills, e.g. emotional intelligence, adaptability and work ethic. which are not actively taught at school level. He also mentions that activities that workers carry out today have the potential to be automated. About 60% of all occupations can be at least 30% automated. This means that occupations will change. One-third of new jobs created in the United states in the past 25 years did not exist, or barely existed before. (Manyika, 2017).

This in turn, will mean that organizations will have to focus on change management and encourage employees to differentiate their skills and upskill themselves. Continuous and lifelong learning must be fostered. The way that skills were evaluated and measured previously will also change. Up to now, skills transfer from generation to generation meant that the skill that is transferred will enable the next generation to use this skill for a few more years. Going forward, the skills transferred will only be relevant for a short period of time and then these skills will have to be enhanced. In a study done by McKinsey’s Paris office, it was found that the internet destroyed 500 000 jobs in France in the past 15 years, but at the same time created 1.2 million others. Thus a net addition of 700 000 or 2.4 jobs created for every job destroyed. (Manyika, 2017).

Another consideration is to change the hearts and minds of people to embrace the change. Employee-employer relationships will change and people will have to adapt.

In an article by Markovitch et al., (2014), the idea of roll in, not out is discussed. The concept is that a new organizational unit should be established to drive the new digital process in parallel with the current process. Employees are brought into this new unit as volumes increase and this ensures a much easier transition than trying to spend time and energy to change old habits and behaviours. (Markovitch et al., 2014).

Big data

Data was identified as a major missing component to the framework. This includes data enrichment, data management and data analytics. Going forward a data centric customer experience is required. Data is required to effectively understand customers. This will assist in anticipating what they will require. In future, predictive analytics will be the "differencing factor". Joshi (2017), founder and CEO of Allerin shed some light on why this is important. The why he defines as to retain customers loyalty and to maintain regular profits. This is done by identifying new data, reaching out to customer and development of full-scale data projects. (Joshi, 2017).

Data is also required to identify processes that need to be optimised and automated. It is used to verify biometric information and to create digital investment platforms. Data is a major component of blockchain technology to ensure verification can be done and also of gamification to help understand where there are areas of improvement required for adoption for example.

To implement natural language processing and self-learning robots, data is required to design and monitor this.

Data sharing within the organization is important. This is to ensure a better customer experience because data is shared across the platform. An example of this is that once an identity number is shared, the address and other key relevant information is shared. The customer does not have to give this information again. This enables the customer to

take up various products and services across the banking platform. This may also change the way banking handles their processes going forward. An example of this is that if a customer has shown certain types of behaviour for a predetermined period of time, they may qualify for a larger home loan than they would now, using the tractional banking rules.

In call centres data can be used to handle the bulk of the calls that come through and the remainder can be handed off to the call centre agents.

The above is in line with findings from van Dyk (2019), in her study on Industry 4.0 that found that the way analytics will work for Industry 4.0 include automated analytics and robotic processes for digital tasks. (van Dyk, 2019). According to a PwC article, data analytical capabilities are the top priority for most of these big banks. (Camarate, 2017).

According to Dewa et al., (2019), big data analytics technology is an enabling technology for Industry 4.0. (Dewa et al., 2019). There are volumes of data available and new data is generated at a high speed. To enable Banking 4.0, business banking is investing heavily into big data technologies and the security thereof.

It is clear, that data plays a large role across the pillars for Industry 4.0. and is an important supporting layer to enable Industry 4.0.

Security

Three participants agree that security is a key consideration. All pillars and capabilities that are build, must be underpinned by security, ensuring maximum security when designed and built. This goes hand in hand with risk that must be managed and solved where possible.

According to Dewa et al., (2019), Authentication and fraud detection technologies are critical to enable Industry 4.0. (Dewa et al., 2019). With the high rate of cybercrime, security is the number one selling point for the bank.

Legacy systems

Two participants mentioned that legacy systems and how one maintains or decommissions these has a huge impact and cost associated with it. Yet, if not done, the future of the bank is in jeopardy. Upgrading the current systems into a platform is very important for the future of the bank. This item is already discussed and incorporated in the digital investing pillar as discussed in Section 5.4 Pillar 4 - Digital investment.

Eco system

To ensure survival, one participant mentioned that partnerships and collaboration between industries is required, creating an eco-system of value. This must not just be profit driven but also customer centric.

In a Journal article the concept of co-opetition was explored. This is simultaneous pursuit of collaboration and competition. The findings were that although challenging, co-opetition creates mutual benefits and generates innovation. This also causes subsequent co-opetition among other firms and large benefits are gained. (Park, 2011).

Risk based approach

Two participants also mentioned there is a risk as we go into the unknown. We are doing things we have not done before. These risks must be identified and managed accordingly. Risk experts must be included in discussions of new way of doing things from the start.

One participant said that customer empathy is something that must be actively managed. Customers do not always want to go digital and want further assistance to talk to a person. We are social beings and require interaction.

Maturity of third industrial revolution

One participant raised an interesting point and said that we are only now getting to the maturity of the impact on the third industrial revolution, which used electronics and information technology to automate production.

5.6.1 Summary:

The human and big data elements come out the strongest among all the participants. All expressed the value of considering this more. Although not so many participants identified security, this is an important element to consider. Cyber-attacks have increased over the last few years. According to Milkovich (2018), there is a hacker attach every 39 seconds, half a billion personal records were stolen in 2018 and that it takes nearly 6 months for companies to detect data breach. (Milkovich, 2019). Banks need to ensure that what is implemented is done so with maximum security.

6 Chapter 6 – Developing a Conceptual Framework for Industry 4.0 in Banking

This chapter proposes a revised framework for Industry 4.0 in Banking

The framework from Deloitte's, Dr Kobler et al., (2016), was used as a base for the research. The five pillars i.e. gamification, blockchain technology, biometric technology, digital investment and process automation were mentioned as the building blocks. Refer to Figure 2.1: Banking Business Models of the future , repeated below for easy of reference.

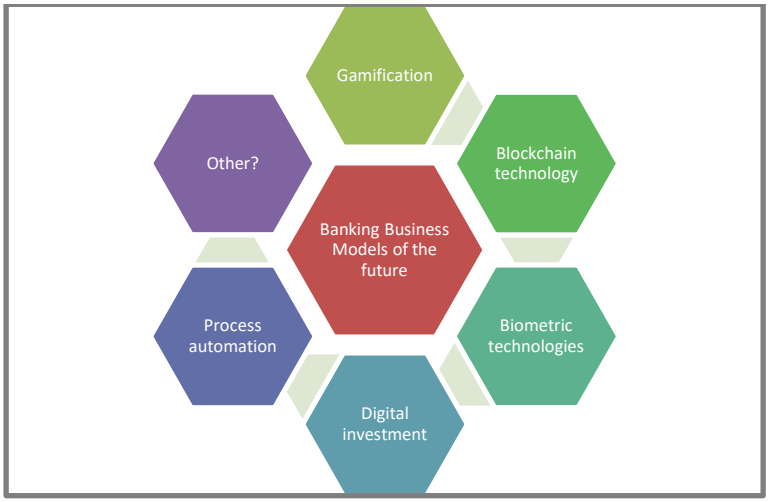


Figure 2.1: Banking Business Models of the future

From the research done, the following conclusions are drawn:

6.1.1 Order of framework

It was established that not all the pillars in the framework are as relevant to all environments as others in the current banking environment. This is discussed per pillar below:

6.1.1.1 Gamification

Gamification was described as enabler for a more enjoyable and richer customer experience. Throughout the study this definition has changed slightly to also include the fact the game mechanics are used to modify customer behaviour. This research established that training and development came out as important applications of

gamification, i.e. to ensure that compulsory regulatory training is done in a more enjoyable way. To ensure a more enjoyable customer experience is important, and elements should be used in the design thinking, but this is not a core banking function. The pillar also came out as being immature in banking as well as worldwide and still needs to be explored more as a whole. If one, however just look at one aspect, i.e. more enjoyable user experience, banks are actively driving this in their process thinking as well as customer interfaces.

6.1.1.2 Blockchain technology

It is concluded that blockchain technology had limited applications and is a technology that must still be developed to a more mature stage before banking can consider this. Although use cases of cross border transactions and easy flexible payments came through strongly, the risk and regulatory frameworks are not mature enough to incorporate this as an active product of the bank. The second key consideration is the key currency of banking is trust. Since blockchain technology is still a new technology, should the bank incorporate this as a key product, it could be preserved by investors and customers as a gamble, jeopardising the key currency, i.e. trust element, of the bank. Thirdly the technology is not widely adopted as yet. Once this is more widely adopted within the industry closed networks (permission blocks) might be considered. The low volumes compared with current systems (e.g. VISA), that blockchain technology can handle is also still a huge barrier for adapting this technology widely.

6.1.1.3 Biometric technology

It was established that the use cases for biometric technologies are vast. There is major opportunity within call centres to use voice recognition and to use finger prints as signature for contracts and verification and authentications of customers. There are however a few road blocks. Regulations, for example, require signatures to be in wet ink for some contracts. Secondly, the advancement of digital infrastructure i.e. artificial intelligence and robotics using natural language processing, is not at advanced stages as yet to enable the processing of the bulk of the call volumes. With the necessary digital investment and security implementations, these roadblocks may be overcome and enable biometric technology to be used for many efficiencies and use cases.

6.1.1.4 Digital investment

The original framework included digital investment as a pillar on its own. From this research, it is established that digital investment should rather be changed to digital investing and become a supporting, or base pillar. The reason for this is that digital investment is much more than robo-advice in the investment space. Digital investing is required for the enablement of all the other pillars. To establish a more enjoyable customer experience, digital investment is required to ensure that customer and user interfaces are rebuilt, the enablement of blockchain technology also required vast digital investment to enable platforms to build and support this. Biometric technology must be integrated into current systems and processes. To ensure this is done as effectively as possible, digital investment is required. Process automation cannot be done without investment in digital technologies and systems.

The only reservation is to ensure that robust legal frameworks are put in place to ensure that, where the lines are blurred between man and machine, the required legislation is in place to protect where necessary and prevent fraud.

In conclusion it is thus established that digital investing is a base pillar for all the other pillars.

6.1.1.5 Process automation

Process automation is a key component of Industry 4.0. Without process automation, there will be no straight through processing and a lot of manual processes. Currently this dampens efficiency, in that vast amount of data capturing is required, in and between systems and this not only causes bottlenecks and increased time to execute the process, but it also introduces problems like typing errors for example. It is however clear that process automation goes hand in hand with process optimization and establishment of process relevance. If a process is not optimised but automated only, this may mean that possible other integration points were not considered, and wastage not identified. The optimization and identification of the relevance of processes is sometimes lacking. It was concluded that not just process automation but also process optimization is a continuous improvement activity. This must be done in organizations on a continuous basis. System integrations should be managed efficiently and effectively.

6.1.1.6 Section conclusion

The current framework is, thus, relevant and applicable for Industry 4.0. with the following changes:

- Process automation should change to process optimization and automation.
- Digital investment should change to digital investing to broaden the scope of this important pillar and become a base pillar.

6.1.2 Timing of framework

The timing of the implementation required for each pillar was also investigated. An order of implementation was established. As follows.

6.1.2.1 Process automation and optimization

Process automation and optimization was established to be highly relevant and widely implemented throughout the organization. The recommendation is that this is the first step to ensure the bank is ready for Industry 4.0.

6.1.2.2 Biometric technology

Biometric technologies have vast benefits once implemented appropriately. This is the second pillar that must be implemented to ensure alignment and readiness for Industry 4.0.

6.1.2.3 Gamification

Gamification and a more enjoyable customer experience are an important aspect to consider. If systems and processes are hard to use, customers and users will try to avoid these where possible and just not use it.

This is however third on the list of timing and importance. The reason for this is that if the basics are not right, i.e. process automation and optimization and biometric technologies, there are limited use cases to enable gamification and more enjoyable customer experiences. These will then be limited to learning and development and not imbedded in the bank's DNA.

6.1.2.4 Blockchain technology

Blockchain technology is last on the list for timing and implementation importance. The main reason for this is that this is a new technology and still in an investigation phase. Banking, in general, is not associated with front runners in cutting edge technology. Rather they use established technology that has proven that it is trustworthy. Blockchain technology is still in its infancy stages when it comes to regulatory aspects, volumes and adoption. This is thus currently not a technology that should be in that front line of implementation for Industry 4.0.

As some of these aspects, however, fall into place, blockchain technology can change banking significantly. This should be consistently monitored.

6.1.3 Supporting pillars to the framework

Four supporting pillars were identified as part of the research, namely, human resources, digital investing, big data and security.

6.1.3.1 Human resources

Buy in from employees and customers is important to execute any strategy. Without the hearts and the minds of the people imbedded in the strategy, no successful strategy can be implemented. A transformative purpose is required for employees and customers to support the Industry 4.0. journey. This means that all should understand the why? Why is this required and why is this necessary. The how? is as important to understand, i.e. how am I, as the employee, impacted?
If these questions can be answered efficiently and effectively, the implementation of the strategy for Industry 4.0. will be successful.

People do however need to understand that change is inevitable. If they are unwilling to change and adapt, this will negatively impact them.

It is important for the bank to continuous update all employees of the latest developments and changes that happens and progress made. Also establish ways for employees to avail themselves for growth opportunities.

6.1.3.2 Digital investing

As discussed earlier, digital investing is a core supporting pillar to ensure the success of Industry 4.0. Investment in digital infrastructure across the board is required to enable processes and technologies. Vast investments are required to ensure that systems and processes are optimised, and legacy systems are replaced and that there is still a great customer experience. To enable biometric technology, gamification and blockchain technology, digital investing is required and thus identified as a base pillar.

6.1.3.3 Big data

Big data is also established as a base pillar for all other pillars. The reason for this is that data is required to understand which processes must be optimised, it is also used to enable biometric technologies and gamification. Data is also used for the execution of blockchain technology use cases. Data can assist the bank to enable them to understand their customers better. To enable customers to get the correct and required products and not just the latest special. Data enrichment is also required and have various applications. Data impacts the strategy and inform management decisions.

6.1.3.4 Security

Security underpins all of the pillars. The best process automation and optimization should be executed, using maximum security. The same for all the other pillars. Everything that is implemented must be done with maximum security. As mentioned before, the key currency of banking is trust. Privacy of customers must be valued, and risk must be minimized. With exceptional security the bank will continue to draw more customers and expand their foot print and enhancements required for Industry 4.0.

6.1.4 New framework

The new framework is depicted in Figure 6.124: Industry 4.0 Readiness Framework (HM Bohmer, 2020 ©). The four main pillars are process optimization and automation, biometric technologies, gamification and blockchain technology. The four supporting pillars that underpins these are human resources, digital investment, data analytics and security. This is encompassed by a customer centric approach, i.e. what will the customer think, experience or do. This is depicted in figure 6.1.

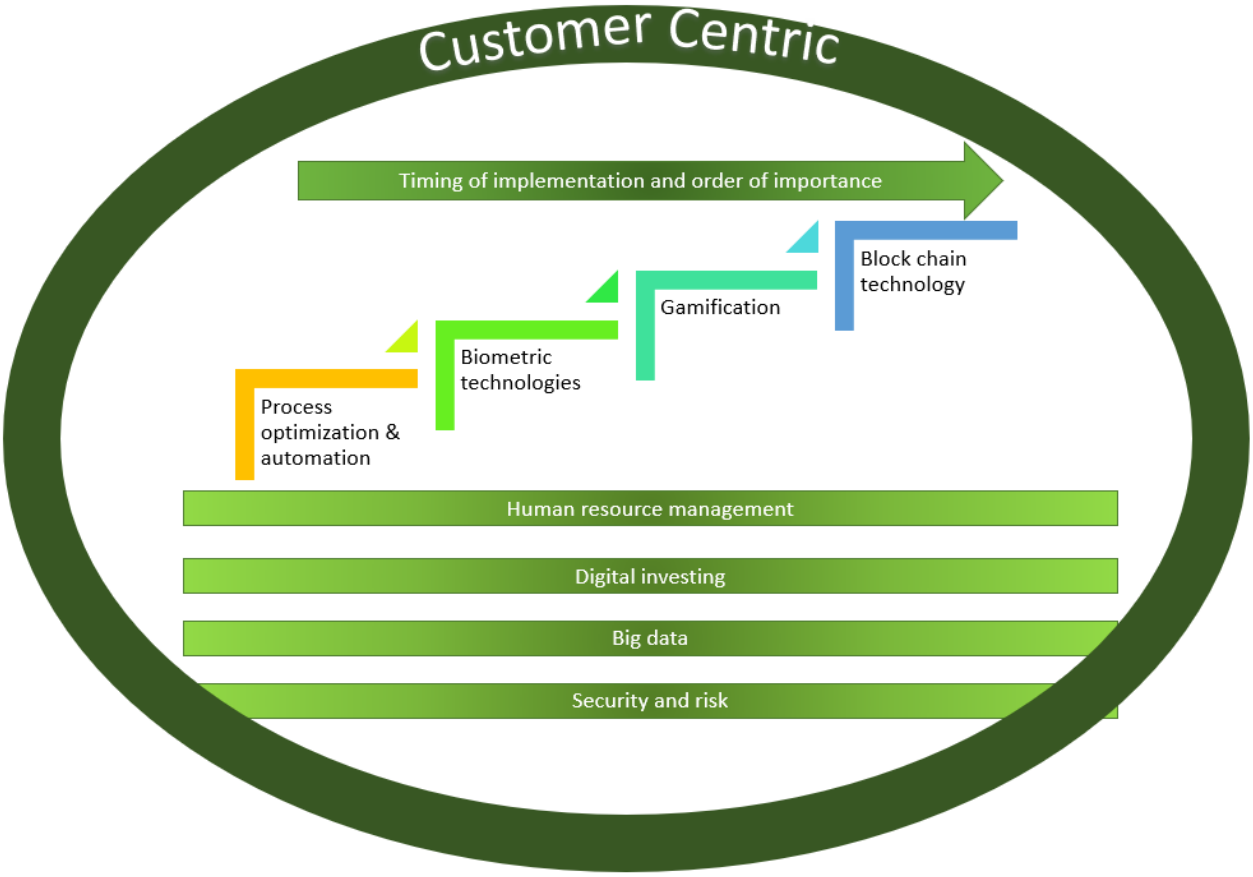


Figure 6.1 : Industry 4.0 Readiness Framework (HM Bohmer, 2020 ©)

6.2 Evaluating the implementation of Industry 4.0

To evaluate the implementation of Industry 4.0 in the business banking environment of the investigated South Africa bank the following was found. From a gamification perspective, implemented had a 50/50 split between implemented and not implemented, blockchain had zero implementation, biometric technologies nearly all participants were implementing this or at least investigating the implementation. For digital investment,85% of business units are implementing this actively and the other 15% are in advanced stages of investigating this. All business units were implementing process automation.

From the above, it is clear bank is currently implementing all of these game changing pillars in our organization to a more or lesser degree. Please see the figures below.

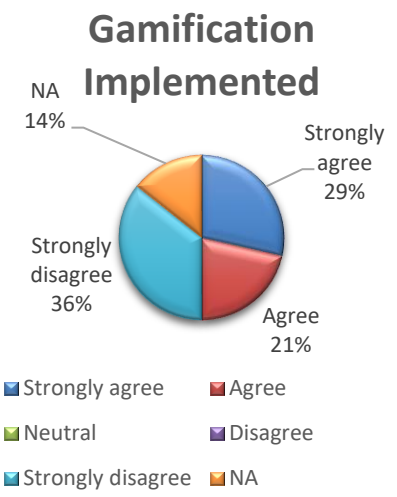


Figure 4.3 6: Implemented - Gamification

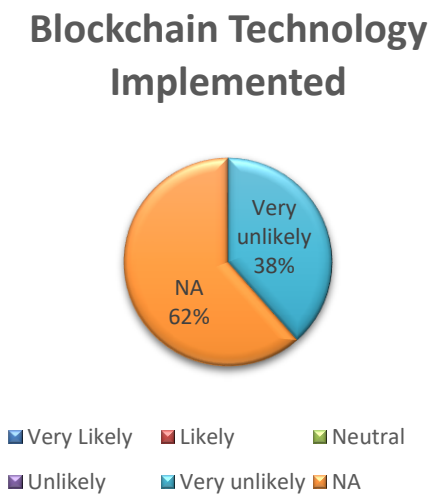


Figure 4.811: Implemented - Blockchain Technology

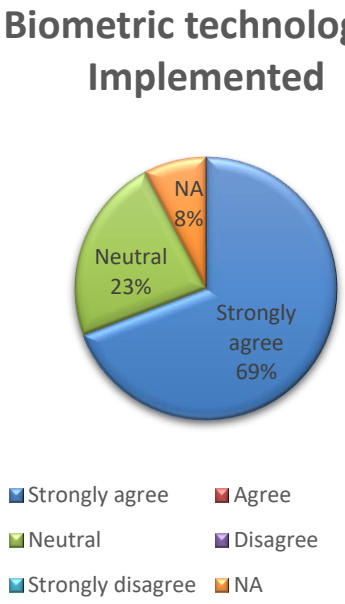


Figure 4.1215: Implemented - Biometric Technologies

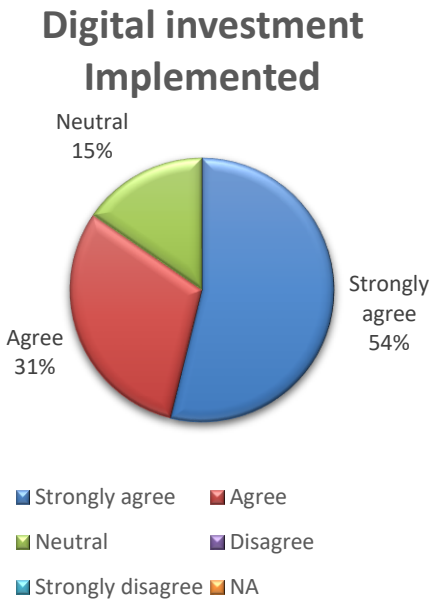


Figure 4.1518: Implemented - Digital investment

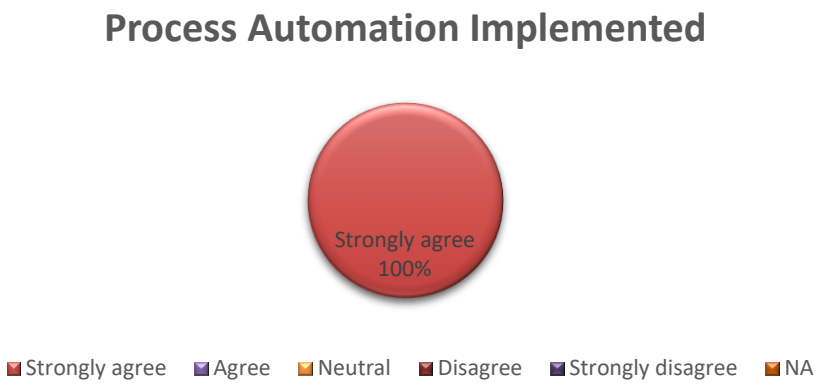


Figure 4.18 21: Implemented - Process Automation

6.3 Identifying the impact of the changes due to Industry 4.0, (2015 to 2019).

From the research it is clear that, except for blockchain technology, all of the other pillars are either investigated and/or implemented for the last 5 years, even though some might have been limited to 1 or 2 business units, e.g gamification and digital investment. Please see figures below.



Figure 4.69: Timing of usage - Gamification

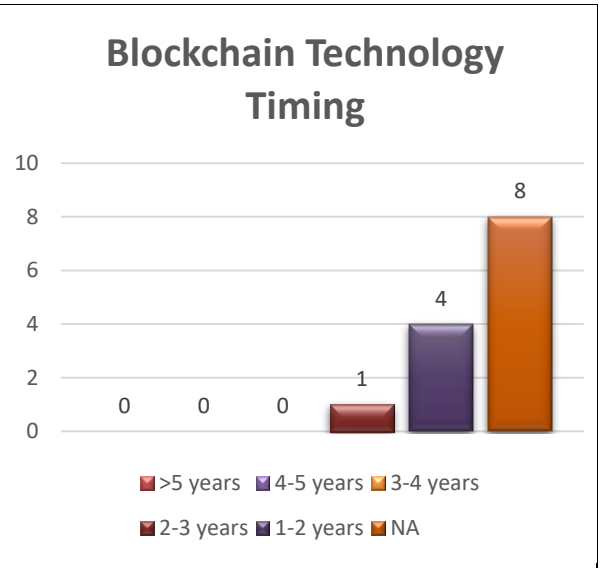


Figure 4.1013: Timing of usage - Blockchain Technology

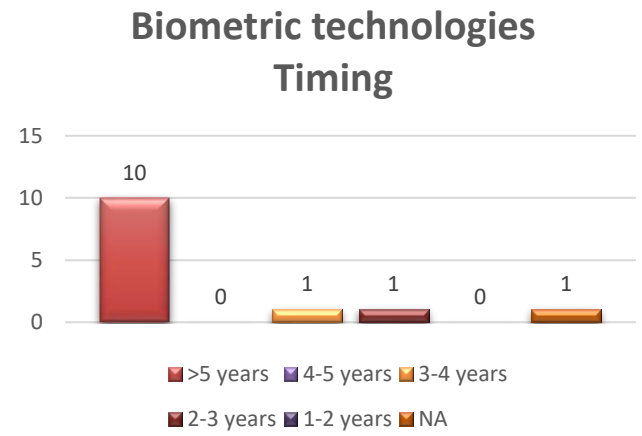


Figure 4.1417: Timing of usage - Biometric Technology

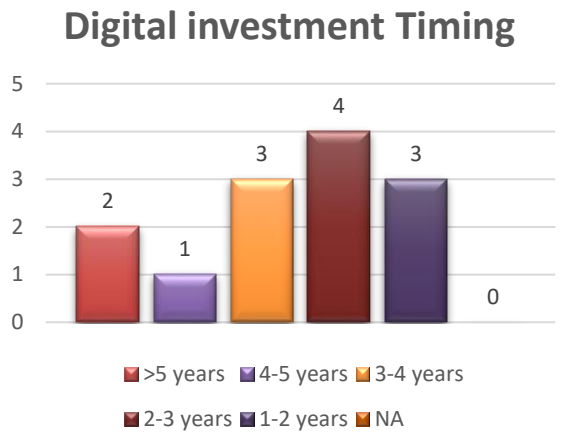


Figure 4.17 20: Timing of usage - Digital investment

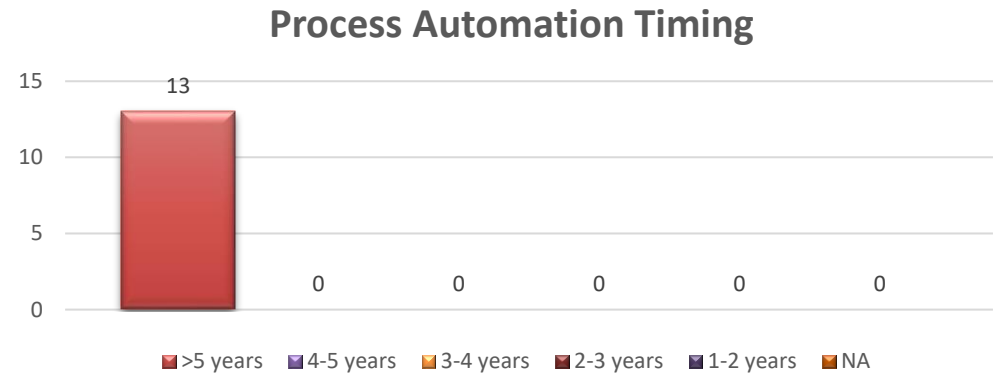


Figure 4.20 23: Timing of usage - Process Automation

The change in business models and strategic focus are evident in the graphs above. The bulk of the participants only started looking at gamification as part of their business models in the last 3 years. This has a significant impact on the way business models and strategies are formulated. Blockchain technology only started impacting business models in the last 2 years, yet the impact is still in an exploratory phase. Biometric technologies and process automation has had an impact on business models for the last 5 or more years. This impact is increasing as the focus greater. Digital investment is gaining momentum and has had a major impact on the business models in the last 5 years.

7 Chapter 7 Conclusions and Recommendations

The study started with the critical research question: What is the impact of Industry 4.0 on Traditional Business Banking Business models in a big South African Bank? How ready are we for this digital transformation?

The main objective of this research is thus, to investigate the impact of Industry 4.0 on Business Banking Business models in a South African Bank

This will be achieved by,

- Developing a Conceptual Framework for Industry 4.0 in Business Banking based on the research from Deloitte
- Evaluating the implementation of Industry 4.0 in the Business Banking Environment of a South African Bank.
- Identifying the impact of the changes due to Industry 4.0, in the Business Baking environment of a South African Bank between 2015 to 2019.

The impact of Industry 4.0 on business models is significant. Traditional banking models include branch banking, maintaining legacy systems and operating within complex structure. Future business models include digital banking or Fintech, capabilities or self-run centres of excellence, which included systems to support this and that are ideally self-maintained systems (including machine learning) and lean efficiency processes that are optimised to ensure complexity and only incorporated where absolutely required. These will enable banks to re-invent themselves and keep up with the increasing competition on the financial industry.

This should be done by leveraging their current industry advantage, i.e. being an established bank with thousands of current customers whom already trust them, to continue to innovate and grow and use their existing big data lakes to extract the information and reports required.

To elaborate, gamification was not a topic that was even considered 5 years ago within the banking context, yet now the bank has large projects and initiatives that investigates this and seek implementations of this pillar. This pillar will in turn be part of the enablers to ensure a smooth and customer centric experience and will continue to move the branch banking, or brick and mortar model of banking to a digital bank. It will also have an impact on the complex structures of the bank as all complex structures will be questioned and optimised where possible, to implement gamification.

Biometric technologies have also shaped the focus of business models. Call centres and branch banking can be done more effectively if implemented correctly. With regards to this pillar, the bank is actively implementing this and investigating new avenues to implement. Branch banking will be revolutionized by this as customers can be identified without any physical documentation. This will also impact complex structures and processes.

Blockchain technology is still in the infancy stages of development, regulation, legislation and adoption. As mentioned before, the key currency of the bank is trust and the only proven technologies are incorporated in their systems. The bank should however continue to monitor the progress on blockchain technology as this currently does not have an impact on the business model per se. Once implemented it will however have an impact on branch banking as this will encourage digital banking models, maintenance of legacy systems will be impacted as new systems and integration will be required and complex structures are challenged through blockchain technology.

Digital investing will ensure the current legacy systems are either decommissioned or enhanced to a place where a large legacy bank will become a customer efficient, cost effective digital bank. This will enable self-maintained systems and capabilities or platforms to establish the centres of excellence. This cannot be done with our optimised processes and structures. These changes will impact the business models and strategy to ensure that digital banking will become critical ibn the customer decision of the bank of choice.

Process optimization and automation will impact branch banking as customers will be serviced more efficiently. It also impacts the maintenance of legacy systems in the sense that if processes are optimised some of the systems may not be necessary anymore or optimised to use new systems. Complex structures are also impacted when processes are optimised and automated. To be ready for the digital revolution, the bank should actively focus on optimising business processes throughout.

Human resource management, big data and security and risk are the new pillars identified throughout this research. These pillars will impact traditional banking models in that they support the other pillars to effectively operate and be implemented. They assist in identifying changes required.

So, are we ready for this transformation? From the above research done, the conclusion is that if this bank continues on the current path, they are getting ready for the impact of Industry 4.0. All pillars are implemented or investigated actively and there is focus to drive this actively. Blockchain technology may be seen as the exception, but without a clear broader framework available to monitor it, this is currently sufficient.

7.1 Recommendations

To take this topic further the following can be investigated and researched. One of the points that came up in the “Other” section was the risks associated with the new way of doing things in Industry 4.0. Very little, if any, research has been done regarding this topic related to Industry 4.0. This has an impact on employees and customers.

Empathy with customers and the impact on them also came up as a point to explore more. The impact of these changes are a point for consideration.

It is recommended that further study is done on these two aspects to explore the findings from this study further.

8 References

Anderson, R. (2007). Thematic Content Analysis.

Annual Financial Statements First Rand. (2019). Annual financial Statements First Rand.

Annual Financials African Bank. (2018). *African Bank*. Retrieved from https://www.africanbank.co.za: https://www.africanbank.co.za/en/home/corporate-info-financial-reporting/

Annual Financials Capitec, B. (2019). *Capitec Bank*. Retrieved from https://resources.capitecbank.co.za: https://resources.capitecbank.co.za/Integrated_annual_report_2019.pdf

Bandara et al., O. a. (2019). A Model for Assessing Maturity of Industry 4.0 in the Banking Sector. *Proceedings of the International Conference on Industrial Engineering and Operations Management Bangkok, Thailand, March 5-7, 2019* (p. 1141). Bangkok, Thailand: Department of Industrial Management, Faculty of Science University of Kelaniya Sri Lanka.

Baptista, G. (2015). Why so serious? Gamification impact in the acceptance of mobile banking services. *Emerald Publishing Limited*.

Bayón, P. S. (2018). *A LEGAL FRAMEWORK FOR ROBO-ADVISORS.* Bern, Switzerland: Editions Weblaw. Retrieved from Schweighofer/Kummer/Saarenpää/Schafer (dirs.), Datenschutz/LegalTech: Tagungband des 21 Internationalen Rechtsinformatik Symposions IRIS

Benmlih-Taya, N. (2018). *https://www.quora.com/*. Retrieved from https://www.quora.com/How-many-transactions-do-typical-banks-process-everyday: https://www.quora.com/How-many-transactions-do-typical-banks-process-everyday

Bennett, K. (1995). Legacy systems: coping with success . *IEEE Software*, pp19-23.

Berger, R. (2019). *Robo advisors that make investing effortless*. Retrieved from https://www.forbes.com: https://www.forbes.com/sites/robertberger/2015/02/05/7-robo-advisors-that-make-investing-effortless/#6ab8de904ae4

Blockgeeks. (2020). *https://blockgeeks.com*. Retrieved from Blockgeeks: https://blockgeeks.com/guides/blockchain-scalability/

Bocken et al., M. a. (2018). Sustainable business model archetypes for the banking industry. *Journal of Cleaner Production, Vol 174, Elsevier*, pp150-169.

Businesstech. (2019). *New banks launching in South Africa soon*. Retrieved from https://businesstech.co.za/: https://businesstech.co.za/news/banking/260077/6-new-banks-launching-in-south-africa-soon/

Camarate, J. (2017). *A market place without boundaries - The future of banking - A South African perspective.* PwC.

Canvanizer. (n.d.). Retrieved from canvanizer.com: https://canvanizer.com/new/business-model-canvas

Chen et al., Z. ,. (2017). The transition from traditional banking to mobile internet finance: an organizational innovation perspective - a comparative study of Citibank and ICBC. *Financial Innovation*.

Christensen, C. (1997). The innovator's dilemma: when new technologies cause great firms to fail. *Harvard Business School Press, Cambridge*, p125-131.

Cohen, D. C. (2006). *Robert Wood Johnson Foundation*. Retrieved from Qualitative Research Guidelines Project: http://www.qualres.org/HomeSemi-3629.html

Condos, J. C. (2016). *Blcokchain Technology.*

Davamanirajan, P. a. (2009). Assessing the Business Value of Information Technology in Global Wholesale Banking: The Case of Trade Services. *Journal of Organizational Computing and Electronic Commerce*, p5-16.

deCos, L. (2015). OPPORTUNITY FOR BANKS TO UTILIZE GAMIFICATION AS A TOOL TO PROMOTE FINANCIAL EDUCATION TO CHILDREN. Degree programme in International Business.

Dewa et al., M. a. (2019). INDUSTRY 4.0: A MYTH OR A REALITY IN SOUTH AFRICA? *SAIIE29 Proceedings,* (p. 15). Stellenbosch, South Africa: 2018 SAIIE.

Drath, R., & Horch, A. (2014). Industrie 4.0: Hit or Hype? *IEEE Industrial Electronics Magazine (Volume: 8 , Issue: 2 , June 2014)* , https://ieeexplore.ieee.org/abstract/document/6839101.

Drever, E. (1995). *Using Semi-Structured Interviews in Small-Scale Research. A Teacher's Guide.* Scottish Council for Research in Education, Edinburgh.

Dworkin, S. (2012). Sample Size Policy for Qualitative Studies Using In-Depth Interviews. *https://link.springer.com/article/10.1007%2Fs10508-012-0016-6#citeas*.

Eaton et al., C. a. (2011). Understanding Big Data. In P. Z. Eaton, *Understanding Big Data* (p. p6). McGraw-Hill Osborne Media.

Etikan, I. (2016). Comparison of Convenience Sampling and Purposive Sampling. *American Journal of Theoretical and Applied Statistics*, 1-4.

Ganzarain, J., & Errasti, N. (2016). Three stage maturity model in SME's toward industry 4.0. *Journal of Industrial Engineering and Management (JIEM)*, pp1119-1128.

Gåsland, M. 2.-L. (2011). *Game Mechanic based E-Learning. Master's thesis. Trondheim: Norwegian University of Science and Technology.*

Grant, E. (2016). *The rise of Biometric Technology in banking*. Retrieved from https://www.financedigest.com: https://www.financedigest.com/the-rise-of-biometric-technology-in-banking.html

Guoping et al, L. Y. (2017). Fourth Industrial Revolution: technological drivers, impacts and coping methods. *Chinese Geographical Science, Volume 27, Issue 4*, pp 626–637.

Hawkins, M. (2019). President and Chief Financail Officer, Salesforce. www.linkedin.com.

Hennink et al., M. a. (2017). Code Saturation Versus Meaning Saturation: How Many Interviews Are Enough? *Qualitative Health Research*, 591–608. https://doi.org/10.1177/1049732316665344.

Huberman et al., ,. M. (2014:p71). *Qualitative data analysis: a methods sourcesbook.* USA: Sage Publications.

Investopedia. (2019). *Business Model*. Retrieved from https://www.investopedia.com: https://www.investopedia.com/terms/b/businessmodel.asp

Investopedia.com. (2019). *Fintech.* Retrieved from https://www.investopedia.com: https://www.investopedia.com/terms/f/fintech.asp

Itonics. (2019). *The digital bank how to make business models fit for the future*. Retrieved from https://medium.com/datadriveninvestor/: https://medium.com/datadriveninvestor/the-digital-bank-how-to-make-business-models-fit-for-the-future-fa2120ca4ec1

Jämsä-Jounela, S.-L. (2007). Future trends in process automation. *Science Direct, Elsevier Annual Review in control Volume 31, Issue 2*, pp 211-220.

Jetter, M. G. (2009). Technological Innovation and Its Impact on Business Model, Organization and Corporate Culture – IBM’s Transformation into a Globally

Integrated, Service-Oriented Enterprise. *Business & Information Systems Engineering*, pp37-45.

John Thompson, J. M. (2017 p 39). *Strategic Management Awareness and Change.* Andover, Hampshire, UK: Andrew Ashwin.

Jørgensen, H. a. (2007). Die Change Management Routemap: Empirie trifft Erfahrung. *Zeitschrift für Organisationsentwicklung*, pp87-89.

Joseph, M. M. (1999). Service quality in the banking sector: the impact of technology on service delivery. *International Journal of Bank Marketing Vol 17*, pp182-193.

Joshi, N. (2017). *To be customer-centric, you have to be data-centric*. Retrieved from www.allerin.com: https://www.allerin.com/blog/to-be-customer-centric-you-have-to-be-data-centric

Kelley, T. R. (2010). Optimization, an Important Stage of Engineering Design. *Utah State University - DigitalCommons@USU*, pp. pp18-23. Retrieved from https://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1031&context=ncete_publications

Killick, S. (2019). *Robotic Process Automation*. Retrieved from https://www.pwc.co.za/: https://www.pwc.co.za/en/services/advisory/robotic-process-automation.html

Kissflow. (2019). *Reasons why you automate your business process*. Retrieved from https://kissflow.com: https://kissflow.com/bpm/business-process-automation/reasons-why-you-automate-your-business-process/

Knight, J. (2019). Managing Ethics in Research. *Chair, University Human Research Ethics Committee (Non-Medical)*.

Kobler et al., D. D. (2016). *Banking Business Models of the Future.* Deliotte. Retrieved from https://www2.deloitte.com/content/dam/Deloitte/lu/Documents/financial-services/performancemagazine/articles/lu-banking-business-models-of-the-future-24052016.pdf

Lasi et al., H. P.-G. (2014). Application-Pull and Technology-Push as Driving Forces for the Fourth Industrial Revolution. *Business and Information Systems Engineering*, pp239-242.

Liang, Y. G. (2016). Blockchain application and outlook in the banking industry. *Financial Innovation*.

Mane et al., P. (. (2011). Review of Multimodal Biometrics: Applications, challenges. *International Journal of Biometrics and Bioinformatics (IJBB), Volume 3, Issue 5*, 33.

Manhart, K. (2015). Potenzial für den Mittelstand. Industrie 4.0 - Die nächste Revolution?. *http://www.tecchannel.de/itstrategie/2077662/industrie_40_die_naechste_revolution/.* .

Manyika, J. (2017, May). *Technology, jobs, and the future ofwork*. Retrieved from fs2.american.edu: http://fs2.american.edu/dfagel/www/Class%20Readings/Marx/Technology,%20jobs,%20and%20the%20future%20of%20work%20_%20McKinsey%20&%20Company.pdf

Market research. (2019). *My Market Research*. Retrieved from https://www.mymarketresearchmethods.com/quantitative-vs-qualitative-research-whats-the-difference/

Markovitch et al., P. W. (2014, May). Accelerating the digitization of business processes. *Co r p o r a t e F i n a n c e P r a c t i c e*.

Maume, P. (2019). REGULATING ROBO-ADVISORY. *Texas Journal of International Law, Volume 54 (2018/2019)*. Retrieved from https://ssrn.com/abstract=3167137

Mekinjić, B. (2019). THE IMPACT OF INDUSTRY 4.0 ON THE TRANSFORMATION OF THE BANKING SECTOR. *Journal of Contemporary Economic*, p6-27.

Meszaros et al., R. a. (2016). *How Blockchain Technology can Revolutionize Banking*. Retrieved from https://www.accenture.com/in-en/insight-blockchain-technology-how-banks-building-real-time: https://www.accenture.com/in-en/insight-blockchain-technology-how-banks-building-real-time

Meszaros, R. a. (2016). *Blockchain - How banks building real timeglobal payment network*. Retrieved from https://www.accenture.com/: https://www.accenture.com/_acnmedia/PDF-35/Accenture-Blockchain-How-Banks-Building-Real-Time-Global-Payment-Network.pdf#zoom=50

Microsoft. (2019). *https://azure.microsoft.com/en-in/overview/what-is-cloud-computing/*. Retrieved from https://azure.microsoft.com/en-in/overview/what-is-cloud-computing/: https://azure.microsoft.com/en-in/overview/what-is-cloud-computing/

Milkovich, D. (2019, Sept). *15 Alarming Cyber Security Facts and Stats*. Retrieved from www.cybintsolutions.com: https://www.cybintsolutions.com/cyber-security-facts-stats/

Moreno et al., J. P. (2015). Accenture: The Everyday Bank: A New Vision for the Digital Age, 2014. p1-5.

Muntean, C. (2011). Raising engagement in e-learning through gamification. *In The 6th International Conference on Virtual Learning ICVL. Cluj-Napoca.*

Natsas and Roopnarain, R. R. (2019). *Major Banks Analysis April 2019.* Retrieved from file:///C:/Users/f4924460/OneDrive%20-%20FRG/Other/Wits%20swot/Project/major-banks-analysis-april-2019.pdf: file:///C:/Users/f4924460/OneDrive%20-%20FRG/Other/Wits%20swot/Project/major-banks-analysis-april-2019.pdf

Ormrod and Leedy, J. E. (2016). *Practical Research: Planning and design 11ed.* Pearsone Education, Always learning.

Park, D. R.-J. (2011). Co-opetition between giants: Collaboration with competitors for technological innovation. *Research Policy Volume 40, Issue 5, June 2011, Elsevier*, Pages 650-663. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S0048733311000187

PASA. (2018). *http://www.pasa.org.za/national-payment-system/overview*. Retrieved from http://www.pasa.org.za/: http://www.pasa.org.za/national-payment-system/overview

Picot A, R. R. (2008). Information, organization and management. . *Springer, Berlin*, p7.

Prause, G. (2015). SUSTAINABLE BUSINESS MODELS AND STRUCTURES FOR INDUSTRY 4.0. *Journal of Security and Sustainability issues nr.5_2 internetui*.

Rennunga, F. ,. (2016). Service Provision in the Framework of Industry 4.0. *ScienceDirect - International Symposium in Management*, p372-377.

SABRIC. (2018). *https://sabric.co.za/*. Retrieved from https://sabric.co.za/: https://sabric.co.za/

Saebi, T. L. (2017). What Drives Business Model Adaptation? The Impact of Opportunities, Threats and Strategic Orientation. *Long Range Planning Volume 50, Issue 5, October 2017,*, pp567-581.

Saldana, J. (2009). *The coding manual for Qualitative researchers.* Los Angeles, London, New Deli, Singapore, Washington DC: SAGE.

SAPTeams. (2019). *Internet-of-things.html*. Retrieved from https://www.sap.com: https://www.sap.com/africa/trends/internet-of-things.html

Schwab, K. (2018). The Fourth Industrial Revolution.

Sentryo.net. (2019). *Sentryo*. Retrieved from www.sentryo.net/: www.sentryo.net/the-4-industrial-revolutions/

Sharma, G. (2017). Pros and cons of different sampling techniques . *International Journal of Applied Research 2017; 3(7):* , pp749-752.

Simoes, J. D. (2013). A social gamification framework for a K-6 learning platform.

Skinner, C. (2014). *Digital Bank stratagies to launch or become a digital bank.* Singapore: Marshall Cavebdish Business.

Ślusarczyk, B. (2017). Industry 4.0: Are we ready? *Polish Journal of Management Studies* , 232-248.

Ślusarczyk, B. (2018:p232-p248). Industry 4.0 – Are we ready? *POLISH JOURNAL OF MANAGEMENT STUDIES Vol. 17 no. 1*, p232-p248.

Statista. (2019). *Statista*. Retrieved from https://www.statista.com/statistics/: https://www.statista.com/statistics/488376/forecast-of-smartphone-users-in-south-africa/

Strauss, A. L. (2017). *The Coding manual for Qualitative researchers.* Saldana.

Subvista. (2010, 03 25). *The Process of thematic analysis*. Retrieved from Sub Vists: http://subvista.wordpress.com/2010/03/25/new

System, S. (2019). *Survey System*. Retrieved from Survey System: https://www.surveysystem.com/sscalc.htm

Temkin, S. (2018). *PWC*. Retrieved from https://www.pwc.co.za: https://www.pwc.co.za/en/press-room/major-banks-analysis2.html

Thakkar, D. (2019). *Using Biometric Authentication for Customer Verification (KYC)*. Retrieved from https://www.bayometric.com: https://www.bayometric.com/biometric-authentication-customer-verification-kyc/

Thompson, J. J. (2017: p55). *Strategic Management Awareness and Change.* Andover, Hampshire, UK: Andrew Ashwin.

Thompson, J. M. (2017: p33). *Strategic Management Awareness and Change.* Andover, Hampshire: Andrew Ashwin.

University Of Missouri. (2019). *QUALITATIVE RESEARCH DESIGNS*. Retrieved from http://www.umsl.edu/~lindquists/qualdsgn.html

Vacca, J. R. (2007). *Biometric technology and verification systems.* Burlington, MA 01803, USA: Elsevier Inc.

van Dyk, L. (2019). What does Industry 4.0 hold for the discipline of production and operations management? *TRACC and POMS Conferance* (p. 21). Cape Town: CCI GrowthCon.

Vaughan, W. (2015). *Open vs Closed Blockchains — Let's End This Madness.* Retrieved from https://medium.com: https://medium.com/@WayneVaughan/open-vs-closed-blockchains-let-s-end-this-madness-8313e4095ead

Vizologi. (2019). *Vizologi*. Retrieved from Vizologi: https://vizologi.com/business-strategy-canvas/

Vyas, S. (n.d.). Impact of E-Banking on Traditional Banking. *School of Computer Science and Information Technology, Singhania University, Pacheri Bari, Jhunjhunu – 333515*, 4.

Wengraf, T. (2001). *Interview 'Facts' as Evidence to Support Inferences to Eventual Theorization.* SAGE Publishing.

Wengraf, T. (2001). *Qualitative Research Interviewing.* Sage Publication.

Wengraf, T. (2004). *The Biographic Narrative Interpretive Method Short guide.*

Wikipedia. (2019). *https://en.wikipedia.org*. Retrieved from Business Model: https://en.wikipedia.org/wiki/Business_model

Willmott et al., M. H. (2014, May). Strategic principles for competing in the digital age. *McKinsey Quarterly*.

Withers, I. (2019). *Reuters*. Retrieved from https://af.reuters.com: https://af.reuters.com/article/africaTech/idAFKBN1O30LX-OZABS?feedType=RSS&feedName=investingNews

Wu et al., X. a.-Q. (2014). Data mining with big data. *IEEE Transactions on Knowledge and Data Engineering (Volume: 26 , Issue: 1 , Jan. 2014)*, 97-107.

Yazdanifard et al., J. B. (2014, July). Applying gamification to the service industry as an effective way of gaining and retaining customers.

Yin, R. R. (2019). Case Study research and Applications Design Methods. In R. R. Yin. SAGE Publishing.

9 Appendix A – Respondents invitation letter

Date: 16 August 2019

Dear Interviewee,

Re: Participation in Research on "Banking 4.0 - The impact of Industry 4.0 on current Business Banking Business models in a big South African Bank*. How ready are we for this digital transformation?"

Thank you for agreeing to participate in an interview to assist with the research done on the impact of Industry 4.0 on business banking models in our bank*.

I am a part-time MSc student in the School of Mechanical, Industrial and Aeronautical Engineering at the University of the Witwatersrand, under the supervision of Mrs. Bernadette Sunjka. My MSc title is: "Banking 4.0 - The impact of Industry 4.0 on current Business Banking Business models in a big South African Bank*. How ready are we for this digital transformation?"

My belief is that the with the dawn of the digitization era, also referred to as Industry 4.0, all companies should analyse their readiness for this drastically change. I would specifically like to understand the impact of Industry 4.0 on your current business models and how it will impact the survival of the company.

I would like to formally invite you to participate in this study. As an expert and manager in our company*, a big and well-established bank in South Africa, your knowledge and experience would contribute significantly.

The study will be conducted between September and November 2019. Involvement in the study would entail two (2) face-to-face interviews with you, at your convenience. During these interviews I would like to understand based on your views and experience, how ready our company are for the digital transformation. I will also discuss a framework with you regarding the general digital journey and understand more about the issues faced in this

Participation in the study is voluntary, and you may withdraw at any time. Anonymity (regarding company name and any owner/manager/employee names) and confidentiality of information provided will be assured and respected. I would like to record the interviews, so I can later transcribe them. Your consent at the time of the interview will be requested. If you do not wish the interviews to be recorded this will be respected.

The results of the study will form part of my MSc dissertation report, and may also be reported in academic papers and at conferences. A summary of the results of the research will be made available to you on request.

Please contact me if you have any questions regarding the research and participation in the study.

I look forward to hearing from you.

Yours faithfully

Marlene Böhmer

Tel: 083 701 3586 Email: marlenebohmer@gmail.com

Supervisor: Tel: 011 717 7007 Email: Bernadette.Sunjka@wits.ac.za

*Company name omitted for privacy purposes

10 Appendix B – Letter of Consent



Dear Participant,

Thank you for accepting to participate in this study. Please complete this consent form as you see appropriate. By signing this consent form, you are indicating that you have read and understood the description of this study and that you agree to the terms as described below:

	Mark with X	
	YES	NO
I confirm that I have read and understood the information about this study as provided in the participant's information sheet.	X	
I understand that my participation is voluntary and that I am free to withdraw at any time without any penalties or negative consequences against me.	X	
I grant permission for the interview to be audio recorded.	X	
I agree that the information I provide may be treated as strictly confidential and anonymous and only the research team will have access to the interview data.	X	
I understand that the information acquired from the interview will not be recorded in excess of what is required for this study.	X	
I agree that the results of this study may be recorded in academic journals and at conferences.	X	
I have had the opportunity to ask any questions related to this study and I have had all my questions answered to my satisfaction.	X	
I may request a report summary, which will come as a result of this study.	X	

With full knowledge of all above-mentioned terms, I agree to participate in this study.

Participant		Consent taken by (Researcher)	
Name		Name	Marlene Böhmer
Signature		Signature	
Date		Date	

11 Appendix C – Research Instrument - Interview questionnaire



Interview schedule for Research Project for degree of Masters of Science in Engineering (50/50)

Title: Banking 4.0 - The impact of Industry 4.0 on current Business Banking Business models in a big South African Bank: How ready are we for this digital transformation?

*Student Name: Helena M Böhmer (*1761521), *Supervisor: Bernadette Sunjka*
School of Mechanical, Industrial and Aeronautical Engineering, University of the Witwatersrand, Johannesburg, South Africa.

Pre-amble: • Testing current business model with conceptual framework – explain this framework • Explain the first 3 revolutions • Explain what Industry 4.0 is - rapid development and advances in technology and digital transformation. One platform. Banking is a technology-based business. • Impact on our business – Banking is a technology driven business. We use a lot of IT systems to drive our business models • Test framework as not complete	
1.	**How do you understand digital transformation?**
2.	**What is the current business models that is used in your area? How is business done in your area?**
3.	**How did this change in the last 5 years?**

4.	**Interviewer to explain gamification. In your area, are the initiatives that drive gamification? How is this implemented in your area and how far?**
5.	**Was this considered 5 years ago?**
6.	**How is blockchain technology used in your area to assist e.g. simplify payments?**
7.	**Was this considered 5 years ago?**
8.	**Biometric technologies are implemented to ensure quick verification of customers. These include fingerprint verification, voice recognition etc to move away from passwords. How this is used in your area?**
9.	**How was this implemented 5 years ago?**
10.	**Digital investment, e.g. robo-advisors whom advise on investments or various products that is available for the customer need. What digital investments are made to assist with transaction volumes increase? How are these implemented. Have you experience a change/effect due to this investment thus far?**
11.	**When did this start and what progress was seen over the last 5 years?**
12.	**Process automation – making as-is process automatic: how this is used in your area? What is the impact of this? What initiatives are implemented to ensure large scale cost reduction?**
13.	**Is there improvement/change in the last 5 years?**

	How is this changing the business models?
14.	**Other – Missing from the framework?**

12 Appendix D - Interviews transcribed

Participant 1:



Interview schedule for Research Project for degree of Masters of Science in Engineering (50/50)

Title: Banking 4.0 - The impact of Industry 4.0 on current Business Banking Business models in a big South African Bank: How ready are we for this digital transformation?

*Student Name: Helena M Böhmer (*1761521), *Supervisor: Bernadette Sunjka*

School of Mechanical, Industrial and Aeronautical Engineering, University of the Witwatersrand, Johannesburg, South Africa.

Pre-amble: • Testing current business model with conceptual framework – explain this framework • Explain the first 3 revolutions • Explain what Industry 4.0 is - rapid development and advances in technology and digital transformation. One platform. Banking is a technology based business. • Impact on our business – Banking is a technology driven business. We use a lot of IT systems to drive our business models • Test framework as not complete	
1.	**How do you understand digital transformation?** We had a business model focusing in branch. Digital transformation is moving away from branch
2.	**What is the current business models that is used in your area? How is business done in your area?**

	Enable the digital move and migrate customers. Projects are implemented to enable things like finger print ID to log into accounts and verify customers as another form of authentication. Then a customer can have a better user experience. They do not have to stand in a que for a consultant to wait to make payments.
3.	**How did this change in the last 5 years?** Mainly through automation of various systems and processes using various technologies
4.	**Are there projects/initiatives or actions in your area planned or already running in your area that ensure alignment between current area and this new digital world? How far are you along this journey?** Answered in Q2
5.	**Interviewer to explain gamification. In your area, are the initiatives that drive gamification? How is this implemented in your area and how far?** It should, but I don't think currently we have a lot of stuff that's gamified. We look at usability first and then tech thereafter. This is not massive on the online channel We look at this on a project by project basis but still a lot of work needs to be done.
6.	**Was this considered 5 years ago?** There is no focus on gamification currently.
7.	**How is blockchain technology used in your area to assist e.g. simplify payments?** There are only one team in RMB that is experimenting with this currently there is not a huge focus on this within Digital. This tech can be used going forward but storing documentation and using personal information is in the distant future. We have heavy dependency on current tech, it will be difficult to change
8.	**Was this considered 5 years ago?** No, there is not a great focus, only within the last year. But definitely for the future, say in the next year years..

9.	**Biometric technologies are implemented to ensure quick verification of customers. These include fingerprint verification, voice recognition etc. to move away from passwords. How this is used in your area?** App and online log in and branch access.
10.	**Was this implemented 5 years ago?** Yes, from 5 years ago.
11.	**Digital investment, e.g. robo-advisors whom advise on investments or various products that is available for the customer need. What digital investments are made to assist with transaction volumes increase? How are these implemented. Have you experience a change/effect due to this investment thus far?** Secure chat is currently used to assist customers to help answer some questions. This then free our consultants to deal with more complex queries. They have bots that clean up data with efficiency. The Bot clear in 1 day 1000 to 4000 records vs person 1000 per week. (the bot is only in pilot, can be geared up more if required)
12.	**When did this start and what progress was seen over the last 5 years?** More than 5 years ago
13.	**Process automation – making as-is process automatic: how this is used in your area? What is the impact of this? What initiatives are implemented to ensure large scale cost reduction?** This is focused on extensively. Bots are used to optimise mundane processes.
14.	**Is there improvement/change in the last 5 years?** **How is this changing the business models?** There are a lot of focus on process automation currently and since the last 5 years.

15.	**Are there any other things that you are looking at in your area that can help with the digital transformation or things we should look at to help optimise and get ready for the transformation?** Answered below
16.	**Other - What is missing from this framework?** Decision making – using tech to ID problems within our system and solve problems efficiently. Use Internet of Things (IoT) to understand the customer better. Artificial Intelligence (AI) – build back into front end facing systems Human impact Use drones for delivery. We can use aviation technology within the bank

Participant 2:



Interview schedule for Research Project for degree of Masters of Science in Engineering (50/50)

Title: Banking 4.0 - The impact of Industry 4.0 on current Business Banking Business models in a big South African Bank: How ready are we for this digital transformation?

*Student Name: Helena M Böhmer (*1761521), *Supervisor: Bernadette Sunjka*
School of Mechanical, Industrial and Aeronautical Engineering, University of the Witwatersrand, Johannesburg, South Africa.

Pre-amble: • Testing current business model with conceptual framework – explain this framework • Explain the first 3 revolutions • Explain what Industry 4.0 is - rapid development and advances in technology and digital transformation. One platform. Banking is a technology based business. • Impact on our business – Banking is a technology driven business. We use a lot of IT systems to drive our business models	
1.	**How do you understand digital transformation?** Self service. The client can apply for overdrafts/loans etc via online/app. How do we do contracts (traditional manual tasks which are regulated) online?
2.	**What is the current business models that is used in your area? How is business done in your area?** Moving processes and systems into a digital space and improve user experience to enable banking everywhere

3.	**How did this change in the last 5 years?** In the last 10 years it changed. In 2017 there were only three people to automate the business process. Now to digitise (put things on a platform) there are over 50 people. The focus is much larger. There were a lot of building blocks that needed to be put in place first. One can for example get real time scoring (real time reply from systems), this can be digitised on systems as part of a larger system.
4.	**Interviewer to explain gamification. (Customer experience, competitiveness amongst ourselves) In your area, are the initiatives that drive gamification? How is this implemented in your area and how far?** This is relevant. Currently one can open accounts via online. This is customer centric and creates an enjoyable customer experience. We also focus on preapprovals for customers. Thus if a customer require a specific product, they are already pre approved and this can be taken up within seconds.
5.	**Was this considered 5 years ago?** The focus on this has increased within the last 5 years creating a better customer experience.
6.	**How is blockchain technology used in your area to assist e.g. simplify payments?** Single trusted source is relevant to credit. If the single trusted source can be vetted, credit can be done for those customers. Currently we are able to do scoring etc for our own customers, but for customers at other banks we cannot. With a single trusted source of data this can be done for other customers as well. (Verify buyer and seller). Books (credit records of customers) are sold off, thus one can bypass the bank. This is relevant but we are not focusing on this currently. Regulation on this must be finalised.
7.	**Was this considered 5 years ago?**

	This is not considered as there is no priority. There are talk of this within the last year, but definitely something for the future, about 5 years to go.
8.	**Biometric technologies are implemented to ensure quick verification of customers. These include fingerprint verification, voice recognition etc to move away from passwords. How this is used in your area?** This is relevant. Within credit we should use this more. Open account via selfie. But we need to contract you with the same tech. Business case and priority must prevail.
9.	**How was this implemented 5 years ago?** Implementation started about 2 years ago
10.	**Digital investment, e.g. robo-advisors whom advice on investments or various products that is available for the customer need. What digital investments are made to assist with transaction volumes increase? How are these implemented? Have you experience a change/effect due to this investment thus far?** This advice can be valuable in the credit space to advise customers on the way forward. Customers can take up products now which are not always the correct product for them because it is easier etc. with a robo advisor customers can get the correct advice and talk up products required. We need to be able to consume a lot of data to understand customer behaviour in order for us to give advice on the correct products for customers. Many businesses are small and require advice on facilities. Currently we do not give our business customers advice on facilities that must be used.
11.	**When did this start and what progress was seen over the last 5 years?** In the last 2 years there has been a major focus on this

12.	**Process automation – making as-is process automatic: how this is used in your area? What is the impact of this? What initiatives are implemented to ensure large scale cost reduction?** This is relevant We need to optimise more as we are only looking to automate the process currently. Process optimization is within the business space not in the system space. Need a clear as is process
13.	**Is there improvement/change in the last 5 years?** **How is this changing the business models?** In the last 5 years there has been a major focus on this
14.	**Other - What is missing from this framework?** There is more momentum Jobs might change due to automation. E.g. in Limitman there are a lot of people capturing information. This might be automated soon. Number of people halved, yet portfolio increased 5 times. More focus on people change. Skillsets change over time. A lot of credit managers but not a lot of developers, now more developers but less credit managers. Systems can manage more volumes

Participant 3:



Interview schedule for Research Project for degree of Masters of Science in Engineering (50/50)

Title: Banking 4.0 - The impact of Industry 4.0 on current Business Banking Business models in a big South African Bank: How ready are we for this digital transformation?

*Student Name: Helena M Böhmer (*1761521), *Supervisor: Bernadette Sunjka*
School of Mechanical, Industrial and Aeronautical Engineering, University of the Witwatersrand, Johannesburg, South Africa.

Pre-amble: • Testing current business model with conceptual framework – explain this framework • Explain the first 3 revolutions • Explain what Industry 4.0 is - rapid development and advances in technology and digital transformation. One platform. Banking is a technology based business. • Impact on our business – Banking is a technology driven business. We use a lot of IT systems to drive our business models	
1.	**How do you understand digital transformation?** For the first time we have things that make the human task easier not just physically, but also intellectually easier. This does mean that the cognitive contribution can be negated. Decisioning models is not new, but it was based on decision trees (if, then, else). Going forward interpretation will be required. Models can not only use linear information, but also complex information that up to now was only in the human brain. Previously human capabilities were extended (quicker and faster), but now it is replaced.

	The question around, where does people fit in, in 100 years from now?
2.	**What is the current business models that is used in your area? How is business done in your area?** This area gives transactional solutions e.g. payments, transfers, account verifications etc. The services that are offered is commoditised over the last few years. Process are improved, previously payments were expensive and were time consuming. Now payments are done by the thousands per minute, without human intervention. Payment is easy = move value. But it is part of a larger commercial process and at the end the payment flow. Going forward these transfers (payments) will be for free. This is not a differentiator. Going forward the value for clients will be how do a support the "something else" that the customer require as support to the moving of value e.g. payments. How can I help client with sourcing and GL reconciliation. Help clients with governance efficient and a differentiator. We are working towards understanding the client's behaviour. E.g. if I know their payment cycle I know when they have extra cash and when they require bridge funding. Understand how we can understand the corporate value proposition for their employees. Once we understand, how can we enhance our value proposition to make the employees value proposition more attractive which can not only benefit the employees and client, but also the bank. This can be due to the maturity of the 3rd revolution. But how to we look wider in Industry 4th. Understand the clients of our clients and their spending behaviour. E.g. we know that 17% of clients stop at another fast food chain with in 20min of them stopping at our client's fast food chain. Why is that? Maybe there is a behavioural pattern that the client obtains one piece of the value of the first stop and another piece at the second shop. Once we have this information, we are able to enhance out value

	proposition. This is complex data analytics which humans cannot do (currently) but machines are able to do this. How can we take our clients through a personalised process?
3.	**How did this change in the last 5 years?** NA – answered above
4.	**Are there projects/initiatives or actions in your area planned or already running in your area that ensure alignment between current area and this new digital world? How far are you along this journey?** NA – answered above
5.	**Interviewer to explain gamification. (Customer experience, competitiveness amongst ourselves) In your area, are the initiatives that drive gamification? How is this implemented in your area and how far?** This is not relevant currently in the day to day business. This is however in an exploratory phase and development teams investigate this.
6.	**Was this considered 5 years ago?** Only been considered with in the last 1 year
7.	**How is blockchain technology used in your area to assist e.g. simplify payments?** This is relevant, and investigation was done. But there is not a wide spread use case. Ripple and global transfers were technology that was considered but the current SWIFT already solved for this. Another use case is there clients are using blockchain in trading crypto currency we as a bank provide security for them to assist with their business. Current solutions are not reliable enough. In banking we currently do thousands of transactions per second. Crypto currency will only be able to do a few hundred per minute. Regulation is also a problem – Crypto cannot be guaranteed by a reputable body e.g. US government that guarantee dollars.

	It is also not a commodity e.g. oil, gold etc. that can be use to trade. Also, not a store of value for clients. There is a use case for movable assets and bond registrations e.g. vehicles, diamonds etc. but the infrastructure (Bankserv, deeds office etc) is still lacking. Stable coins are a possible use case. Current crypto currency is dependent on supply and demand. With a fiat currency one look at interest rates, inflation political stability etc. to get value. Stable coins (crypto currency) are linked to a fiat currency. If this pilot is successful, banking will start looking at how to trade in this currency. Banking is not going so much about the movement of value but value-added activities. Sore of value is not the biggest use case any more In the last 5 years we look at this accelerated
8.	**Was this considered 5 years ago?** This is only considered 1 year ago. Will be considered in the next 5 years.
9.	**Biometric technologies are implemented to ensure quick verification of customers. These include fingerprint verification, voice recognition etc to move away from passwords. How this is used in your area?** This is relevant. We need to look at a risks and security associated with this. Need to look at more than 1 biometric. Authorizations is done using biometric. And smart phones are used. Going to be more and more
10.	**How was this implemented 5 years ago?** Focus on this for the last 5 years
11.	**Digital investment, e.g. robo-advisors whom advice on investments or various products that is available for the customer need. What digital investments are made to assist with transaction volumes increase? How are these implemented? Have you experience a change/effect due to this investment thus far?** Robo advicers are not bias and are able to give better and more accurate information. Not conflict of interest.

	No relevant in the corporate space. More for low end customers. This can be used in the asset management space for individual investors. E.g. passive investment
12.	**When did this start and what progress was seen over the last 5 years?** Started about 1 year ago
13.	**Process automation – making as-is process automatic: how this is used in your area? What is the impact of this? What initiatives are implemented to ensure large scale cost reduction?** This is done extensively. RPA is used. Processes are checked (sanity checks are done) to see if it is relevant and makes sense and then automated. All processes that need a high level of repetition and large volumes need to be moved are used for this. Well defined processes.
14.	**Is there improvement/change in the last 5 years?** Started about 5 years ago
15.	**Other - What is missing from this framework?** **How will this impact the current employee, employer relationship.** Main difference between the first 3 revolutions and Industry 4.0, is that previously work done could be handed over to the next generation. With the dawn of Industry 4.0, one is not able to hand over the work done to other generations. Skills and work done previously one were able to do for the next 10 to 20 years. It could be handed over and then improved as it was still valuable. Now, people will need to be re-skilled and re-trained to still be relevant in jobs of the future. The demand is not less by gone in the next 5 years. How do we handle data and use this going forward. Industry 4.0 will change the concept of how we move the human context. Robots are used to monitor call centre agents.

	What is the regulation around robots, is it an entity that must pay tax, does it have legal rights and responsibilities.

Participant 4:



Interview schedule for Research Project for degree of Masters of Science in Engineering (50/50)

Title: Banking 4.0 - The impact of Industry 4.0 on current Business Banking Business models in a big South African Bank: How ready are we for this digital transformation?

*Student Name: Helena M Böhmer (*1761521), *Supervisor: Bernadette Sunjka*
School of Mechanical, Industrial and Aeronautical Engineering, University of the Witwatersrand, Johannesburg, South Africa.

Pre-amble: • Testing current business model with conceptual framework – explain this framework • Explain the first 3 revolutions • Explain what Industry 4.0 is - rapid development and advances in technology and digital transformation. One platform. Banking is a technology based business. • Impact on our business – Banking is a technology driven business. We use a lot of IT systems to drive our business models • Test framework as not complete	
1.	**How do you understand digital transformation?** We went from manual to automation. Principal – when we automate we go through a process of standardization Exceptions are not dealt well with in automation. Do simple well not complex and expiation. First focus is to look at the simple to automate functions and processes. We first standardise and then optimise

	There are a vast domain of people and business that we need to manage, hence we are standardising first and then optimising. Optimization is where we do machine learning and RPA. Once standardised we can use robotics to execute and do machine learning. Now one can take away the admin component from people and rather use their skills for judgemental work Value vs volume – volume is where there are a lot of admin work that must be done and value is where value is added – skills, experience and knowledge is applied Currently we are in the process to move from standardization to optimization. The optimization journey is still long. Digital transformation is never ending. The more data one collects on a process, the more simplified you make the process. One can then add more volume-based processes and then add more value. Summery – digitization is to automate and optimise simple mundane (repetitive, well structured) processes and allow people to do the value adding activities.
2.	**What is the current business models that is used in your area? How is business done in your area?** Answered in Q1
3.	**How did this change in the last 5 years?** Larger focus – much more focus on this. Only started about 5 years ago. Before we had limited, to no digital investment, in digitization. We had 37 standalone systems. Modular architecture is great, but it must talk to each other and become a platform. Last 4 years there was raped investment done toward digital transformation. R300million Results – structured data is collected so one can optimise. And also learn more about your processes. Previously it was manual – thus no “cookie trail” and hard to understand the processes because one cannot measure it. Efficiencies are important for digitization

4.	**Interviewer to explain gamification. In your area, are the initiatives that drive gamification? How is this implemented in your area and how far?** Gamification is when you make something simple fun. Credit is a very complex regulated environment. Currently we are looking more at user experience and how we simplify this experience. After this is done one can look at gamification. Gamification cannot work in a credit space. What we can do is to simplify the process to ensure that the customer have a good experience. Make it quick and easy. Not all tools can be used in digitization for every product. Gamification is for education and training internal. Measure where you are, before you gamify. Sometimes people are just not ready for it. Where are the people on the change management curve? Maybe we must jump gamification into Artificial Intelligence (AI) that AI can do the thinking to help simplify the process. People must do the value adding contributions. Foundation on gamification are applied but not to the full scale. It can be used as a marketing and adoption tool. But it takes a lot of effort and investment and results are not always that great. Months to develop and only 1 month in the clients world
5.	**Was this considered 5 years ago?** No only started looking at it in the last 1 year. Only in marketing and consumer.
6.	**How is blockchain technology used in your area to assist e.g. simplify payments?** Willing participants that is trusted in an exchange. When I received something I must trust that you are giving me the correct item. We want to remove paper, the transaction is a contract. Smart contracting. Blockchain can work for import and export. Exporters and importers and banks are on the same platform. Trusted exchange is done with data on this platform. Blockchain can only work if all (people and companies) participate in the ecosystem.

	The key assumption is that all participants that do exchange must be tech savvy. Everyone wants to do it but there is a trust issue. How do we get them all to participate? Use case 2 – to contract with big corporates. Legalities and regulation is stopping us. E.g. Signature must be in wet ink for suretyships. If we can use data exchange to do the contracting. Contracting takes a long time. With blockchain this can take a lot shorter. The market place concept of peer to peer lending. Regulatory issue is holding us back to build this out in banking. More focus on the last 3 years.
7.	**Was this considered 5 years ago?** Currently these is no focus on this. Maybe in the next 5 years.
8.	**Biometric technologies are implemented to ensure quick verification of customers. These include fingerprint verification, voice recognition etc to move away from passwords. How this is used in your area?** Credit use this. Currently call centre and biometric is used to verify customers. But the systems are all internal. And we are not using this internally as yet for internal customers on our internal systems. Since uses that use these systems are internal and behind the companies fire wall there is not a use case for this. We may however use object character recognition. Verification of a document. Verification of something. In this case a document.
9.	**How was this implemented 5 years ago?** Yes, from 5 years ago

10.	**Digital investment, e.g. robo-advisors whom advice on investments or various products that is available for the customer need. What digital investments are made to assist with transaction volumes increase? How are these implemented? Have you experience a change/effect due to this investment thus far?** Robo-advice is where the robot can ask many questions and the use will give the correct answer. E.g. Siri We are only touching on this. Asking a question and giving an answer, which is a scoring model. Someone must speak to you. Language is also a problem, in which language do the robot speak. What if the person has broken language of express himself not clearly? Use case is on banking App and online for training of customers. But to apply through the complex robots are good for volume transactions but not for serious judgemental tasks. Not in the credit world. When there is human judgement required one need a person. Not for top end customers. But for average customers. There is a limitation, we still want human interaction. Banking is large and serve a variety of people. Millennials will talk to robots. Currently banking is too complex and not user friendly to use this effectively on a wide scale. Here we need a trusted advisor. This may work in investments. There are so many options. A robot can help make a decisions but employees are needed for judgemental tasks..
11.	**When did this start and what progress was seen over the last 5 years?** 1 year ago we started
12.	**Process automation – making as-is process automatic: how this is used in your area? What is the impact of this? What initiatives are implemented to ensure large scale cost reduction?** A robot can work very well there.

	Integration must be done real time. Not in batch. Once a process is automated it can run 24/7. Risk is integration failures. A bot is interim architecture to end state architecture. But it provide a lot of relieve in the short term. Process optimization phases - Connection of data, understanding of data, next is events and triggers.
13.	**Is there improvement/change in the last 5 years?** Started implementing process optimization more than 5 years ago.
14.	**Other – missing from the framework** Machine learning – data support these things This can be part of robo advisory and natural language processing. Data is collected and feedback into the system. The system will improve and give a better output next time. All the pillars can run on this or not. If one can do this on machine learning, the system improve itself and there is not a big investment required every 3 to 5 years. In this way one can learn from yourself continuously and this can go exponentially. Artificial Inelegance (AI) is the architecture that must be used. AI = machine learning, natural language processing and robotics. Impact of this on people. Execution is holding us back and change management is to slow. This may cut out the people at the bottom of the salary chain. We need to upskill these employees. This will also expose top management whom does not add value to the organization but just get salaries. This may cause job losses in the lower bands. People must be re-deployed. We must start with this process. We need to rapidly apply change management to reskill people. We need to rapidly and exponentially deliver services quicker. The digital transformation is imminent. It will happen. People must not be short sighted. They must be willing to change. Companies doing business

	traditionally will not exit in 10 years. So if we are not changing the company the company is at risk of failure. Rapid digitization cannot replace experience.

Participant 5:



Interview schedule for Research Project for degree of Masters of Science in Engineering (50/50)

Title: Banking 4.0 - The impact of Industry 4.0 on current Business Banking Business models in a big South African Bank: How ready are we for this digital transformation?

*Student Name: Helena M Böhmer (*1761521), *Supervisor: Bernadette Sunjka*
School of Mechanical, Industrial and Aeronautical Engineering, University of the Witwatersrand, Johannesburg, South Africa.

Pre-amble: • Testing current business model with conceptual framework – explain this framework • Explain the first 3 revolutions • Explain what Industry 4.0 is - rapid development and advances in technology and digital transformation. One platform. Banking is a technology based business. • Impact on our business – Banking is a technology driven business. We use a lot of IT systems to drive our business models • Test framework as not complete	
1.	**How do you understand digital transformation?** Organization under go to maximize the value they create from new technologies. They are disruptive in their industry. Their primarily offer is a digitization or automation capability. This can be intelligent and proactive as supposed to only responding or improving efficiencies of steps in a process.

	Combined with this is the importance of platform thinking which enables a complex set of interactions to occur spontaneously and simultaneously within an eco-system. This is different to the value chain business models of traditional companies in that industry. Therefore the larger organization will invest in capability that it can harness to make progress on that digital journey of transformation, and through which those disruptive business models can be implemented. It is not a “waterfall” journey but an iterative journey, Agile and experimental. Companies must combine agile ways of working so that they can pivot as quickly as they need to when they release something works or does not work, because the frameworks and technologies that are out there still require use cases to be implemented, for us to demonstrate customer value, shareholder value. From this we gain valuably learnings that will then improve the way we tackle the next phase. This is different from previous journeys for large organizations. Currently we do things the other way around – use tested and tried methodologies. Its revolutionary.
2.	**What is the current business models that is used in your area? How is business done in your area?** AREA: PMO for the groups digital transformation journey. Business model is journey management. Impact on various business models and overview of all programmes that impact the digital transformation journey. They are at the forefront of the day to day activities and ways of working. Design artefacts on the wall, no boardroom tables and leverage creativity from a trust base source.. One capability – this approach need to be on any floor to help employees harness this creativity and trust based approach. My role is planning the journey on digital transformation. This is not predictable. Need some plan – cannot look at all the 4IR topics need to prioritise.

	There are various areas that they are involved in around payments, collections, investments etc.
3.	**What changed in the last 5 years?** Banking is a highly regulated and risk averse industry. Market like stability but within teams there can be more agility. But as one roll up into an organization, there needs to be extreme clarity on what your next quarter will look like as the market rewards you for this. One cannot run an organization on a stand-up meeting. It needs governance and structure. But the cultural approach and collaboration that one can bring and what happens behind the scenes can be changed. Banks are still in the process to figure out if they need to organise themselves around product or customers, is it segment, or a juristic vs individua? Going forward we will be organising ourselves around capabilities. These are not the traditional support functions e.g. IT, HR Finance etc. These are communities of practice. And multi-functional teams. How we draw from these and use these is how the organization of the future will flourish in the changing world. We have an owner manager culture but we have organised it again on a segment or business unit. Now we must leverage owner manager around e.g. go and build be best AI natural language processor in the world. This is a capability that everyone within the bank can plug in and use it in their area. e.g. Lego only have one yellow brick department. There are different configurations/built required. But they don't build a new department or factory every time. They leverage of what there already is and only build what is necessary. Harness of what there is. This is where we are – currently getting the capabilities in place.
4.	**Interviewer to explain gamification. In your area, are the initiatives that drive gamification? How is this implemented in your area and how far?**

	Gamification is a capability. Broader of customer enjoyment. It is behaviour modification. They are busy building a model and IP that will enable gamification based on what we currently think this is for the bank. Rewards and incentive driven modification of human behaviour is one approach which we have done well with ebuks. Another approach is around public recognition. E.g. CV on Linked-In for exmple is more updated than a Word document. Reason for this is that Linked-In gamify updating your CV. It will tell you that you are e.g. 60% complete. Create increased awareness via crowd source awareness that can verify certain information. Thus, linked in has modified behaviour. What are the use cases for banking? Customer enjoyment is one. Is it an avatar that pop into your banking? Is it a new user experience or different way of doing things? Is it another interface e.g. banking through a fridge? Use experience and customer enjoyment.
5.	**Was this considered 5 years ago?** We had gamification via ebuck but we did not see it as gamification. The lens we used to look at this was as adoption of products and channels. Days of channel adoption is over. Wat to ensure your customer interact in a way that extract value for all role players in the ecosystem. Exponential companies (companies where buyers and sellers come together without the firms core employees actualy doing this e.g. UBER/AIRBNB). This is called the network effect – a product or service becomes more valuable the more people use it. Extended way of thinking about gamification is how do we use the network effect to extract value in the banking eco system. This has not been done in banking before. Currently we are doing some use cases for these, from about 2 years ago.
6.	**How is blockchain technology used in your area to assist e.g. simplify payments?** There is an element of trust when we are using banking in the traditional way. Easy to do banking currently and we keep record of transactions.

	Crypto currency, e.g. Bit Coin uses blockchain or distributed leger as the system to do transactions. Making payments easier using this assume that you can use bit-coin to make payments to any merchant. This will make payments a lot cheaper and quicker. But does the merchant accept bit-coin or crypto currency as part of their payments? How do we convert this back to fiat currency (these are Rand, dollar etc. That is guaranteed by government). Thus, payments are a use case of blockchain. And this use case manifest is a crypto currency. Blockchain technology is much more interesting to banks for different use cases e.g. trade or freight forwarding, settlements across border and of registered transactions e.g. settlement of houses/cars. Record of transactions in a blockchain is held with every singly node (customers) participating in that network. E.g. App is a node that has access to a ring fenced set of transactions where blockchain has access to every single transaction. Blockchain threatens the revenue that banks make related to the commission of money send. This is a R10 trillion dollar payment market. Massive pool of revenue that crypto currency say that we can do it quicker, cheaper and faster. Trust element is still a major advantage for banks, people are more nervous of crypto currency. For banking the use cases to look out for is the non-crypto currency use cases. This is where peer to peer sales and transactions happen. And transparency is required. In future a use case can be that we offer a blockchain as a service to any individual of business transaction that needs to be recorded. There are currently investigations by the reserve bank to explore how to use blockchain technology effectively. They have to investigate if they will

	have a reserve on crypto currency. If this is approved, the fundamental why of how we think of money will have to change. Bit coin does not have a legislative oversight. Bit coin is for money what email was for the post. Use of bit coin depends on the adoption and legislation (handle of a dispute, taxes etc) Banking may go into an interbank “closed” blockchain to do payment and settlements more efficiently. Currently we are not looking within the bank specifically at bitcoin or blockchain technology. There is a payment modification stream running to disrupt. First rand does have investment in crypto currency start-ups but currently we are not bringing these into traditional banking. How will this look? Will you have a Bitcion account that you can access through your app and do simple transfers between you R account and your bitcoin account? How will these transactions be verified? Not a massive focus on this currently.
7.	**Was this considered 5 years ago?** No, this has not been considered. Maybe in the next 5 years, if technology advances allow for it.
8.	**Biometric technologies are implemented to ensure quick verification of customers. These include fingerprint verification, voice recognition etc to move away from passwords. How this is used in your area?** There is a capability called security where we try to leverage the digital resourced in one place. Biometrics is what is called three factor authentications.

	Password –One1 factor authentication – something you know. Two factor authentications is something you have – separate devise e.g. phone or digi tag or App thus something separate from the thing you want to gain access from. Three factor authentication – something you are. E.g. finger print, retina scan, facial reignition. Enterprise focus is currently on 2FA. Customer space there is biometric authentication, but more because it is a legislative requirement. Not convinced that we are using this to authenticate the citizens of our eco system. The thump print you scan only sync with home affairs, thus an extra level of assurance that this is the person that stand in fort of me. Currently only used for FICA requirements. Voice recognition – this is used on call centres as a customer convenience and a fraud management issue. Saving time in a call centre.
9.	**How was this implemented 5 years ago?** Going forward we may not use this as the first way of authenticating – started 5 years ago.
10.	**Digital investment, e.g. robo-advisors whom advice on investments or various products that is available for the customer need. What digital investments are made to assist with transaction volumes increase? How are these implemented? Have you experience a change/effect due to this investment thus far?** Digitising the investment process. This is about decisions and wealth creation. People with discretionary assets/income will use this as a tool to invest and make decisions about this. Decisioning made can come from AI that can analyse lots of data (from the person/market/investments) and can make recommendations. There is currently a robo advisor running in FNB. But this is limited scenario.

	Specific AI where a machine can do one thing really well is here today. AI general intelligence (copied the human mind) is 50 to 100 year away. This is where machines become self-aware. Before the dirty and dangerous jobs were AI 'ed. We were happy to give this away. The jobs that can be automated is the one's given away. Within investments if there is specific outcome required one can plug that information into an algorithm and this will be able to give you the specific advice required within a specific portfolio. This can do a good a job as a human. If however there are a general requirement, e.g. help me with my wealth, AI (Artificial Inelegance) cannot solve for this as the moment. AI work where things are specific and predictable and output criteria does not change, a machine beat a human, hands down. Where things are more general, humans is required. Trick is to get that sweet stop where machines end and humans start. What are the jobs of the future, what role does a human play and what role does a machine play. Self-driving cars vs trucking – fleet of trucks automated on highways. Predictions are normally wrong For banking – what is the repeatable input output scenarios, where a machine will do it better. What are the more creative roles that humans will do better? Less advisors and more portfolio manager, whom will understand goals and risks etc. Low market entry level customers can still have access to the robo advisor, if they are willing to populate this information to get to the answer.
11.	**When did this start and what progress was seen over the last 5 years?**

	We started 3 years ago
12.	**Process automation – making as-is process automatic: how this is used in your area? What is the impact of this? What initiatives are implemented to ensure large scale cost reduction?** Any flow of work is a process. Are we looking at value chain business models when we optimise the processes? E.g. we have a producer and a consumer. The product goes from a producer to a consumer and revenue goes back up. 4IR says everyone is producers, everyone is consumers. So it is spontaneous and simultaneous interaction of buyers and sellers. E.g. offer a bedroom in your house. Planforms are powerful as they bring together producers and consumers. Will our process optimization principals look at value chain thinking or life stages? Customers are interested in their life stage, and we are looking at moving paper faster from one department to the next. We must look at the interaction between people in the eco system as effective as possible. Uber leverage eco system thinking, not so much value chain thinking. Uber gives all the information to the customer and service providers and allow them to interact in the most efficient way. Thus processes are designed around this and not how can I do what I am doing currently to the best of my ability.
13.	**Is there improvement/change in the last 5 years?** Yes, we are busy with this for 5 years
14.	**Other - What is missing from this framework?** **Comments of the framework – add, remove** There are specific capabilities and conceptual priorities mixed. Data analytic are very important as part of process design. Bio-metric may be to low level, rather look at a broader security framework – link to trust of origination. The bank uses a framework that highlight capabilities which is driven by principals on how to implement and execute these.

	Lots of overlap and interaction – e.g. gamification must be built with maximum security using biometric. This can include AI/robotics and data Human element – people need a specific sense of value through their job. How will we scope and assess skills for these jobs? There will not be chaos in banking. But if a call centre agent can be replaced by a AI/robot that can natural language process and help with queries based on a library of a 1000 use cases, we should be able to solve 80% of calls and the 20% is handed off to humans. Volume of call centre agents will change. Look at up skilling and reskilling, new culture. People will always be necessary. Cost to income ratio of new companies is way lower that established companies. We will have to look at all avenues to ensure we can compete in the future. Need to be more efficient.

Participant 6:



Interview schedule for Research Project for degree of Masters of Science in Engineering (50/50)

Title: Banking 4.0 - The impact of Industry 4.0 on current Business Banking Business models in a big South African Bank: How ready are we for this digital transformation?

*Student Name: Helena M Böhmer (*1761521), *Supervisor: Bernadette Sunjka*
School of Mechanical, Industrial and Aeronautical Engineering, University of the Witwatersrand, Johannesburg, South Africa.

Pre-amble: • Testing current business model with conceptual framework – explain this framework • Explain the first 3 revolutions • Explain what Industry 4.0 is - rapid development and advances in technology and digital transformation. One platform. Banking is a technology based business. • Impact on our business – Banking is a technology driven business. We use a lot of IT systems to drive our business models • Test framework as not complete	
1.	**How do you understand digital transformation?** This is to use data to create value, not only for your own business but also for other businesses. Moving away from a vertical silo approach to a horizontal approach where we are building a platform. We are able to build business to both sides. There is not always a money driven approach. For digital transformation one creates an eco-system and everyone can become part of the eco

	system. The more information one can get and the more one can share and start having common data share, the more the revenue model or business model can work. Shared value concept instead of working in your own line of business and only do what you do. No more paper – this is part of the transformation.
2.	**What business models do you use in your area and how are you getting ready for it?** Currently our business models are not ready for digital transformation. We are employing a change manager to assist with the journey. The problem that they are facing is that even if they want to change the business model it is part of the larger organization. We got a lot of resistance from other areas. In iCustomer the customer journey begins in that the customer record starts and also closes at a point in time. To transform the bank one must build out the platform businesses for customer as this is the core of all banking. The customer record is created and the quality of the record is held in iCurstomer. The business model was that they get “orders” in from other businesses e.g. cheques, card etc. Then this functionality is build on the core system. New model – the platform have the following capabilities and these are the services that is in each of these services. E.g. verification is a capability and within this is a service that include recode the verification, store and retrieve it. Thus, if a request comes in for a service, the business unit can plug into this and start using it if its available.(API). If there is a request for the service that is not in the capability this service must be added and to be used for all going forward. The model then include a capability lead whom have a technical team that support them. The problem is that at the moment the rest of the bank does not work like this – pizza team/Amazon model. Difficult to change your business model in isolation. We want to give ownership and build horizontal.

3.	**How did this change in the last 5 years?** More focus in this model – on the last 5 years. But very uncomfortable. 2 models – one group sitting separately and building a “new” bank and the rest of us run the bank. Or use the resources we have to transform as we go – this is what we are doing. We are changing as an organization. (we must be able to produce on a daily basis and build new platform.) This is a massive effort to get people to understand. This takes longer. Execs are aligned. Digital transformation has a wide definition
4.	**Interviewer to explain gamification. In your area, are the initiatives that drive gamification? How is this implemented in your area and how far?** This is not done in iCustomer. Very practical. One must do these things in this area. If this is not done one can not do business with the bank. (account is closed). A bit of a stick approach at the moment.
5.	**Was this considered 5 years ago?** No. Not considered yet
6.	**How is blockchain technology used in your area to assist e.g. simplify payments?** No used in the area. Role is to create customer records and this is not part of the business model.
7.	**Was this considered 5 years ago?** No, not considered as yet.
8.	**Biometric technologies are implemented to ensure quick verification of customers. These include fingerprint verification, voice recognition etc to move away from passwords. How this is used in your area?** Core service for iCustomer.

	This can be built as a service that other companies can use and even the government can use. This is core to the iCustomer business model. As they verify and authenticate customers.
9.	**How was this implemented 5 years ago?** Yes – to verify customers in the last 5 years
10.	**Digital investment, e.g. robo-advisors whom advice on investments or various products that is available for the customer need. What digital investments are made to assist with transaction volumes increase? How are these implemented? Have you experience a change/effect due to this investment thus far?** Once a customer record is created, we start learning form the customer. How they do transfers and interact with us as a bank. What products they use. This information is fed back into the system and data sets are build out based on these interactions to understand customer better. These data sets can have major impact and benefit for advisory of our customers as data can be shared. This data can also assist the bank to help customers on their customer journey. Data sets are build and then data is enriched. E.g. recording the customer's last interaction as positive or negative and assist with the new customer interaction. This gives context to the offer or new interaction with the bank.
11.	**When did this start and what progress was seen over the last 5 years?** Yes, was implemented from 3 years ago
12.	**Process automation – making as-is process automatic: how this is used in your area? What is the impact of this? What initiatives are implemented to ensure large scale cost reduction?** Do a lot of process optimization. All processes must be reengineered. They track measures of success, as-is mapping, to-be mapping, where the gaps are and process failures.

	New processes are important as the current process may not support digitization. Old way of doing things must change.
13.	**Is there improvement/change in the last 5 years?** Yes, was implemented from 5 years ago
14.	**Other - What is missing from this framework?** **Comments of the framework – add, remove** Other – the hearts and minds of people must change. Does people understand what this is? Do people embrace this? Risk management is critical in digital transformation. The company go into a new space. In depth risk assessment is required from a legal and compliance and regulatory point of view. How will we constantly protect the client in this environment. Customer centricity is important on this journey. Client and company must benefit. Client experience is important. The bank does not understand this currently. What does the customer want not what does the company want to do with the customer. We want customers to open accounts. They want house finance, car finance etc. Outside in approach. We are taking existing processes and just automate it or digitise it. Customer experience science is important to understand. If it is easy to use a customer will use it. If this is hard to use customers will avoid using it.

Participant 7:



Interview schedule for Research Project for degree of Masters of Science in Engineering (50/50)

Title: Banking 4.0 - The impact of Industry 4.0 on current Business Banking Business models in a big South African Bank: How ready are we for this digital transformation?

*Student Name: Helena M Böhmer (*1761521), *Supervisor: Bernadette Sunjka*
School of Mechanical, Industrial and Aeronautical Engineering, University of the Witwatersrand, Johannesburg, South Africa.

Pre-amble: • Testing current business model with conceptual framework – explain this framework • Explain the first 3 revolutions • Explain what Industry 4.0 is - rapid development and advances in technology and digital transformation. One platform. Banking is a technology based business. • Impact on our business – Banking is a technology driven business. We use a lot of IT systems to drive our business models • Test framework as not complete	
1.	**How do you understand digital transformation?** I think it's quite simple having a look at how do you leverage the digital world and the digital ecosystem that's evolving to compliment potentially transform. Sometimes people think you need a digital product. But transformation can be applied to anything, digital product or traditional product.

2.	**What is the current business models that is used in your area? How is business done in your area?** Implementation of the digitization of all banking products
3.	**How did this changes in the last 5 years?** **Is transformation more rapid?** In banking we have been at this longer. Banking has been digitising in the last 20 years. This has not been applied equally to all areas of the bank. We looked at processes but not other areas. Now we are focusing on other areas more.
4.	**Interviewer to explain gamification. In your area, are the initiatives that drive gamification? How is this implemented in your area and how far? Is it relevant?** Gamification is still very raw. There is good theory in this. In what this could be. We are about 3 years away from leveraging the benefits of Gamification properly. I think maybe just maybe three years away from leveraging the promises of gamification property to figure out how to actually use this to improve our customers lives.
5.	**Was this considered 5 years ago?** This is only on the horizon for the 3 years.
6.	**How is blockchain technology used in your area to assist e.g. simplify payments?** Use cases for blockchain technology depends a lot on the trust element. To leverage this we need an industry decision. The industry must work together to make this work. We are looking at this in isolation, but it is like a hammer. One need to find the right nail to use it on. We need collaboration from an industry point of view to implement blockchain. There are various other technologies that can be used that are simpler. There are different ways to collaborate on the trust element to collaborate.

	Trust is the main element. How do you verify and trust? This must be an industry call. Difficult to leverage proper benefit if only one player is invloved. Use cases must be defined to add real value.
7.	**Was this considered 5 years ago?** No, this is not considered. Maybe in the next 4 years.
8.	**Biometric technologies are implemented to ensure quick verification of customers. These include fingerprint verification, voice recognition etc to move away from passwords. How this is used in your area?** There are use cases for this. We are leveraging these today if you look at the offerings on our channels. E.g. biometric is imbedded on the App. This does unlock a lot of value and business opportunities. Going forward some things will be taken for granted. And the fraud threads may increase. E.g. one can copy facial verification with new technology called “deep fake” This fake your biometrics. This is concerning and these bad actors will pose a huge thread. This is good for the industry and we are leveraging this. There is a risk but should be combined with something else. 1 factor plus 3rd factor authentication and an example.
9.	**Was this implemented 5 years ago?** Yes and a lot of this was done to verify customers in the last 5 years.
10.	**Digital investment, e.g. robo-advisors whom advice on investments or various products that is available for the customer need. What digital investments are made to assist with transaction volumes increase? How are these implemented? Have you experience a change/effect due to this investment thus far?** There are focus on this. With the investment, part of the business on the digitization journey needs a platform and digital is the place for this. Obviously interesting challenges comes in changing the traditional legal framework. But there are ways to work around them. E.g. legislation around whom can give advice. If this is digitized, what does this mean?

	What is the legal framework? This might take some time. We are looking at simple tasks first.
11.	**When did this start and what progress was seen over the last 5 years?** There is a greater focus on this in the last 3 years from a digital perspective.
12.	**Process automation – making as-is process automatic: how this is used in your area? What is the impact of this? What initiatives are implemented to ensure large scale cost reduction?** This definitely received a lot of attention over the last three ot four years. Previous it wasn't such a big agenda item. So we are starting to see the impact and the benefits of this. I think the challenge is our mindset. Are we automating an inefficient process or are we optimising it while we automate? Reengineering is important. Must do this first. Efficiencies are driven and this is an obviously one.
13.	**Is there improvement/change in the last 5 years?** **How is this changing the business models?** Yes - 5 years
14.	**Other - What is missing from this framework?** What are the cashless options – needing cash vesus not needing cash (Process) – do we need cash? Your view of human impact: Business models will change, and jobs types will change. But there will be new challenges. There will be a next revolution after this one. Are we managing effectively to upskill these employees which will be impacted by this new way of doing things? We are always providing opportunities, but it is the employees choice. The vision must be related to the employees that they can make informed decisions. Using AI, RPA? Yes, this is a risk use case that is focused on and we are using these tools to solve problems.

Participant 8:



Interview schedule for Research Project for degree of Masters of Science in Engineering (50/50)

Title: Banking 4.0 - The impact of Industry 4.0 on current Business Banking Business models in a big South African Bank: How ready are we for this digital transformation?

*Student Name: Helena M Böhmer (*1761521), *Supervisor: Bernadette Sunjka*
School of Mechanical, Industrial and Aeronautical Engineering, University of the Witwatersrand, Johannesburg, South Africa.

Pre-amble: • Testing current business model with conceptual framework – explain this framework • Explain the first 3 revolutions • Explain what Industry 4.0 is - rapid development and advances in technology and digital transformation. One platform. Banking is a technology based business. • Impact on our business – Banking is a technology driven business. We use a lot of IT systems to drive our business models	
1.	**How do you understand digital transformation?** Moving business to platform. This enable business to use source data
2.	**What are the current business models that is used in your area?** **How is business done in your area?** Our strategy is digitising
3.	**Please elaborate on above with regards to …..**

	We need to ensure that all our services and products are available on digital channels to enable customers to bank everywhere
4.	**How did this change in the last 5 years?** There is a greater focus on this within the last 2 years.
5.	**Interviewer to explain gamification. (Customer experience, competitiveness amongst ourselves) In your area, are the initiatives that drive gamification? How is this implemented in your area and how far?** This is relevant but not executed successfully. This is happening at a slow pace. There is a lot of red tape. Priority is on sales not equally in the other areas.
6.	**Was this considered 5 years ago?** The talk and investigation on gamification started in the last 1 year. Mainly around training and development
7.	**How is blockchain technology used in your area to assist e.g. simplify payments?** Yes is relevant for banking. We must explore this more. Risk and compliance must be considered. Currently this is not regulated. Risk must be looked at up front.
8.	**Was this considered 5 years ago?** This is not considered yet. Should be in the next 3 years.
9.	**Biometric technologies are implemented to ensure quick verification of customers. These include fingerprint verification, voice recognition etc to move away from passwords. How this is used in your area?** This is relevant. We are not using this effectively in business, only for single member entities..
10.	**Was this implemented 5 years ago?** Definitely started in the last 5 or more years to verify customers
11.	**Digital investment, e.g. robo-advisors whom advice on investments or various products that is available for the customer need. What digital investments are made to assist with transaction volumes**

	increase? How are these implemented? Have you experience a change/effect due to this investment thus far? This is relevant for the volumes for scoring but this is currently not been done. We are not focusing on this enough.
12.	**When did this start and what progress was seen over the last 5 years?** More focus on this in the last 2 years.
13.	**Process automation – making as-is process automatic: how this is used in your area? What is the impact of this? What initiatives are implemented to ensure large scale cost reduction?** We have processes but we are not looking at these effectively. Changing a process take forever as there are a lot of documentation required.
14.	**Is there improvement/change in the last 5 years?** Yes, major focus on the last 5 years to optimise and automate.
15.	**Other - What is missing from this framework?** People and execution. People within their 40s can execute better and younger people can come up with good ideas. These two groups must work together efficiently. One group think, and another group do. Risk management • We need to build stuff. Ensure to building negatively as well. What could go wrong? • Upskilling people. • Finding the balance between thinkers and doers. Force the change but understand the eco system when things change.

Participant 9:



Interview schedule for Research Project for degree of Masters of Science in Engineering (50/50)

Title: Banking 4.0 - The impact of Industry 4.0 on current Business Banking Business models in a big South African Bank: How ready are we for this digital transformation?

*Student Name: Helena M Böhmer (*1761521), *Supervisor: Bernadette Sunjka*
School of Mechanical, Industrial and Aeronautical Engineering, University of the Witwatersrand, Johannesburg, South Africa.

Pre-amble: • Testing current business model with conceptual framework – explain this framework • Explain the first 3 revolutions • Explain what Industry 4.0 is - rapid development and advances in technology and digital transformation. One platform. Banking is a technology based business. • Impact on our business – Banking is a technology driven business. We use a lot of IT systems to drive our business models	
1.	**How do you understand digital transformation?** Answer the question - How mature are we relative to the framework and what are we missing? Digital transformation is underpinned by Moore's law Digitization is around automation and process optimization. Use technology to automate stuff. Digital transformation is a larger topic to relook at business models and associate operating models. During the first to third revolution there were

	a lot of automation. Pipeline based businesses. i.e. supplied goods, find customers and delivery. Now with Industry 4.0 how do we rethink our business models, e.g. Uber, Air B&B. This is a platform to get consumers and suppliers of good together. How do we create value for both suppliers and consumers?
2.	**What is the current business models that is used in your area? How is business done in your area?** Digitization space – traditional we went to branching. Now do it yourself via phone and online banking. Digital transformation- Market place by matching a plumber with a customer (both are customers)
3.	**Are there projects/initiatives or actions in your area planned or already running in your area that ensure alignment between current area and this new digital world? How far are you along this journey?** Yes, this journey has started a few years back, about 4 or 5 years. There are various projects and initiatives that we are looking at to solve for long term sustainability
4.	**Interviewer to explain gamification. (Customer experience, competitiveness amongst ourselves) In your area, are the initiatives that drive gamification? How is this implemented in your area and how far?** Gamification is a tool that talks about behavioural economics – how do you influence people's actions and behaviours to do certain things with a positive outcome. This is one level one can pull to influence customer experience. Enjoyable customer experience talks about how you build processes (use great technology) to be efficient for the customers e.g. banking 24/7 via cell phone.

	Use data to understand the customer and make suggestions with a customer can take up by the push of a button, e.g. wife just had a baby, thus increase life insurance.
5.	**Was this considered 5 years ago?** Since 2000 we are doing this. It was called loyalty programmes but the science and how we mature around this has exploded. Definitely increased in the last 5 years.
6.	**How is blockchain technology used in your area to assist e.g. to simplify payments?** This is relevant. We had a blockchain team and we are looking at it is some ways. There is lots of hype about this. But there is still a journey on how we leverage this and how we should apply this.
7.	**Was this considered 5 years ago?** No, only from about 1 year ago, Should increase in the next 3 years.
8.	**Biometric technologies are implemented to ensure quick verification of customers. These include fingerprint verification, voice recognition etc to move away from passwords. How this is used in your area?** This is a game changer. The days of always having to have a face to face to verify and authenticate is long gone. Difficult to digitize if there is always a human interaction required. When we setup our citizens it is critical to get our verification correct. Finger print important – look at cyber-crime and security I know FNB will keep my money save. But do they keep my data safe – thinking identity theft. Whom can access my profile. For what are they using my data?
9.	**Was this implemented 5 years ago?** This was started 5 or more years ago and mainly to verify customers. Now also to verify employees and log into various digital channels

10.	**Digital investment, e.g. robo-advisors whom advice on investments or various products that is available for the customer need. What digital investments are made to assist with transaction volumes increase? How are these implemented? Have you experience a change/effect due to this investment thus far?** Advice will differentiate us in banking going forward. Many people can do payments and be the trusted money managers to advise me about investments and debt etc. Very difficult to scale traditional advisors, they are emotional too…there is risk there. Advice them of instruments and the RM will also use robot advice to advice the “wealth” clients. Tool set for human advisors
11.	**When did this start and what progress was seen over the last 5 years?** There is a lot of focus on this in the last 1 year.
12.	**Process automation – making as-is process automatic: how this is used in your area? What is the impact of this? What initiatives are implemented to ensure large scale cost reduction?** Do we need to process? e.g. AirB&B – started the business by solving for a need in the accommodation space and yet they do not have a single traditional business process, e.g. cleaning rooms, serving food etc. They just created the platform to enable clients with demand. They do not own sheets/block of flats. Once the business model is decided, then you can start with your processes to build what is required to sustain your business. E.g. what is the future state? Optimise irrelevant process (e.g. cheque that will be irrelevant next year) There must be only one process for a capability e.g. Know Your Customer on the Regional Manager versus self-service vs low end banking should

	all be the same. Available on all channels. Same process and programme is used to do the function. DIY or assisted should be the same process. Currently because we are behind our fire walls some processes are not so secure. This is a problem in that if we are doing capabilities and expose these, tit might compromise security.
13.	**Is there improvement/change in the last 5 years?** There is a major focus on this in the last 5 years to optimize all processes and digitize where applicable
14.	**Other - What is missing from this framework?** There are rational and logical topics. But what about “The people”. Someone needs to drive this transformation. Banes report – only 5% of digital transformation programmes achieve or exceed expectation. 25% meet a diluted set of expectation and the rest fail. Reason – human behaviour. 1. Why: • What are the transformative purpose? • Behaviour of employees. • That people believe it and internalise. 2. Platform = collection of capabilities (e.g. data, interfaces), what are the important things to invest in regarding people, process, system and data to achieve your goal as an organization. How do you invest in these? (skills and tech) 3. Machine learning and AI = but this is tool set There needs to be a pillar around people transformation 80% is about the people. This is more than change management

Participant 10:



Interview schedule for Research Project for degree of Masters of Science in Engineering (50/50)

Title: Banking 4.0 - The impact of Industry 4.0 on current Business Banking Business models in a big South African Bank: How ready are we for this digital transformation?

*Student Name: Helena M Böhmer (*1761521), *Supervisor: Bernadette Sunjka*
School of Mechanical, Industrial and Aeronautical Engineering, University of the Witwatersrand, Johannesburg, South Africa.

Pre-amble: • Testing current business model with conceptual framework – explain this framework • Explain the first 3 revolutions • Explain what Industry 4.0 is - rapid development and advances in technology and digital transformation. One platform. Banking is a technology based business. • Impact on our business – Banking is a technology driven business. We use a lot of IT systems to drive our business models • Test framework as not complete	
1.	**How do you understand digital transformation?** Digital transformation is happening and is needed for the evolvement and it is relevant. We cannot afford to have baby steps in growing. It needs to be exponential in growth and thus the only way is to be disruptive. Digital and digital transformation is just enablers. Using new tech like AI, robotics and robotics.

	There are a second part we should be fearful off. This is emerging markets, e.g. Thyme Bank and Discovery Bank and also other fintechs whom never provided finance before whom now provide funding etc. to consumers at cheaper rates that we as banks can offer, especially in the business/commercial space. These companies already have platforms to manage customers.
2.	**What is the current business models that is used in your area? How is business done in your area?** Business is done traditionally but we need to digitally transform and be more disruptive otherwise we will remain a legacy bank. Traditional banking is brick and mortar banking where there are a lot of branch banking involved. Going forward most transactions will have to be done on App or online banking. Only about 5% is required in the commercial space. Currently as a consumer one basically does not have to walk into a branch at all. We must aim for the same in business. Account opening, beneficiary validation and accelerated payments, it is about the eco system. As an example, if you bank as a company e.g. Eskom, then ensure that their employees and family members are also banking with us. Extend foot print of out banking platform. We are currently moving at the cusp of the wave of transformation in the middle. We are disrupting but not exponentially disrupting. E.g. clients, regulators and new entrants to the market.
3.	**How did this change in the last 5 years?** The pace was lesser 5 years ago. The environment changed. So as a bank we need to increase our speed of disrupting. We need to look at how do we exponentially grow as a big organization. This is to keep up with the demand and with the customer experience. We are changing our focus from what we are about, to what the customer want and experience. There is also a regulatory framework which is disruptive. We are disrupting ourselves. We come up with ideas but we cannot execute and implement it effectively. This is the forces of disruption.

4.	**Are there projects/initiatives or actions in your area planned or already running in your area that ensure alignment between current area and this new digital world? How far are you along this journey?** Yes. Number of projects. Robotics (RPA type tech), machine learning. This is to enable event driven banking and data driven banking and predictive banking. New tech is also used e.g. drones are used to do valuations on big farms. In business we are focusing on data models and predictive analytics and scoring for companies and businesses in the smaller markets. Main use case – predicting and getting rid of the loan renew work for frontline. Tools and techniques used are machine learning. Not currently robotics as these are for day to day and admin intensive tasks.
5.	**Interviewer to explain gamification. In your area, are the initiatives that drive gamification? How is this implemented in your area and how far?** Not a topic in our space but it is relevant and something to look at, at a later stage. It also allows for competition within the frontline. E.g. I have more sales than my colleague, thus increase excellence within and thus be more competitive as a bank giving a better customer experience. All benefit.
6.	**Was this considered 5 years ago?** More focus now in the last year.
7.	**How is blockchain technology used in your area to assist e.g. simplify payments?** In business banking not so much. Blockchain tech is new within South Africa. There is nothing concretely implemented within SA. Some companies are using it and building platform with blockchain tech but not specifically for banking as yet. **Is this relevant for banking?** Yes. Specifically, where we need to understand our customers and to verify information. The theory of blockchain is powerful but the implementation needs to be considered and explored much more.

8.	**Was this considered 5 years ago?** No, not considered. Should be a focus within the next year.
9.	**Biometric technologies are implemented to ensure quick verification of customers. These include fingerprint verification, voice recognition etc to move away from passwords. How this is used in your area?** This is relevant but it needs to be extended that it works together with AI. E.g. we need to use AI in streaming cameras. Thus as a customer comes in, facial recondition is used to identify the customer to ID book and the profile. A customer trail is built up over time and we can use data to understand when and how a customer interact with us as a bank. This is used but can be used more exponentially to determine the demographic of the person that go into the branch/call centre etc.
10.	**How was this implemented 5 years ago?** Comparing to fintech we are way below due to the smaller size of these companies. As a bank we are keeping up with the latest tech. but need to be more exponential. Implemented in the las 3 years.
11.	**Digital investment, e.g. robo-advisors whom advice on investments or various products that is available for the customer need. What digital investments are made to assist with transaction volumes increase? How are these implemented? Have you experience a change/effect due to this investment thus far?** This is used in the consumer and retail space. This is not relevant for the business space as it is more complex. Robo-advisors are the traditional retail dynamics. Not the latest tech. The tech used is a simple decision tree and not for business. Only used in wealth and investment space. Not relevant in business.
12.	**When did this start and what progress was seen over the last 5 years?** In the last 2 years major investment was made.

13.	**Process automation – making as-is process automatic: how this is used in your area? What is the impact of this? What initiatives are implemented to ensure large scale cost reduction?** FACT is implemented which facilitates credit in the business space. This is a workflow system. We got rid of the paper process and systems e.g. Siebal We are however lacking in the optimization part and the re-engineering part of this process.
14.	**Is there improvement/change in the last 5 years?** More focus in the last 5 years.
15.	**Other - What is missing from this framework?** We need to explore been a data driven organization. AI – tools used is RPA (robotics), machine learning. This will assist keeping up with the digital revolution not been followed. We need partnerships and co-innovating with smaller companies that can help with tech and resources and new solutions for current problems. Need a X factor. **What is the risk vs benefit of opening up organizational secrets to new fintech's?** We are moving quicker. Yes there is a risk of none delivery or business secrets leaking, but the opposite risk is that we will not exist in 10 years time. You can also use a team on the side, not part of the day to day business, to explore if we can disrupt and change. Need clear thinking space.
16.	**How will this impact the current employee, employer relationship.** Valid and relevant. We will have new jobs in 3 to 5 years time. It is up to us to upskill. There is going to be redeployment. Bots cannot do all jobs. E.g. people doing credit factory work will be able to do deal structuring now as they already know finance. Better use of time and skill. It is up to us that the generation that is up and coming that they are skilled in the right things. Maths and science.

Participant 11:



Interview schedule for Research Project for degree of Masters of Science in Engineering (50/50)

Title: Banking 4.0 - The impact of Industry 4.0 on current Business Banking Business models in a big South African Bank: How ready are we for this digital transformation?

*Student Name: Helena M Böhmer (*1761521), *Supervisor: Bernadette Sunjka*
School of Mechanical, Industrial and Aeronautical Engineering, University of the Witwatersrand, Johannesburg, South Africa.

Pre-amble: • Testing current business model with conceptual framework – explain this framwork • Explain the first 3 revolutions • Explain what Industry 4.0 is - rapid development and advances in technology and digital transformation. One platform. Banking is a technology based business. • Impact on our business – Banking is a technology driven business. We use a lot of IT systems to drive our business models	
1.	**How do you understand digital transformation?** Optimization of processes and digitising of systems and products
2.	**What is the current business models that is used in your area? How is business done in your area?** Focus on single platform and optimization. Taking away legacy systems.
3.	**Please elaborate on above with regards to legacy systems.**

	There are currently 49 credit systems that we work on. We are working towards a single platform, single interface, single log in. Employees can log into one system and can get what they require to complete a credit application. Currently there are multiple “sign-on’s” required for various systems. There are multiple and duplicate processes.
4.	**Are there projects/initiatives or actions in your area planned or already running in your area that ensure alignment between current area and this new digital world? How far are you along this journey?** All projects that is done currently has to have a form of optimization. If it is an optimization project or a project that has a user experience impact we need to ensure alignment in the design to ensure optimization. There are currently multiple projects which include, user interface, customer experience and process optimization which all must be aligned with the digital strategy of the company.
5.	**Interviewer to explain gamification. In your area, are the initiatives that drive gamification? How is this implemented in your area and how far?** All initiatives touch on this as the main objective is to ensure that our users (customers) has a better user experience. The main idea for all projects is to ensure that the turnaround time in which a customer get feedback is shortened. So if a customer request took 10 days to reply to, now it only takes about 1 or 2 days. We also give customers options to apply online, we want to give a customer immediate feedback on the credit offering. Certain processes are shortened. So instead of taking all customers through a full process, only the necessary steps are done. Quicker feedback and cut the banker out for smaller facilities where all the steps are not necessary. This leads to customer convenience and instant gratification. This is a journey and will take about 2 years to implement. The first component is automation to ensure rails are built for the great customer experience.

6.	**Was this considered 5 years ago?** From about 2 years ago a major focus was on how to make things easier for customers
7.	**How is blockchain technology used in your area to assist e.g. simplify payments?** This is not relevant to credit currently. Geo payments e-wallet payments are currently made in company, but not in credit. There is appetite for this in the credit space when we are moving internationally. Will have to be solution with the online offerings.
8.	**Was this considered 5 years ago?** No – not considered yet. Maybe in the next 5 years.
9.	**Biometric technologies are implemented to ensure quick verification of customers. These include fingerprint verification, voice recognition etc to move away from passwords. How this is used in your area?** This is in a banking currently, e.g. branches, telephone banking and app. For credit, we want to move our credit approvals on the company App which will then utilise the ID finger print sensors. System access are also moved to 2FA. Once an employee want to access the system they need to approve the access via the FNB App using the fingerprint verification.
10.	**Was this considered 5 years ago?** Yes – to verify customers for the last 5 years
11.	**Digital investment, e.g. robo-advisors whom advice on investments or various products that is available for the customer need. What digital investments are made to assist with transaction volumes increase? How are these implemented? Have you experience a change/effect due to this investment thus far?** There are pre-approval credit offers that are currently pushed to customers. These are all online and can be done on the app as well. The customer will only have to click on the offer, and then the money will be available in their account systematically. No need to go to the branch or to

	a banker to pre-approve and submitting forms. This is a straight through process (STP) that can be done real time and online.
12.	**Was this considered 5 years ago?** Yes, more focus in the last 4 years
13.	**Process automation – making as-is process automatic: how this is used in your area? What is the impact of this? What initiatives are implemented to ensure large scale cost reduction?** Yes, this is done in credit. Part of process optimization. There are a team of 100 employees that is capturing data at the moment due to various systems. Putting this on one platform eliminated this component and is a major cost saving. It also reduces finger errors and data are more accurate. Credit approval was done in a paper based format. Now it is an online process. The application can be viewed and approved online. The company also work on a concept called capabilities. This means that if an area is doing something similar than other areas, all areas should be aligned. Areas need to feed off the already developed capabilities. So all the areas can use the same platform to the common function. This will optimise how things are done and reduce the duplication of effort with one systems.
14.	**Was this considered 5 years ago?** Yes, more focus in the last 5 years
15.	**Do you have statists of information on project that you are working on regarding optimization? These can include number of optimization projects, costing related to these projects, saving related to these projects.** Data team to be contacted.
16.	**Are there any other things that you are looking at in your area that can help with the digital transformation or things we should look at to help optimise and get ready for the transformation?** This company is the market leader for credit. So nothing to be added for now.

17.	**Other - What is missing from this framework?** HR policies and process to be automated. Give employees a different way to interact with the company. Learning and development must be looked at first. This must include advice to employees. Give a portal to apply and less relay on a person. Focus is external currently to stay competitive. But we can do self-focus as well.

Participant 12:



Interview schedule for Research Project for degree of Masters of Science in Engineering (50/50)

Title: Banking 4.0 - The impact of Industry 4.0 on current Business Banking Business models in a big South African Bank: How ready are we for this digital transformation?

*Student Name: Helena M Böhmer (*1761521), *Supervisor: Bernadette Sunjka*
School of Mechanical, Industrial and Aeronautical Engineering, University of the Witwatersrand, Johannesburg, South Africa.

Pre-amble: • Testing current business model with conceptual framework – explain this framework • Explain the first 3 revolutions • Explain what Industry 4.0 is - rapid development and advances in technology and digital transformation. One platform. Banking is a technology based business. • Impact on our business – Banking is a technology driven business. We use a lot of IT systems to drive our business models	
1.	**How do you understand digital transformation?** To ensure the products and services are on digital channels and easy accessible to clients and employees
2.	**What is the current business models that is used in your area? How is business done in your area?** Outside in approach, customer centric, vs push products to the customer

	We don't sell products as this is what we have but rather educate the customer and lead them to the products they need. What does the customer want? As a result of customer need they then apply for a home loan. For example what is the angst moment (renew car licence by end of week) is solved for. Then as a second step, use this to collect data to enable us to engage better with our customers and provide them with products for their need. Within credit status we understand your status and what we can offer you. We can see behavioural change through this tool. Second – do everything on the platform. Leverage existing rails of the bank. Engage with various areas to get the processes in place to enable NAV to leverage off this and use on the front end. Mostly front end development. Follow various mandated, e.g. can not break out to a call centre. Have to wait sometimes for other areas Build IT that it can play out on any platform
3.	**Has did this change in the last 5 years?** 4 years, yes.
4.	**Are there projects/initiatives or actions in your area planned or already running in your area that ensure alignment between current area and this new digital world? How far are you along this journey?** Themes was the start – NAV home, car, money etc Align processes Use data now across themes. E.g. if you rent connect the dots to inform the customer that they can buy a property for the same amount as what they are renting for. Inform them of the options available – e.g. homes for sale in their area

	With saving goals it is about behaviour tracking – if client can save consistently for 2 years one may offer them a credit limit which is different than what we currently do.
5.	**Interviewer to explain gamification.(Customer experience, competitiveness amongst ourselves) In your area, are the initiatives that drive gamification? How is this implemented in your area and how far?** Credit status – display the credit status of the customer: red, amber, green. As this is done the customer behaviour change as we advice them what to do to improve their status from e.g. red to Amber or Amber to green. The customers that engage with these tools change their behaviour. Saving goals – Goal orientation, setup the goal, where am I according to my goal? More enjoyable way of saving. People that did not save are now saving or saving more than previously
6.	**Was this considered 5 years ago?** No, 4 years ago.
7.	**How is blockchain technology used in your area to assist e.g. simplify payments?** This is relevant. There is no priority. Banks does not support crypto currency business at the moment. The bank does look at this in principal in an experimental phase. Going forward it may be considered. This is not a proven technology. Banking key currency is trust – Thus we should not experiment at the expense of the customer with industries that is not mature enough. This might break trust. No regulatory framework.
8.	**Was this implemented 5 years ago?**

	Looking at this within the last year. Should have more focus in the next 5 years.
9.	**Biometric technologies are implemented to ensure quick verification of customers. These include fingerprint verification, voice recognition etc to move away from passwords. How this is used in your area?** Relevant But leverage of existing capabilities. To log in one use biometrics
10.	**How was this implemented 5 years ago?** No, not yet implemented.
11.	**Digital investment, e.g. robo-advisors whom advice on investments or various products that is available for the customer need. What digital investments are made to assist with transaction volumes increase? How are these implemented? Have you experience a change/effect due to this investment thus far?** Robo-advise is giving advice to customers. The framework around this is not mature as yet. We are using this in a generic way. Digitization of the investment process is definitely the end game. We are not there yet. We are building the blocks towards this. There are currently decision trees to help a customer to choose a product. Example, choose a category and sub category. Then a product is proposed. This touches on robo-advice but does not look at the “wealth” advice for a customer as a whole. Data is used to make suggestions to customers. This takes a lot of time. To build things and bring everything together will be at least 10 to 15 years
12.	**When did this start and what progress was seen over the last 5 years?** 2 years ago – more focus to ensure services are on digital channels.

13.	**Process automation – making as-is process automatic: how this is used in your area? What is the impact of this? What initiatives are implemented to ensure large scale cost reduction?** They do touch on this. There is automation before optimisation, which is a concern. Process optimization is relevant and worked on in this area. Also automation is used. If digital fulfilment does not exist, there is part of the project that can not go in. This may not be this areas responsibility, but they are driving this. Big advantage for all areas to optimise and digitise processes as this will increase the ability for product houses to increase the sales volumes.
14.	**Is there improvement/change in the last 5 years?** Significant change in the last 5 years.
15.	**Other - What is missing from this framework?** People must still have something to do. The way people will engage and their role will change. The world will not be run by robots. The employees in the bank – the vision is that we want to service more customers with the same work force. People do have angst around this and could be managed more effetely. Different levels of awareness in the bank of progress in this. We need to consider how we interact with our customers in this digital world. How do we ensure that we still know what the customer journey is and show empathy towards them? We can not only push digitisation and not be compassionate. Maybe have a tool to identify customers that need assistance with their finances, e.g. suggest that they can speak to a team of people and can help them with things. When do you need a human touch and when to digitise? Explore assisted self-service more and more. Self-aware robots are 50-100 years away.

Participant 13:



Interview schedule for Research Project for degree of Masters of Science in Engineering (50/50)

Title: Banking 4.0 - The impact of Industry 4.0 on current Business Banking Business models in a big South African Bank: How ready are we for this digital transformation?

*Student Name: Helena M Böhmer (*1761521), *Supervisor: Bernadette Sunjka*
School of Mechanical, Industrial and Aeronautical Engineering, University of the Witwatersrand, Johannesburg, South Africa.

Pre-amble: • Testing current business model with conceptual framework – explain this framework • Explain the first 3 revolutions • Explain what Industry 4.0 is - rapid development and advances in technology and digital transformation. One platform. Banking is a technology based business. • Impact on our business – Banking is a technology driven business. We use a lot of IT systems to drive our business models	
1.	**How do you understand digital transformation?** Banking has been technology driven over the last 40 years. Banking was organised around organizational silos. Now we are putting the customer in the middle of of business. And then the segment is built around this. Building a platform that is multi value proposition. The platform gives you a contextual product for the client at the right time. Before we had the cheque product house, the credit card product house and Homeloans etc. although the customer interacted with us as a bank, they experienced various experiences and we were not “talking” to each other internally.

	Before we were building “stacks” and each one interacted with the customer differently. Now we have a single platform with the customer at the centre. All product houses have to service this through a data driven approach.
2.	**What is the current business models that is used in your area? How is business done in your area?** Answered in nr 3
3.	**How did this change in the last 5 years?** For most of the bank this started in the last 5 years. Competition is fierce with fintech and neo neo-banks . (These banks will run from the start with a primary digital interface.) Transformation away from paper and optimised processes as well as transformation away from product silos to customer centric.
4.	**Are there projects/initiatives or actions in your area planned or already running in your area that ensure alignment between current area and this new digital world? How far are you along this journey?** Deliver a largely digital product with human intervention only when required. The platform must understand the customer needs and life cycle. Then tap into the product house to fulfil these needs. Citizen where all employees and customers can work on the same platform is the first step to this transformation. One requires a single definition of the customer and if you would like to speak to the customer one need to ensure he is on this platform. Projects to allow for customers uploading and edit and maintain. Digital set up of a juristic profile. Challenge – whom is the mandated person? Enterprise sales platform – to allow for contextual sales. This onboard customer for sales within the digital space. Principals - 1. Single definition of citizen 2. All services on the platform 3. All data in one place

	4. Secure 5. All interaction tracked on platform 6. Context creates value Time frame for this journey – 5 years. If this is not done in 5 years we will be out competed by other banks, Facebook, Google, Apple etc all new competitors. (2024)
5.	**Interviewer to explain gamification. In your area, are the initiatives that drive gamification? How is this implemented in your area and how far?** This one of the 12 capabilities. Within business banking this is not very relevant at the moment. This is more for consumer banking. We have a product called “Nav.” Less relevant to commercial and business banking
6.	**Was this considered 5 years ago?** No, only in the last 2 years
7.	**How is blockchain technology used in your area to assist e.g. simplify payments?** Currently not with in business banking. In international banks they are looking at this. But not within FNB. **Is this relevant?** Distributed ledger is relevant where you have multiple parties confirming transactions if contrary to our current regulatory set-up. Moving currencies e.g. bitcoin in fundamentally contrary to our current monetary system where we know the customer and do the necessary checks. This may be able to play a role in future but there is some journey ahead. There is a market demand for swift exchanges (Ripple show this). Not implemented yet.
8.	**Was this considered 5 years ago?** Is considered within the last 2 years. Will be implemented in the next 5 years.

9.	**Biometric technologies are implemented to ensure quick verification of customers. These include fingerprint verification, voice recognition etc to move away from passwords. How this is used in your area?** In branches we have devises that verify finger prints with department of home affairs. Moving away from signatures and checking ID documents. Also use finger print authentication to log into App to online banking. Once we have natural language processing in our call centres we will use this for the bulk of the queries.
10.	**How was this implemented 5 years ago?** Yes, from 5 years ago.
11.	**Digital investment, e.g. robo-advisors whom advice on investments or various products that is available for the customer need. What digital investments are made to assist with transaction volumes increase? How are these implemented? Have you experience a change/effect due to this investment thus far?** We have to build the bank and run the bank area. Run the bank is to service customers with what we have currently. Build the bank is to apply building the new using the X journey. API, secure authentication Currently the X programme is getting a large sum of investment to build the bank using different capabilities. These are a set of processes that a client can do their banking with. This is then assisted or un-assisted. All these new systems will result in development required.
12.	**When did this start and what progress was seen over the last 5 years?** Yes, large digital projects, within the last 5 years. Relevant
13.	**Process automation – making as-is process automatic: how this is used in your area? What is the impact of this? What initiatives are implemented to ensure large scale cost reduction?**

	Onboarding on single member entities by way of the Appazone process. Selfie based verification and authentication was build into this. Build integration into 3rd party services. Client can onboard with a selfie and open up a cheques account in a few minutes. Without going to back office fulfilment. CRE – optimization of branched based process where a customer can update their permissions and other information which is currently a manual process with lots of paper work. Continue on the journey where most processes are straight through processes with a small amount of drop off or human intervention. Integration errors must be picked up by human intervention. Staff will become a lot more advisory instead of administrative.
14.	**Is there improvement/change in the last 5 years?** Yes, in the last 5 years
15.	**Other – what is missing from the framework?** The platform must understand what the customer need as well as the life cycle and where human intervention is required. End goal = customers and employees work on same systems Allow contextual sales (data) Staff more advisory

Participant 14: Only interviewed for gamification



Interview schedule for Research Project for degree of Masters of Science in Engineering (50/50)

Title: Banking 4.0 - The impact of Industry 4.0 on current Business Banking Business models in a big South African Bank: How ready are we for this digital transformation?

*Student Name: Helena M Böhmer (*1761521), *Supervisor: Bernadette Sunjka*
School of Mechanical, Industrial and Aeronautical Engineering, University of the Witwatersrand, Johannesburg, South Africa.

Pre-amble: • Testing current business model with conceptual framework – explain this framework • Explain the first 3 revolutions • Explain what Industry 4.0 is - rapid development and advances in technology and digital transformation. One platform. Banking is a technology based business. • Impact on our business – Banking is a technology driven business. We use a lot of IT systems to drive our business models	
1.	**How do you understand digital transformation?** NA
2.	**What is the current business models that is used in your area? How is business done in your area?** NA
3.	**Please elaborate on above with regards to …...** NA

4.	**How did this change in the last 5 years?** NA
5.	**Are there projects/initiatives or actions in your area planned or already running in your area that ensure alignment between current area and this new digital world? How far are you along this journey?** Gamification has a lot of success globally with regards to training – this is implemented in First Rand – centre of excellence. Engagements with NAV and wellness(Insurance). NAV is a natural marriage for gamification where consumers and suppliers come together. Wellness – people to register Fit-bits to help the bank monitor your health to help give you more accurate insurance premiums. 3 Use cases chosen: 1 – Escape room created – people in a room must solve riddles and clues to escape the room. This tests the ability for people to adapt to change in the digital world. Gamification should be fun and this can be used for team building. This is a tool for the organizational development specialists to use this to take teams through the escape room and then discuss sensitive topics with the employees. Improve team productivity and dynamics. Create a safe environment to discuss difficult topics. 2 – Branch staff engagement pilot – Mystery shoppers' concept. An objective for branches is to drive customer engagement. Targeting 16 branches within Gauteng in 3 week period. Had external consultants doing the mystery shopping. Completed a questionnaire to see what must be measured. E.g. did you feel welcome, did they understand your financial need, did they smile, was there are solution for the problem etc. no rewards, only winning to have the best score as a branch. 3 – Risk and compliance training must be done and this must be reported to SAAB. Up to now this is done as a tick box exercise, and not necessarily getting the benefit of having an engaged employee getting a lot out of the training. Create an engaging experience around this. Going forward also a focus on the external customer with NAV

6.	**Interviewer to explain gamification. In your area, are the initiatives that drive gamification? How is this implemented in your area and how far?** Gamification is part of capability for First Rand Enjoyable customer experience is part of this but not the main driver and the problem that one is trying to solve. The driver is customer engagement. Approach – get away from the fact that this is a buzz word and understand what this is. This is an immature capability in South Africa and international. Engagement with a lot of international stakeholders, consultants and during conferences gave us an understanding of this topic. Definition: Game based design thinking and game-based mechanics to none gaming contexts. There are niche areas in gamification – Game based learning and engagements The problem statement must define what and why you want to gamify Is eBucks gamification as this is behavioural economics and changes the way one interact with the bank and has aspects of gamification and uses gamification mechanics. Not a prime example as voluntary participation and intrinsic motivation is at the heart of gamification. Gamification principals is more based on games, not because there is a monetary value or reward associated with this. The motivation is intrinsic motivation meaning driving a feeling of relatedness, autonomy, mastery or purpose. This is a gap for eBucks. Thus reward system is not classified as a gamification capability, since if the reward is taken away from the system, the people will not continue to participate. Game mechanics is used though, e.g. game mechanics, rewards and levels. RAMP (Relatedness (people are social beings and want to be part of something), Autonomy, Mastery (People want to become masters/expert

	at something) and Purpose) – gamification framework used in First Rand. These are the motivators for various people and is used to implement. Steps: • What is the problem statement? • ID audience • To what extend are they driven by the RAMP framework. • Game dynamics (1 level higher than game mechanics) – define narrative, what do you want your audience to feel, threatened, competitive or part of a bigger cause e.g. Discovery Vitality – healthy living (There are 6 dynamics). • Mechanics – this is the frills that bring the dynamics to life – e.g. progress must be articulated clearly in the system, how close are they to winning? (e.g. EBucks – levels).
7.	**Was this considered 5 years ago?** No only, 2 years ago
8.	**How is blockchain technology used in your area to assist e.g. simplify payments?** NA
9.	**Was this considered 5 years ago? NEW** **NA**
10.	**Biometric technologies are implemented to ensure quick verification of customers. These include fingerprint verification, voice recognition etc to move away from passwords. How this is used in your area?** NA
11.	**How was this implemented 5 years ago?** **NA**
12.	**Digital investment, e.g. robo-advisors whom advice on investments or various products that is available for the customer need. What digital investments are made to assist with transaction volumes**

	increase? How are these implemented? Have you experience a change/effect due to this investment thus far? NA
13.	**When did this start and what progress was seen over the last 5 years?** NA
14.	**Process automation – making as-is process automatic: how this is used in your area? What is the impact of this? What initiatives are implemented to ensure large scale cost reduction?** NA
15.	**Is there improvement/change in the last 5 years?** **How is this changing the business models?** NA
16.	**Do you have statists of information on project that you are working on regarding optimization? These can include number of optimization projects, costing related to these projects, saving related to these projects.** NA
17.	**Are there any other things that you are looking at in your area that can help with the digital transformation or things we should look at to help optimise and get ready for the transformation?** NA

13 Appendix E – Coding: In vivo and hypothesis

First & second level of coding

Gamification:

Respondent	Respondent 1	Respondent 2	Respondent 3	Respondent 4
To what degree is it implemented? High 5, medium 3 low 1	1	4	1	0
Is it relevant? High 5, medium 3 low 1	5	5	5	3
Code	Not massive	Relevant	Exploratory phase	User experience
	Other priorities	Straight through processing	Dedicated team	Quick and easy
	Can add value	Customer centric pre approvals		Education and training
		Friendly customer experience		Change management curve to be considered
Timing (with in last 5 years = 5, 2 years = 3, last year = 1 not at all = 0)	0	5	1	1

Respondent	Respondent 5	Respondent 6	Respondent 7	Respondent 8
To what degree is it implemented? High 5, medium 3 low 1	5	0	1	4
Is it relevant? High 5, medium 3 low 1	5	0	5	5
Code	Customer enjoyment and behaviour modification	Not applied	Need to use this to simplify customers lives	Low priority
	Model is build to enable gamification			Relevant
	EBucks was done - driving behaviour			Slow pace
	Public recondition			
	This is new to banking			
	Channel adoption			
Timing (with in last 5 years = 5, 2 years = 3, last year = 1 not at all = 0)	2	0	3	1

Respondent	Respondent 9	Respondent 10	Respondent 11	Respondent 12
To what degree is it implemented? High 5, medium 3 low 1	5	1	4	5
Is it relevant? High 5, medium 3 low 1	5	1	5	5
Code	Need to mature	Future - incentivising employees to give a better customer experience	Ensure better user experience	Behavioural change through education (e.g. show red, amber green of credit status and info on how to improve)
	Availability 24/7	Relevant	Lessen turnaround time and immediate feedback = better customer experience	Goal orient saving goals = more enjoyable way of saving
	Data to understand customer		Apply online	
	Push of a button offers			Relevant
			Relevant	
Timing (with in last 5 years = 5, 2 years = 3, last year = 1 not at all = 0)	5	1	2	4

Respondent	Respondent 13	Respondent 14
To what degree is it implemented? High 5, medium 3 low 1	1	5
Is it relevant? High 5, medium 3 low 1	1	5
Code	Not relevant in business banking, rather consumer banking	Immature capability internationally
		Must drive customer engagement
		Use game based design thinking and mechanics
		Mostly used for training
		RAMP model- driving a feelings of relatedness, autonomy, mastery or purpose.
		5 steps - problem statement, understand audience, RAMP framework, game dynamics and game mechanics.
		3 current use cases and 4th to come for external customers
Timing (with in last 5 years = 5, 2 years = 3, last year = 1 not at all = 0)	2	2

Blockchain technology:

Respondent	Respondent 1	Respondent 2	Respondent 3	Respondent 4
To what degree is it implemented? High 5, medium 3 low 1	0	0	0	1
Is it relevant? High 5, medium 3 low 1	3	3	3	3
Code	Limited use cases	Relevant	Investigation phase	Trusted exchange
	Regulation	Single trusted source	No wide spread use case	Contracting
	Legacy systems	Inter bank transactions	Reliability issues	Closed eco system
	Future solution	No priority	Regulation issues	Regularity issues
			Movable assets	
			Not quick enough (Volume)	
	Limited investigation and focus	Regulation	Stable coins	
Timing (with in last 5 years = 5, 2 years = 3, last year = 1 not at all = 0)	0	1	1	0
Future focus (Years)	5	5	5	5

Respondent	Respondent 5	Respondent 6	Respondent 7	Respondent 8
To what degree is it implemented? High 5, medium 3 low 1	1	0	1	0
Is it relevant? High 5, medium 3 low 1	3	0	3	4
Code	Payment - a lot of work still to be done. Cheaper faster quicker (World wide $10 trillion)	Not used and not relevant	Trust element	Risk and compliance to be considered
	Rather use for cross boarder transactions and settlement of cars/houses etc		Work together with industry - collaboration	Not regulated
	Trust still to be proven		Trust is the main element	Involve risk upfront
	Banks to focus on peer to peer sales and transactions			
	Regulation and legislations to be explored (Handel of dispute, taxes etc)			
	Closed block chain for banking may be explored			
	Not massive focus			
Timing (with in last 5 years = 5, 2 years = 3, last year = 1 not at all = 0)	0	0	0	0
Future focus (Years)	5	0	4	3

Respondent	Respondent 9	Respondent 10	Respondent 11	Respondent 12	Respondent 13
To what degree is it implemented? High 5, medium 3 low 1	1	1	0	0	0
Is it relevant? High 5, medium 3 low 1	5	0	0	5	3
Code	Still a journey	Not business banking	Not applicable	No priority currently	Distributed leger to confirm transaction is relevant
	Not a lot done so far	Too new tech		banks does not support crypto currency businesses - not mature industry	Regulation a problem
		No banking platform as yet		Bank in experimental phase - but trust weight more	Contrary to the monetary system
		Use to understand customers and verify information		Not proven tech	International (Swift) large opportunity
		Exploratory stage		No regulatory framework	
Timing (with in last 5 years = 5, 2 years = 3, last year = 1 not at all = 0)	1	0	0	1	2
Future focus (Years)	3	1	5	5	5

Respondent	Respondent 1	Respondent 2	Respondent 3	Respondent 4
To what degree is it implemented? High 5, medium 3 low 1	5	3	3	5
Is it relevant? High 5, medium 3 low 1	3	3	3	5
Code	Enabler	Contacting use case	More than 1 biometric	Verify customers
	Richer customer experience	Richer customer experience	Authorizations are done	Internal systems behind fire wall
	Authentication		Increase going forward	Object character recognition
	Drive efficiencies			
Timing (with in last 5 years = 5, 2 years = 3, last year = 1 not at all = 0)	5	2	5	5

Respondent	Respondent 5	Respondent 6	Respondent 7	Respondent 8
To what degree is it implemented? High 5, medium 3 low 1	5	5	5	5
Is it relevant? High 5, medium 3 low 1	5	5	5	5
Code	Security related capability	Core service	Implemented	Not used effectively
	This is 3rd factor authentication	Build to be used by other companies as well	Unlock value and business opportunities	Used for business only single member entities
	Enterprise focus is 2FA	Used to verify customers	Risk - fraud	
	Used for FICA (extra layer of security that sync finger print to home affairs)		Use 2 forms of biometrics	
	Voice recognition in call centres			
	Not to authenticate citizens			
Timing (with in last 5 years = 5, 2 years = 3, last year = 1 not at all = 0)	5	5	5	5

Respondent	Respondent 9	Respondent 10	Respondent 11	Respondent 12	Respondent 13
To what degree is it implemented? High 5, medium 3 low 1	5	3	5	0	5
Is it relevant? High 5, medium 3 low 1	5	5	5	5	5
Code	Game changer for other organizations as well	Extended to work with AI	Relevant in branches and call centre	Log in use case is relevant	Branches used (Fingerprint - home affairs)
	Verification can be done automatically	Used to ID customer	Move credit to app and online and use Biometric to approve		Moving away from signatures and ID checking
	Cyber crime risk	Help collect data to enhance customer experience			Login to App (Online banking)
		Track customer interaction with bank			Future = natural language processing in call centres
		Understand demographic in branch and call centre			
Timing (with in last 5 years = 5, 2 years = 3, last year = 1 not at all = 0)	5	3	5	0	5

Respondent	Respondent 1	Respondent 2	Respondent 3	Respondent 4
To what degree is it implemented? High 5, medium 3 low 1	5	4	5	4
Is it relevant? High 5, medium 3 low 1	3	3	3	5
Code	Drive efficiencies	Credit advise	Better and faster	Scoring model
	Clean data	Correct products enhance	No conflict of interest	Various languages problem - Clarity
	Information	Data crunching required	Low end customers	Training
		Small business benefit	Asset management space	Volumes not judgemental
		No priority	Passive investment	Vast lake of information
			Legal framework	Legislation
		No advise currently		
Timing (with in last 5 years = 5, 2 years = 3, last year = 1 not at all = 0)	5	2	1	1

Respondent	Respondent 6	Respondent 7	Respondent 8	Respondent 9
To what degree is it implemented? High 5, medium 3 low 1	5	5	4	5
Is it relevant? High 5, medium 3 low 1	5	5	5	5
Code	Data is collected	A platform is required	Important	Advise will differentiate us in future
	Advisory for customers - customer journey	Need to change legal framework	Nor enough focus	Difficult to scale financial advisors
	Enrich data (e.g. last interaction can give context to banker)		Relevant for volumes of scoring	Use as toolset for advisors
			Legal framework	
Timing (with in last 5 years = 5, 2 years = 3, last year = 1 not at all = 0)	3	3	2	1

Respondent	Respondent 10	Respondent 11	Respondent 12	Respondent 13
To what degree is it implemented? High 5, medium 3 low 1	3	4	3	5
Is it relevant? High 5, medium 3 low 1	3	5	5	3
Code	Not relevant for business in current form	STP for credit applications	Framework not mature for full solution	Efficiencies
	Digital management is	Real time	Defiantly the end game	Service customers with what we have while enhancing to platform (X journey
			Building blocks in place	Building different capabilities
			Now only decision trees to help choose product	Assisted or unassisted self services
			Data required to assist customers	Legal considerations
			Need at least 15 years to get this done	
			Governance and legal	
Timing (with in last 5 years = 5, 2 years = 3, last year = 1 not at all = 0)	2	4	2	5

Process automation

Respondent	Respondent 1	Respondent 2	Respondent 3	Respondent 4
To what degree is it implemented? High 5, medium 3 low 1	5	5	5	5
Is it relevant? High 5, medium 3 low 1	5	5	5	5
Code	Optimization missing	Relevant	Use RPA as tool	Use RPA as tool
	Mundane processes	System enablement of current processes	Automated	Automate first then optimise
	Time efficiencies	Process optimization is missing	Not optimised currently	Need Realtime
		Limited resources to assist	Priority is high volume and repetition	Risk integration failures
				Need to correct data first
				Data can give insight
			Condition - well defined process	Understand events and triggers
Timing (with in last 5 years = 5, 2 years = 3, last year = 1 not at all = 0)	5	5	5	5

Respondent	Respondent 5	Respondent 6	Respondent 7	Respondent 8
To what degree is it implemented? High 5, medium 3 low 1	5	5	5	5
Is it relevant? High 5, medium 3 low 1	5	5	5	5
Code	New way - everyone is a producer and a consumer and revenue goes in all directions	Re-engineer all processes	ID process to optimise	Not done efficiently
	Platforms are required to execute	Rate and measure as is success	Efficiencies important	Al lot of admin to change process
	Need to look at people vs eco system and interact in the most efficient way	Identify gaps		
		New processes to be implemented		
Timing (with in last 5 years = 5, 2 years = 3, last year = 1 not at all = 0)	5	5	5	5

Respondent	Respondent 9	Respondent 10	Respondent 11	Respondent 12	Respondent 13
To what degree is it implemented? High 5, medium 3 low 1	5	5	5	5	5
Is it relevant? High 5, medium 3 low 1	5	5	5	5	5
Code	Process optimization then atomization is important	Replace paper based process	Shorten processes (optimization)	Process optimization is done	STP to onboard a customer - open cheque account in minutes
	Need to ID relevant process	Process automation is important	Data is captured from system to system	Automation is also done	Focus on STP with minimal human intervention
	Not automate irrelevant processes	Lack in process optimization	Finger error	Help identifying places of improvement	Human to be used for integration errors
	Only 1 process for capability/function		Some still paper based	Will increase sales volumes	
	Need to ensure security		Online process for credit approval		`
			Do alignment with capabilities		
Timing (with in last 5 years = 5, 2 years = 3, last year = 1 not at all = 0)	5	5	5	5	5

Other

Respondent	Respondent 1	Respondent 2	Respondent 3	Respondent 4
Code	Data centric customer	Job types will change	Impact on human intellect	Focus on Machine learning
	IoT for logistics (e.g. drones)	Number of people reduce (volume)	Interpretation	Natural language processing
	Human Impact (Current employees)	Need focus on people change	Complex information	Self learning robots = smaller future investment
	AI as supporting tech	Diverse skills required	Human capability's are replaced no extended	Growth exponential with self learning
			Payments not a differentiator anymore	People impact and change management
			Maturity of 3rd revolution	Affect people at bottom of salary chain
			Hand over to next generation (Skills not relevant for 100/20 years)	Expose management that does not add value
			Data	Redeployments and skills changes
			Regulation to mature	People willing to change
				Experience will never be replaced by machines
				Data is key to understand our customers effectively

Respondent	Respondent 5	Respondent 6	Respondent 7	Respondent 8
Code	Human element			
	Digital transformation is a journey that a large organization under go to maximize value	Use data to create value for your and other businesses	Cash less options	People and execution
	Use of new technologies - digitise and automate	Not vertical silo but horizontal platform	Job changes	Need to split executers and thinkers
	Priority has huge impact	Not always money driven	Upskill employees	Risk management to be enhanced
	Banking is highly regulated - "paper work" and clear plan and strategy is required	Create a eco system	Change management	Build with negative (What could go wrong)
	Organise themselves around capabilities not product or people	Common data share	Security	Upskill people
	Capabilities and conceptual priorities are mixed	No more paper		Force change in the eco system does not always work if proper analysis is not done
	Data analytics are very important for process design and redesign	This business model is part of a larger business model - Change management important		
	Bio-metric to low level - look at security	Change the heart and minds of people (Understanding)		
	There are over lap - e.g. gamification must be build with max security	People need to embrace this		
	How will we scope and assess skills	Risk management - going into a new space (Don't know what you don't know)		
	Call centre best example - solve for 80% of use cases through natural language processing and 20% handoff to humans	Customer centricity (Client and customer must benefits)		
	Legacy company have cost to income ratio to protect. Not easy to transform	Customer experience science - easy to use		

Respondent	Respondent 9	Respondent 10	Respondent 11	Respondent 12	Respondent 13
Code	Rethink business models	Need to grow exponentially		People roles will change	
	Platform thinking	Digital transformation is enablers	Current model - single platform optimization	Use data across themes - not silo approach (e.g. 1. rent = afford home loan = proposed properties in the area 2. Customer save for 2 years = behaviour change = credit limit)	Platform must understand the customer need and life cycle
	Create value for both suppliers and consumers.	Emerging markets / Fintech threat	Take away legacy systems	employees of the bank - service more customers with the same number of staff	Human intervention minimal
	Traditional branch	Cheaper rates	Single sign on. 49 systems. Make it less and integrated	Need to keep tabs on customer journey - empathy	End goal = customers and employees work on same systems
	Now DIY	Also try to bank company + employees benefit	Automate HR processes (L&D)	Tool is required to identify customers whom require more assistance	Allow contextual sales (data)
	Marketplace is a platform that match supplier with customer	FNB is at the middle of the wave of transformation			Staff more advisory
	The people - transformative purpose	Challenge - execute disruption efficiently			
	Behaviour of employees	New tech - drones for valuations			
	Platform = collection of capabilities	Focus on data models and predictive analytics			
	Machine learning	use robotics and self learning			
	Change management	Data driven organization			
		Partnerships required (co-innovating)			
		Impact on employer employee relationship			

14 Appendix F – Second level of coding continued: Pattern coding

Gamification

Maturity

Participants 1, 6, 8, 9, 13 and 14 agreed that this is a capability the need to mature if we want to gain priority in the organization.

Participants 6 and 13 said that they do not see the value of this as a priority at the moment.

Priority

Participants 1,2, 3, 4, 5, 7, 8, 10, 11, 12 and 14 said that this is relevant in their business units, although only in an exploratory phase and that other priorities is currently driven.

Learning and development

Participants 4 and 14 mentioned that the best use case and implementation for this currently is for learning and development and used as a training tool. Responded 5 agreed and added that this can drive channel adoption if customers are educated on what is available. Participant 2, 10 and 11 added that if employees are trained that they are able to drive a better customer experience. Participant 14 added that this can drive customer engagement. Participant 12 added that the clients behaviour changes through implementing game based principals

User Experience improvement

Participants 2 said that the user experience will improve significant with the implementation of gamification as the back bone of the design. Straight through processing will assist the customer to get to their need met sooner and more efficient. Participant 5 agreed that customer enjoyment will modify the customer behaviours and if something is done easier and quicker customers will use this more. Participant 9 agreed that it will be possible for customer offers to be available 24/7 and participant 11 added that the turnaround time will be much quicker ensuring a better customer experience. Participant 14 said that game-based design thinking is important to ensure a better customer experience

Blockchain technology:

Participants 6, 10 and 11 said that this is not relevant.

Although 3 participants agreed that this is not relevant, most said that there is still a journey ahead and a future solution may be possible.

Participant 1 said that there are limited use cases.

Participants 2, 3, 4, 5, 8, 12 and 13 said that there are still regulatory issues/frameworks that must be considered and bedded down e.g. tax considerations and disputes before implementation can proceed..

Participant 10 and 12 mentioned that this is still an industry that must mature as it is in the experimental phase. Participants 1,3 and 5 agreed and they added that this can be a future solution and still need to be proven.

Participant 13 said that the distributed ledger is part of the blockchain technology and is relevant in banking and swift transactions (across border). Participant 4 agreed and added that a trusted exchange will be possible when doing contracting, specifically cross border. This might mean a closed eco system. Participant 3 and 5 agreed and added the value for cross border transactions when it comes to settlement of cars etc. in a closed eco system. Participant 2 agreed and said that a single trusted source for interbank transactions. Participant s 1, 2, 5, 9 agreed that the problem is priority and focus, Participant 3 added that there is no wide spread use case and that reliability is still an issue. The volumes that is used for payments in banking is large and no blockchain technology can handle this at the moment.

Participant 7 said that trust is the main currency of the bank and the blockchain still need to prove themselves to be a trusted partner. Participant 12 agreed and added that this is not proven tech. Participant 13 also said that this is contrary to the monetary policy and Participant 3 said that there is not tech that is quick enough to manage the current payment volume per second.

Biometric technology

Participants 1 and 2 agreed that biometric technology will give the customer a richer customer experience. Participant 6 and 9 agreed and added that this can also be used to verify customers automatically. Participants 5, 11 and 13 extended this idea and added that in call centres this can be used to identify customers using voice recognition and natural language processing which ensure a richer customer experience. This was further extended by participant 10 that said that this is an effective way to identify customers

Participant 8 added that there are limits to this technology and that it is only used for single member entities and not for larger companies.

Participant 1 said that this is an enabler to drive efficiencies for the bank and the customers and that authorizations can be done using biometric. Participant 3, 4 and 11 agreed and added that authorizations, approvals and verifications of customers are done and this will increase going forward. If this can be done using biometrics, this will drive efficiencies. Responded 13 added that this will enable us to move away from signatures and Participant 3 agreed that we can do contracting using biometric going forward. Participant 7 agreed that this will unlock value and business opportunities. Participant 10 underlined this idea by adding that we will be able to more effectively collect data about our clients and help enhance their customer experience. We will be able to identify their demographic and with which channel they interacted (call centre/branch etc.) and assist them more effectively.

From a security and risk/fraud perspective participant 3,5,7 and 9 agreed that more than 1 biometric element must be used, example, finger print and password/voice/face recognition

Participant 6 and 9 mentioned that this capability must be so robust and well defined that this service to verify customers can be used by other companies as well. This is a game changer

Participants 7, 12 and 13 highlighted that we are already using biometrics to assist customers.

Digital Investment

Efficiencies:

Participant 1 said that digital investment will drive efficiencies. Participant 2 agreed that digitization is the better and faster option to get results participant 4 said that for volumes this is the way to go and can drive efficiencies. Participant 5 agreed and added that to analyse a lot of data and make recommendations based on specific rules is where robots and systems win humans, hands down. Participant 8 said that this is for volumes of scoring and agreed with participant 4 and 5 on this topic. Participant 9 said that it is difficult to scale financial advisors and is much more expensive. Digital investment can be scales much quicker to drive efficiencies and help do data crunching. Participant 11 said that STPs will be done for credit applications and drive a quicker customer experience and less handoff points. Participant 12 said that data is required to assist customers and that digital investment will drive efficiencies. Participant 13 is also of the opinion that digital investment is key for efficiencies and scaling for the bank.

Considerations:

Participant 1 said that a prerequisite for this to work is to have clean data. Participant 2 mentioned that a lot of data crunching is required to make this work. Participant 4 said that this is not for judgemental credit as this is to complex and must be considered case by case. She also added that in South Africa with the various languages and low levels of education in robo advice will be difficult to implement. Participant 5 mentioned that self-aware robots are 50 to 100 years away and that robots are good at giving a specific answer to a specific question very well. They can do one thing very well and give specific outputs to specific inputs. Participant 7 said that platform is required. This means that the bank needs to be able to use and leverage off any system and capability to assist a customer effectively. Participant 2 and 8 said that priority is required and more focus to ensure that this is implemented efficiently. Participant 11 mentioned that real-time information and data is required to ensure that robo-advisors can work efficiently. Participant 12 said that robo advice is definitely the end

game but the framework is not mature as yet for this to be implemented effectively. These things take time, at least 15 years and we are busy putting the building blocks in place to do this.

Current progress:

Participant 6 said that they are already busy collecting data and enrich this to ensure that they are able to give customers accurate advice. Things like giving the banker context on the customer's experience from the last visit as an example. This enables the bank to interact with their customers more efficiently.

Legal:

Participant 3 said that the legal framework under which digital investment and robo-advisors must work must still mature. Participants 4, 8, 12 and 13 agreed that the current legal landscape does not allow for full on robo-advice. The governance and legal considerations is important for robots.

Participant 2 said that we are currently not giving advice to our customers using robots. Going forward this will be a great additional service to our customers. It will enable the bank to advise them to choose the right product. Participant 1 agreed that information to customers is banking of the future. This information will enable them to make decisions. Participants 5 and 6 agreed and said that advisory for customers are the future of the bank. Participant 9 took this idea a step further and said that the robo advise will be a tool kit that bankers can use to advise their customers. Participant 12 added that for now we only have a high-level decision tree that is used to choose a product and no advice is given but this is a capability of the future. Participant 13 said that the future is self-service - assisted self-service or un-assisted self-service.

Participant 2 said that an advantage of robo advise is that the bank is able to give advice to more customers. From individuals to small and medium size businesses. Participant 3 agreed that this service would be a great addition for low end clients as well as clients whom do passive investments. He added that his can also work in the asset management space. Participant 5 agreed that this will work well in the entry level as well as the high-end wealth clients' space. Participant 9 said that advise will differentiate us from the future and that we need to roll our available advice as wide as possible and that robo advise is a solution for this. He also added that assisted and unassisted self-service is required for this.

Participant 10 said that this tool is not relevant for business

Participant 3 and 4 said that a major advantage is that there is no conflict of interest using a robo-advisor as it is programmed making the best decision using with vast “data lake” to extract available information.

Process automation

All 13 participants said that process automation was something that was implemented in their area, that it is highly relevant and has been worked on in the last 5 years. All participants confirmed that process automation is key for the relevance of the bank of the future.

Participant 1 to 11 raised the fact that optimization is as important. Participant 1 and 2 said that many times optimization is missing when a process is automated. Participant 3 said that they do not optimise currently, and that automation is more their focus. Participant 4 said that they automate first and then optimise. Participant 5 mentioned that they are looking at people vs the eco system and how they interact in the most efficient or optimised way. Participant 6 said that they are actively re-engineering processes to ensure optimization before automation is done. Participant 7 said that efficiencies are important. Participant 8 and 10 said that the bank is not currently looking at efficiencies but only to automate processes. Participant 9 said that process optimization is done before automation and that only relevant processes should be optimised. (The example - don't optimise cheque process as we are not using this going forward). Participant 12 said that they are actively involved in process optimization and influencing this although they are not always the executers of this.

Participant 1 and 3 agreed that process automation should be done for mundane or processes with high repetition rate.

Participant 5 mentioned that it is important to identity the correct processes to identify which to optimise and automate. Participant s 2 and 9 agreed in that only relevant processes must be automated. Participant 3 mentioned that before a process can be automated it must be well defined.

Participant 4, 10 and 12 mentioned that process automation is important and that paper based processes must be replaced. Participant 11 agreed and also added that system integration is important. This will eliminate finger error. Participant 13 agreed that STP's are required and focus on minimal human intervention is required. Humans must be used for monitoring and integration errors.

Most participants agreed with the benefits of process optimization and automation. Participant 1 mentioned time efficiencies will result. Participant 2 mentioned, going forward limited resources will be used to assist with capture between systems. Participant 6 added that realtime data is required and the only way to do this is system integration and process optimization. Participant 12 added that this will increase sales volumes. Participant 11 mentioned that there are still a lot of paper-based processes. This is time consuming. Online processes for credit approval are still in the infancy stages. Once this is on the automated platform, there will be more alignment of processes and less integration errors.

Participant 2 mentioned that lots of work is done currently to ensure current processes are on systems. This is the first building block for more integration and opportunities for optimization.

Participant 4 highlighted issues with process optimization. This entails integration failures. Also that the correct data is required and that data give insight. Responded 8 added that there is a lot of work required to change a process. This includes regulatory frameworks and governance paper work. This is a time-consuming process. Buy in of relevant stakeholders is required. Participant 8 also mentioned that gaps must be identified before processes can be automated.

Participant 5, 9 and 11 highlighted that new ways of thinking is required as "platforms" is the way of the future. This means one process for a function/capability. Revenue goes in all directions and not the traditional one direction.

Other

Human element

All participants agreed that the impact on the human element must be considered to a larger extent. Participant 1 said that the current employees will have different jobs in a few years' time. Participant 2 agreed and added that we need to focus on people change management and that diverse skills will be required. The same number of people will execute more volume of transactions. Participant 3 added that Industry 4.0, will extend human capabilities. He added that in the past a skill was developed and then handed over to the next generation to continue to implement this. With the pace of Industry 4.0 skills that are developed will only last a short period of time before it changes. Participant 4 added that the human impact and change management is a huge element to consider. Participants 5 and 7 also mentioned the human element and said we need to look at upskilling our employees as jobs will change, change management is important. Participant 5 added that the way we assess skill will have to change. Responded 8 talked about people and execution and how this will change, people must be upskilled. Participant 6 and 9 talked about a transformative purpose. What will make people want to change their behaviour? To change the hearts and minds of people to embrace the change. Participant 10 added that there will be a change in the employee, employer relationship. Participant 11 mentioned that the HR processes will have to be updated and change to cater for this change. Participant 12 said that people's roles will change. Participant 13 agreed that jobs will change and human intervention will be a minimum. Participant 9 also mentioned that change management is important

Data

Many participants agreed that data must be a element to consider. Participant 1 called it a data centric customer experience. Participant 3 said that data is required to effectively understand our customers. Participant 4 said that data is key to understand our customers effectively and anticipate what they will require. Respondedn4 and 10 also added that natural language processing and self learning robots require data to be designed and monitored. Participant 5 also added that data analytics are very important for process design and

redesign. Responded 6 talked about common data share. to be able to related data on a common platform. Participant 9 talked about machine learning. this is also a data element as machines learning require data to enable it to function properly. Participant 10 added that we must focus on data models and predictive analytics. Participant 12 added that we need to use data across themes - not silo approach (e.g. 1. rent = afford home loan = proposed properties in the area, 2. Customer save for 2 years = behaviour change = credit limit). Participant 13 added that the platform must understand the customer need an life cycle and this will use data for contextual sales. Responded 5 added that call centres for example can use data to handle bulk of the calls that come through and the remainder can be handed off the call centre agents.

Participant 5 mentioned that Biometric is to a low level as a pillar and that security must rather be looked at.

Participant 5 and 11 said that legacy systems and how one maintain or decommission these has a huge impact and cost associated with it. Yet, if not done the future of the bank is in jeopardy.

Participant 6 said that value must be created for you business as well as other businesses. Need to create an eco system that is not always profit driven but customer centricity driven. User experience is important, what is the customer science to use something? If it is easy to use customers will use it. if not, they will use something else.

Participant 6 and 8 mentioned that risk must be involved up front to ensure change happen efficiently. We are going to the unknown and it is important that risks are identified and addresses upfront.

Participant 12 said that customer empathy is something that must be considered. Customers does not always want to go digital. there must be a way that we as a bank can identify this to assist clients according to their need. Participant 13 added that going forward banks will be more advisory in capacity

Maturity of the 3rd industrial revolution

Participant 3 said that we are only now at the maturity of the impact on the 3rd industrial revolution.

Security

Participant 5 and 7 placed emphases that all of the capabilities is underpinned by security. Everything must be build with maximum security in mind. Participant 8 added that one must build on what can go wrong. this will ensure that risks are taken into consideration and maximum security is used.

Partnerships

Participant 10 added that new partnerships is required to ensure we stay relevant and that if we don't cultivate this, we might find ourselves out of business soon.

15 Appendix G - Ethical clearance

From: **Bruno Emwanu** <Bruno.Emwanu@wits.ac.za>
Date: Wed, Oct 16, 2019, 16:24
Subject: Bohmer Helena ethics clearance number
To: 1761521@students.wits.ac.za <1761521@students.wits.ac.za>
Cc: BERNADETTE Sunjka <Bernadette.Sunjka@wits.ac.za>

Dear Helena,

I am pleased to inform you that the School Ethics Committee has completed assessing your ethics application for your MSc 50/50 research and clearance has been provided.

The ethics clearance number for your research report is MIAEC 223/19

Please use your ethics clearance number as a reference for all future correspondence on this matter.

By copy of this email, your supervisor is also informed.

Regards,

Dr. Emwanu