

ABSTRACT

**AN EVALUATION OF MOBILE BANKING AS A TOOL FOR ENHANCING
FINANCIAL INCLUSION IN NAMIBIA: A CASE OF FNB NAMIBIA**

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ABSTRACT

Financial inclusion is a multi-dimensional concept of financial development that enables affordable access through availability and equality of opportunities to access financial services, especially among previously disadvantaged social groups. Namibia has one of the most developed financial systems in Africa, and is blessed with a well-run payment system. Yet, Namibia has failed to fully leverage its mobile penetration rate of 97% to deploy financial solutions that can provide an interoperable platform for financial inclusion. As such, this study uses data from a population of the more than 1,2 million mobile banking customers on the FNB Cell phone banking and E-wallet platforms in the period July 2012 to December 2019 (89 months). However, the sample size was restricted by privacy concerns, which saw the study using 74% (66/89 months) of data in the period July 2012 to December 2017 (66 months). The study used a cross-sectional time-series econometric analysis to test Granger causality relationships between mobile banking and financial inclusion. The study found that at the 95% level of confidence, there were significant mean differences (MD) between the unbanked and banked platforms, in terms of value-added services, cash out ratios and financial inclusion channels on the mobile banking platforms. The study also found that among the four identified financial inclusion channels, only Profit Incentives and Financial Penetration channels could be enhanced with mobile banking. While, the other two channels: Financial Access and Account Ownership, influenced the rate of mobile phone adoption. The study concludes that the charge-based value-added services provide the critical intermediation link as to how profit incentives can enhance both mobile banking services and financial inclusion in Namibia. The study recommends that regulators should provide profitability incentives to the banks and other e-money service-providers, as profitable mobile banking platforms can be used as effective tools for enhancing financial inclusion of the unbanked population.

Keywords: Financial Inclusion; Mobile Money Transfer; Cell-phone Banking; Mobile Wallets; Unbanked Populations

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DEDICATION

I dedicate this thesis to God Almighty my creator, my strong pillar, my source of inspiration, wisdom, knowledge and understanding. He has been the source of my strength throughout the study and only through his wings have I soared. I also dedicate this work to my husband; who encouraged me all the way and whose encouragement made sure that I gave it all that was required to finish this course. Finally, I dedicate this paper to my three daughters, Danielle, Rhisdiah and Engelmunde so that it serves as an encouragement to study, work hard and dream big no matter what the circumstances.

ABBREVIATIONS AND ACRONYMS

ADF	Augmented Dickey- Fuller (ADF)
AIC	Akaike Information Criterion
ATM	Automated Teller machines
BLNS	Botswana, Lesotho, Namibia and South Africa
CGAP	Consultative Group to Assist the Poor
CMA	Common Monetary Area
DFS	Digital Financial Services
DOI	Diffusion of Innovations
FIS	Financial Inclusion Strategy (FIS)
FNB	First National Bank of Namibia
FPE	Finally Prediction Error
GDP	Gross Domestic Product
HQIC	Hannan-Quinn information criterion
KYC	Know Your Customer (KYC)
LL	log likelihood
LM	Lagrange Multiplier (LM)
LR	Likelihood ratio
PEOU	Perceived Ease of Use
PIN	Personal Identification Number

POS	Point-of-sale
PSD	Payment System Determinations
PU	Perceived Usefulness
RMSEA	Root-mean-square-error
SADC	Southern African Development Community
SBIC	Schwartz information criterion
TAM	Technology Acceptance Model
UNCTAD	United Nations Conference on Trade and Development
VAR	Vector Autoregression
VEC	Vector Error Correction
VIF	Variance inflation
WDI	World Development Indicators

DECLARATION

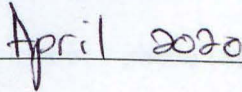
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Signature



Date

CHAPTER 1 : INTRODUCTION AND BACKGROUND OF THE STUDY

1.1. Introduction

Mobile phones affect the lives of billions of people globally, including the poor (Oluwatayo, 2012). The changing mobile technology has revealed opportunities and allowed nearly three billion people without bank accounts to access financial services (Oluwatayo, 2012). The lack of opportunities to access financial services by vulnerable and poor groups has motivated innovation among financial institutions in a variety of ways. That includes mobile banking, though its effectiveness in the context of Namibia is yet to be evaluated. Mobile banking is therefore significant in that it brings financial services to the previously 'unbanked' areas, improving financial inclusion.

Mobile banking refers to the electronic banking that uses mobile phone technology to deliver electronic financial services to customers (Sekantsi & Motelle, 2016). It has been regarded as a powerful new customer relations method for financial services companies (Inoque, 2019) as, mobile banking can reach the previously 'unbanked' low income earners and the unemployed as long as they have access to a cell phone (Sekantsi & Motelle, 2016).

The purpose of this chapter is to provide an overview of the research study by initially describing the research background and the problem. Next, the research objectives and questions are outlined followed by an outline of the scope and significance of the study, along with the limitations of the study. Finally, the chapter provides an outline of the structure of the thesis.

1.2. Background of The Study

Financial inclusion is generally regarded as a process of ensuring access to and usage of basic formal financial services for individuals at an affordable cost (Mbutor & Uba, 2013). Financial inclusion is a multi-dimensional concept of financial development that enables affordable access to financial services, especially among previously disadvantaged social groups (Inoue, 2019; Sekantsi & Motelle, 2016). The Namibia Financial Inclusion Survey (NFIS) done in 2017 indicated that the country's banking population increased to 67.9% in 2017, up from 45% in 2011. In addition, 64.7 % considered the Automated Teller Machines (ATMs) as the most comfortable banking channel (Namibia Statistics Agency, 2018).

Namibia has enjoyed a 50% mobile penetration rate by 2011, and it improved to 97% in 2015 (Christiaan & Kammy, 2012). Leveraging cellular networks to deploy financial solutions provides a platform for financial inclusion (Manyika, Lund, White, & Berry, 2016) though its effectiveness is yet to be evaluated in the context of Namibia. FNB Namibia has been pushing for the interoperability of mobile banking system, which needs approval from the Bank of Namibia. However, the Bank of Namibia (BoN) is yet to approve the interoperability of mobile wallets across the banks, as well as the rules to keep digital wallets safe and prevent fake wallet transactions. The introduction of mobile wallet interoperability and its integration to the bank clearing system will go a long way in ensuring that the entire range of banking products and services are available through mobile channels as is the case in Kenya, through the M-PESA platform (Agufa, 2016).

The earliest forms of mobile banking services were offered via Short Message Service (SMS), then with the introduction of the first primitive smart phones that had Wireless Application Protocol (WAP) support enabling, the use of the mobile web (Immo, 2015). In 1999, European banks started to offer mobile banking on the mobile web platform to their customers and this continued until 2010 (Financial Access Initiative, 2010). The mobile banking system operates in such a way that a specific sequence of SMS messages will enable the system to verify if the client has sufficient funds in his or her wallet and authorise a deposit or withdrawal transaction at the agent (Pandy & Crowe, 2017). When depositing money, the merchant receives cash and the system credits the client's bank account or mobile wallet. In the same way the client can also withdraw money at the merchant: through exchanging SMS to provide authorisation, the merchant hands the client cash and debits the merchant's account (Demirguc-Kunt, Klapper, Singer, & Oudheusden, 2015).

In Africa, M-Pesa pioneered the mobile phone-based money transfer, financing and microfinancing service, when it was launched in 2007 by Vodafone for Safaricom and Vodacom, the largest mobile network operators in Kenya and Tanzania (M-Pesa, 2015). It has since expanded to Afghanistan, South Africa and India. In 2014 it expanded to Romania and in 2015 to Albania (Mutiga, 2014). M-Pesa is a branchless banking service where customers can deposit and withdraw money from a network of agents that includes airtime resellers and retail outlets acting as banking agents. The M-Pesa service spread quickly, and by 2010 had become the most successful mobile-phone-based financial service in the developing world, reaching 17 million registered users in Kenya by 2012 and 7 million registered users in Tanzania by 2016 (M-Pesa, 2015). The service has been

lauded for giving millions of people access to the formal financial system and for reducing crime in otherwise largely cash-based societies (Financial Access Initiative, 2010).

Mobile phone networks now cover more than 70% of people in emerging economies and are projected to reach over 90% by the year 2020 (Manyika *et al.*, 2016). This has seen the diversification of options banks can use to provide services to their customers (Aghdaie & Faghani, 2012). Mobile banking was introduced in Namibia by First National Bank (FNB) in 2007 (Haynes, 2007). The bank's mobile platform was motivated by the drive to offer clients/customers remote access to their financial accounts from their mobile devices. Since then, mobile banking has had a revolutionary impact on the scope of business and how day to day transactions are carried out. The success of M-PESA in Kenya has had a huge impact on banks and fintech companies in Africa. This innovation spurred banks like FNB Namibia and fintech companies like MobiPay and MTC to introduce their mobile wallets. Since, then banks in Namibia have been gradually shifting their focus away from the brick and mortar distribution of banking services towards digital channels that offer lower operating costs to more of the currently unbanked clients (Radcliffe, 2013). Despite this, there are no studies in Namibia that could be found to have evaluated the effectiveness of mobile banking as a tool for financial inclusion. As such, there is need to explore factors that are associated with mobile banking and financial inclusion in Namibia. To fill this inherent gap, this study evaluates how mobile banking enhances financial inclusion in Namibia.

1.3. Statement of the Problem

Maherali (2017) notes that 45% of the developing world's population has access to mobile phones and this presents an opportunity to reach the unbanked. For instance, in Kenya, more than 70% of adults have a mobile money account, while over 30% of adults use mobile phones to make payments from a traditional bank account (Klapper & Popovic, 2018). Additionally, mobile money has helped 194,000 Kenyan households climb out of poverty, enabling women to move from farming into business and retail, and helping families build up savings. The rise of mobile money has led to an increase in bank accounts with an overall account ownership of over 50% in seven sub-Saharan African countries and 80% in three regional economies (Klapper & Popovic, 2018).

A FinScope Survey done in 2007 indicates that 51.7% of the Namibian bankable population were unbanked, especially in the rural areas (FinMark Trust, 2007). However, follow-up surveys done in 2017 indicate that this number has been reduced to 22% (Namibia Statistics Agency, 2018). The researcher could not find any research that could show whether this was as a result of mobile banking as a tool for financial inclusion.

Namibia has nine banking institutions that are established under the Banking Institutions Act, 1998 (Act No. 2 of 1998). These compete for customers from a small population of 2.4 million (Namibia Statistics Agency, 2018). FNB as an early adopter of mobile wallets in Namibia, accounts for more than 1.2 million users, which is more than 50% of all mobile banking users in Namibia. However, mobile banking in Namibia still faces teething problems, with the Bank of Namibia (BoN) yet to approve the interoperability of mobile wallets across the banks, as well as the rules to keep digital wallets safe and prevent

fake wallet transactions. This study is made necessary by the fact that mobile banking is still at its initial stages of adoption, while its progression is being driven by financial inclusion legislation. Therefore, this study aims to explore how mobile banking through wallets can be used as a tool for financial inclusion, by empirically measuring the effectiveness and sustainability of mobile banking wallets in Namibia.

1.4. Objectives of The Study

The main objective of the study is to explore how mobile banking through wallets can be used as a tool for financial inclusion, by empirically measuring the effectiveness and sustainability of mobile banking wallets in Namibia. The specific objectives are:

- To determine the levels at which the banked and unbanked populations transact on mobile wallets in Namibia;
- To identify the key financial inclusion channels that drive mobile wallet usage and growth in Namibia;
- To establish the optimum supply and demand side balance for incentivising mobile wallet adoption in value added services for both the consumers and banking institutions.

1.5. Hypotheses of the study

The study makes the following hypotheses:

Hypothesis 1: Objectives of The Study

H₀: There is no significant difference between the value to volume levels per transaction on the mobile banking platforms for the banked and unbanked customers of a Namibian commercial bank;

H₁: There is a significant difference between the value to volume levels per transaction on the mobile banking platforms for the banked and unbanked customers of a Namibian commercial bank.

Hypothesis 2:

H₀: Mobile banking does not enhance financial inclusion in Namibia

H₁: Mobile banking enhances financial inclusion in Namibia;

Hypothesis 3:

H₀: There is no significant difference between the value to volume levels of the different value added service offered on both the mobile banking and mobile wallet platforms of the Namibian commercial bank;

H₁: There is a significant difference between the value to volume levels of the different value added service offered on both the mobile banking and mobile wallet platforms of the Namibian commercial bank;

1.6. Significance of The Study

This study contributes to the literature by providing new knowledge regarding the use and effectiveness of mobile banking as a tool for financial inclusion, especially from a

developing country context. Findings from this study give insights to the banks, service providers, regulators on the potential of mobile banking as a tool for financial inclusion in Namibia. Moreover, this study is also of great importance to the various banks whose systems are still not interoperable to develop a sustainable model that caters for the financially excluded population. Moreover, the study provides guidance on mobile banking expansion with specific focus on both the banked and unbanked populations.

1.7. Limitations of the Study

One fundamental limitation is that financial inclusion and mobile banking cannot be directly measured and will need to be measured by means of proxies such as mobile wallet subscribers with bank accounts or the number of value-added services used on the mobile platform (Sekantsi & Motelle, 2016). While, mobile banking data is often aggregated with other digital banking data like electronic transfers and internet banking, there is a need to disaggregate this data and only commercial banks can provide this information. Thus, limiting access to data from one consenting commercial bank and the aggregated banking data publicly available on the Bank of Namibia Payment System Statistics.

1.8. Delimitations of The Study

The study is delimited to the mobile wallet transaction volumes from one commercial bank's data for the period 2013 to 2017. The study is further delimited by the definition of the mobile money service (MMS), which is often confused with mobile banking service (MBS), but the two are quite different. Porteous (2006) argues that the difference between MMS and MBS is that one is an "additive" service and the other a "transformational" service. Where, MBS is an additive service to the banked population and refers to services

such as cell phone banking, which allows people to manage their bank accounts through a cell phone. While, MMS is a transformational service that allows people to obtain financial services such as money transfers, value added financial services, saving, credit, and insurance through their cell phones without a need to have a bank account. MMS including mobile wallets like FNB's E-wallet service is transformational because it significantly changes the way financial services are provided, and it promises expansion of financial services to the financially excluded populations (FinMark Trust, 2016).

Mobile money service (MMS) refers to services provided by the mobile money service provider to support the utility of mobile money for the consumer which includes, among others, cash in, cash redemption at various channels and mobile payments services such as person-to-person, business-to-person and government-to-person (FinMark Trust, 2016). In this study, this distinction is made by referring to MBS as Cell phone Banking Individual (CBI) and MMS as E-wallet or by adding the suffix unbanked to the variable, for example, MBR_unbanked.

1.9. Organisation of the Study

The study is divided into six main chapters:

Chapter One: Introduction – this chapter includes the background to the research and the research problem. It further presents the research aims, objectives, research questions and the significance of the research.

Chapter Two: Literature Review – this chapter reviews empirical and theoretical literature on how mobile banking through wallets can be used as a tool for financial inclusion. The

chapter also presents a contextual overview of the Namibian payment and settlement system, which provides the legal framework for mobile money services in Namibia. The chapter also discusses the developments and progresses in financial inclusion and how mobile banking services are part of the initiatives for enhancing financial inclusion in Namibia. The literature review identifies gaps as observed in the existing literature towards which this study is intended to contribute.

Chapter Three: Research Methodology – this chapter discusses research methods available to researchers and also gives a summary of research methodology theory and concepts. It further explains the research methodology used in this study and the reasons the researcher chose the methodology.

Chapter Four: Results, Discussion and Interpretation of Findings – in this chapter the data analysis and interpretation are presented. All the findings are summarised and analysed in this chapter.

Chapter Five: Conclusions and Recommendations – this chapter presents the conclusions of the research and identifies the positive issues and makes recommendations to the organisation to overcome the negative issues. Opportunities for further research are also discussed.

CHAPTER 2 : LITERATURE REVIEW

2.1. Introduction

This chapter presents a contextual overview of the Namibian payment and settlement system, which provides the legal framework for mobile money services in Namibia. The chapter further reviews empirical and theoretical literature on how mobile banking through wallets can be used as a tool for financial inclusion. The chapter starts with an overview of the mobile money services and e-money issuers. The chapter also discusses the developments and progresses in financial inclusion and how mobile banking services are part of the initiatives for enhancing financial inclusion in Namibia. The chapter ends with the theoretical framework for financial inclusion and empirical studies highlighting the gaps in the existing literature towards which this study is intended to contribute.

2.2. The Namibian Payment and Settlement System

An efficient and well-run payment system is vital for the efficient functioning of any economy (BoN, 2017). As such, Namibia, with one of the most developed financial systems in Africa, is blessed with well-run payment system. While, the country's banking institutions are sound, profitable, and adequately capitalised, benefiting from its close ties with South Africa (Shimweetheleni, 2016). However, Triki & Faye (2013) argues that 23% of adults in Africa have an account at a formal financial institution. Additionally, there is a large variation in account ownership ranging from 42% in Southern Africa to 7% in Central Africa (Triki & Faye, 2013). Thus, making it difficult to benchmark financial inclusion measures for African countries.

There is need to contextualise the Namibian payment and settlement system, to allow for the benchmarking of financial inclusion progress and developments in Namibia. Moreover, the smooth functioning of the infrastructure for an enabling payment and settlement system is essential for financial inclusion. Payment systems are not just infrastructures like roads and bridges, they come in various forms, such as computer applications, point-of-sale devices, cheques and so on. In this regard, the central bank plays a crucial role by providing the ultimate settlement asset in the form of central bank money and overseeing all systems that are directly connected to it (BoN, 2017).

The Bank of Namibia's mandate to oversee the Namibian Payment System (NPS) is provided for in section 2(2)(a) of the Payment System Management Act, 2003, as amended, (Act No. 18 of 2003) which states that one of the functions of the Bank of Namibia is to oversee, inspect and monitor the NPS, the operation of the Body, system participants and service providers (BoN, 2017). The central bank also operates the Namibia Interbank Settlement System (NISS), the system that enables the final settlement of Electronic Funds Transfer (EFT), Cheques, Debit and Credit card transactions between licensed commercial banks and authorised non-bank financial institutions. At the end of each business day, banks pay what they owe each other in the NISS (BoN, 2017).

Another important part of the NPS is NamClear, the payment clearing house which enables interoperability of the licensed banks and facilitates the switching of payments that have payers and payees from different banks. For instance, when one party sends a payment from Bank A to be received by another party at Bank B, such a payment is switched by NamClear and sent to the NISS for settlement. Payments settled on NISS are final and cannot be reversed. The central bank monitors that participating banks have

sufficient funds in their accounts on NISS to honour their obligations (BoN, 2017). Figure 2.1 presents an overview of the Namibian Payment System.

Designated financial market infrastructures (FMI) are multilateral systems that provide the infrastructure for transferring, clearing, and settling payments, securities, and other financial transactions among participating financial institutions. The NISS is an example of an FMI.

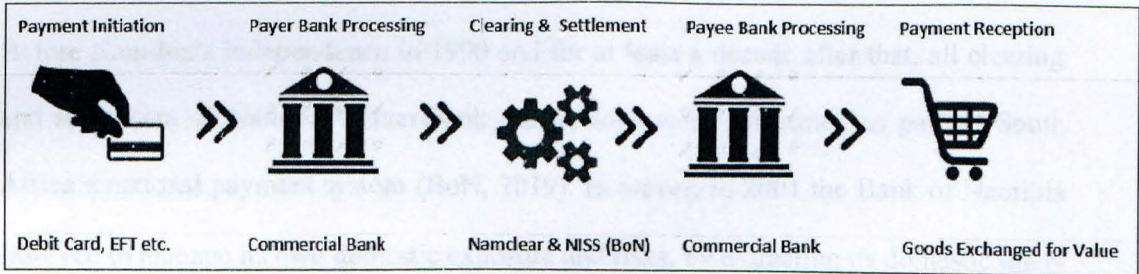


Figure 2.1 Graphical Presentation of the Namibian Payment and Settlement System
Source: (BoN, 2017)

Figure 2.1 shows the graphical overview of how payment transactions are processed in the national payment system from when a trade is agreed upon between a customer (payer) and supplier (payee), to the time the value reaches the supplier for goods and services provided. The payment instruments and payment schemes within the NPS are mechanisms which users of payment systems use to transfer funds between accounts at banks or other financial institutions (BoN, 2017). These include Credit cards, Debit cards, Electronic Funds Transfers (EFT) and Electronic Money (E-Money) schemes, and Electronic Wallets offered by various banks and fintechs in Namibia.

Lastly, the Payments Association of Namibia (PAN) in collaboration with the Bank of Namibia provides regulatory oversight to the providers of critical infrastructural services of critical services, such as point of sale and ATMS. An Automatic Teller Machine (ATM) is an example of a critical infrastructure necessary for the withdrawal of cash without entering a branch (BoN, 2017).

2.3. Technological Evolution of The Namibian Payment System

Before Namibia's independence in 1990 and for at least a decade after that, all clearing and settlement of Namibia's inter-bank transactions were performed as part of South Africa's national payment system (BoN, 2019). However, in 2001 the Bank of Namibia resolved to manage its own domestic exposure and risks, by extracting its domestic inter-bank transactions from the South African national payment system, and clear and settle domestic transactions locally (BoN, 2019).

This resulted in the introduction of the National Payment System (NPS), and Namibia's own settlement system, the NISS which followed a year later. Since then, the Bank of Namibia has been responsible for the promotion of payment system reforms.

These reforms have seen changes related to the development of enabling infrastructure, oversight of the national payment system, as well as keeping abreast of international developments in the payment system arena and developing legislation and supporting regulations and policies (BoN, 2017). Figure 2.2 presents the timeline of the evolution of the Namibian Payment System.

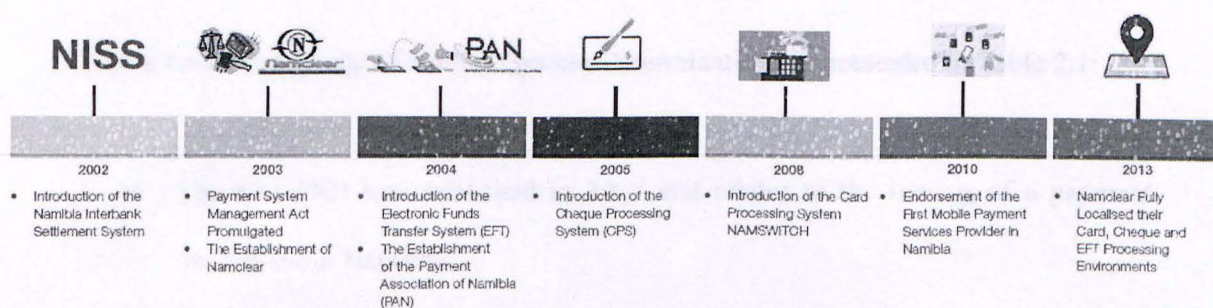


Figure 2.2 Timeline Technological Evolution of the Namibian Payments System

Source: (BoN, 2019)

Figure 2.2 indicates the promulgation of the Payment System Management Act in 2003, and the establishment of Namclear in the same year. Consequently, Namclear become operational in 2004, with the establishment of the EFT system to clear all domestic EFT transactions. While, the implementation of the cheque processing system followed in 2005. Shortly after that, in 2006, the Bank of Namibia set up the Payment Association of Namibia (PAN) whose role is to govern and manage certain aspects of the NPS. By April 2008, Namswitch (the Namibian Card processing system) enabled all inter-bank card transactions that emanate from automated teller machines (ATMs) to be cleared and processed locally, while card transactions at point-of-sale (POS) terminals could be cleared and processed locally as from implemented (BoN, 2019).

2.4. Mobile Money Regulatory Framework in Namibia

As part of the payments regulatory function, the Bank of Namibia develops certain regulations that are known as Payment System Determinations (PSDs). With, each Payment System Determination made and maintained by the Bank of Namibia is used as part of the regulatory framework and oversees a specific aspect of the NPS (BoN, 2019).

There are currently eight Payment System Determinations as presented in Table 2.1:

- The first PSD was published in 2007 and relates to the issuing of a payment instrument in Namibia.
- While, PSD-2 published at the end 2017, was introduced to forbid Namibian institutions, businesses and individuals from issuing, accepting or processing domestic cheque payments over N\$100,000.
- PSD-3 was published and took effect on 16 November 2018, revoked the previous PSD-3 that was published and took effect on 1 March 2012. PSD-3 is the Determination on Issuing of Electronic Money in Namibia.
- While, PSD-4 seeks to protect and promote the treatment of card transactions in the country and
- PSD-5 and PSD-6 are regulatory tools for enhancing Financial Inclusion in Namibia, through an affordable, effective and efficient NPS.
- PSD-7 is the determination providing guidelines for assessing the efficiency of the NPS.
- PSD-8 is the Determination on the Imposition of Administrative Penalties in the NPS (BoN, 2019).

Table 2.1 Payment System Determinations for the Namibian Payment System

No.	Name of Determination	Summation of Determination
PSD-1	Determination on Issuing of a Payment Instrument	PSD-1 was published on 29 June 2007. However, it only took effect on 28 September that year. PSD-1 applies to persons who intend to issue a payment instrument in Namibia. It defines the assessment process and minimum requirements to issue such instruments. Thus, PSD-1 serves as the first point of contact to operate within the NPS.
PSD-2	Determination on the Reduction of the Item limit for Domestic Cheque Payments within the Namibian National Payment System	PSD-2 was published and took effect on 6 December 2017. It applies to all banking institutions and Namclear, as well as to businesses and individuals who issue, accept and/or process cheque payments within the NPS. PSD-2 also forbids these institutions, businesses and individuals from issuing, accepting or processing domestic cheque payments over N\$100,000. (Note: Cheques are in the process of being phased out in Namibia)
PSD-3	Determination on Issuing of Electronic Money in Namibia	PSD-3 was published and took effect on 16 November 2018. This current PSD-3 revoked the previous PSD-3 that was published and took effect on 1 March 2012. It applies to everyone who intends to issue e-money services in Namibia. When it is applied, PSD-3 is read together with PSD-1 and the Guidelines for Issuers of Electronic Money and other Payment Instruments (see later herein).
PSD-4	Determination on the Conduct of Card Transactions within the National Payment System	PSD-4 was published on 30 September 2012 and came into effect on 30 June 2013. It applies to all persons in Namibia engaged in processing card transactions or acquiring card transaction merchants. PSD-4 also offers guidance on how domestic, regional and international card transactions should be routed, and defines specific preventive provisions on the acquisition and treatment of domestic e-commerce and brick-and-mortar POS merchants. Thus, PSD-4 seeks to protect and promote the treatment of card transactions in the country. (See later herein for more on cards as payment instruments and how to conduct card transactions safely.)
PSD-5	Determination on the Standards for a Basic Bank Account and Cash Deposit Fees within the National Payment System	PSD-5 was published and came into effect on 31 March 2015. It applies to all banking institutions. PSD-5 is the Bank of Namibia's regulatory tool for ensuring as many people in Namibia as possible have access to affordable financial services. Thus, according to this Determination, all banking institutions are compelled to offer at least one basic bank account for anyone earning N\$2,000 or less per month. PSD-5 also forbids banking institutions from charging a cash deposit fee on any individual account; equally any business that has a turnover of N\$1,000,000 or less per year should not be charged cash deposit fees.
PSD-6	Determination on the Criteria for Authorisation of Participants in the Clearing and Settlement Systems	PSD-6 was published on 6 February 2013 and became effective on 31 August 2013. It provides guidance to persons who want to participate in clearing and settlement systems. PSD-6 is to be read together with the Starter Pack for Participation in the Clearing and Settlement Systems. This Starter Pack provides prospective participants with guidelines and a checklist by means of which to operate.
PSD-7	Determination on the Efficiency of the National Payment System	PSD-7 was published and took effect on 31 December 2014. It provides guiding principles for assessing the efficiency of the NPS. PSD-7 applies to all system participants, payment instrument issuers and service providers within the NPS who deal with immediate settlements, EFTs, card payments, cheque payments, e-money payments, or any other payment instrument recognised by the Bank of Namibia.
PSD-8	Determination on the Imposition of Administrative Penalties in the National Payment System	PSD-8 was published and was effected on 25 April 2017. It provides guiding principles and criteria to assess cases where authorised NPS participants delay their compliance with any NPS regulation or law. PSD-8 also defines the procedure and process for the Bank of Namibia to determine and calculate an appropriate administrative penalty amount where participants do not comply with NPS regulations and law.

Table 2.1 shows the key regulatory determinations guiding the mobile money services in Namibia, with PSD-3 first published in 2012, promotes the safe issuing of e-money (Mobile money services). This regulation offered financial service providers an enabling environment to make payments easier with a wider reach (BoN, 2019).

The introduction of e-money regulation (PSD-3) saw the introduction of the MobiPay E-wallet services in Namibia. The licensing of the MobiPay by the Bank of Namibia set the ground rules for mobile money services in Namibia. According to the MobiPay (2012) e-wallet terms and conditions, the mobile wallet allows any person with a valid Namibian cell phone number to receive funds to the value of up to a maximum N\$ 2,000 (two thousand Namibia Dollars) in his/her e-wallet account and/or to a maximum of N\$ 25,000 (twenty-five thousand Namibia Dollars) monthly without any registration (MobiPay, 2012).

PSD-3 regulations require that upon first receipt of funds in the e-wallet account, the e-wallet account holder be issued with a secret PIN code with which to transact and access his/her e-wallet funds securely. This PIN code is for the sole purpose of protecting the e-wallet account and is linked to the e-wallet account holder's cell phone number. However, the mobile services providers reserve the right to close the e-wallet account if it has not been used or has been dormant for longer than 180 days and the e-wallet account holder hereby accepts responsibility to keep such account active (MobiPay, 2012).

2.5. Mobile Money Services And E-Money Initiatives in Namibia

A Bank of Namibia (2018) position paper on the 'Interoperability in the National Payment System' notes that the objective of the Bank of Namibia was to achieve 70%

interoperability of all payment instruments by 2020 as envisioned in the NPS Vision 2020, and to ensure that full interoperability is achieved by 2025. However, the paper conceded that interoperability has been achieved to a large extent across the retail payment streams i.e. Cheque, Electronic Fund Transfers (EFT) and Card, while Electronic Money (e-money) issued by both banks and non-banks remains closed loop (not interoperable) (BoN, 2018).

Interoperability is the ability of different payment systems to connect with one another (Arabéhéty, Chen, Cook, & McKay, 2016). In simple terms, interoperability enables a user of one e-money issuers scheme to send to or receive money from another user on a different e-money issuer's scheme. Interoperability normally requires technical compatibility between systems and networks, hence the need for common rules, standards and commercial agreements (Arabéhéty, *et al.*, 2016). Without interoperability, senders and recipients of mobile money services (MMS) are restricted to a single e-money issuer's scheme, which restricts financial access to services, systems and infrastructure such as ATMs and POS devices which might not be available country wide. However, with interoperability, a user will have the option to send e-money and perform financial transactions across e-money schemes and channels (ATM, POS device or merchant) belonging to different e-money issuers without being a client of all the e-money issuers (BoN, 2018). Therefore, initiatives towards interoperability have the potential of playing enhancing the expansion of e-money and financial inclusion in Namibia.

The absence of interoperability in e-money can be attributed to a lack of collaboration among e-money issuers and the fact that e-money is a relatively new payment instrument in Namibia (BoN, 2018). According to the central bank the Mobile Money Service (MMS)

activity between 2010 and 2013 was limited for any meaningful interoperability to happen. As a result, the Determination on Issuing Electronic Money (PSD-3) which became effective on 1 March 2012 did not mandate interoperability, but requires e-money issuers to use technical standards and specifications that ensure that interoperability is feasible at low cost in the future (BoN, 2018). However, this requirement has to date not been enforced and none of the e-money issuers have provided proof that their e-money services and systems have the technical capabilities and specifications to become interoperable (BoN, 2018).

The regulator believed that the licensed E-money issuers especially non-banks were at an infancy stage of issuing e-money and mandating interoperability at that early stage of e-money services development in Namibia would have been counterproductive and thus hamper innovation (BoN, 2018). However, the number of licensed e-money issuers, as well as the volumes and values of e-money in Namibia grew exponentially over the 2013 – 2017 period. With, the number of licensed e-money issuers growing from 1 non-bank e-money issuer (MobiPay) in 2010 to 8 e-money issuers comprising of both banks (3) and non-banks (5), at the end of 2017 (see Table 2.1).

While, e-wallet transaction volumes (MMT) rose from 8.3 million in 2013 to 17.8 million in 2017 and the transaction values (MBR) rose from N\$1.5 billion to N\$10.6 billion over the same period (BoN, 2018). Interestingly, the FNB e-wallet accounted for 33% of the reported industry MMT in 2013 (2.7 million) and by end of 2017 the volumes accounted for 55% of industry MMT (9.8 Million). Thus, making the FNB e-wallet the most dominant player at the end of 2017.

Table 2.1 Licensed Mobile Money Services and E-money Issuers in Namibia

No.	Name of E-money Issuer	Access Channel
1	MobiCash Payment Solutions (MobiPay)	Mobile application, USSD
2	First National Bank of Namibia	Mobile application, USSD
3	Standard Bank Namibia	Mobile application, USSD
4	Bank Windhoek	Mobile application, USSD*
5	Namibia Post Limited	Card
6	Nam-mic Payment Solutions	Card
7	Virtual Technology Services	USSD
8	Vivo Energy Namibia	Card

MMS in Namibia has seen an expansion in the type of e-money services and value addition services namely e-commerce payments, merchant payments, subscriptions, airtime and utility payments i.e. water and electricity (BoN, 2018). However, the lack of interoperability of these 8 e-money platforms increases inefficiencies and may hamper financial inclusion objectives of holistically bridging the gap between the banked and unbanked population in Namibia (BoN, 2018). The Bank of Namibia has started initiatives to bring the e-money stakeholders together and are currently working out the mechanism for an e-money payment clearing house (PCH) that will fall under the relevant structures of the National Payment System to ensure that the interoperability of e-money benefits all e-money issuers and the NPS as a whole (BoN, 2018).

Figure 1.1: Financial Access by country in 2016

Source: (Prati et al, 2016)

At the country level however, Sub-Saharan Africa (SSA) and South Africa (SA) have the highest number of financially included population. They are followed by the Common Market for Eastern and Southern Africa (COMESA) countries of SACU-BLNS countries of Botswana (76%), Lesotho (81%), Namibia and Swaziland with 71% of their adult population financially included. Excluded countries such as the Democratic Republic of Congo (43%), Malawi (43%)

2.6. Developments and Progress in Namibia’s Financial Inclusiveness

According to the SADC Financial Inclusion Strategy (FIS) (2016) the overall, financial inclusion in the SADC region is relatively low and varies widely across member countries. While, over half of adults (66%) living in the SADC region, are financially included, which is 12% higher than the continent-wide average, 41,9 million people (34%) still do not have access to either formal or informal financial services or products, as illustrated in Figure 2.3.

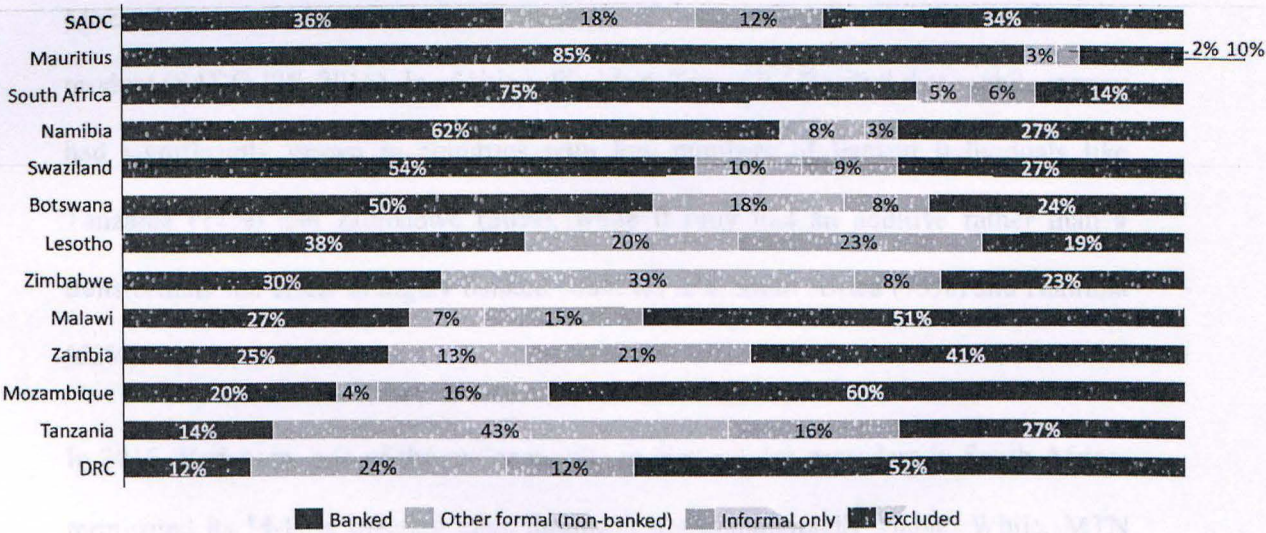


Figure 2.3 Financial Access by countries in SADC

Source: (FinMark Trust, 2016)

At the country level however, Mauritius (90%) and South Africa (86%) have the highest number of financially included populations. They are followed by the Common Monetary Area (CMA) countries or SACU-BLNS countries of Botswana (76%), Lesotho (81%), Namibia and Swaziland with 73% of their adult population financially included. Conversely, countries such as the Democratic Republic of Congo (48%), Malawi (49%)

and Mozambique (40%) are experiencing extremely low levels of financial inclusion, with over 50% of the population lacking access to financial services of any kind (FinMark Trust, 2015).

The Low regional performance and substantial variation between countries points to the need for a more coherent financial inclusion strategy. With, a larger percentage of the included population in upper-middle-income countries, like Mauritius, South Africa and Namibia, using up to three to four financial products compared to the DRC, Zambia, Mozambique and Malawi where the majority of those included only use one financial product (SADC-FIS, 2016). In addition, Fin Mark Trust (2016) noted that mobile money had significantly grown in countries with low numbers of banked individuals like Tanzania (14%) and Zimbabwe (30%), while it only had an additive rather than a transformational effect in highly banked countries like South Africa (75%) and Namibia (62%).

In 2016, Vodacom, one of the major mobile money service providers in South Africa, terminated its M-Pesa offering after finding it not commercially viable. While, MTN South Africa also halted new mobile money sign-ups. This South African experience is similar to that of developed economies where mobile money has had an additive effect of increasing cell phone banking use for people with banking accounts rather than the transformative effect of mobile money services, as experienced in Kenya (FinMark Trust, 2016). Similarly, trends in Namibia have supported this notion, with FNB Namibia's E-wallet service surpassing MobiPay as the most dominant e-money issuer in Namibia. This is further corroborated with the eventually 50.9% acquisition of MobiPay by Standard

Bank Namibia (The Namibian, 2019), which effectively makes the mobile and e-money market in Namibia, dominantly additive rather than transformative.

FinMark Trust (2016) also notes that the success of mobile money is influenced by both macro-level and individual-level factors. At a macro-level, the availability of mobile telecommunication infrastructure and hence wider access to mobile phones coupled with a conducive regulatory environment are important. Yet, the availability of mobile money services does not guarantee uptake because people's decision to adopt mobile money depends on whether or not they have access to the conventional financial services such as a bank account, mobile banking and internet banking bank (FinMark Trust, 2016). As such, the success of mobile money services providers in Namibia going forward will critically depend on how the regulatory framework around the interoperability of the platforms will be implemented.

As it stands, the closed-loop e-money schemes that not yet interoperable and the stringent regulation on Know Your Customer (KYC), limits the attractiveness of mobile money service to the unbanked customers and leads to a low level of usage. The Bank of Namibia intend to mandate interoperability by the year 2025 through the issuance of a regulation. As part of its approach to ensure stakeholder inclusivity and transparency, the BoN continuously consult and engage the NPS industry on its readiness and strategies to spearhead interoperability by 2025 through its position paper (BoN, 2018).

2.7.Theoretical Framework

Mobile banking is still at its initial stages of adoption and the concept requires more research, especially within developing countries that have been slow to accept such

advances (Klapper & Popovic, 2018). This study aims to explore how mobile banking through wallets can be used as a tool for financial inclusion, by empirically measuring the effectiveness and sustainability of mobile banking wallets in Namibia. As such, the study uses the Diffusion of Innovation Theory to understand how the rate of adoption of mobile banking in general and mobile wallets in particular can be used to enhance financial inclusion. While, the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) theory provides insight into the financial inclusion channels facilitated by the adoption and utilization of financial technologies towards financial inclusiveness.

The Innovation diffusion theory is used to explain how the innovation of mobile banking technology has transformed the Namibian payment system. While, the TAM is important to the study, as it explains how or why a certain technology was accepted in place of another. This is particularly, important in the Namibian context, where closed-loop e-money schemes not yet interoperable. The TAM can provide insights into the factors limiting the attractiveness of mobile money services to the unbanked customers and leading to a low-level technological acceptance and usage. Thirdly, the UTAUT theories are crucial to the explanation of the relations and causality between financial inclusion and mobile banking, within a Namibian context. The theories are discussed in greater detail in the following sections:

2.7.1. Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM) was developed by Davies in 1986 (Agufa, 2016). Two key beliefs were used to develop TAM: perceived usefulness and perceived ease of

use and users' attitudes, intentions and actual computer usage behaviour. Behavioural intention is jointly determined by attitude and perceived usefulness. Attitude is determined by perceived usefulness (PU) and perceived ease of use (PEOU). TAM replaces determinants of the attitude of the theory of Reasoned Action (TRA) by perceived ease of use and perceived usefulness (Nyagilo, 2019). The TAM affirms that the systems real utilization is established by each user's behavioural intention for usage and is inspired by an individual's perception to the system. The theory also explains that the perception towards new technology has a direct relation to its functionality as well as the simplicity of the system (Agufa, 2016).

TAM can be used to explain how variations in consumer behaviours to mobile money services can lead to enhancing financial inclusion in Namibia. The adoption and utilization of financial technology are highly influenced by perceived ease of use and usefulness of the technology (Nyagilo, 2019). In addition, mobile banking is perceived to be useful as it brings financial services (access to cash, money transfer and savings) closer to the people.

2.7.2. The Unified Theory of Acceptance and Use of Technology (UTAUT) theory

The unified theory of acceptance and use of technology (UTAUT) is a technology acceptance model formulated by Venkatesh and others in "User acceptance of information technology: Toward a unified view" (Nyagilo, 2019). Farah, Hasni, & Abbas (2018) argues that many theories and models have been devised to understand individual behavioral intention with regard to technology usage, including the technology acceptance model (TAM) (Davis et al., 1989), TAM2 (Venkatesh, 2000), TAM3 (Venkatesh and

Bala, 2008), UTAUT and UTAUT2 (Venkatesh *et al.*, 2003, 2012). However, few studies have attempted to expand the theory itself to further enhance its accuracy.

Koksal (2016) emphasized the importance of conducting future studies that additionally measure the causality between mobile banking and the actual behavior itself. Nyagilo, (2019) used the UTAUT theory to explain the adoption and utilisation of financial technology, as a financial inclusion instrument in Rural Kenya. In relation to price value, the adoption of agency banking, automated teller machines or mobile banking is cheap as customers do not need to buy any other phone as the mobile money application is compatible with any type of phone (Nyagilo, 2019).

This study adapts the UTAUT theory and examine the impact of the financial inclusion channels that proxy on a consumer's intention to adopt mobile banking within the Namibian context. As this will help digital banking managers understand the financial inclusion channels that are greatly influenced by mobile banking, thereby ultimately enabling e-money issuers to access a greater customer base and increase their overall revenues.

2.7.3. Diffusion of Innovation Theory

The Diffusion of Innovations (DOI) theory was proposed by Rogers (1995) to explain the approach through which innovation can be passed via different ways over certain period among different users (Agufa, 2016). The Innovation diffusion theory explores the ways in which innovative ideas are passed from one generation to the other. The diffusion of an innovation, in this case mobile money services, is not instantaneous (Peruta, 2017), as it

is conveyed through various channels continually among individuals of the same social beliefs (Agufa, 2016).

The diffusion of innovations theory explains that innovationists apply normal distribution curve which can be partitioned into five segments to categorize users in terms of innovativeness. The five segments of users are modernizer, early modernizers, and timely mass, late mass and stragglers (Agufa, 2016). The Diffusion of Innovations Theory can be used by mobile money services providers to gain absolute advantage over competitors by rewarding those who capitalise on the user segmentation by converting them into loyal customers. Peruta, (2017) notes that during the first years of diffusion of mobile money the number of countries and users was small. Then a growth stage will be witnessed through a rise in both numbers. The epidemic model of technology diffusion explains this slow take off and ensuing period of growth, which followed an S-shaped curve (Peruta, 2017). As knowledge provided by earlier adopters are the key drivers to ensuring more adoption. Potential adopters learn about the new technology from previous adopters and they learn how to use it effectively and about its potential profitability (Peruta, 2017).

2.8. Empirical Review

The empirical review was done by focusing on studies of mobile money transfer services in Africa and the studies that examined the relationship between mobile banking and financial inclusion within different theoretical lens.

2.8.1 Mobile Money Transfer Services in Africa

The onset of the new millennium saw developing countries in South Asia and Sub-Saharan Africa adopting mobile first approach to services due to the rapid growth in mobile phone subscription. This led to the World Bank (2012) observing that the developing world was “more mobile” than the developed world. Subsequently, the World Bank’s World Development Indicators (WDI) data shows that mobile phone subscriptions grew at an average annual rate of 954 percent in South Asia and 208 percent in sub-Saharan Africa (World Bank, 2016).

This is remarkably high compared to the annual growth of 46 percent in East Asia and Pacific, 23 percent in Central Europe and 15 percent in Europe and Central Asia, and 12 percent in North America (FinMark Trust, 2016). Moreover, in some developing countries, more people have access to a mobile phone than to clean water, a bank account or even electricity (Demirguc-Kunt *et al.*, 2015). James (2014) attributes such a rapid growth in mobile phones in developing countries to the lack of technological infrastructure in the form of paved roads, post offices, taxis, public phones, rail transport and so on.

These high mobile phone penetration rates have also improved access to banking services for the previously unbanked in these developing countries (Oluwatayo, 2012). The developing world has thus followed the “mobile first” development approach, while mobile communications have added value to legacy communication systems and have supplemented and expanded existing information flows in the developed countries (World Bank, 2012). Innovations in the mobile phone sector such as multi-SIM card phones, low-value recharges, and mobile payments have originated in developing countries (FinMark

Trust, 2016). Consequently, Mobile Money Transfer (MMT) is seen as a value addition service (VAS) that has proved to be a key component of poverty reduction in Africa (Mutong'Wa, Campus, Khaemba, & Mengich, 2014).

Mobile money has been a fast-growing phenomenon in developing countries around the world but particularly in East Africa (Paelo, 2017). With, most studies on mobile money transfers and its impact on financial inclusion using the Kenyan market as the benchmark. Ouma, Odongo, & Were (2017)'s study on mobile financial services and financial inclusion, as a boon for savings mobilization in selected countries in sub Saharan Africa, looked at Kenya, Uganda, Malawi and Zambia. While, Paelo, (2017) focused mostly on the East African countries of Kenya, Uganda and Tanzania, which have shown remarkable mobile money growth.

Similarly, Robb & Vilakazi (2015) compared the contestability and outcomes of the mobile payments markets in Kenya, Tanzania and Zimbabwe. While, Arabéhéty, *et al.*, (2016)'s digital finance interoperability and financial inclusion scan of 20 countries used Kenya and Tanzania with 6 other African countries against countries in South Asia and South America. On the other hand, Peruta's (2017) claims on the development of mobile money services in emerging and developing countries, singled out Kenya, Tanzania, Uganda, Burundi and Rwanda.

Peruta (2017) noted that a large and growing body of research on these countries focused on support the need to develop new tools, such as mobile money, in order to fight financial exclusion (Arabéhéty, Chen, Cook, & McKay, 2016; Demircuc-Kunt, Klapper, Singer, & Oudheusden, 2015) As well, investigate the factors that make mobile money successful in

Africa (GSMA, 2017; Klapper & Popovic, 2018; Nyagilo, 2019; Robb & Vilakazi, 2015). Additionally, most studies (Agufa, 2016; Farah, Hasni, & Abbas, 2018; Ouma, Odongo, & Were, 2017; Waiganjo, 2018; Zhang, Lu, & Kizildag, 2018) provided assessments of the how the adoption of mobile money contributes to financial inclusion using evidence from the banking sector.

Most relevant studies have been conducted under the auspices of organisations such as GSM Association (GSMA), the Consultative Group to Assist the Poor (CGAP), the Bill and Melinda Gates Foundation, the United Nations Conference on Trade and Development – UNCTAD or MNOs (Peruta, 2017). Paelo (2017) noted that Kenya, Uganda and Tanzania, were part of the 16 countries globally, where mobile money accounts outnumber bank accounts. For instance, in Kenya growth of mobile money subscribers between 2010 and 2016 has been 142%. While, in Uganda and Tanzania, the growth rate of mobile money subscribers between 2011 and 2016 has been 610% and 172% respectively (Paelo, 2017).

A study by CGAP (2014) found that the mobile money market in Kenya was the most developed in Africa, with 14.2 million active users. Accordingly, this study uses empirical evidence from Kenyan studies to benchmark and compare it with the Namibian experience. In light of this reality, most literature discussed had a bias towards lessons learnt in Kenya. Additionally, the degree to which mobile money is capturing the unbanked market differs across countries. For instance, in Kenya 43 percent of adults who report having used mobile money in the past 12 months do not have a formal account. While, in Sudan the figure was 92 percent. This heterogeneity may reflect the varied and

fast-evolving regulations surrounding mobile money (CGAP, 2014). Thus, motivating this study to discuss the evolution of mobile money regulations in Namibia.

Ouma *et al.*, (2017) revealed that the growing and deepening the scope for mobile phone financial services is an avenue for promoting savings mobilization, especially among the poor and low income groups with constrained access to formal financial services (Ouma *et al.*, 2017). While, a recent study by the GSMA (2017) points to a decade of growth in mobile money services in the Africa region following the launch of M-Pesa in Kenya in 2007. The study noted that there are now seven markets in Africa where more than 40 percent of adults are active mobile money users, these include Gabon, Ghana, Kenya, Namibia, Tanzania, Uganda and Zimbabwe (GSMA, 2017).

The reports further noted that mobile money is now achieving mass-market adoption in all corners of Sub-Saharan Africa, enabling millions of people to access financial services for the first time and contributing to economic growth and social development (GSMA, 2017). The reports highlight the great strides countries like Namibia have made to now be comparable to the Kenyan success story. Therefore, this study seeks to provide context into the lessons learnt in Namibia by exploring how mobile banking through wallets can be used as a tool for financial inclusion, by empirically measuring the effectiveness and sustainability of mobile banking wallets in Namibia.

2.8.2 The relationship between Mobile Banking and Financial Inclusion

Various studies show the relationship between mobile banking and financial inclusion within different theoretical lens (Agufa, 2016; Arabéhéty, Chen, Cook, & McKay, 2016; Demircuc-Kunt, Klapper, Singer, & Oudheusden, 2015; Farah, Hasni, & Abbas, 2018;

Financial Access Initiative, 2010; FinMark Trust, 2016; Ismail, Moya, Bwiino, & Ismael, 2017; Klapper & Popovic, 2018; Mbutor & Uba, 2013; Nyagilo, 2019).

For instance, Nyagilo (2019) uses the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT) theory and Financial Intermediation Theory (FIT), studied the role of financial technology, as an instrument of financial inclusion in rural Kenya. The study found that mobile banking and agency banking both had a positive and significant influence on financial inclusion in the rural Kenya. However, unlike mobile banking, which takes advantage of the high mobile phones penetration in the rural areas, agency banking requires customers to visit agents, normally located in shopping centers. The study also found that the introduction of mobile banking and agency banking had led to a significant decrease in the utilization of automated teller machines (ATMs). The study recommended that policy makers consider mobile banking in their formulation of policies because of the technological developments and the expected switch from physical branch networks to technologically supported banking services.

Zhang, Lu and Kizildag, (2018) used the traditional TAM theory factors to investigate the factors influencing bank consumers to adopting mobile banking apps to facilitate their banking services. The study found that banks should aim to gain trust from its clients because it was critical to the active adoption of mobile banking apps. The study recommended that banks needed to pay more attention to reliability and privacy features when designing and promoting mobile banking technology to consumers. While, advertisements to bank clients should stress the “fun” aspects of the mobile banking apps to attract them to the use of mobile banking technology (Zhang *et al.*, 2018).

Agufa (2016) relied on the theory of financial innovations, the innovation acknowledgment model and the dispersion of development hypothesis, to explain the effect of digital finance on financial inclusion in the banking industry in Kenya. The study found an insignificant negative relationship between agency banking, mobile banking and internet banking with financial inclusion in the banking industry in Kenya. The study concluded that digital finance had no significant transformative effect on the Kenyan banking sector's financial inclusiveness. As such, mobile banking in Kenya had the additive effect of lowering the operating cost associated with opening and operating branches to improve their profitability and financial performance. The study recommended that to ensure the usage and adoption of digital financial services, banks should create more awareness of such services and offer them at lower cost to enhance the usage of digital financial services.

Ismail, Moya, Bwiino, & Ismael, (2017) employed the UTAUT theory to investigate the effects of mobile money services adaptation in the rural parts of Uganda. The study found that customer expectancy, social factors, transaction costs determine the adoption of mobile money services in rural Uganda. Mobile Money Transfer (MMT) service providers were thus encouraged to do promotional campaigns that target consumer behaviour, towards encouraging individual adoption and actual usage of MMT services among customers

Waiganjo (2018) employed the Diffusion of Innovation Theory and the Theory of Financial Intermediation to study the effect of mobile banking investment on financial

profitability in Tier one banks in Kenya. The study found that the monthly value moved through mobile banking, and the number of users of mobile banking significantly influenced financial profitability of the banks. The study also found significant positive associations between increased customer base, mitigating fraud and cybercrime, investing in security systems, and risk management practices with increases in the financial profitability of the banks. The study recommended the need for policy makers to switch from physical branch networks to technologically supported banking channels.

Peruta (2017) exploited the new technology diffusion frameworks to evaluate the patterns of adoption of mobile money in emerging and developing countries. Drawing on technology diffusion theories, the study assessed the main trends explaining differences in adoption levels among the countries observed. The study found that the results of the cluster analyses support the predictions in the technology diffusion literature. However, most of the observations in the case studies did not support the idea of financial inclusion based on mobile money. As the trends observed, suggested links between mobile banking adoption levels and banking system efficiency. The study also found that decreasing dependence of mobile money services on the banking system is promising to achieving the objective of financial inclusion. These finding support the notion that additive effects of mobile banking will not enhance financial inclusion.

2.9. Summary

Porteous (2006) made an excellent distinction between the mobile money service and mobile banking service distinguishing them as “transformational” and “additive” services respectively. Porteous (2006)’s definition is critical to this study in that, it helps in

answering the research question of: does mobile banking enhance financial inclusion? The evaluated studies concur that Porteous (2006)'s definitions of the mobile money service (MMS), and the proposition that additive services such as mobile (cell phone) banking, which allows people to manage their bank accounts through a cell phone, does not significantly enhance or improve financial inclusion. While, the transformational services that allow people to obtain financial services through their cell phones without a need to have a bank account, significantly improve financial inclusion.

The reviewed literature showed extensive literature on mobile banking and financial inclusion in Africa. However, the literature showed extensive bias towards the successful use cases in East Africa, specifically in Kenya. As such, the study found gaps in literature on how other mobile markets like Gabon, Zimbabwe and Namibia have progressed in adopting mobile money transfers to the levels currently enjoyed in Kenya and the rest of East Africa. The gaps entail how the dominant platforms like M-PESA in Kenya or Econet in Zimbabwe have capitalised on the growing need of the unbanked populations in their countries. However, they fail to provide guidelines on how other African countries with different payment systems legislation should address financial inclusion using mobile money transfers. As such, this study addressing this gap by providing context into how mobile banking adaptation in Namibia, was driven by financial inclusion legislation aligned regulations.

Therefore, this study provides interesting perspectives and contextualises the factors that have influenced the innovation diffusion of mobile money transfers in Namibia. As well as, its contribution to financial inclusion progression in Namibia. While, the reviewed literature showed that the decreasing dependence of mobile money services on the banking

system is promising for achieving the objective of financial inclusion. The heterogeneity and varied nature of the regulations surrounding payments systems and mobile money poses challenges to effectively measuring and comparing cross country impacts of mobile money on financial inclusion. The next chapter presents research methodology employed in the study.

1.2 Research Design

The study uses a research design which involves the measurement and analysis of the causal relationship between variables within a value-free context (Weinstein, Kruger, & Marshall, 2014). Creswell (2014) states that in non-experimental quantitative descriptive and correlational designs, researchers use correlational statistics to describe and measure the degree of a relationship between two or more variables. In line with the research objective, the study adopts a quantitative approach that uses a cross-sectional design (Bryman & Burgess, 2015). As a survey, a cross-sectional study takes a single shot of the situation, while the case control makes it an observational analytical study (Tobias, et al., 2018). The cross-sectional case-control study design is retrospective in nature, thereby allowing for the utilization of a symmetric time series in comparing two groups: one already financially included and the other financially excluded.

CHAPTER 3 : RESEARCH METHODOLOGY

3.1. Introduction

This chapter looks at the methodology of the study, that is, the approach used by the researcher to collect and analyse the data towards achieving the objectives of this study. The chapter is divided into the research design, population, sampling and data sources, analytical framework, regressions equation, description of variables in the regression model, data analysis, reliability and validity and finally research ethics.

3.2. Research Design

The study uses a research design, which involves the measurement and analysis of the causal relationship between variables within a value-free context (Welman, Kruger, & Mitchell, 2014). Creswell (2014) notes that in non-experimental quantitative descriptive correlational designs, researchers use correlational statistics to describe and measure the degree of associations between two or more variables. In line with the research objectives, the study adopts a quantitative approach that uses a cross sectional design (Bryman & Bell, 2015). As a study, a cross sectional study takes a snap shot of the situation, while the case control makes it an observational analytical study (Toledano, et al., 2018). The cross-sectional case-control study design is retrospective in nature, thereby allowing for the utilisation of econometric time series in comparing two groups: one already financially included and the other financially excluded.

3.3. Population

The population of the study is the data on the more than 1,2 million users mobile banking customers and transactions on the FNB Cell phone banking and E-wallet platforms in the period July 2012 to December 2019 (89 months). FNB, as an early adopter of mobile wallets in Namibia, accounts for the majority of mobile money transfers (MMT) with currently more than 1,2 million users which is more than 50% of all mobile banking users in Namibia (FNB, 2018). Moreover, the e-wallet platform population includes both FNB account holders and those currently not holding accounts with the bank. Therefore, for the purposes of this study, the research assumes that all those not having an account with the bank are the unbanked population.

3.4. Sampling and Data Sources

The study used convenience sampling, which is a non-probability sampling method that sampled the conveniently available data provided by FNB. The study employed secondary data spanning 89 months from July 2012 to December 2019, sourced from First National Bank (FNB) Namibia. A convenient sample was used in order to protect the confidential and trade information of the Bank. As such, FNB availed data for 66 months spanning from July 2012 to data ending December 2017. The sample size was restricted by privacy concerns, which saw the study using data spanning 5 years out of the 8-year mobile banking data. Thus, the sample size was 74% (66/89 months) of the population. As such, the study sample consisted of 9 variables with 66 time series values. The choice of the variables employed was informed by both literature (Agufa, 2016; Arabéhéty, *et al.*, 2016; Demircuc-Kunt, *et al.*, 2015; Farah, *et al.*, 2018) and data availability constraints. A

detailed data description covering the predictor category, description, sources and a priori expectations is presented in Table 3.1

Table 3.1 Variables used in the model and descriptions

Category	Abbreviation	Description	Source	Expected sign
Variables of interest				
Mobile Banking Revenue	MBR	Total Mobile Banking Revenue (N\$)	FNB Raw	
Revenue from the E-wallet platform	MBR_Unbanked	Total E-wallet Revenue (N\$)	FNB Raw	
Unbanked population on the E-wallet platform	E-wallet	MBR_unbanked/MBR	Author	
Explanatory Variables				
Volume Factor	MMT	Total Mobile Banking Transactions (Volume)	FNB Raw	+
Commission-based value-added service (VASE)	VASE	Prepaid Electricity (N\$/Volume)	FNB Transformed	+
Charges-based value-added service (VASA)	VASA	Prepaid Airtime(N\$/Volume)	FNB Transformed	+
Cash transferred to Mobile Wallet platform from Bank Account (SSM)	SSM	Send Money into Mobile Wallets (N\$/Volume)	FNB Transformed	+
Financial Inclusion Channels				
Financial Access (TAVR)	TAVR	Transacting / Active (%)		+
	Transacting	The number of transacting customers in the last three months (Volume)	FNB Raw	+
	Active	The number of transacting customers in the last six months (Volume)	FNB Raw	+
Financial Penetration (CICO)	CICO	SSM/ATM	Author	+
	ATM	Cash-out from the ATM withdrawals (N\$/Volume)		+
Account Ownership (RCMT)	RCMT	REG/MMT (%)	Author	+
	REG	Registered Customers (Number)	FNB Raw	+
Profit Incentives (CCR)	CCR	Commission/Charges	Author	+

Commissions	Prepaid (Volume)	Electricity	FNB Raw	+
Charges	Prepaid (Volume)	Airtime	FNB Raw	+

Table 3.1 indicates the variables used and their transformation from raw to suit the purposes of this study. The FNB raw refers to the data retrieved from FNB, while, the transformed data is the per transaction values derived from the raw volumes and dollars. Lastly, the author calculation refers to variables calculated in the context of this study's data. For instance, the unbanked population percent was calculated using the contribution of the mobile wallet revenues to the total mobile banking revenues of the Bank.

3.5. Data Analysis

The data was retrieved from FNB through a Microsoft Excel Sheet, the data was sorted and filtered to come up with usable data. Additionally, the variables were transformed into ratios and percentages in order to control for multicollinearity. Yoo, Mayberry, Bae, *et al.*, (2014, p. 17) observed that *"to measure the degree of collinearity among the variables, the simple pairwise correlation matrix can be used and multicollinearity is suspected if the correlation coefficient between two variables exceeds the customary 0.8 threshold"*. As such, the study used the spearman rank correlation test in order to check for pairwise association between all the variables. The study then used cross-sectional analysis to compare the cell phone banking and e-wallet platforms. To give statistical meaning to the analysis, graphical representations were used to compare the trends between the two platforms. The descriptive analysis section focused on giving context on the variables of interest, while inferential analysis done using cross-sectional time-series

econometric procedure was carried out to test causal relationships between mobile banking and financial inclusion.

Due to limitations in access to data, the mobile banking revenues model was formed with variables, which the bank felt comfortable in sharing. As such the Total Mobile Banking revenue model was specified as follows:

$$MBMT = f(VASA, VASE, TAVR, MMT, RCMT, CICO, CCR, SSM) \quad (1)$$

Where;

MBMT is average value of mobile banking per transaction calculated as MBR/MMT

MBR is Total Mobile Banking Revenue for both cell phone banking and e-wallet platforms of the commercial bank (Value) in a given month

MMT is the Total Mobile Money Transfers for both cell phone banking and e-wallet platforms of the commercial bank (Volume) in a given month;

VASE is the revenue from the commission-based value-added service for Electricity;

VASA is the revenue from the charge-based value-added service such Airtime;

TAVR representing the measure of financial access is the Transacting to Active Volumes ratio, which is the number of transacting volumes in the last three months over the number of active volumes in the last six months;

RCMT representing the measure of the ownership of mobile banking accounts, is the ratio of Registered Customers to Total Mobile Money Transfers (Customer/Volume);

SSM is the Cash Transferred to the Mobile Wallets from the Banked populations' account with the commercial bank (Value/Volume);

CICO representing the penetration rate of mobile wallets is the ratio of the Cash transferred to Mobile Wallets (SSM) and the Cash-out from the ATM withdrawals;

CCR representing the profitability incentive is the ratio of Commissions to Bank Charges for the services (%);

The equation specification combines the estimates of both the banked and unbanked customers utilising the mobile wallet platform. In line with the study's assumptions on the unbanked population and the financial inclusiveness of the e-wallet platform. The study creates a proxy variable that calculates the mobile banking revenue from the unbanked population as follows:

$$MBR_{unbanked} = MBR * (1 - CBI/REG) \quad (2)$$

Where:

MBR_unbanked represents the Total Mobile Banking Revenue for e-wallet platform of the commercial bank (Value) in a given month;

CBI is Total registered for the Cell phone Banking Individuals platform of the commercial bank (Value) in a given month;

REG is Total Customers on the e-wallet platforms of the commercial bank (Value) in a given month;

3.5.1. Estimation Procedure

The study implements an econometric estimation procedure that includes unit root tests, lag selection, cointegration tests, estimation of the long-run equation, and diagnostic checks for autocorrelation, heteroscedasticity and normality, causality time-series. Tests, as well as the forecast-error variance decomposition analysis. Based on empirical literature, theoretical economic knowledge and the driving objective of the study, the equation 1 variables are used to estimate the VAR model in equation 2 below:

$$X_t = b_i + \sum_{i=1}^k \beta_i X_{t-1} + \mu_i \quad (3)$$

Where X_t is further expressed as:

$X_t = (\text{MBMT}, \text{MBR_Unbanked}, \text{CICO}, \text{CCR}, \text{SSM}, \text{RCMT}, \text{MMT}, \text{VASA}, \text{VASE}, \text{TAVR}, \text{E-wallet})$, which is a vector of equation 1 variables. Where, E-wallet variable representing the percentage of unbanked platform users is calculated as the ratio of MBR_unbanked to MBR.

b_i represents the intercepts of autonomous variables

β_i represents the matrix of coefficients of all the variables in the model

X_{t-1} = vector of the lagged variables

μ_i = vector of the random error terms.

3.5.2. Unit root tests

Econometric literature proposes different methodological alternatives to empirically analyse the long-run relationships and dynamic interactions between two or more time-series variables (Hill, Griffiths, & Lim, 2018). Standard regression techniques, such as ordinary least squares (OLS), require that the variables be covariance stationary. A variable is covariance stationary if its mean and all its auto-covariances are finite and do not change over time (Pesaran, Shin and Smith 2001). Moreover, covariance-stationary processes are $I(0)$. While, first difference stationary processes are also known as integrated processes of order 1, or $I(1)$ processes (Toda and Yamamoto 1995).

Stationarity of a series of data can influence its behaviour significantly, in that with a stationary series, shocks to the system will eventually die away. Moreover, non-stationary data can lead to spurious regressions and thus depict a fake relationship. In addition, standard asymptotic analysis (for example, t - and F - distributions) cannot be applied to non-stationary variables (Hill et al, 2018). In this study, the augmented Dickey Fuller (ADF) unit root test, was used in testing the presence of unit root. The actual procedure is to compute T -statistics, τ . If the absolute value computed T -Statistics are greater than the ADF critical value, the hypothesis that there is a unit root is rejected, then the time series is stationary. The series is integrated of order one denoted a $I(1)$, therefore the variable needs to be differenced to achieve stationarity.

3.5.3. Cointegration Analysis

Cointegration analysis is then considered, if unit root test confirm that the variables are non-stationary in their levels (Hill, Griffiths, & Lim, 2018). Granger and Engle (1987) raised the possibility that two or more integrated, nonstationary time series might be cointegrated, so that some linear combination of these series could be stationary even though each series is not. Also, variables are cointegrated if they share the same stochastic trend over an extended period of time (Gujarati, 2009). Cointegration analysis provides a framework for estimation, inference, and interpretation when the variables are not covariance stationary (Bierens, 2010).

The most common cointegration tests such as the Engle–Granger Engel residual based test and the Johansen approach or bounds testing procedure were also carried out as part of the pre-estimation tests. Parker, et al. (2011) argue that the bounds test is relatively more efficient in small sample data sizes as is the case in most empirical studies on African countries. Cointegration implies that if in long run, two or more series move closer together, even though the series themselves are trended, the difference between them is constant.

Furthermore, these variables might drift apart in the short run, but in the end, they are constrained. Based on the existence of Cointegration relationship between variables, the Vector Error Correction, which according to Johannes (1990) avoids the arbitrary selection of endogenous and exogenous is employed. The Error Correction Mechanism are employed to identify the long-run and short-run dynamics among the variables.

3.5.4. Vector Autoregression (VAR)

The Vector Auto regression (VAR) modelling technique is used for forecasting systems of the interrelated time series and for analysing the dynamic impact of random disturbance on the system of variables (Pesaran & Shin, 1999). The VAR Approach sidesteps the need for structural modelling by modelling every endogenous variable in the system as a function of the lagged value of all of the endogenous variables in the system (Adeleye, 2018).

It aims to come up with an unkind model that captures relevant variables without including too many variables. Moreover, it does not require the orthogonalization of shocks and is, therefore, not affected by the ordering of the variables used in the VAR models (Ogboko, 2018). The VAR approach is particularly important to this study because of the exploratory nature of the investigation into how mobile banking through wallets can be used as a tool for financial inclusion. The VAR approach makes it easy to identify the key financial inclusion channels that drives mobile wallet usage and growth in Namibia.

However, the use of VAR models does not allow the researcher to obtain the variance decomposition for any single equation of the system. Thus, limiting the researcher from distinguishing between the direct impact of the policy shock on any single variable in the system and the impact resulting from innovations in other variables of the system (Ogbokor, 2018). Despite, its weaknesses the study adopted, the Engle and Granger (1987) two steps method to estimate the VAR model. Since, the VAR model allows the incorporation of feedback in the multivariate model in which all variables allowed to affect each other. Hence, the interaction of all the ten variables was captured, allowing for

the identification of the significant interactions between mobile banking and financial inclusion.

3.5.5. Granger Causality Test

The Toda-Yamamoto causality tests were used to establish whether there is a causal relationship between the variables under study. Engel and Granger (1987) identify that if cointegration exists between two variables in the long-run then there must be either unidirectional or bi-directional granger causality between these two variables. The null hypothesis of no Granger causality is tested. The null hypothesis of no Granger causality between two variables is rejected if the probability is less than 5% (0.05) while the null hypothesis is not rejected in the event that the probability is greater than 0.05, signifying that there is no causal relationship between the variables. As result, the Granger Causality results will be used to test the hypothesis in set in Chapter 1.

3.6. Reliability and Validity

To establish the reliability and validity of the results, the research carried out a number of model fitness, stability and diagnostic tests. The study used a VAR approach to explore the relationships in the equation above. In specifying the model, the study assumed that there were no specification and measurement errors, as this ensures that the endogenous and exogenous variables are accurately measured (Gelman & Hill, 2007). Ayemere and Elijah (2015) noted that the choice of the techniques for regression is predicated by the assumptions made about the stochastic term and its correlation with the explanatory/exogenous variables.

Therefore, the reliability and validity of our model is established through a sequence of diagnostic steps starting with the test for stationarity to avoid spurious regression resulting from the trend movement of most macroeconomic variables. On the other hand, the reliability of the data was established by using the value to volume ratios that allowed the researcher to identify any outlier figures or inconsistencies between the values and volumes. This was followed by the test for cointegration to establish whether there is a long run relationship between variables. Prior to this the researcher determined the appropriate lag length for the variables using conventional lag length selection procedures. Where cointegration is established one then has to estimate a vector error correction model (VECM).

In the case of long run relationships, a VECM gives long-run structural relations plus information on adjustment, which provides better insight in economic processes. Validity was enhanced with the inclusion of robustness checks, and residual testing. The residual tests detected whether autocorrelation and heteroscedasticity were a serious problem in the model. The study uses the Lagrange Multiplier (LM) test for autocorrelation and White's Heteroscedasticity test for heteroscedasticity (Torres-Reyna, 2007).

3.7. Research Ethics

The main issues regarding ethics were addressed by the researcher and approved by the Namibia Business School's research ethics committee and these were: the privacy of actual and potential participants; whether the participation was voluntary or not; obtaining consent from participants; confidentiality of data and ensuring anonymity; avoiding harming, embarrassing, stressing or discomforting participants by any means. In this

context, an Informed Consent letter explaining the research purpose and the type of data requested was presented. This was done in compliance with meeting ethical demands of studies of this nature, which requires that participants get involved after an informed consent. Subsequently, written permission was sought from and granted by the Digital Manager and Head of Marketing from FNB Namibia (Appendix B).

To protect the confidential trade information, the data was coded in the form of ratios and percentages and anonymity of the key trade information was assured, with all data and information collected for this research solely used for academic purposes. Additionally, to ensure confidentiality and protect the trade information in the bank, the researcher was permitted to use historical data to end of 2017. Taking the ethical issues into consideration enhances the reliability as well as credibility of study (Kumar, 2014). In addition, the wording of the variables used was done carefully to avoid harming, embarrassing, stressing or discomforting participants. The researcher was also expected to respect the respondents' privacy as well as treating the provided information confidentially (Saunders, 2014).

3.6. Summary

This chapter looked at the research design and methodology used in this research. The chapter also discussed the population, sampling and data collection and processing procedures, reliability and validity, as well as research ethics. The next chapter presents and analyses the findings.

CHAPTER 4 : RESULTS AND DISCUSSIONS

4.1. Introduction

The study findings in this chapter are presented in relation to the aims and objectives of the study, which was to explore how mobile banking through wallets can be used as a tool for financial inclusion, by empirically measuring the effectiveness and sustainability of mobile banking wallets in Namibia. The chapter includes results from the data preprocessing, descriptive statistics, unit root test, optimal lag length selection, model estimation and Granger causality tests. This chapter further presents the diagnostic tests which include autocorrelation, heteroscedasticity and the model specification test. Furthermore, the chapter performs a robustness check of the model. Finally, the chapter gives an interpretation of the results obtained from analysis.

4.2. Descriptive Summary

The descriptive statistics provide a very useful initial examination of the data and is important in providing insight into the nature of the variables in the dataset, including their distribution and trends. In order to effectively address the first objective of the study, which was to determine the level at which the banked and unbanked population transact on mobile wallets in Namibia, the study presents a cross sectional descriptive analysis. This is done in order to decompose aggregate variables and provide a comparative analysis of the unbanked and the banked populations which are presented as cell phone banking (Banked Only) and E-wallet platform (Financial inclusion/unbanked population). Table 4.1 presents the panel data summary of for the period July 2012 to December 2017.

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Table 4.1 Descriptive Summary of the Banked and Unbanked Populations Panel

Data

Variable	Description	Platform	N	Mean	Std Dev.	T	df	p-value	Mean Difference	Std. Error Difference
CICO	Cash-in to Cash-out ratio	Banked	63	4.3%	2.6%	-116.9	124	0.00	-98.5%	0.8%
		Unbanked	63	102.8%	6.1%					
CCR	Commission to Charges ratio	Banked	66	5.3%	2.3%	4.35	127	0.00	1.4%	0.3%
		Unbanked	63	3.8%	1.3%					
VASA	Prepaid Airtime	Banked	66	22.80	3.03	15.52	127	0.00	6.29	0.41
		Unbanked	63	16.51	1.11					
VASE	Prepaid Electricity	Banked	66	171.49	12.43	29.02	126	0.00	64.87	2.24
		Unbanked	62	106.62	12.85					
TAVR	Transacting to Active Ratio	Banked	66	77.7%	4.6%	21.65	123	0.00	26.3%	1.2%
		Unbanked	59	51.4%	8.6%					
SSM	Send Money into Mobile Wallet	Banked	66	468.12	132.82	-1.13	127	0.26	-22.29	19.80
		Unbanked	63	490.41	85.95					
RCMT	Registered Customers/MMT	Banked	66	0.07	0.02	-3.04	130	0.00	-0.02	0.01
		Unbanked	66	0.09	0.06					
MMT	Mobile Banking Transactions	Banked	66	5,684,405	2,199,718					
		Unbanked	66							
MBR	Mobile Banking Revenue	Banked	66	577,807,719	456,083,944					
		Unbanked	66							

The Descriptive table displays the sample size, mean, standard deviation, T-statistics, p-value, mean difference and standard error for both groups. While, the MMT and MBR was the aggregated values and volumes of both groups. The results in Table 4.1 indicate that the overall average mobile banking revenue (MBR) for the FNB was N\$578 million, while the mobile banking transaction (MMT) averaged 5,7 million transactions per month in the period July 2012 to December 2017. On the other hand, the minimum of N\$68,9 million in July 2012 shows the cell phone banking values before the growth of mobile

wallets and a maximum of N\$1,6 Billion in December 2017. MBR values show the exponential growth of mobile banking business from these two platforms. Additionally, the results show MMT values, which is the corresponding volume of transactions to the MBR. However, the aggregated MMT and MBR values highlights are presented to highlight the size and importance of mobile banking in Namibia. Consequently, the other variables were calculated as ratios in line with the ethical considerations of protecting the participating bank's trade information.

The data of revenues (MBR) and transactions (MMT) provided did not segregate between the banked and unbanked population. As such, the study had to compute a platform identification variable, which allowed for the segregation of customers who had bank accounts with FNB (banked) and those who did not have accounts (unbanked). Those without accounts with the bank represented the unbanked populations. The results for the T-test statistics in Table 4.1 were to establish whether there was a significant difference between the value to volume levels per transaction on the mobile banking platforms for the banked and unbanked customers of a Namibian commercial bank. These findings confirm that there is a significant difference between the banked and unbanked platforms. Therefore, for further analysis, only the unbanked platform and the aggregated data was used to measure the impact of mobile banking on financial inclusion.

4.2.1. Hypothesis 1: Unbanked versus Banked Platform

Hypothesis 1 tested whether there was a significant difference between the value to volume levels per transaction on the mobile banking platforms for the banked and unbanked customers of a Namibian commercial bank.

The findings in Table 4.1 indicate a significant difference between the CICO values and levels of the two groups with a Mean Difference (MD) of 98% (p-value < 0.01). The average CICO rate for the Banked clients was 4%, while for the Unbanked clients it was 103%, which shows that the Banked clients use the mobile banking platform instead of cash. On the other hand, the Unbanked clients mainly used the mobile platform as a cash out. Therefore, there is need for incentives to encourage the unbanked to use the platform for other uses like credit, savings or insurance.

The findings also indicated a significant difference between average profitability incentives (CCR) of the two groups, measured as the ratio of Commissions to Bank Charges for the services. The findings show that the Banked platform (5.3%) has a higher average profitability incentive than the unbanked platform (3.8%). These findings are supported by the results of both the commission based (VASE) and charges based (VASA), with the Banked having an average of N\$22.8 per transaction per month compared to N\$ 16.51 for the unbanked.

The findings also show the significant difference between the levels of financial access between the banked and unbanked platforms. The Transacting to Active Volumes ratio (TAVR) between the two platforms has a mean difference of 26.3% (p-value < 0.05) per month over the period of 2012 to 2017. The transacting customers are customers who have transacted on the platform in the last three months, while active refers to the customers who transacted in the last six months. The Transacting to Active ratio (TAVR) values show that on average 65% of the active customers used the platform in the last three months.

Moreover, RCMT representing the measure of the ownership of mobile banking accounts, is the ratio of Registered Customers to Total Mobile Money Transfers (Customer/Volume). While, the RCMT variables shows ratio of customers to transactions, the results show that on average 7 to 9 customers would be involved in 100 transactions on each platform per month. Lastly, SSM, which is the Cash Transferred to the Mobile Wallets from the Banked populations' account with the commercial bank (Value/Volume) was found to be average between N\$468 to N\$490 per transaction for both platforms.

4.3. Trend Analysis of the Mobile Wallet Platform

In order to get a clearer picture of the trends, graphs are used to highlight and explain time trends of the Unbanked population platform (E-wallet) data. Figure 4.1 presents the E-wallet platform data trends over the February 2013 to December 2017, which had a more complete dataset.

The results in Figure 4.1 show a decline in RCMT curve (The number of registered customers per mobile transactions declined over the years) since mobile wallet was introduced. It demonstrates that wallets have become the new preferred channel to transact. This can be as a result of pricing changes brought about when wallets were introduced as a free service, where senders needed a bank account to send funds to the wallet, pay a minimum fee to send but the receiver can draw for free or share. As a result, customers prefer using their wallet to transact instead of their mobile account.

Moreover, the wallet account needs to comply with the Know your customer (KYC) requirements, meaning there was no formal registration process for the wallet account. As

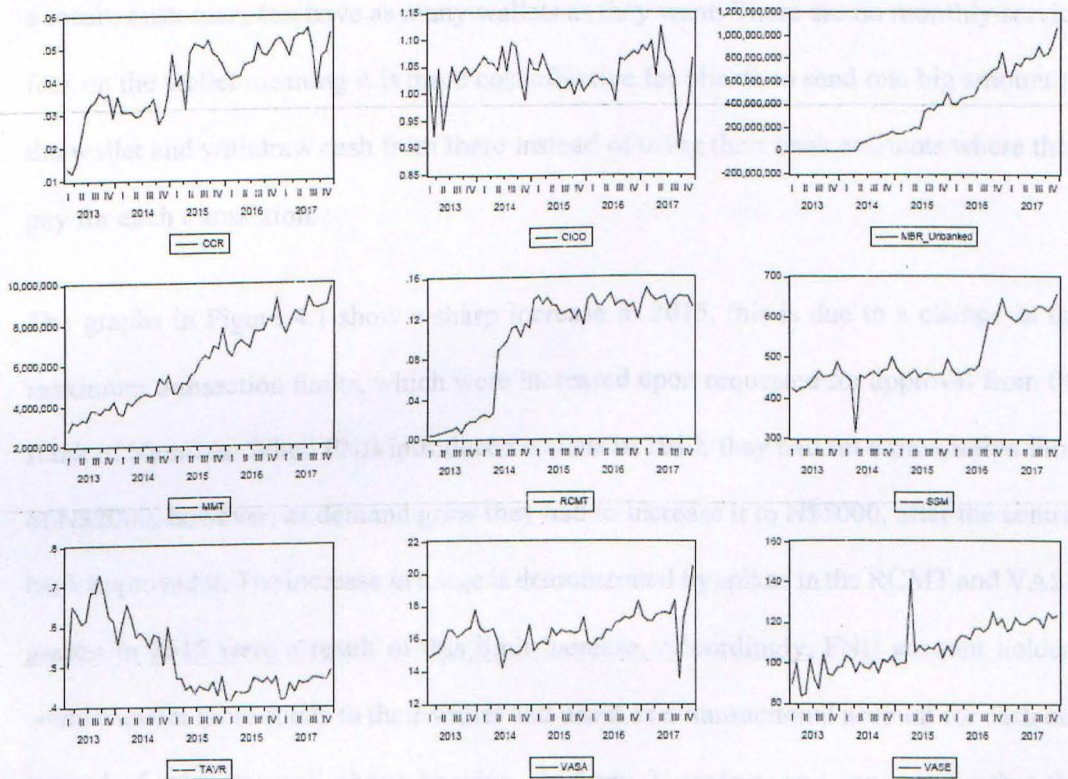


Figure 4.1 E-wallet platform data trends

The results in Figure 4.1 show a decline in RCMT curve (The number of registered customers per mobile transactions declined over the years) since mobile wallet was introduced. It demonstrates that wallets have become the new preferred channel to transact. This can be as a result of pricing changes brought about when wallets were introduced as a free service, where senders needed a bank account to send funds to the wallet, pay a minimal fee to send but the receiver can draw for free of charge. As a result, customers prefer using their wallet to transact instead of their mobile account.

Moreover, the wallet account needs to comply with the Know your customer (KYC) requirements, meaning there was no formal registration process for the wallet account. As

a result, customers can have as many wallets as they want. There are no monthly service fees on the wallet meaning it is more cost effective for clients to send one big amount to the wallet and withdraw cash from there instead of using their bank accounts where they pay for each transaction.

The graphs in Figure 4.1 show a sharp increase in 2015, this is due to a change in the maximum transaction limits, which were increased upon requested for approval from the Bank of Namibia. When FNB introduced wallets in 2012, they had set a transaction limit of N\$2000, however, as demand grew they had to increase it to N\$5000, after the central bank approved it. The increase in usage is demonstrated by spikes in the RCMT and VASE graphs in 2015 were a result of this limit increase. Accordingly, FNB account holders could transfer more funds to their wallet and use it as a transactional account for cash out instead of using the cell phone banking platform. Therefore, one can assume that the increase in wallet usage is as a result of easy and free transactions as well as the increase in limits from N\$2000 to N\$5000. However, the graphs show a flattening in 2016, when the bank introduced services charges on wallet platform.

Figure 4.1 also indicated the trend graph for TAVR which shows the relationship between transacting customers to active customers. The findings indicated that mobile banking customers were using their account actively in relation to wallet users. While the customer base for mobile wallets are high, usage is low because many clients uses wallets to cash out as soon as they receive their funds. Moreover, this can also be as a result of the limited value-added services on the mobile wallet versus the cell phone banking account.

The implications of these findings are that the mobile wallet platform is only providing remittance service to the unbanked population but not the full access to the value-added services of mobile banking. Furthermore, the Namibian mobile wallet works as a remittance channel, mainly used for money transfers, limited value-added financial services.

Whereas, studies in Southern and East Africa used mobiles for money transfers, value added financial services, money transfers, value added financial services, saving, credit, and insurance (Ouma, Odongo, & Were, 2017). Therefore, the mobile platform in Namibia, still has opportunities to limit the amount of cash in circulation and providing a means for the financially excluded populations to save and get digital loan for everyday purchases, like in Kenya, Tanzania and Zimbabwe (Robb & Vilakazi, 2015).

4.4. Pre-Estimation Results

4.4.1. Unit Root Tests

Since, the data is time-series in nature, it is important to confirm its stationarity. The unit root test was conducted using Augmented Dickey- Fuller (ADF) test to determine the stationary properties of the variable. The test uses a null hypothesis that the data are non-stationary and alternative is that they are stationary. The natural logarithm of the data variables was tested for stationarity so as to avoid the problem of spurious regression. The null hypothesis of a unit root is rejected in favour of the stationary alternative in each case if the test statistic is more negative than the critical value ($\alpha = 0.05$). The results of the unit root test of the variable at levels are reported in the Table 4.2.

Table 4.2: Augmented-Dick Fuller (ADF) Unit Root Tests

Variable	Level- I(0)	First difference - I(1)	Level/Diff
CCR	-2.128	-9.141***	I(0)/I(1)
CICO	-3.794***	-4.966***	I(0)/I(1)
MBR_UNBANKED	-1.071	-6.261***	I(0)/I(1)
MMT	-1.132	-6.363***	I(0)/I(1)
RCMT	-1.905	-8.266***	I(0)/I(1)
SSM	-1.624	-5.809***	I(0)/I(1)
TAVR	-1.872	-7.821***	I(0)/I(1)
VASA	-2.921*	-5.840***	I(0)/I(1)
VASE	-1.333	-6.702***	I(0)/I(1)
MBMT	-1.013	-5.936***	I(0)/I(1)
Unbanked	-2.021	-9.201***	I(0)/I(1)

***, ** and * represents the rejection of the null hypothesis at the 1%, 5% and 10% level of significance respectively

Source: Author's compilation

Table 4.2 shows the results of the unit root tests, with most of the variables become stationary at first difference, with exception of CICO and VASA which are stationary at level. However, all variables become stationary at first difference, I(1). Therefore, the results show that the variables have an integration order of 1.

Adeleye, (2018) notes that when the time series are stationary in levels or I (0) series, it implies that any shock to the system in the short run quickly adjusts to the long run. Hence, only the long run model should be estimated. However, when the series are stationary at first difference, I (1), as is the case with this study's findings. Then, there is need to establish the significance of the variables in the model, as this helped in identifying the appropriate econometric model to use (Hill, Griffiths, & Lim, 2018).

Therefore, before specifying the model to use for estimating the relational effects of Mobile banking indicators on the financial inclusion measures. There was need to test for cointegration. If there is cointegration, the study specifies the long-run model and estimates a Vector Error Correction Model (VECM). However, if there is no cointegration, the study specifies only the short-run model and apply the Vector Autoregression (VAR) estimation technique (Adeleye, 2018).

Moreover, there is an argumentative issue in literature on the use of VAR models, in cases of non-stationarity. The issue pertains to there being no clear cut on the choice of estimating the variables in levels and differenced (Ogbokor, 2018). Moreover, Enders (2004) advocates for the traditional approach of transforming the data to stationary regressors prior to estimation, regardless of whether the point of focus is long- run or short-run relationships. In this study, the variables were transformed into ratios and percentages. As such, any interpretation of the estimation model was done using the ratios and percentages.

Peruta, (2017) notes that during the first years of diffusion of mobile money the number of countries and users was small. Then a growth stage was witnessed through a rise in both numbers. The epidemic model of technology diffusion explains this slow take off and ensuing period of growth, which followed an S-shaped curve (Peruta, 2017). As knowledge provided by earlier adopters are the key drivers to ensuring more adoption. Potential adopters learn about the new technology from previous adopters and they learn how to use it effectively and about its potential profitability (Peruta, 2017).

The findings from the unit root tests controls for the S-shaped data by making it stationary or mean reverting around a linear model. And, since the results showed that the data only becoming stationary at first difference, there is need to verify further the relevance of the model, by testing for cointegration. This is based on the assumption that a long run relationship exists in the model. However, there is need to first test for an appropriate lag, before estimating the cointegration of any of the variables of interest.

4.4.2. Pre-estimation Lag Selection

In estimating the possibility of cointegration in the data, special attention needs to be given to ensure an appropriate specification of the lag length is done. However, there is no hard-and-fast-rule on the choice of lag length (Adeleye, 2018). It is basically an empirical issue. Gujarati (2009) notes that there is no a priori guide as to what the maximum length of the lag should be. However, he argues that estimating successive lags reduces the degrees of freedom making statistical inference somewhat unstable. Moreover, in economic time series data, successive values (lags) tend to be highly correlated increasing the likelihood of multicollinearity in the model (Adeleye, 2018).

Wooldridge (2016) recommends that the number of lags should be typically small, in order not to lose degrees of freedom. While, Gujarati (2009) states that the nominal and true level of significance to test statistical hypotheses becomes an important issue in such sequential searches like the one used in this study. For instance, if the lag length, k , is incorrectly specified, the researcher will have to contend with the problem of misspecification errors. Thus, making it imperative to determine the maximum lag length, before estimating a time series equation.

Moreover, including a lot of lagged values in the equation can result in multicollinearity, which leads to imprecise estimation due to variance inflation (VIF) of standard errors. As such, the study uses selection criterion measures like the Akaike or Schwarz and the model that gives the lowest values of these criteria is chosen. The calculation and selection of the appropriate or optimum number of lags is done using various selection criteria used in STATA 15 for the pre-estimation lag selection menu. The selection criteria include sequential modified Likelihood ratio (LR), the log likelihood (LL), the Finally Prediction Error (FPE), Schwartz information criterion (SBIC), Akaike Information Criterion (AIC) and Hannan-Quinn information criterion (HQIC), test statistics (each test at 5% level).

Table 4.3 presents the findings.

Table 4.3: Results for Lag Length Selection

Lag	0	1	2	3	4
LL	-1785.98	-1735.79	-1725.62	-1693.89	-1672.23
LR		100.39	20.34	63.46	43.314*
Df		25.00	25.00	25.00	25.00
P		0.00	0.73	0.00	0.01
FPE	2.7E+22	1.1e+22*	2E+22	1.8E+22	2.4E+22
AIC	65.85	64.9377*	65.48	65.23	65.35
HQIC	66.21	65.6434*	66.54	66.64	67.12
SBIC	66.77	66.7626*	68.21	68.88	69.92

NB: * significant at the 5% level of confidence

Endogenous: MBR_Unbanked MBMT SSM VASA VASE, **Exogenous:** CICO CCR TAVR RCMT_cons

Table 4.3 findings indicate the maximum significant lag selected for model of the 9 variables of interest to the study. The selection of the lag is guided by the column with the largest number of significant criteria at the significance level of 5% (*). The findings show that the maximum number of lags to include for the estimation is column 1 (lag 1),

as the selection criterions values for FPE, AIC, HQIC and SBIC, were all showing significant values at this lag. Therefore, the appropriate lag length for the equation was 1.

4.4.3. Johansen Cointegration Test

The Johansen cointegration test was used to establish the long-run cointegration equations between the variables of interest. In determining the number of co-integrating vectors, the study checked for Cointegration using Johansen's Trace Test. For the test statistics, the initial Johansen test is a test of the null hypothesis of no cointegration against the alternative of cointegration. The STATA output in Table 4.4 releases two statistics, Trace Statistic and Max-Eigen Statistic. The rejection criteria are at 0.05 level and the rejection of the null hypothesis is indicated by an asterisk sign (*) in the table. The null hypothesis is rejected if the probability value is less than or equal to 0.05. Moreover, we reject the null hypothesis if the Trace or Max-Eigen statistic is higher than the 0.05 critical value.

Table 4.4 Johansen tests for cointegration with Trend (none), N = 58

Maximum Rank	parms	LL	eigenvalue	trace statistic	5% critical value
0.00	0.00	-1351.01	.	204.88	175.77
1.00	17.00	-1320.89	0.65	144.65	141.20
2.00	32.00	-1295.77	0.58	94.41*	109.99
3.00	45.00	-1279.24	0.43	61.36	82.49
4.00	56.00	-1265.37	0.38	33.62	59.46
5.00	65.00	-1255.05	0.30	12.97	39.89
6.00	72.00	-1250.78	0.14	4.43	24.31
7.00	77.00	-1249.26	0.05	1.38	12.53
8.00	80.00	-1248.57	0.02	0.00	3.84
9.00	81.00	-1248.57	0.00		

From the results in Table 4.4, the null hypothesis of no cointegrating equation is rejected at the 5% level. The null hypothesis for this test differs in case of differing ranks, with the test beginning from rank (r)= 0, where there is no cointegration amongst the variables and

also accepts the first null hypothesis (rank =1) that is not rejected (Table 4.4). However, the results confirm the existence of cointegration, with the equation having cointegrating at rank 2 (Trace = 94.41, $p < 0.05$), giving us sufficient reasons to reject the null hypothesis of no long-run relationship at 5% significance level. Thus, suggesting the existence of at least 2 cointegration equations among the studied variables. Hence, the study concludes that at least two unique long-run relationship exists between the variables of mobile money and financial inclusion. This implies that there is evidence to suggest that in the long run the impact of mobile banking on financial inclusion in Namibia, might be noticeable.

These findings support the predictions from the diffusion of innovations theory, which explains that innovationists apply normal distribution curve which can be partitioned into five-time based segments to categorize users in terms of innovativeness. The five segments of users are modernizer, early modernizers, and timely mass, late mass and stragglers (Agufa, 2016). The findings are consistent with the notion that Diffusion of Innovations Theory can be used by mobile money services providers to gain absolute advantage over competitors by rewarding providers, who capitalise on the user segmentation by converting them into loyal customers over time. This approach is evident in Namibia, Zimbabwe, Kenya and Tanzania, where the dominant players in these countries are currently enjoying more than 50% market shares because they are reaping the rewards of being the first and having evolved with the market needs and growth in customers.

Peruta, (2017) notes that during the first years of diffusion of mobile money the number of countries and users was small. Then a growth stage was witnessed through a rise in

both numbers. The epidemic model of technology diffusion explains this slow take off and ensuing period of growth, which followed an S-shaped curve (Peruta, 2017). As knowledge provided by earlier adopters are the key drivers to ensuring more adoption. Potential adopters learn about the new technology from previous adopters and they learn how to use it effectively and about its potential profitability (Peruta, 2017).

4.4.4. Postestimation Lag selection

Lag selection is an important step in estimating the VAR model, special attention needs to be given to ensure an appropriate specification of the lag length so as to ensure no serial correlation from the residuals. Moreover, lag selection is done during pre-estimation and post-estimation. The pre-estimation lag selection is discussed above. The postestimation lag selection is used to obtain the information needed to compute the statistics from the estimated VAR model. The postestimation lag selection was carried out using STATA 15.

Figure 4.2 presents the results.

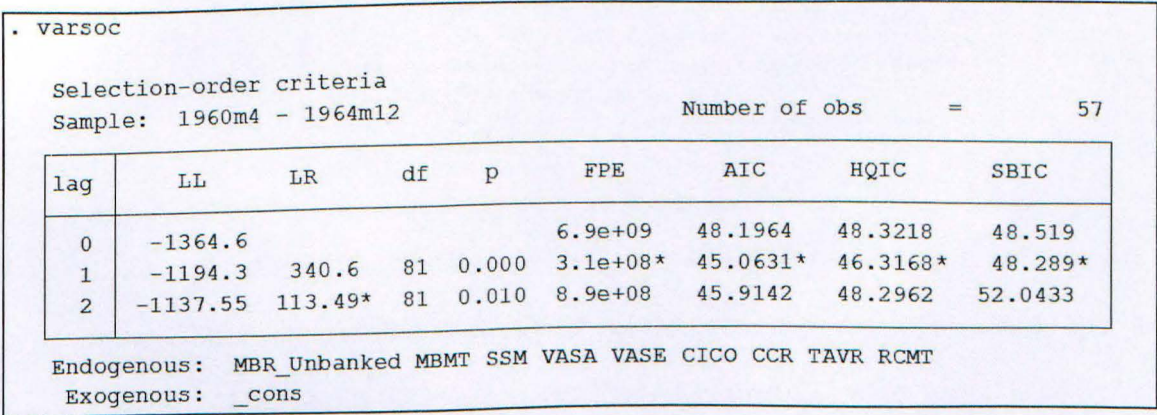


Figure 4.2 Post-estimation Lag Selection

4.4.5. Stability Test

In order to determine whether the number of cointegrating equations correctly specified, a VAR stability test is conducted. The stability test checks the eigenvalue stability condition in a VAR model. The results of the stability conditions are shown Figure 4.3 below:

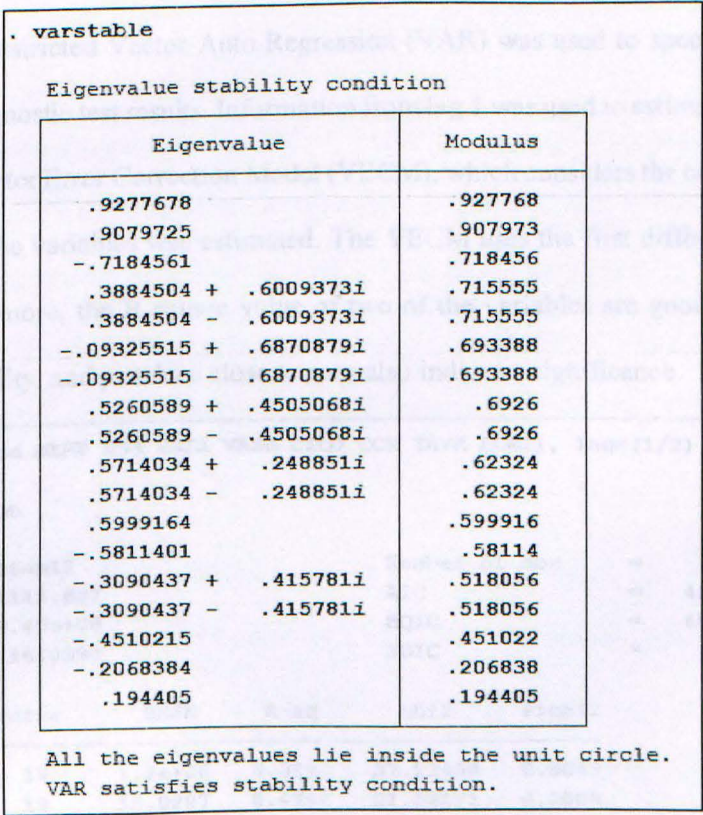


Figure 4.3 Stability Condition of the VAR Estimates

Figure 4.3 indicates the eigenvalue stability condition of the VAR model, and to satisfy the stability conditions all roots should lie inside the circle and the modulus has to be less than one. At the chosen lag length of 1, the results showed that all the modulus were less than one. The stability check thus confirms that the VAR model is well specified at rank 2.

4.5. Estimation Results

Since, the Johansen cointegration test revealed the cointegration between the time series contains up to two stable cointegrating equations. The unrestricted Vector Auto Regression (VAR) was not applicable and the Vector Error Correction Model (VECM), which takes into account the cointegrating relations among the variables was estimated. However, the unrestricted Vector Auto Regression (VAR) was used to specify a model guided by the diagnostic test results. Information from lag 1 was used to estimate the VAR model and the Vector Error Correction Model (VECM), which considers the cointegrating relations among the variables was estimated. The VECM uses the first difference of the variables. Furthermore, the R-square value of two of the variables are good enough to justify their causality, and p-values close to zero also indicates significance.

. var D.(MBR_Unbanked MBMT SSM VASA VASE CICO CCR TAVR RCMT) , lags(1/2)					
Vector autoregression					
Sample: 1960m5 - 1964m12					
Log likelihood = -1115.837			Number of obs	=	56
FPE = 9.48e+08			AIC	=	45.95845
Det(Sigma_ml) = 1640334			HQIC	=	48.35619
			SBIC	=	52.143
Equation	Parms	RMSE	R-sq	chi2	P>chi2
D_MBR_Unbanked	19	1.2e+08	0.3994	37.23458	0.0049
D_MBMT	19	13.0287	0.4792	51.52171	0.0000
D_SSM	19	44.2705	0.3428	29.20573	0.0459
D_VASA	19	1.04791	0.4614	47.97381	0.0002
D_VASE	19	7.98529	0.5656	72.91581	0.0000
D_CICO	19	.046445	0.4626	44.10748	0.0006
D_CCR	19	.005523	0.3927	35.43444	0.0083
D_TAVR	19	.046507	0.3762	27.36264	0.0724
D_RCMT	19	.019358	0.3939	33.97854	0.0127

Figure 4.4 Results of the Short-run effects equations from STATA

Figure 4.4 shows the results of estimation of the short-run dynamics. The results are in 9 parts, representing equations of the variables. The results show that only 6 equations are significant with p-values less than 0.05. The R-square values are mildly high with D_VASE having the highest R-sq. of 0.56, however, the equation of D_MBMT with the second highest R-sq. of 0.4792. As such, this equation captures the aggregated value of the mobile banking platform.

The lowest root-mean-square-error (RMSE) of 0.0055 indicates the best fitting model, as a result the equation for the change in Profit incentives (D_CCR) was best fitting model. However, the long run equations have MBMT as one of the dependent variables so for short term dynamics, VAR model based on D_MBMT for the study. The results for the selected model, where D_MBMT is the dependent variable are presented in Table 4.5 on the next page.

The estimated short-run Coefficients of the VAR (1/2) Model for change in MBMT in Table 4.5, was used to explore the short-run causality relationships between mobile banking and financial inclusion. Since, the stability tests suggest that lag 1 information to be more stable. The interpretation was based on lag 1, which has significantly identified causality effects among the lagged difference of the variables. The constant identified in the D_MBMT model was not significant.

L2D	-11.35829	93.4235	-1.26	0.21	Negative
cons	0.0587467	3.42346	0.44	0.66	Positive

The significance of causality relationships is interpreted from the individual lag betw coefficients and p-values for each independent variable. Thus, the results show that the

Table 4.5: Estimated Short-run Coefficients of the VAR (1/2) Model for MBMT

D_MBMT dependents	Coef.	Std.	z	P>z	Causality
MBR_Unbanked					
LD.	9.29E-08	3.70E-08	2.51	0.01	Positive
L2D.	8.41E-08	3.93E-08	2.14	0.03	Positive
MBMT					
LD.	-0.5437104	0.2700877	-2.01	0.04	Negative
L2D.	-0.3995837	0.2489432	-1.61	0.11	Negative
SSM					
LD.	-0.0339517	0.0544651	-0.62	0.53	Negative
L2D.	-0.0803675	0.0578904	-1.39	0.17	Negative
VASA					
LD.	-12.63299	2.843973	-4.44	0.00	Negative
L2D.	-7.587685	3.576088	-2.12	0.03	Negative
VASE					
LD.	0.2359844	0.2011343	1.17	0.24	Positive
L2D.	0.163788	0.2111008	0.78	0.44	Positive
CICO					
LD.	-14.04755	49.20623	-0.29	0.78	Negative
L2D.	-48.91457	43.81574	-1.12	0.26	Negative
CCR					
LD.	1466.869	359.2105	4.08	0.00	Positive
L2D.	1264.928	474.0862	2.67	0.01	Positive
TAVR					
LD.	-42.49968	40.34813	-1.05	0.29	Negative
L2D.	47.71298	41.68556	1.14	0.25	Positive
RCMT					
LD.	26.35464	95.16369	0.28	0.78	Positive
L2D.	-113.9859	90.40255	-1.26	0.21	Negative
_cons	0.6587467	1.488866	0.44	0.66	Positive

The significance of causality relationships is interpreted from the individual lag beta coefficients and p-values for each independent variable. Thus, the results show that the

change in Mobile banking revenue per transaction (D_MBMT) is positively influenced by the first lag difference of $MBR_unbanked$ ($\beta = 9.29E-08$), CCR ($\beta = 1466.86$). While, the first lag differences of $MBMT$ ($\beta = -0.544$) and $VASA$ ($\beta = -12.63$) have negative effects. The results imply that all thing being equal, a 1% increase in the Profit Incentives (CCR) will result in a N\$1466.87 increase in mobile banking revenue per transaction.

In other words, if the bank introduces a new commission-based value-added services of vital importance, they will likely see a growth in the usage and value of the mobile platform. While, a N\$1 per transaction increase in charges on the mobile platform services would result in a N\$12.63 per transaction reduction in the mobile banking revenues per transaction. The results also suggested the $MBMT$ revenues have been decreasing over time, for each N\$1 per transaction of $MBMT$ received in the previous month, reduces the current month $MBMT$ by 54 cents.

Lastly, to increase the $MBMT$ value by N\$1 per transaction, requires at least an $MBR_unbanked$ revenue of N\$ 10,8 Million. In other words, this value represents a rough estimate of the mobile banking platform development and start-up costs. This value for interoperability efforts in Namibia, as it highlights the expected costs of integrating the unbanked sections of the population into the mainstream banking or integrating one banking mobile platform with another. This cost represents a barrier to entry for any new fin tech or commercial bank.

4.5.1. Diagnostic Tests

The post estimation checks carried out included the residual test is to detect whether serial correlation and heteroscedasticity were a serious problem in the model. Therefore, autocorrelation was tested using Lagrange Multiplier (LM) test. The multivariable LM test statistics for residual serial correlation, with the null hypothesis that there is no serial autocorrelation. The LM test results fulfil the LM serial correlation conditions with observed chi-square probability values of 0.17793 (lag 1) and 0.6041(2), which were all above the recommended 0.05 value for the null-hypothesis to be rejected. Thus, we conclude that the models are a good fit and satisfies the serial correlation test criteria. As such, the model is stable, reliable and valid, with no serial autocorrelation among the model variables.

4.6. Hypothesis Test Findings

The Toda-Yamamoto Granger non-causality Wald test results are summarised in Table 4.6

Table 4.6: Granger Causality Wald Test Summary

Equation	Excluded	chi2	Df	Prob>Chi2
Account Ownership (RCMT)	Financial Penetration (CICO)	20.39	2	0.00
	Financial Access (TAVR)	6.96	2	0.03
	Cash transferred to Mobile Wallet platform from Bank Account (SSM)	10.15	2	0.01
Average Mobile Banking Value per transaction (MBMT)	Profit Incentives (CCR)	9.64	2	0.01
	Charges-based value-added service (VASA)	8.27	2	0.02
Charges-based value-added service (VASA)	Profit Incentives (CCR)	21.82	2	0.00
	Financial Penetration (CICO)	8.81	2	0.01
	Commission-based value-added service (VASE)	9.89	2	0.01
	Average Mobile Banking Value per transaction (MBMT)	11.71	2	0.00
	Revenue from the E-wallet platform (MBR_unbanked)	18.31	2	0.00

	Cash transferred to Mobile Wallet platform from Bank Account (SSM)	7.43	2	0.02
Financial Access (TAVR)	Account Ownership (RCMT)	9.40	2	0.01
Profit Incentives (CCR)	Commission-based value-added service (VASE)	8.95	2	0.01
	Charges-based value-added service (VASA)	8.10	2	0.02
Revenue from the E-wallet platform (MBR_unbanked)	Profit Incentives (CCR)	21.86	2	0.00
	Charges-based value-added service (VASA)	16.12	2	0.00

Table 4.6 indicates the results from the hypothesis testing of significant causality relationships from between Mobile Banking variables to Financial Inclusion channels. The null hypothesis of no causality was tested in both directions. The findings showed that the relationships were either uni-directional or bi-directional for both directions. The interpretations of the Granger causality findings in Table 4.6 are then graphically interpreted into the network diagram presented in Figure 4.5 below.

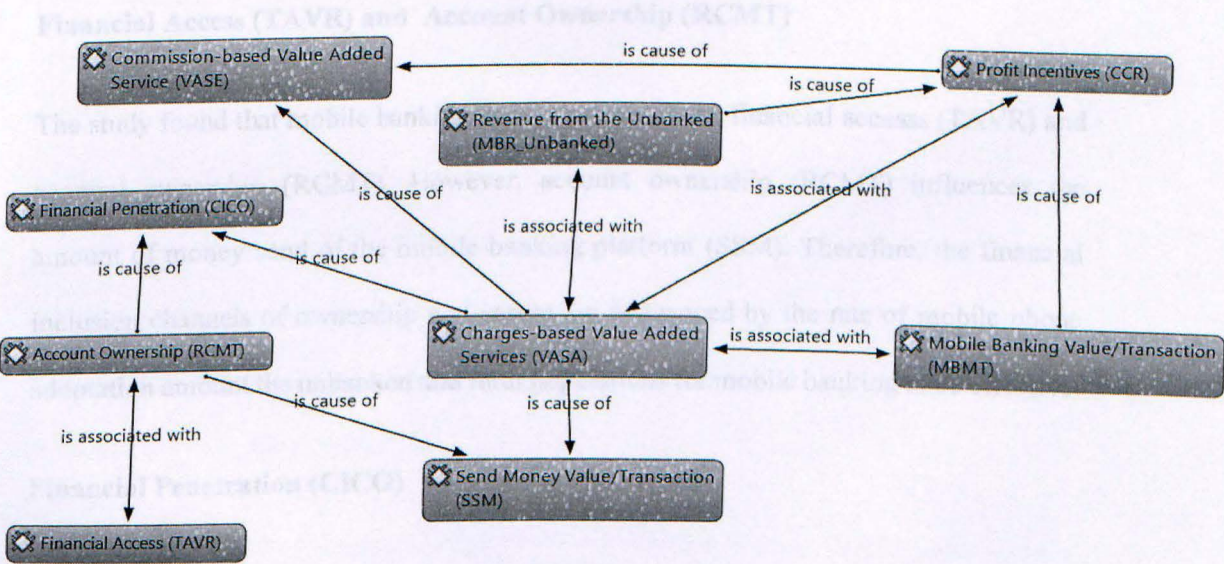


Figure 4.5: Mobile Banking and Financial Inclusion Causality Summary

Figure 4.5 Network Diagram is used to interpret the Granger Causality relationships, with the uni-directional relationships having a single causality arrow (“is a cause of”). While, the bi-directional Granger causality relationships presented with the double arrow

(“associated with”). The study uses this graphical representation to summarise the interpretation of causality between the mobile banking variables and Financial Inclusion channels. The interpretation is presented in line with the study’s three hypothesis as follows:

4.6.1. Mobile banking does not enhance financial Inclusion in Namibia

Hypothesis 2 tested whether mobile banking can be used as a tool to enhance financial inclusion in Namibia. The study identified four financial inclusion channels which includes Financial Access (TAVR), Financial Penetration (CICO), Account Ownership (RCMT) and Profit Incentives (CCR) channels.

Financial Access (TAVR) and Account Ownership (RCMT)

The study found that mobile banking does not enhance the financial accesss (TAVR) and account ownership (RCMT). However, account ownership (RCMT) influences the amount of money send of the mobile banking platform (SSM). Therefore, the financial inclusion channels of ownership and access are influenced by the rate of mobile phone adoption amount the unbanked and rural populations for mobile banking to be effective.

Financial Penetration (CICO)

The Namibia Financial Inclusion Survey (NFIS) done in 2017 indicates that the country’s banking population increased to 67.9% in 2017, up from 45% in 2011. In addition, 64.7 % considered the Automated Teller Machines (ATMs) as the most comfortable banking channel (NSA, 2018). Moreover, Namibia enjoyed a 50% mobile penetration rate by 2011, which improved to 97% in 2015 (Christiaan & Kammy, 2012). Despite, the improved

mobile penetration rate, the financial penetration has been slow. While, leveraging on cellular networks to deploy financial solutions provides a platform for financial inclusion (Manyika, et al., 2016). The study findings indicated financial penetration (CICO) depended on account ownership (RCMT) and the charges-based value-added services (VASA). While, mobile banking has a VASA-mediated relationship with financial penetration (CICO). Therefore, mobile banking can be used as a tool to partially enhance financial penetration.

Profit Incentives (CCR) channels

The study found that mobile banking can be used as a tool to enhance the financial inclusion channel of profit incentives (CCR). Figure 4.5 indicates that the growth in charges-based value-added services (VASA) drives mobile wallet usage and growth. The VASA is in turn driven by its bi-directional relationship with the profit incentives (CCR) of the Bank. The findings implies that the profitability of mobile banking is in turn influenced by the amount of profit that can come from financial inclusiveness, more than the need to increase financial access or account ownership. This is because increasing financial access and enhancing account ownership are costly to maintain and thus would reduce their profitability incentives.

Overall, the results show that the charge-based value-added services (VASA) provides the critical link to how mobile banking enhances financial inclusion. Figure 4.5 shows that Financial Inclusion starts with having financial access (TAVR) and this access leads to an increase in account ownership (RCMT), which is needed for the financially excluded or unbanked populations to have a means to use the mobile platform and send money (SSM).

Moreover, increasing the levels of account ownership will enhance the financial inclusion through financial penetration (CICO), where the unbanked recipients on the mobile platform will be able to not only cash out through ATMs but also have access to Cash in through the same platform. As such, mobile banking needs to offer more value-added services that would motivate the unbanked population to participate on the platform. Thus, allowing the mobile banking platforms to further enhance financial inclusiveness, while also enhancing the profitability of the platform to the banks for further effectiveness and sustainable growth

4.6.2. Value Added Services

Hypothesis 3 tested whether there was a significant difference between the different value added services offered on both the mobile banking (banked) and mobile wallet (unbanked) platforms of the Namibian commercial bank. The study found that there was a significant difference between the commission-based value added services (VASE) and the charge based value added services (VASA). Figure 4.5 indicates that the charges-based value-added services like airtime sales (VASA) on the platform significantly influenced the commission-based value-added services like electricity (VASE). The findings imply that financial inclusion is driven by profit incentives offered by the tapping into the unbanked populations.

The results also show that the charge-based value-added services (VASA) provides the critical link to how mobile banking enhances financial inclusion, as it provides mediating link between MBR_unbanked (unbanked) and MBMT (banked). This implies that profit incentives are important for any mobile banking initiative, including financial inclusion.

Therefore, there is need for regulators to provide profitability incentives to the banks and FinTech's involved with e-money services in Namibia. These findings are important to the Bank of Namibia, as the regulator to ensure that the Determination on Issuing Electronic Money (PSD-3), the current PSDs and other regulations in the pipeline provide profit incentives. Therefore, the more profitable the mobile banking platform is, the more it will enhance financial inclusion of the unbanked customers.

Figure 4.5 findings are consistent with the Diffusion of Innovations Theory, which posits that commission-based services can be used to gain absolute advantage over competitors, by rewarding the first adopters who capitalise on the user segmentation by converting them into loyal customers. Once, they achieve market dominance they would revert to charge based value-added services. Peruta, (2017) notes that during the first years of diffusion of mobile money the number of countries and users was small. Then a growth stage will be witnessed through a rise in both numbers. The epidemic model of technology diffusion explains this slow take off and ensuing period of growth, which followed an S-shaped curve (Peruta, 2017).

Potential adopters learn about the new technology from previous adopters and they learn how to use it effectively and about its potential profitability (Peruta, 2017). Similarly, the growth in VASA is in turn influenced by the profit incentives (CCR) for the Bank. Commercial Banks are motivated by profitability of the mobile banking platform and would invest in technologies that will enhance the Financial Inclusion channel of profitability (CCR). Moreover, the profitability of the mobile banking is in turn influenced by the amount of profit that can come from financial inclusiveness, more than the need to increase financial access or account ownership. This is because increasing financial access

and enhancing account ownership are costly to maintain and thus would reduce their profitability incentives.

4.7. Summary

This chapter presented the cointegrating and causal relationship between public debt, budget deficits and economic growth in Namibia. To this end, the study used a VAR model to explore the relationships. In the analysis, the unit root test for stationarity was done to avoid spurious regression resulting from the trend movement of most macroeconomic variables. This was followed by the testing for cointegration using the Johansen cointegration method to establish whether there was a long run relationship. In addition, the appropriate lag length for the variables was done during pre-estimation and post-estimation procedures. The analysis established two network diagrams, one for economic growth factors and the other for job creation factors that graphically presents the granger causality relations. The VAR/VEC model was then estimated and the equation with the best fit was for the D_MBT. The chapter ended with the network diagram of the Granger causality relationships. The next chapter presents the conclusions and recommendations of the study.

CHAPTER 5 : CONCLUSIONS AND RECOMMENDATIONS

6.1. Introduction

This chapter concludes this research with a summary of key findings from the econometric tests conducted herein, in line with the stated research problem and objectives. Following the presentation and discussion of the empirical results in the previous chapter, this chapter provides a summary of the entire study, draws conclusions, outlines policy implications of the findings, makes policy recommendations, and offers suggestions for further research.

6.2. Conclusions

The main objective of the study was to explore how mobile banking through wallets can be used as a tool for financial inclusion, by empirically measuring the effectiveness and sustainability of mobile banking wallets in Namibia. The conclusions of the study are presented against the specific objectives of the study which were:

- To determine the levels at which the banked and unbanked populations transact on mobile wallets in Namibia;
- To identify the key financial inclusion channels that drives mobile wallet usage and growth in Namibia;
- To establish the optimum supply and demand side balance for incentivising mobile wallet adoption in value added services for both the consumers and banking institutions;

- To recommend ways in which mobile banking can sustainably be used, as a tool for enhancing financial inclusion in Namibia.

6.2.1. Objective 1: The levels at which the banked and unbanked populations transact on mobile wallets in Namibia

On the basis of the findings, the study concludes that the average mobile banking revenue (MBR) was N\$578 million per month, with a minimum of N\$68,9 million in July 2012 and a maximum of N\$1,6 Billion in December 2017. The average mobile banking revenue highlighted the exponential growth of mobile banking business from both banked and unbanked populations. From 2014 to 2017, the number of unbanked populations on the mobile wallet increased from 25% in 2014 to 66% in 2017.

The study concludes that for each 1 banked person on the FNB mobile banking platform, there are 2 unbanked people on FNB mobile wallet relying on the money the banked people send. The study also concludes that on average the banked people send N\$479 in one transaction and 46% of this money was cashed out using the ATM withdrawals. While, the remaining money in the E-wallet account was used to buy on average electricity of N\$140 and airtime of N\$19.73 per transaction.

The study concludes that transacting customers represented on average 65% of the active customers on the mobile wallet platform in the last three months. While, on average 8 customers would be involved in 100 transactions on the platform. In addition, the study found no significant difference between the value to volume levels per transaction on the mobile banking platforms for the banked and unbanked customers of a Namibian

commercial bank. In conclusion, the study found that at the 95% level of confidence, there were significant mean differences (MD) between VASA (N\$6.29), VASE (N\$64.87), CCR (98%), CICO (1.4%), TAVR (26.3%), RCMT (2 out of 100) between the unbanked and banked platforms.

6.2.2 Objective 2: The key financial inclusion channels driving mobile wallet usage and growth in Namibia

The study identified four financial inclusion channels which included Financial Access (TAVR), Financial Penetration (CICO), Account Ownership (RCMT) and Profit Incentives (CCR) channels. The study concludes that the growth in charges-based value-added services (VASA) drives mobile wallet usage and growth. The VASA is in turn driven by its bi-directional relationship with the profit incentives (CCR) of the Bank. Consequently, the profitability of the platform is in turn influenced by the amount of profit that can come from financial inclusiveness, more than the need to increase financial access or account ownership. This is because increasing financial access and enhancing account ownership are costly to maintain and thus would reduce their profitability incentives.

The study concludes that the charge-based value-added services (VASA) provide the critical intermediation link as to how profit incentives (CCR) enhance both mobile banking and financial inclusion. Other channels include financial access (TAVR) which lead to an increase in account ownership (RCMT), that is needed for the financially excluded or unbanked populations to have a means to use the mobile platform and send money (SSM). Moreover, increasing the levels of account ownership enhances the

financial inclusion through financial penetration (CICO), where the unbanked recipients on the mobile platform are able to, not only cash out through ATMs, but also have access to the Cash-in facilities through the same platform.

6.2.3. Objective 3: The optimum supply and demand side balance for incentivising mobile wallet adoption in value added services for both the consumers and banking institutions

The study concludes that any positive changes in Mobile banking revenue is influenced by the previous month's Total E-wallet revenue and profit incentives from sales of airtime and electricity. On the other hand, the prior month, average revenue per transaction, and direct airtime sales have negative effects on the mobile banking revenue. The results imply that all things being equal, a 1% increase in the Profit Incentives (CCR) will result in a N\$1466.87 increase in mobile banking revenue per transaction per month. In other words, if the bank introduces new commission-based value-added services of vital importance, they will likely see a growth in the usage and value of the mobile platform.

While, a N\$1 per transaction increase in charges on the mobile platform services would result in a N\$12.63 per transaction reduction in the mobile banking revenues per transaction. The results also suggested the MBMT revenues have been decreasing over time, for each N\$1 per transaction of MBMT received in the previous month, reduces the current month MBMT by 54 cents.

Lastly, to increase the MBMT value by N\$1 per transaction, requires at least an MBR_unbanked revenue of N\$ 10,8 Million. In other words, this value represents a rough estimate of the mobile banking platform development and start-up costs. This value can be used to estimate the cost interoperability efforts on the commercial bank, as it highlights the expected costs of integrating the unbanked sections of the population into the mainstream banking or integrating one banking mobile platform with another. This cost represents also a barrier to entry for any new fin tech or commercial bank.

6.3. Recommendations

On the basis of the conclusions above, the following recommendations were made on how mobile banking can be used as a tool to enhance financial inclusion of unbanked populations. The study found that unbanked clients mainly used the mobile platform as a cash out. Therefore, there is need for incentives to encourage the unbanked to use the platform for other uses like credit, savings or insurance. Therefore, the e-money service providers need to integrate their services with other financial service providers like cash loans, insurance and other credit providers in close collaboration with the regulators like NAMFISA, Ministry of Finance and Bank of Namibia. As such, the study recommends that the policy makers focus on an interoperability platform that will build on the successes of the early adopters who now have loyal customers on their existing platforms.

With regards to the key financial inclusion channels driving mobile wallet usage and growth in Namibia. The study found that among the four identified financial inclusion channels, only Profit Incentives and Financial Penetration channels can be enhanced with mobile banking. On the other hand, the other two channels: Financial Access and Account

Ownership influenced the rate of mobile phone adoption as additive services. Porteous (2006) noted that additive services such as mobile (cell phone) banking, which allows people to manage their bank accounts through a cell phone, does not significantly enhance or improve financial inclusion. In contrast, the transformational services that allow people to obtain financial services through their cell phones without a need to have a bank account, significantly improve financial inclusion.

The study also found that the charge-based value-added services (VASA) provide a critical mediating link between the banked and unbanked platforms. This implies that profit incentives are important for any mobile banking initiative, including financial inclusion. Therefore, there is need for regulators to provide profitability incentives to the banks and other FinTechs involved with e-money services in Namibia. The more profitable the mobile banking platforms are, the more it will enhance financial inclusion of the unbanked customers.

With regards to the key financial inclusion channels driving mobile wallet usage and growth in Namibia. The study recommends the following actions to drive transformative financial inclusion through mobile wallets by:

- understanding consumer needs and staying connected as the unbanked needs evolve from predominantly cash out based to value added services;
- designing products that adequately address those needs and create a customer pull towards an interoperable mobile platform;
- leveraging and riding on high mobile penetration rate of above 97% and the cheap and widely available third-party distribution networks, that are sustainable due to

economies of scale, by offering common 'infrastructure rails' for multiple products to ride on. This would be similar, to how the Zambian electricity distributor is renting out its fibre optic space to telecommunications companies;

6.4. Recommendations for Future Research

The study recommends further research on the same topic covering all the 8 e-money issuers in Namibia. The study recommends future research that creates a baseline database on the industry transactions and volumes, as there seems to be no central and accurate database of the closed loop e-wallet schemes. Furthermore, there is need to carry out questionnaire surveys to assess the behaviour intentions of use for value added services.

References

- Adeleye, B. N. (2018, March 24). *Time Series Analysis (Lecture 4 Part 1): Johansen Cointegration Test in EViews*. Retrieved August 10, 2019, from <https://cruncheconometrix.blogspot.com/2018/03/time-series-analysis-lecture-4-part-1.html>
- Aduda, J., & Kingoo, N. (2012). The Relationship between Electronic Banking and financial performance among commercial banks in kenya. *journal of finance and investme analysis*, 1(3), 99-118.
- Agufa, M. (2016). The Effect Of Digital Finance On Financial Inclusion In The Banking Industry In Kenya. *Masters Thesis*. Nairobi: School Of Business, University of Nairobi.
- Andersson, F. (2016). Identifying and modelling cycles and long waves in economic time series. In J. Ljungberg, *Structural Analysis and the Process of Economic Development* (pp. 54-75). London: Routledge.
- Arabéhéty, P. G., Chen, G., Cook, W., & McKay, C. (2016). *Digital Finance Interoperability & Financial Inclusion: A 20-Country Scan*. Working Paper. Washington, DC: Consultant Group to Assist the Poor.
- Baumann, C., Elliott, G., & Hamin, H. (2011). Modelling customer loyalty in financial services: a hybrid of formative and reflective constructs. *International Journal of Bank Marketing*, 29(3), 247-267.

Bierens, H. J. (2010). *Cointegration analysis*. Pennsylvania: Pennsylvania State University.

BoN. (2017, October). Payment and Settlement Systems. *Public Education, 1*.

BoN. (2018, August 2). Interoperability in the National Payment System. *Position Paper*. Windhoek: Bank of Namibia.

BoN. (2019, January). Understanding the Namibian National Payment System. *Newsletter*. Windhoek: Payment and Settlement Systems Department, Bank of Namibia.

Bryman, A., & Bell, E. (2015). *Business research methods*. USA: Oxford University Press.

Demirguc-Kunt, A., Klapper, L., Singer, D., & Oudheusden, P. V. (2015, April). The Global Findex Database 2014: Measuring Financial Inclusion around the World. *Policy Research Working Paper 7255*.

Farah, M. F., Hasni, M. J., & Abbas, A. K. (2018). Mobile-banking adoption: empirical evidence from the banking sector in Pakistan. *International Journal of Bank Marketing*. doi:10.1108/IJBM-10-2017-0215

Financial Access Initiative. (2010, May 27). *M-KESHO in Kenya: A new step for M-PESA and mobile banking*. Retrieved from Financial Access Initiative: <http://www.financialaccess.org/blog/2015/7/16/m-kesho-in-kenya-a-new-step-for-m-pesa-and-mobile-banking>

- FinMark Trust. (2016, December). The role of mobile money in financial inclusion in the SADC region: Evidence using FinScope Surveys. *Policy research paper No. 03/2016*. FinMark Trust.
- FNB. (2018). CEO's Address on Financial Inclusion . Windhoek: First National Bank of Namibia.
- Geraldes, M. .. (2014, February 12). *MTC, MobiPay launch MTC Money*. Retrieved from lelamobile.com: <http://www.leramobile.com/content/10181/MTC-MobiPay-launch-MTC-Money/>
- Gravetter, F., & Forzao, L. (2012). *Research Methods for Behaviour Sciences*. Wadsworth: Cengage Learning.
- GSMA. (2017). The Mobile Economy: Sub-Saharan Africa 2017. Online: GSMA Intelligence. Retrieved from <https://www.gsmainelligence.com/research/?file=7bf3592e6d750144e58d9dcfac6adfab&download>
- Gujarati, D. N. (2009). *Basic econometrics*. Dehli: Tata McGraw-Hill Education.
- Haynes, L. (2007, April 25). FNB introduces cellphone banking. Windhoek: The Namibian Newspaper Interview.
- Hill, R. C., Griffiths, W. E., & Lim, G. C. (2018). *Principles of econometrics*. New York: John Wiley & Sons.
- Immo, B. (2015). *The Economist Hard Facts On Software - Mobile Wallets*. Retrieved from

<http://allafrica.com/stories/201206230083.html>, <https://www.fnb.co.za/downloads/SendMoney/Product-Guidelines.pdf>

Ismail, L., Moya, M. B., Bwiino, K., & Ismael, K. (2017). Examining determinants of behavioural intention in adoption of mobile money transfer services in Uganda. *ICTACT Journal on Management Studies*, 3(1), 433-439.

Klapper, L., & Popovic, A. (2018, June 29). *Five ways Nigeria can realize mobile technology's potential for the unbanked*. Retrieved from [blogs.worldbank.org/african/](http://blogs.worldbank.org/african/five-ways-nigeria-can-realize-mobile-technologys-potential-for-the-unbanked): <http://blogs.worldbank.org/african/five-ways-nigeria-can-realize-mobile-technologys-potential-for-the-unbanked>

Kumar, R. (2014). *Research Methodology*. New Dehli: APH Publishing.

Lin, H., & Wang, Y. (2006). An examination of the determinants of customer loyalty in mobile commerce contexts. *Information & management*, 43(3), 271-282.

Mann, C. J. (2003). Observational research methods. Research design II: cohort, cross sectional, and case-control studies. *Emergency medicine journal*, 20(1), 54-60.

Mbutor, M., & Uba, I. A. (2013, November). The impact of financial inclusion on monetary policy in Nigeria. *Academic Journals*, 5(8), 318-326. Retrieved from http://www.academicjournals.org/article/article1383044040_Mbutor%20and%20Uba.pdf

MobiPay. (2012). *MobiPay E-wallet Terms and Conditions*. Windhoek: MobiPay.

Moneycontrol.com. (2017, October 12). *Interoperability of mobile wallets: everything you need to know*. Retrieved from Moneycontrol.com:

<http://www.moneycontrol.com/news/trends/current-affairs-trends/interoperability-of-mobile-wallets-everything-you-need-to-know-2411323.html>

M-Pesa. (2015, August 12). *M-Pesa And The Rise Of The Global Mobile Money Market*.

Retrieved from forbes.com:

<https://www.forbes.com/sites/danielrunde/2015/08/12/m-pesa-and-the-rise-of-the-global-mobile-money-market/#3947c385aecf>

Mutiga, M. (2014, January 20). Kenya's Banking Revolution Lights a Fire. *The New York Times*.

Mutong'Wa, S. M., Campus, G. E., Khaemba, S. W., & Mengich, E. M. (2014). A comparative study of critical success factors (CSFS) in implementation of mobile money transfer services in Kenya. *European Journal of Engineering and Technology*, 2(2), 8-31.

Nyagilo, V. (2019). Financial Inclusion In Rural Kenya: An Investigation of The Role of Financial Technology as an Instrument. *International Journal of Business Management and Finance*, 1(1).

Ogboko, C. A. (2018). Foreign Direct Investment and Economic Progress: Application of A Dynamic Model. *International Journal of Economics and Finance Studies*, 10(1), 1-15.

Okiro, K., & Ndungu, J. (2013, May). The Impact of Mobile And Internet Banking on Performance of Financial Institutions in Kenya. *European Scientific Journal*, 9(13), 146-161.

- Ouma, S. A., Odongo, T. M., & Were, M. (2017). Mobile financial services and financial inclusion: Is it a boon for savings mobilization? *Review of development finance*, 7(1), 29-35.
- Ozili, P. (2018). Impact of digital finance on financial inclusion and stability. *Borsa Istanbul Review*, 18(4), 329-340.
- Paelo, A. (2017). A Comparison of the Mobile Financial Services Sector in Kenya, Tanzania and Uganda. *The 3rd Annual Competition and Economic Regulation (ACER) Conference*. Dar es Salaam, Tanzania.
- Pandy, S. M., & Crowe, M. (2017, June 16). Adapting to Mobile Wallets: The Consumer Experience. *Mobile Banking Team Research*. Federal Reserve Bank of Boston .
- PaymentsAfrika.com. (2015). *Mobile Banking Deepens Financial Inclusion*. Retrieved April 10, 2017, from paymentsafrika.com: <http://paymentsafrika.com/payment-news/general/mobile-banking-deepens-financial-inclusion-bot/>
- Peruta, M. D. (2017). Adoption of mobile money and financial inclusion: a macroeconomic approach through cluster analysis. *Economics of Innovation and New Technology*, Online. doi:10.1080/10438599.2017.1322234
- Pesaran, M. H., & Shin, Y. (1999). An autoregressive distributed lag modelling approach to cointegration analysis. In S. Strom, *Econometrics and Economic Theory in the 20th Century (Chapter 11)*. *The Ragnar Frisch Centennial Symposium* (p. 175). Cambridge: Cambridge University Press.

Planting, S. (2013). *Please send me money via eWallet Mobile money transfer increasing in popularity*. Retrieved from moneyweb.co.za:

<https://www.moneyweb.co.za/archive/please-send-me-money-via-ewallet/>

Plastic, P. (2014). *Cards & payments: digital solutions that benefit issuers and cardholders*. Retrieved April 10, 2017, from poweruppos.net: Retrieved from <http://poweruppos.net/>

Republic of Namibia. (2011). *Namibia Financial Sector Strategy 2011-2021: A Sector Development Document Towards Achieving Vision 2030*. Windhoek: Ministry of Finance.

Robb, G., & Vilakazi, T. (2015). *Mobile Payments Markets in Kenya, Tanzania and Zimbabwe: A Comparative Study of Contestability and Outcomes*. CCRED Working Paper No 8/2015.

Shimweetheleni, W. (2016). *An Investigation On The Impact Of Uncapped Micro-Lending Interest Rates On The Household Indebtedness Levels In Namibia*. Masters' Thesis. Windhoek: ESAMI Business School.

TheEconomist. (2013, May 25). *Why does Kenya lead the world in mobile money*. Retrieved April 18, 2017, from economist.com:

<http://www.economist.com/blogs/economist-explains/2013/05/economist-explains>

Toledano, M. B., Cao, Y., Feychting, M., Ahlbom, A., Fremling, K., Heinävaara, S., . . . Smith, R. (2018). *An international prospective cohort study of mobile phone users and health (COSMOS): factors affecting validity of self-reported mobile*

phone use. *International journal of hygiene and environmental health*, 221(1), 1-8.

Torres-Reyna, O. (2007). Panel Data Analysis Fixed and Random Effects using Stata (v. 4.2) . *Data and Statistical Services*. Princeton University. Retrieved from <http://dss.princeton.edu/training/>

Triki, T., & Faye, I. (2013). *Financial inclusion in Africa*. Addis Ababa: African Development Bank.

UCLA. (2019). *Regression-diagnostics*. Retrieved August 10, 2019, from <https://stats.idre.ucla.edu/stata/webbooks/reg/chapter2/stata-webbooksregressionwith-statachapter-2-regression-diagnostics/>

Waiganjo, C. W. (2018). Effect of mobile banking investment on financial profitability- A Case of Tier one banks in Kenya. *Doctoral dissertation*. Strathmore University.

Welman, C., Kruger, F., & Mitchell, B. (2014). *Research Methodology*. Oxford: Oxford University Press.

Wooldridge, J. M. (2016). *Introductory econometrics: A modern approach*. New York: Nelson Education.

Zhang, T., Lu, C., & Kizildag, M. (2018). "Banking "on-the-go": examining consumers' adoption of mobile banking services". *International Journal of Quality and Service Sciences*, 10(3), 279-295. doi:10.1108/IJQSS-07-2017-0067

APPENDICES

Appendix 1: Language Editing Certificate



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LANGUAGE & COPY-EDITING CERTIFICATE

22nd December 2019

RE: LANGUAGE, COPYEDITING AND PROOFREADING OF DESERY VAN WYK's
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NAMIBIA BUSINESS SCHOOL OF THE UNIVERSITY OF NAMIBIA

This certificate serves to confirm that I copyedited and proofread **DESERY VAN WYK's** Thesis for the **MASTER OF BUSINESS ADMINISTRATION DEGREE** entitled: **AN EVALUATION OF MOBILE BANKING AS A TOOL FOR ENHANCING FINANCIAL INCLUSION IN NAMIBIA: A CASE OF FNB NAMIBIA**

I declare that I professionally copyedited and proofread the thesis and removed mistakes and errors in spelling, grammar, and punctuation. In some cases, I improved sentence construction without changing the content provided by the student. I also removed some typographical errors from the thesis and formatted the thesis so that it complies with the University of Namibia's guidelines.

I am a trained language and copy editor and have edited many Postgraduate Diploma, Masters' Thesis, Dissertations and Doctoral Dissertations for students studying with universities in Namibia, Zimbabwe, Eswatini, South Africa and abroad. I have also copy-edited company documents for companies in the region and abroad.

Please feel free to contact me should the need arise.

Yours Sincerely,

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