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An analysis into client based banking applications in South Africa

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An analysis into client based banking applications in South Africa

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An integrated research report submitted to the Wits Business School, University of Witwatersrand, in partial fulfillment of the requirements for the degree of Master of Business Administration.

Wits Business School

11th March 2013

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DECLARATION

I declare that this research report is my own, unaided work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the Wits Business School, University of Witwatersrand. It has not been submitted before for any degree or examination in any other University. I further declare that I obtained the necessary authorisation and consent to carry out this research.

Date: 11th March 2013

…….

Drushen Naidoo

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For my dearest Lord Ganesha, there has been no obstacle in my life that you have not removed. It's only through your love and grace, that I enjoy each day in this world.

To my darling wife, who guided, loved and supported me throughout this journey. Your love and patience made this a memorable experience. Through this journey in life, I am blessed to have you as my partner. I love you with all my heart.

To my loving and mum and dad, who have instilled the value of education in me at a young age. A parent's love knows no boundaries. Thank you mum and dad for your love and guidance, for without it, I would not have reached this stage in my life. Words cannot express how much I love you.

Finally to my dearest Ama and Ma, thank you for all your love, support and blessings. Love you always, miss you forever.

11th March 2013

ABSTRACT

The relationship between customers and their banks is becoming more dynamic (Ernst and Young, 2012). Customers are seeking greater control in their banking relationship. They are switching banks, changing their behaviours and seeking efficiencies. Banks need to reconfigure their business models, revaluate assumptions and fundamentally change how they interact with customers (Ernst and Young, 2012).

It is estimated that there are over 10 million active smartphones in South Africa (Deloitte, 2013). The convergence of banking services and mobile technologies allows users to conduct banking service at any time or place through mobile banking (Gu, Lee, & Suh, 2009).

The advent of smartphones and tablets has allowed banks to enhance the delivery of mobile financial services through the development of client based banking applications. These client based smartphone applications are developed for specific mobile operating systems such as Apple's iOS, Google's Android, Blackberry's Blackberry OS7.1, 6.0 and 5.0.

Smartphones will allow banks to leverage newer mobile technologies, harness analytics gathered through use of their applications to position products and services that will be of interest to their customers. This could result in increased revenues and it also provides an opportunity to increase market penetration. " As banks develop their strategies for giving customers access to their accounts through cell phones and other mobile devices, they should also regard this emerging platform as a potential catalyst for generating operational efficiencies and as a vehicle for new revenue sources." (Deloitte Development, 2010)

This research attempts to analyse and evaluate the usage patterns of client-based mobile banking applications in South Africa by trying to ascertain what functionalities are performed on mobile banking applications and how often they are performed. This paper attempts to address these questions by building on (Trudel, Boeck, Bastonnais, Rabec, & Bergeron, 2011) typology of functionalities

performed on mobile banking applications by including a new construct, Frequency of Use in the determination of usage patterns.

Keywords

Mobile banking application, usage patterns of mobile banking application, typology of mobile banking application, mobile banking functionalities.

1 INTRODUCTION

1.1 Purpose of the study

The purpose of this research is to analyse and evaluate the usage patterns of client-based mobile banking applications in South Africa.

1.2 Context of the study

Berger and Sinha *(2012)* reveal that the number of South Africans owning, renting or who had access to mobile phones for the period of 2005 to 2009, had increased by 20%. South Africa currently has a mobile penetration rate of 100.48% among its population of 50 million and has the third largest number of mobile subscribers in the continent. 72% of 15 to 24 year olds own mobile phones thus young people are the primary adopters of mobile technology (Beger & Sinha, 2012).

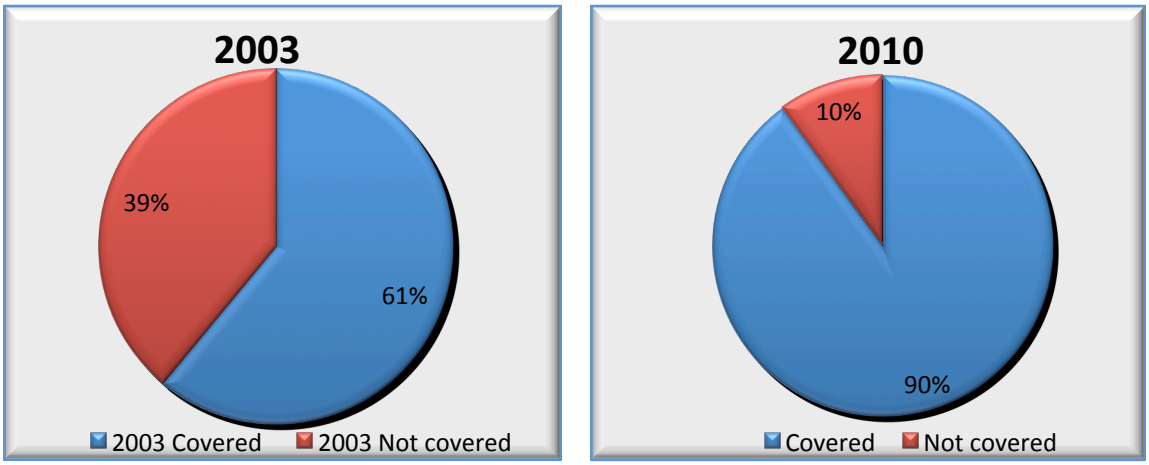

Figure 1: Percentage of the world's population covered by a mobile cellular signal, 2003 compared to 2010. Source International Telecommunication Union Statistics

David Porteous (2006) suggests that the large adoption rate of mobile phones enhances the prospect that financial services i.e. mobile banking and payments executed via mobile phones will also take-off. He asserts that the adoption of mobile banking could have positive developmental consequences that could:

1. Increase the efficiency of payments systems and decrease dependency on cash as a transactional medium
2. Widen the reach of financial services by improving the accessibility and decreasing the cost of offering of formal financial services.

He espouses the transformational effect of mobile banking and proposes that low-income countries may leapfrog the deployment of widespread earlier technologies and infrastructure such as ATMs or Electronic Point of Sales devices (Porteous, 2006). Krugel (2007) reinforces this point of view by stating that there is a clear migration strategy from the banks to move their customers away from fixed-cost based infrastructure such as branches, to those that utilize fewer resources and have lower operational costs such ATMs, POS (Point Of Sales) devices and the internet. Krugel (2007) confirms Porteous statement with respect to the ability of mobile banking leapfrogging the deployment of earlier technologies and infrastructure by stating that none of the aforementioned technologies have the same degree of accessibility as the mobile phone. The coverage of fixed infrastructure setup of POS devices, ATMs and branches relative to the degree of coverage of the cell phone network is lower (Krugel, 2007).

Krugel (2007) espouses both the ability of mobile banking to effectively reach the mass market and dramatically lower cost of banking by mentioning pioneers of mobile banking technology such as MTN Banking, Globe, Smart, Celpay and WIZZIT Bank who were at the time of his research, using mobile technology to increase accessibility to financial services. Mobile banking is a cost efficient channel for banks, as it allows them to charge less for transactions and allows the consumer to have immediate effects to their bank accounts which he believes should translate into a more frequent transactions (Krugel, 2007).

Lenart and Frederiksen (2011) assert that the viability of the mobile banking channel continues to grow as smartphone adoption rates increases and the propagation of banking applications increase. As the user's familiarity to perform banking transactions such as money transfer, bill payment, finding the nearest ATM or branch locations grows, this will increase the potential for the mobile banking channels to grow even further (Lenart & Frederiksen, 2011).

Whilst the paragraphs above make a case for the efficacy of mobile banking by highlighting both the degree of accessibility relative to existing fixed infrastructure and the rate of adoption of mobile phones, the paragraphs below delineate how mobile phones can be used for financial services and proposes how the use of mobile phones for financial services can align to strategic drivers aligned to the bank and discusses the application environment in which mobile phones are used for financial services.

Ivatury and Pickens (2006) propose that Mobile phones can be used for financial services in three different ways: Micropayments (m-commerce), as electronic money (e-money) and as a banking channel (Ivatury & Pickens, 2006).

M-commerce: The use of mobile phones linked to credit cards or bank accounts in Nordic Countries and Japan used to make small payments mainly for transportation and vending machines. This functionality is confirmed by Mas and Kumar who cite Mobile as POS functionality that can serve to substitute cash and capture transactions electronically at the store (Mas & Kumar, 2008).

E-Money: Ivatury and Pickens (2006) mention Globe Telecom in the Philippines, who have technology in place that allow their customers to load cash (or their proprietary currency, G-Currency) onto their mobile phones at selected partner merchants or Globe outlets. Globe Telecom customers then can withdraw as real physical money or transfer G-Currency to nominees across the Philippines or the world or they can purchase products and services using this G-Currency. Customers of M-PESA in Kenya can use their virtual money in repay loans or make deposits to microfinance institutions. This functionality is confirmed by Mas and Kumar (2008) that Mobile-as-ATMs functionality can enable merchants to become cash-in/ cash-out points.

Banking Channel: Ivatury and Pickens (2006) state customers of both, MTN Banking (partnered with Standard Bank of South Africa) and WIZZIT (partnered with the South African Bank of Athens), who use their mobile phones as a primary channel of accessing their bank account. Customers can use their mobile phone to purchase airtime, make payments, perform transfers and balance enquiries. Mobile-

as-Internet machines can allow customers to transact remotely without having to physically access a service point (Mas & Kumar, 2008).

Strategic Value Propositions of Mobile Banking

Mas and Kumar (2008) state that the benefits of mobile banking have to be aligned or related to the bank's own strategic drivers. They highlight some basic core strategies by using mobile phones as an additional self- service channel to promote and protect growth.

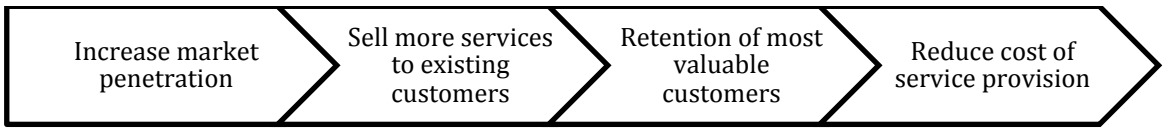

Figure 2: Strategic Value Propositions of Mobile Banking

Increase market penetration –The ability for mobile phones to be used as a channel to target the underserved population segments, and increase market penetration presents the opportunity to grow the revenue pie as well as reduce cost in the deployment of customer touch points into lower income or more remotely located population segments (Mas & Kumar, 2008).

Sell more service to existing customer – Financial institutions exploit new functionality available on mobile phone by developing new products that target that unmet needs of existing customers (Mas & Kumar, 2008).

Retention of most valuable customers – The development of mobile banking services can help retain 20% of customers who generate 80% of the revenue by providing them with breadth of services, and therefore make them less inclined to moving to a competitor (Mas & Kumar, 2008).

Reduce cost of service provision – Banks that seeks to cut cost through the implementation of efficient self-service channels should not be primarily focused on margin but rather on attaining the lowest cost position in the market which should deter competitors from engaging in price wars (Mas & Kumar, 2008).

Tied to the choice of strategic drivers of mobile phone banking is the application environment i.e. both the choice of technology (Mobile Phone Capability) and partnerships between banks and the mobile network operator providers in delivering mobile services to the consumer.

Bezuidenhout and Porteous (2008) discuss the various application environments in which mobile banking can be performed by highlighting that the main technical risk characteristics in the delivery of mobile financial services is both the degree of dependence or independence from a mobile network operator and mobile phone capability. The mobile network operator controls access to the SIM card and the mobile network. The delivery of mobile financial services via a mobile phone may or may not require downloading of an application to the SIM card or the phone, which may then in turn may or may not require participation of the manufacturer or mobile network operator, is highlighted in the matrix below (Bezuidenhoudt & Porteous, 2008).

Table 1: The interaction between Mobile Handset Capability and dependence or independence from Mobile Network Operator as a determinant in mobile application environment

		Mobile Handset Capability	
		Standard (all)	**Advance**
Independent of Mobile Network Operator	Yes	**Use Case 1:** Generic mobile carrier services provided on all phones delivered on all phones accessible directly by the mobile user	**Use Case 2:** Mobile browsing services that are provided on phones **Use Case 3:** Advanced application services that are provided on phones
	No	**Use Case 4:** Secure environment on the mobile phone provided by the Mobile Network Operator	**Use Case 4:** Dedicated secure application environment on a handset

Mas and Kumar (2008) take this a stage further by delineating the application environment choices into client based and network based.

Client based – An application downloaded on the phone is used to control the service. The application may make use of a menu structure to guide the interactions between user and the bank server. Mas and Kumar propose that this service is likely to work faster because:

1. The menu resides on the handset and is not need to be downloaded over the air each time it is called.
2. The application can process information before sending, this improves the amount of data sent and received over the air.

Network Based - No specific application is downloaded, and the service is accessed via the handset's web browser or through USSD (Unstructured Supplementary Data Services) or SMS (Short Messaging Services).

1.3 Problem statement

1.3.1 *Main problem*

Analyse and evaluate the usage patterns of client-based banking applications in South Africa.

1.4 Significance of the study

Research has been conducted into transformational model of mobile banking and use of mobile phones to serve the bottom of the pyramid (Aker & Mbiti, 2010; Au & Kauffman, 2008; Mas & Kumar, 2008). The provision of mobile financial services towards the unbanked and bottom of the pyramid have also relied on earlier generation technologies such as USSD, SMS or client based applications resident on the SIM card (Ivatury & Pickens, 2006; Krugel, 2007; Mas & Kumar, 2008). Research conducted by World Wide Worx has found that more South Africans use mobile phone banking (28% of the population) than Internet Banking (16%) (Harris, 2010).

"Not only is the penetration of mobile devices into the market continuing at a fast rate, but so is the richness of the functionality that these devices have to offer" (Harris, 2010: 22).

The advent of smartphones and tablets has allowed banks to enhance the delivery of mobile financial services through the development of client based banking applications. These client based smartphone applications are developed for specific mobile operating systems such as Apple's iOS, Google's Android, Blackberry's Blackberry OS7.1, 6.0 and 5.0.

Smartphones will allow banks to leverage newer mobile technologies, harness analytics gathered through use of their applications to position products and services that will be of interest to their customers. This could result in increased revenues and it also provides an opportunity to increase market penetration. “ As banks develop their strategies for giving customers access to their accounts through cell phones and other mobile devices, they should also regard this emerging platform as a potential catalyst for generating operational efficiencies and as a vehicle for new revenue sources.“ (Deloitte Development, 2010)

The study will intend to provide guidance to business executives, business analysts and software developers and also enable them to develop applications that are customer centric.

The research attempts to delineate functionalities commonly used, the frequency of use, and desired future functionalities of smartphone banking applications.

1.5 Delimitations of the study

This study will only focus on client-based smartphone banking applications that are installed onto the smartphone memory. It will exclude the client-based applications that are installed on the SIM card as well as network based mobile banking systems. The smartphone is defined for the purpose of my research as a phone capable of running the following mobile operating systems Apple’s iOS, Google’s Android, Blackberry’s Blackberry OS7.1, 6.0 and 5.0. The smartphone must have access to a mobile network operator’s data network.

1.6 Definition of terms

- **Client based**—where an application downloaded on the phone takes control of the service. For instance, the application may present a specific menu and may guide the interactions between user and bank server in a user-friendly way. It is likely to seem to work faster for two reasons: (i) the menu is resident on the handset and does not need to be served OTA each time it is called,

and (ii) the application can process information before sending it so as to optimize the amount of data sent and received OTA. The application can be resident on the SIM (using the SIM Toolkit [STK] programming environment), in which case the menu can be inserted right into the phone's main menu. Or it can be resident on the phone's memory, in which case it is likely to be a Java applet (Mas & Kumar, 2008).

- **Network based**—where there is no specific application downloaded, and the service is presented directly in the way that it is sent from the server to the handset. In this case, the application "look and feel" is determined by the bearer, without any special user interface "packaging" it. Thus, the user interface will be the normal or "native" SMS or USSD interface or the browser (Mas & Kumar, 2008).
- **USSD** – Unstructured Supplementary Service Data. An alternative messaging system.
- **M-Money and M-Banking –** Mobile money and mobile banking respectively, both a subset of electronic commerce.
- **Mobile Payments** – Any payment transaction (close proximity or remote) executed on mobile devices. It excludes Internet payments made through mobile phones (Capgemini, 2011).
- **P2P –** Person to Person Payment
- **Near Field Communication -** NFC can be seen as the fusion of contactless smart card and the mobile phone (Ondrus & Pigneur, 2008).
- **Personal Financial Management Services -** Personal Financial Management Services can be described as a set of tools that help consumers and small business track and manage their finance, create budgets, categorize and anticipate spending, and analyse both the distribution and performance of their investments (BancVue, 2010).

1.7 Assumptions

- The smartphones have access to the Mobile Network Operator's data network. This is vital, as non-access to the data network will either limit the functionality of the client based application or render it inoperable.

2 LITERATURE REVIEW

2.1 Introduction

This section contains a literature review of key themes of relevance to the study.

2.2 Background discussion

Much research has been conducted into the transformational approaches to mobile banking and the delivery of financial services to the unbanked (Bezuidenhoudt & Porteous, 2008; Ivatury & Pickens, 2006; Jack & Suri, 2011; Porteous, 2006; Shambare, 2011). The provision of mobile financial services towards the unbanked and bottom of the pyramid have also relied on earlier generation technologies such as USSD, SMS or client based applications resident on the SIM card (Ivatury & Pickens, 2006; Krugel, 2007; Mas & Kumar, 2008).

The additive approach to mobile banking targets existing banked customers and presents the mobile channel as an additional self-service channel (Koenig-Lewis, Palmer, & Moll, 2010; Porteous, 2006; Püschel, Mazzon, & Hernandez, 2010). A large number of South Africans use mobile banking (28% of the population) than Internet Banking (16% of the population) (Harris, 2010). The advent of smartphones and smartphones and tablets has allowed banks to enhance the delivery of mobile financial services through the development of client based banking applications. These client based smartphone applications are developed for specific mobile operating systems such as Apple's iOS, Google's Android, Blackberry's Blackberry OS7.1, 6.0 and 5.0.

Smartphones will allow banks to leverage newer technologies and harness analytics gathered through use of their mobile banking applications by their clients to enhance and refine the delivery of their existing service offering through these mobile banking applications and create new mobile financial service value propositions.

2.3 Usage Patterns of Client –Based Mobile Banking Applications

2.3.1 *Mobile applications and the Mobile Internet*

Mobile applications are defined as small software programs that execute on smartphones or other mobile devices. They can access the Internet to provide users with services available from a computer or offer services only available from a mobile device (Trudel et al., 2011). Mobile applications are often developed by third parties to provide additional functionality to the phone and are enablers of mobile commerce.

The Mobility 2012: Mobile Internet in South Africa study highlights that the demand for mobile data in increasing and that the average user's mobile phone spend on data has increased by half in the past 18 months from 8% of budget at the end of 2010 to 12% in mid-2012 (Goldstruck, 2012a). Over the same period spend on voice calls has decreased from 77% to 73% (Goldstruck, 2012a).

"The findings represent powerful backing for our strategy of providing banking services across new channels and platforms like Facebook and the apps environment," says Ravesh Ramlakan, CEO, FNB Cellphone Banking (Goldstruck, 2012: 2).

2.3.2 *Mobile commerce an extension of electronic commerce*

E-commerce (Electronic commerce) and m-commerce (mobile commerce) differ due to constraints of mobile devices, thus the usage patterns differ from traditional desktop computers (Barati & Mohammadi, 2009). The ready availability of mobile commerce allows for information access to many new business functions in real time that may have been previously unsupported. These business functions can also be personalized to match individual situations, thus mobile commerce is greater than an extension of e-commerce (Barati & Mohammadi, 2009). The willingness to adopt cell phone banking over other self-service banking channels banking channels such as ATM's or Internet Banking is greater (Shambare, 2011). In South Africa

approximately 28% of banking customers use mobile banking services compared to about 16% that utilise Internet Banking (Shambare, 2011).

2.3.3 *A confluence of factors aiding in the adoption of mobile banking*

Deloitte Development (2010) highlights a convergence of factors that has helped entrenched mobile banking:

- **Rapid adoption of smartphones***:* Consumer have embraced smartphones that allow them to make calls, send and receive e-mail and text messages, browse the internet and perform other tasks through the use of applications.
- **Shifts in consumer preferences***:* Smartphones are providing consumers with options such as the ability to access account information and perform transactions without requiring access to bank branches, ATMs or computers.
- **A significant capability build out:** Banks have invested in the development of their mobile banking capabilities.
- **Product and Service Innovation:** Mobile banking allows banks to offer features to customers that are not available via online banking such as person-to-person payments and real-time fraud notification.

It is the increasing sophistication of smartphones that is creating both new opportunities and options for customers of mobile phone banking (Goldstruck, 2012b).

2.3.4 *Determinants of Usage Patterns*

For the purpose of this research, the following 3 constructs will be analysed and evaluated as determinants of usage patterns:

1. Interactivity
2. Nature of Functionality
3. Frequency of Use

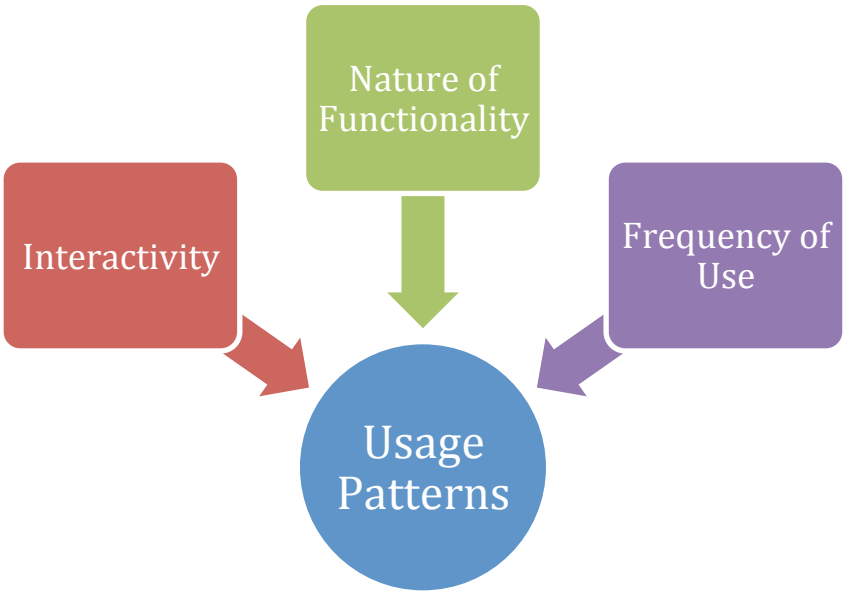

Figure 3: Determinants of Usage Patterns

(Trudel et al., 2011) use the first two constructs, interactivity and nature of functionality to form the framework of typology of functionality contained in mobile banking applications. A typology rather than taxonomy was used, as a typology requires conceptualization along two or more dimensions whereas taxonomy begins empirically with the goal of classifying cases according to measured similarity on observed variables (Bailey, 1994). According to (Trudel et al., 2011) who cite (Bailey, 1994), taxonomies are crated on empirical observation and mobile banking applications are an emerging phenomenon with evolving functionalities and most empirical observations are not yet available.

The typology used by (Trudel et al., 2011) is based on functionality contained in mobile banking applications available on the Canadian and the United States market. For the purposes of this research a third dimension frequency of use, as a construct, is added. They combine the dimensions of interactivity and nature of functionality to derive a four-cell matrix that yields the following types of mobile banking applications (Trudel et al., 2011):

1. Transactive
2. Transpassive
3. Informactive
4. Infopassive

Table 2: Typology of Mobile Banking Applications (Trudel et al., 2011)

Nature/Interactivity	***Passive***	***Active***
Transactional	Transpassive	Transactive
Informational	Infopassive	Informactive

Whilst (Trudel et al., 2011) typology of Mobile Banking Applications Framework classifies mobile banking functionalities into one of 4 categories stated above, it does not highlight the most commonly used functionalities. That dimension could be highlighted through the use of the Frequency of Use Construct that this research intends to use.

2.3.5 *Nature of functionality as a contributing factor in the determinant of usage patterns*

The European Institute for Research and Strategic Studies in Telecommunications initiated the eMporio project in 2001 to analyse the m-commerce market and to produce business models and service scenarios (Panis, Morphis, Felt, Reufenheuser, Nitz, & Saarlo, 2002). The project investigated more than 25 potential

service scenarios grouped into 7 categories of services. Service scenarios were classified according to user types (business and private users) and according to market segment (Business to consumer, consumer to consumer or business to business) (Panis et al., 2002). For the private user type and business to consumer market segment 4 m-commerce services were highlighted based on their prospects to succeed on the market (Panis et al., 2002) :

1. Location based services
2. Micropayment
3. Gambling
4. Intelligent Advertising

The nature of functionality helps present different purposes or utilities of a mobile banking application, which can be categorised into 3 distinct categories (Trudel et al., 2011):

1. **Communicational functionalities** that include all functionality that enable two or more separate entities to diffuse a message from a transmitter to one or more receiver capable of decoding the message and interpreting it. Communication can be synchronous or asynchronous. Examples include requests of account balance and latest transactions performed on the account (Barati & Mohammadi, 2009). Additional opportunities that are specific to mobile functionality: combination of real-time communications, location-based services and banking functionality provides a possibility to create a new value-added service (ACI Worldwide Inc, 2011).
2. **Transactional functionalities** that include a transfer of value such as the ability to transfer funds between accounts and make buy and sell orders in electronic share trading (Barati & Mohammadi, 2009).

- **Informational functionalities** that provide the user with static information such as the ability to receive portfolio and price information (Barati & Mohammadi, 2009).

2.3.6 *Interactivity as a contributing factor in the determinant of usage patterns*

Barati and Mohammedi (2009) view interactivity as a major difference between e-commerce and m-commerce, the interaction style is unique due to the constraints of mobile devices, thus the usage patterns differ from those of traditional desktop computers (Barati & Mohammadi, 2009). The degree of interactivity of a mobile application brings a degree of user involvement to the model (Trudel et al., 2011).

When no input is required from the user to perform a task, interactivity is passive. The display of account balances, updates of latest authorized transactions other such information is considered passive if the information is pushed to the device (Trudel et al., 2011). An active functionality requires input from the user to complete the interaction; it requires the user to voluntarily initiate the process for the application to retrieve data. It includes functionalities that are not automated (Trudel et al., 2011).

The first iteration of mobile applications was focused on presenting information rather than enabling transactions from a mobile device. As mobile devices develop and data entry methods improve, transaction banking initiated from a mobile device will become more prevalent (ACI Worldwide Inc, 2011).

2.3.7 *Frequency of use as a contributing factor in the determinant of usage patterns*

Whilst the first two constructs, assist in both the classification of different functionalities that exist within mobile banking applications and the nature of interactivity (passive or active), the frequency of use construct assist in help understanding how often which functionalities are actively performed or passively received.

A prior empirical study conducted with respect to use and adoption of mobile data services in South and Mauritius state that mobile phone banking and playing online

games are the least popular service, with 83% of the sample not using these 2 services at all (Ramburn & Belle, 2011).

Ramburn and Belle (2011) view the lack of need for services as the chief reason for non-use of mobile data services. A lack of interest in the service, high cost of transactions and lack of awareness follow as the subsequent reasons for non-use. However these factors were not seen as inhibitors but the major difference revealed by the study was the unavailability of the required phone features enabling the use of mobile data services (Ramburn & Belle, 2011).

This augurs well for banks to use mobile banking as a self-service channel, as the functionalities of mobile phones are evolving at a rapid rate. The adoption and use of mobile banking applications could increase. As the functionalities of mobile phones garner greater prominence coupled with both a decrease in the price of data, and an increased awareness of mobile banking application functionality; the adoption of mobile banking applications could increase.

2.4 Enhancement of financial services through current and evolving mobile technologies

2.4.1 *Leveraging newer technologies through the use of smartphones*

Smartphones will allow banks to leverage newer technologies and harness analytics gathered through use of their mobile banking applications by their clients to enhance and refine the delivery of their existing service offering through these mobile banking applications and create new mobile financial service value propositions.

“The number of people using mobile payments is expected to reach 2.5 billion by 2015 Mobile money transactions are expected to reach $670 billion by the same date” (ACI Worldwide Inc, 2011:2).

85% of POS systems are expected to accept mobile payments by 2016, mobile technology will be at the forefront of this change (ACI Worldwide Inc, 2011).

Mobile phones equipped with NFC (Near Field Communication) are expected to transform mobile proximity services such as mobile payments, couponing and ticketing. NFC adds device-to-device communication, reading other contactless chips [RFID (Radio Frequency Identification)] and emulation of contactless card functionalities to mobile phone (Ondrus & Pigneur, 2008). NTT DcCoMo (Japanese Mobile Network Operator) launched their “osaifu-keitai” (mobile wallet function) and had in the course of a year, 20 million subscribers equipped with this feature with 2.6 million customers having activated the credit card functionality (Ondrus & Pigneur, 2008).

For banks, mobile banking offers several opportunities for increasing revenue such as monetizing the value of customer analytics, delivering greater real-time access to products and services and conducting targeted marketing campaigns based on knowledge of consumer preference that banks collect (Deloitte Development, 2010).

2.4.2 *Monetizing the value of customer analytics*

Banks have a broad view of their customer’s spending habits (where their customers like to shop and what their customers like to buy). Thus banks are in a position to bundle data analytics for retailers and other entities seeking customer intelligence, whilst maintain the privacy of individual customer. Merchants in turn could use this aggregated information to target customers more effectively than they might through other means (Deloitte Development, 2010).

2.4.3 *Delivering greater real-time access to products and services*

“Mobile banking could provide bank customers wit the ability to compare options at time and place of purchase.” (Mobile Banking: A Catalyst for improving Bank Performance, 2010) In addition at the time and place of purchase banks could offer value added services such as financing or leasing options and insurance quotes through partnerships (Deloitte Development, 2010).

2.4.4 *Offering discounts and purchasing incentives to bank customers*

Through the establishment of strategic relationships with both manufacturers and retailers that could offer bank customers discount while they analyse product options at the point of sale (Deloitte Development, 2010).

2.4.5 *Conducting targeted marketed campaigns*

Banks could conduct targeted marketing campaigns to customers who use mobile banking by using the GPS functionality in mobile phones to pinpoint their customer's physical location to make relevant offers to their customers. The mobile banking application interface could be used as a real time, tailored advertising engine through the use of behavioural analytics compiled by the bank to develop campaigns tailored to their customers shopping preferences (Deloitte Development, 2010).

2.5 Conclusion of Literature Review

The Literature review analyses (Trudel et al., 2011) typology of mobile banking applications to classify mobile functionalities. The two major constructs in their typology; nature of functionality and interactivity were used as determinants of usage patterns of client based mobile banking applications. A third construct frequency of use was explored as additional determinant to usage patterns of client based mobile banking applications. The literature review also explored methods in which financial services could be enhanced through existing and evolving mobile technologies.

3 RESEARCH METHODOLOGY

This research will make use of a mixed approach that will incorporate both qualitative and quantitative methods.

3.1 Research Design

Qualitative Approaches

3.1.1 *Typology of functionalities contained in mobile banking applications*

The three dimensions that will be used in the determination of usage patterns will be:

1. **Nature of functionality**
2. **Interactivity**
3. **Frequency of use**

The first two dimensions **Nature of functionality** and **Interactivity** are based on (Trudel et al., 2011) Typology Of Mobile Banking Applications Framework. They combine the dimensions of interactivity and Nature of functionality to derive a four-cell matrix that yields the following types of mobile banking applications (Trudel et al., 2011):

1. Transactive
2. Transpassive
3. Informactive
4. Infopassive

Table 3: Typology of Mobile Banking Applications (Trudel et al., 2011)

Nature/Interactivity	***Passive***	***Active***
Transactional	Transpassive	Transactive
Informational	Infopassive	Informactive

The typology used by (Trudel et al., 2011) is based on functionality contained in mobile banking applications available on the Canadian and the United States market. A triangulation approach was employed to gather and classify similar functionality contained in mobile banking applications developed by South African banks.

Whilst (Trudel et al., 2011) Typology of Mobile Banking Applications Framework classifies mobile banking functionalities into one of 4 categories stated above, it does not highlight the most commonly used functionalities. Most commonly used functionalities dimension could be highlighted through the use of a Frequency of Use Dimension that this research intends to use.

3.1.2 *Triangulation approaches - aggregation of mobile banking application functionalities into a single data source*

A triangulation approach was used to classify and gather similar functionality contained in mobile banking applications developed by five major banks ABSA, Standard Bank, First National Bank, Nedbank and Capitec). The five sources of data were obtained from

1. Google,
2. Institutional websites,
3. Apple's App Store,
4. Blackberry's Market and

5. Android's Play Store.

Bank mobile application was searched using the banks institutional website integrated search capabilities. Suggested keywords used for the search were mobile, mobile banking, mobile banking application was entered successfully until a link or the bank' mobile application page was reached or deemed non-existent (Trudel et al., 2011).

The data was then be regrouped, classified and examined as a single data source. This technique of data gathering is an adaption of (Trudel et al., 2011) Data Collection Methodology.

This methodology dissects mobile banking applications into their core functionalities and in this way, will offer a more concise and precise classification. This model reduces the risk of ambiguity in the classification of future functionalities.

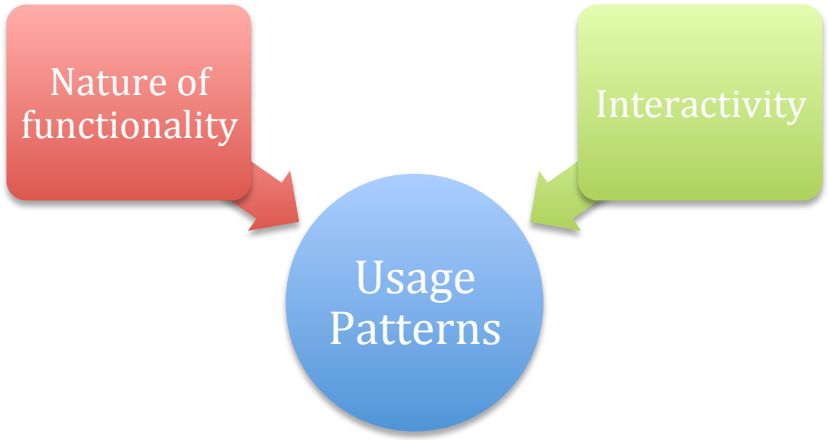

Figure 4: Nature of functionality and Interactivity as determinants of Usage Patterns

Table 4: Aggregation of Mobile Banking functionality contained in Client Based Mobile Banking Applications through the use of (Trudel, Boeck, Bastonnais, Rabec, & Bergeron) Data Collection Methodology

	Functionalities
	Payments
1	Make a proximity payment (a person to person payment) using the mobile application to find recipients
2	Make a once off payment
3	Make payments to payment beneficiaries created on your online banking profile
4	Add a payment beneficiary
5	Send money to any Cellphone number
6	Create future date payments
7	Make a stop payment
8	Set recurring payments
9	Perform a Tax/UIF Payments

	Functionalities
	Fund Transfers
10	Transfer funds between accounts
11	Create a future dated transfer
12	Set a recurring transfer
	Balance Enquiry
13	View Transaction History
14	Perform a Balance Enquiry
15	View Mini Statement
16	View Payment History
17	Search Transactions and Statements
18	View Failed Transactions
19	View Graphs that compare state of your accounts

	Functionalities
	Notification
20	Receive notifications of account activity
	Locate ATM/ Branch Network
21	Locate nearest ATM or branches
	Prepaid Purchases
22	Purchase prepaid electricity, airtime or data
23	View current forex rates, commodity indicators and shares
	Calculators
24	Calculate motor finance, home loan or personal loan repayments
	Administration
25	Change Pin/Password
26	Contact Bank

3.1.3 *Classification of functionalities contained in Client Based Mobile Banking Applications against (Trudel, Bboeck, Bastonnais, Rabec, & Bergeron) Typology of Mobile Banking Applications*

Table 1: Typology of Mobile Banking Applications (Trudel et al., 2011)

Nature/Interactivity	***Passive***	***Active***
Transactional	Transpassive	Transactive
Informational	Infopassive	Informactive

(Trudel et al., 2011) **Nature of functionality construct** is composed of two dimensions:

1. A Transactional dimension
2. An Informational dimension.

Analysing these constructs with respect to transactional banking.

- **A Transaction:** Is the process of transferring money from one place to another. Transactional functionalities include a transfer of value (Trudel et al., 2011). A transaction is an **actively** performed process by the user. A user using a mobile banking application can access functionalities that will allow him/her to actively perform transactions.
- **Information**: can be actively obtained or passively received by the user. The user through the use of functionalities contained in the mobile banking applications can **actively** obtain information about his/her account activity, account status or banking information. The mobile banking application can send notifications to the user about account activity without active input from the user. In these instances Information is pushed to the user via the mobile banking application and is **passively received** by the user.

(Trudel et al., 2011) **The Interactivity Construct** is composed of two dimensions:

1. An Active dimension
2. A Passive dimension

Analysing these constructs with respect to transactional banking.

The Interactivity construct brings the notion of user involvement to the model. The display of account's balance, updates concerning the latest authorised transactions and other such information is considered passive if the information is pushed to the device automatically (Trudel et al., 2011). The application does perform differently according to the user's action, in the case of a **passive functionality** (Trudel et al., 2011).

An **active functionality** requires that the user provide input to complete the interaction.

The tables below classifies the functionalities listed using the rational explained above

Table 5: Classification of mobile banking functionalities

	Functionalities	**Classification**
	Payments	
1	Make a proximity payment (a person to person payment) using the mobile application to find recipients	Transactive
2	Make a once off payment	Transactive
3	Make payments to payment beneficiaries created on your online banking profile	Transactive
4	Add a payment beneficiary	Informactive
5	Send money to any Cellphone number	Transactive
6	Create future date payments	Transactive
7	Make a stop payment	Transactive
8	Set recurring payments	Transactive
9	Perform a Tax/UIF Payments	Transactive

	Functionalities	**Classification**
	Fund Transfers	
10	Transfer funds between accounts	Transactive
11	Create a future dated transfer	Transactive
12	Set a recurring transfer	Transactive
	Balance Enquiry	
13	View Transaction History	Informactive
14	Perform a Balance Enquiry	Informactive
15	View Mini Statement	Informactive
16	View Payment History	Informactive
17	Search Transactions and Statements	Informactive
18	View Failed Transactions	Informactive
19	View Graphs that compare state of your accounts	Informactive

	Functionalities	**Classification**
	Notifications	
20	Receive notifications of account activity	Infopassive
	Locate ATM/ Branch Network	
21	Locate nearest ATM or branches	Informactive
	Prepaid Purchases	
22	Purchase prepaid electricity, airtime or data	Transactive
	View current forex rates, commodity indicators and shares	
23	View current forex rates, commodity indicators and shares	Informactive
	Calculators	
24	Calculate motor finance, home loan or personal loan repayments	Informactive
	Administration	
25	Change Pin/Password	Informactive
26	Contact Bank	Informactive

Quantitative Approaches

3.1.4 *Establishing the frequency of use of functionalities contained within mobile banking applications.*

The third determinant of **Usage Patterns** in this research is the **Frequency of Use construct**. The inclusion of Frequency of Use construct as a determinant of **Usage Patterns** was to ascertain how frequently, what functionalities were actively performed or passively received on Mobile banking applications. Data for **Frequency of use** will be ascertained through a questionnaire.

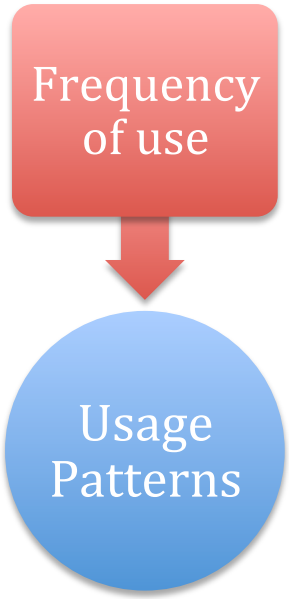

Figure 5: Frequency of use as a determinant of Usage Patterns

3.2 Population and Sample

3.2.1 *Population*

It is estimated that there are approximately 10 million active smartphones in South Africa (Deloitte, 2013). Approximately 7.9 million South Africans access the Internet on their cell phones. Client based mobile banking applications is a relatively new phenomenon in South Africa. The number of client based mobile banking

applications downloaded onto smartphones or tablets downloaded daily is in constant flux.

BusinessTech a South African technology based website that focuses on the intersection of technology and business cites on the 23rd January 2013 that there were approximately 115000 downloads of the Nedbank Application since July 2012. (Writer, 2013a)

ITWeb also a South African based technology website cites that as at 27th Jul 2012, 30 000 FNB users were downloading and registering for the FNB Banking Application per month (Tubbs Bonnie, 2012). Farren Roper, head of FNB Connect ISP says that the rate of downloads of the banking application has grown month on month. “We have grown from gaining 10 000 clients a month, to over 30 000 –which we hope to sustain” (Tubbs Bonnie, 2012). As at 27th July 2012 Roper has stated that approximately 230000 banking clients have signed up for the app. (Tubbs Bonnie, 2012)

Standard Bank has seen their Standard Banking App downloaded 7 389 times over 48 hours since it’s launch according to Money Web a South African based financial website (Jeanette, 2012). Itumeleng Monale, the head of self-service channels from Standard Bank stated that over 5000 unique customers registered their devices, some registering more than one device (Jeanette, 2012).

At the time of evaluation of the research proposal, ABSA had not formally released a banking application for the South African public to use.

The difficulties of estimating the population of client based mobile banking application users is further compounded by:

1. The ability of the client based mobile banking user to download the client based mobile banking application to more than one smartphone.

2. The ability of the client based mobile banking user to download the client based mobile banking application to his tablet.

3. The ability of the client based mobile banking user to download more than one client based mobile banking application to either his smartphone or tablet. i.e. the multi-banked , multi-device user.

A conservative estimate will size the current client based mobile banking application population to approximately 1.2 million users.

3.2.2 *Sample and Sampling Method*

A convenience sampling method was used. A questionnaire was hosted on the Qualtrics website over a three week period starting at the end of the 2nd week of January 2013. A link to the survey was distributed via email to my mailing list and posted on social networking sites and popular South African Technology Websites.

The questionnaire provided in Appendix A will be used. The advantage of a questionnaire is that the respondent can fill it in his own time and at the same time ensuring confidentiality.

3.3 Limitations of the study

This study will only focus on client-based smartphone banking applications that are installed onto the smartphone memory or memory card. It will exclude the client-based applications that are installed on the SIM card as well as network based mobile banking systems. The smartphone is defined for the purpose of my research as a phone capable of running the following mobile operating systems Apple's iOS, Google's Android, Blackberry's Blackberry OS7.1, 6.0 and 5.0. The smartphone must have access to a mobile network operator's data network.

The study is targeting a niche market – users of smartphones. The sample will only look at a limited number of smartphone users.

3.3.1 *External Validity*

External validity is the ability of the research to be generalised across person, setting and times. Sample choice was clearly defined as smartphone users who have the mobile banking application loaded onto their phones. The smartphone is defined for the purpose of my research as a phone capable of running the following mobile operating systems Apple's iOS, Google's Android, Blackberry's Blackberry OS7.1, 6.0 and 5.0. The smartphone must have access to a mobile network operator's data network. The research can be generalized across person, setting and times because of a clearly defined sample.

3.3.2 *Internal Validity*

Ensures that data collection process is uniform through out. This study will ensure internal validity because a single uniform questionnaire will distributed among all respondents. The questionnaire will be made accessible through a single online channel, the Qualtrics webpage that hosts the survey. The internal validity of this study will be supported by the use of the triangulation methodology (Trudel et al., 2011) in the aggregation of functionality contained in client based mobile banking applications.

3.3.3 *Reliability*

Reliability is the extent to which results are consistent and yield the same results on repeated trials (Newendorf, 2002). The research instrument was tested on trial respondents prior to the actual research being conducted to check for ambiguous questions or biased questions. The pre-testing study was sent to 5 respondents in one batch, who were selected on a convenience basis. The respondents were asked to comment on the length of the research instrument, general understanding of words used, evaluating the length of scales and the identification of ambiguous phrases or terms.

4 RESEARCH RESULTS

The sections below present the results of the questionnaire.

Descriptive statistics (such as mean and frequencies) analysis was conducted on the data to help determine the Frequency of Use Construct as a determinant of Usage Patterns. The data was downloaded from the Qualtrics site for analysis.

The data was sorted to group questions according to applicable constructs. Statistical analysis was conducted on the data using both the Qualtrics website and IBM SPSS Statistics.

4.1 Smartphone Demographics

Table 6: Number of smartphones and **Table 7: Type of Smartphone** used, aim to establish the demographics of the mobile population of the study.

Table 6: Number of smartphones

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**Yes**	175.00	93.58	93.58	93.58
	No	12.00	6.42	6.42	100.00
	Total	187.00	100.00	100.00	

93.58% of the respondents have a smartphone. A smartphone for the purposes of this research report as a mobile phone with features that enable it to access the Internet, send and receive emails, can download applications and interact with computers.

Table 7: Type of smartphone used

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**Android**	40.00	21.39	21.39	21.39
	BlackBerry	84.00	44.92	44.92	66.31
	iPhone	46.00	24.60	24.60	90.91
	Windows Phone	1.00	.53	.53	91.44
	Other	5.00	2.67	2.67	94.12
	Don't own a smartphone, own a regular mobile phone	11.00	5.88	5.88	100.00
	Total	187.00	100.00	100.00	

Table 7: Type of Smartphone used, delineates the distribution of the smartphones used by respondents. BlackBerry was the most used smartphone, representing 44.92% respondents of the sample of 187 respondents, followed by iPhone, Android and Other with 24.60%, 21.39% and 2.67% representations of the sample respectively. Windows phone was the least used smartphone representing 0.53% of the sample. 5.88% of the respondents don't own a smartphone but own a regular cellphone.

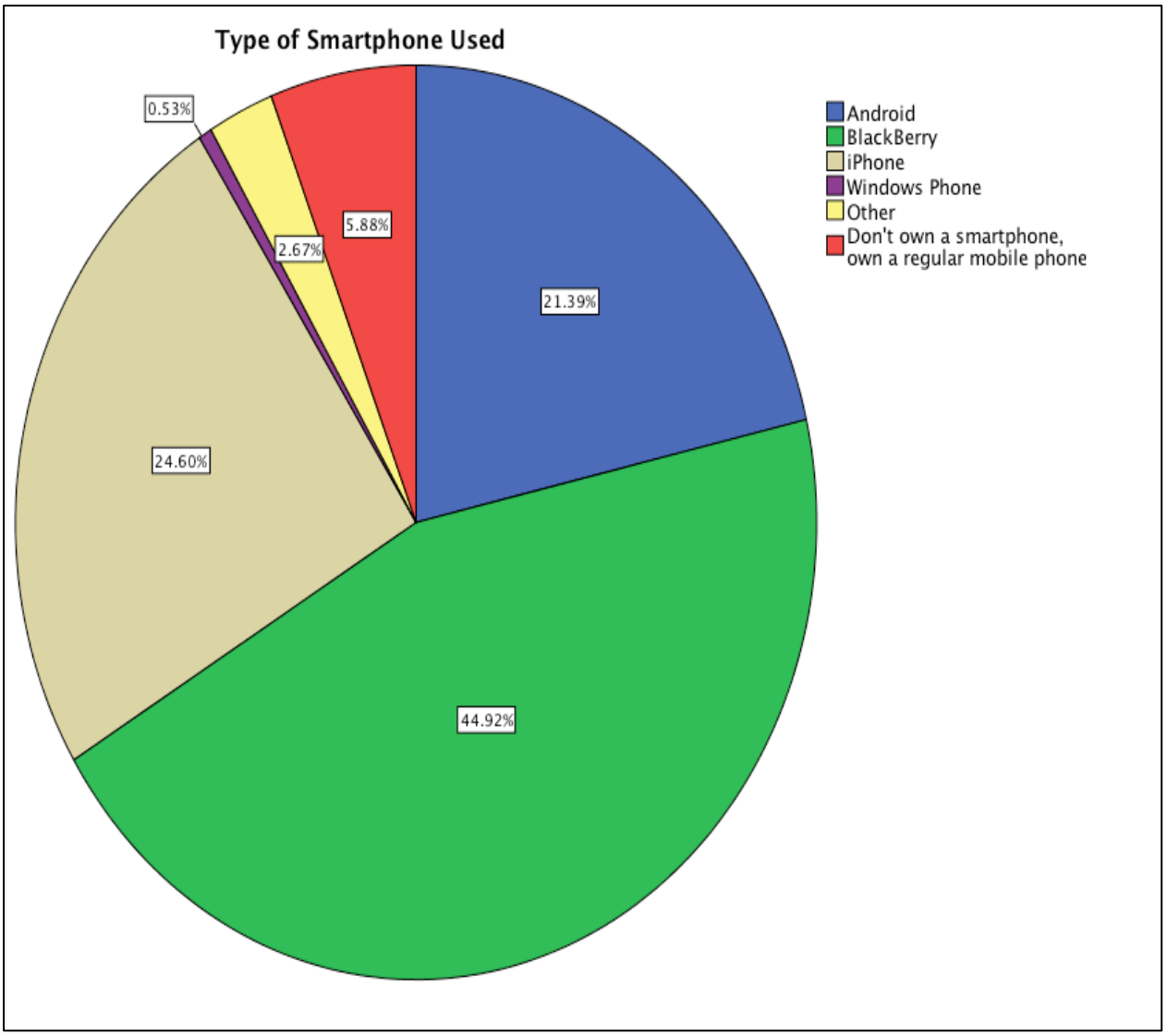

Figure 6: Type of Smartphone Used

4.2 Frequency of Internet usage on mobile phones

Access to mobile banking financial services through the use of mobile banking applications are dependent on the smartphone being able to access the Internet.

Table 8: Frequency of Internet usage of mobile phones

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**In the past 7 days**	166.00	88.77	88.77	88.77
	In the past 30 days	9.00	4.81	4.81	93.58
	In the past 90 days	1.00	.53	.53	94.12
	More than 12 months ago	2.00	1.07	1.07	95.19
	Never	9.00	4.81	4.81	100.00
	Total	187.00	100.00	100.00	

166 Respondents or 87.77% of respondents have used Internet on the mobiles within the past 7 days, 4.87% in the past 30 days, and 0.53% in the past 90 days. 1.07% has accessed the Internet on the mobile phones more than 12 months ago and 4.81% have never accessed the Internet on their mobile phones. The majority of smartphone users (88.77%) access the Internet relatively frequently.

4.3 Access Methods of Mobile Banking

Mobile banking can be accessed via different channels (Web page, text messaging or an application downloaded on your smartphone). When accessed via web page bank servers, recognise that the user is accessing the banking site via a mobile phone and thus reformats the web page, so that it can be accessed through the mobile phone's web browser. Mobile banking can also be accessed through the use of SMS (Short Messaging Service) or through USSD (Unstructured Supplementary Data Services) codes. This method of access (USSD and/or SMS) is denoted as text messaging in the table below. Mobile banking services accessed via the mobile web browser, USSD or SMS can be classified as network based application environment choices as outlined in **Table 1: The interaction between Mobile Handset Capability and dependence or independence from Mobile Network Operator as a determinant in mobile application environment.** (Mas & Kumar, 2008)

Table 9: Mobile Banking accessed via a web page in the last 12 months

		Frequency (N)	Percent	Valid Percent	Cumulative Percent
Valid	**Yes**	83.00	44.39	100.00	100.00
Missing	**System**	104.00	55.61		
Total		187.00	100.00		

Table 10: Mobile Banking accessed text messaging in the last 12 months

		Frequency (N)	Percent	Valid Percent	Cumulative Percent
Valid	**Yes**	33.00	17.65	100.00	100.00
Missing	**System**	154.00	82.35		
Total		187.00	100.00		

Table 11: Mobile Banking accessed via application downloaded onto the smartphone in the last 12 months

		Frequency (N)	Percent	Valid Percent	Cumulative Percent
Valid	**Yes**	74.00	39.57	100.00	100.00
Missing	**System**	113.00	60.43		
Total		187.00	100.00		

Mobile banking applications downloaded onto the users smartphones is gaining prominence as a channel. It is the 2nd most popular channel to access mobile banking behind mobile web browsing. Text messaging, as an access channel is the least used mobile banking method with 33 respondents, using it as mobile banking channel.

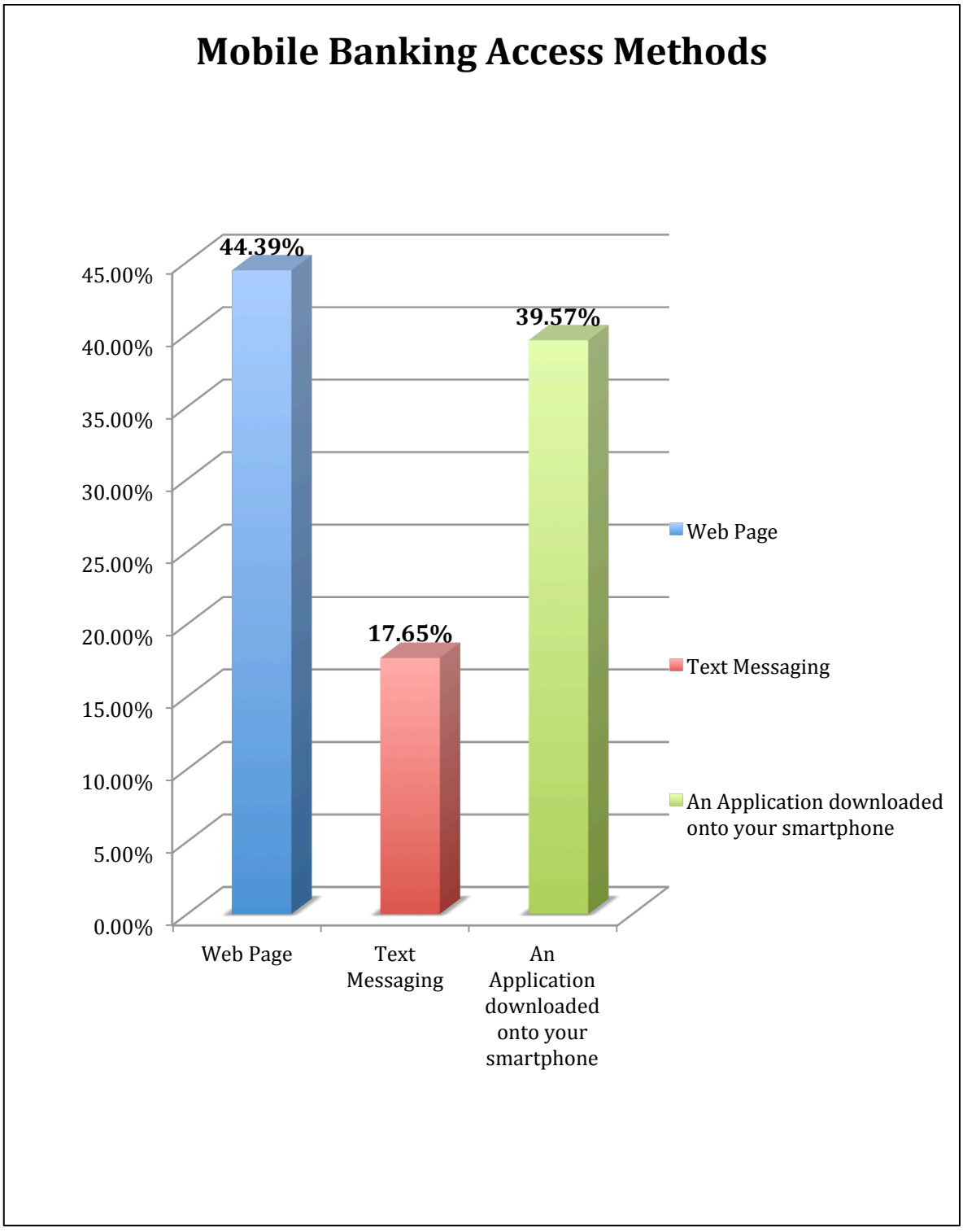

Figure 7: Mobile Banking Access Methods

4.4 Intent to use mobile banking applications

Table 12: Intent to use mobile banking applications.

		Frequency (N)	Percent	Valid Percent	Cumulative Percent
Valid	**Already use**	92.00	49.20	49.20	49.20
	Definitely will use	25.00	13.37	13.37	62.57
	Probably will use	49.00	26.20	26.20	88.77
	Probably will not use	17.00	9.09	9.09	97.86
	Definitely will not use	4.00	2.14	2.14	100.00
	Total	187.00	100.00	100.00	

49.20% of respondents already use mobile banking applications with a further 13.37% of respondents replying that will definitely use mobile banking applications. 26.20% of respondents have responded that they will use mobile banking, with **Probably will not use** and **Definitely will not use Categories** representing a combined total of 11.23% of the sample. This augurs well for mobile banking applications as a self-service channel as the **Already Use** and **Definitely will use Categories** represent 62.57% of the sample.

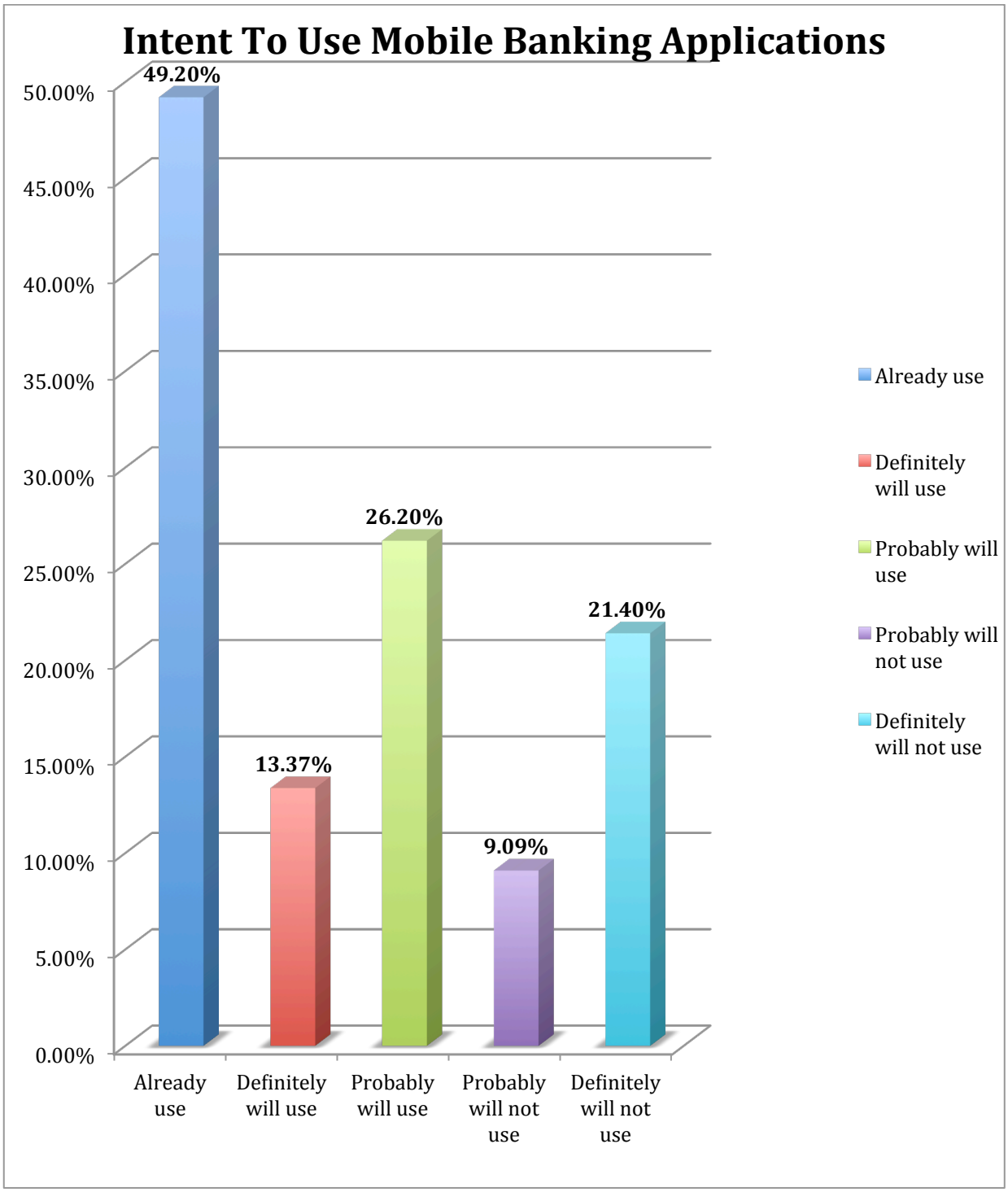

Figure 8: Intent To Use Mobile Banking Applications

4.5 Mobile Banking Applications downloaded for use

Table 13: Mobile Banking Applications downloaded for use.

	Cases					
	Included		Excluded		Total	
	Frequency (N)	Percent	Frequency (N)	Percent	Frequency (N)	Percent
FNB	66.00	35.29	121.00	64.71	187.00	100.00
Standard Bank	38.00	20.32	149.00	79.68	187.00	100.00
Nedbank	34.00	18.18	153.00	81.82	187.00	100.00
RMB	3.00	1.60	184.00	98.40	187.00	100.00
None	49.00	26.20	138.00	73.80	187.00	100.00
Other	19.00	10.16	168.00	89.84	187.00	100.00

Respondents had the ability to select more than one banking application if they were multi-banked. FNB is the most used banking application, followed by Standard Bank, Nedbank, RMB, None and Other.

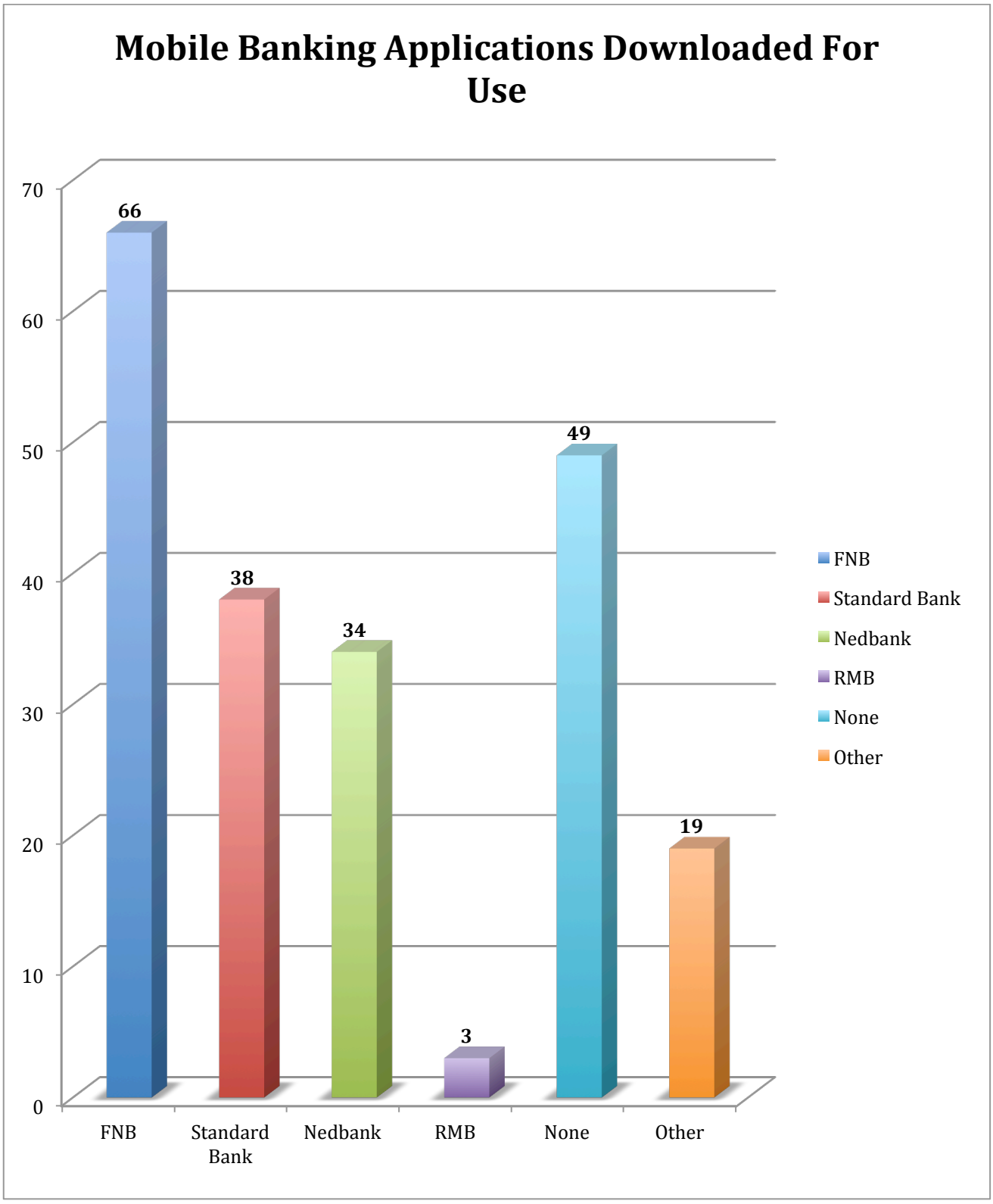

Figure 9: Mobile Banking Application Downloaded For Use

4.6 Functionalities utilised across all banking applications

Table 14: Functionalities utilised across all banking application

	Valid		Missing		Total	
Functionalities Utilized Per Banking Application	**N**	**Percent**	**N**	**Percent**	**N**	**Percent**
Make a proximity payment (a person to person payment) using the mobile application to find recipients						
Make a proximity payment (a person to person payment) using the mobile application to find recipients * FNB	31	16.58%	156	83.42%	187	100.00%
Make a proximity payment (a person to person payment) using the mobile application to find recipients * Standard Bank	19	10.16%	168	89.84%	187	100.00%
Make a proximity payment (a person to person payment) using the mobile application to find recipients * Nedbank	13	6.95%	174	93.05%	187	100.00%
Make a proximity payment (a person to person payment) using the mobile application to find recipients * RMB	3	1.60%	184	98.40%	187	100.00%
Make a proximity payment (a person to person payment) using the mobile application to find recipients * Other	7	3.74%	180	96.26%	187	100.00%
Total	**73**					
Make a once off payment						
Make a once off payment * FNB	38	20.32%	149	79.68%	187	100.00%
Make a once off payment * Standard Bank	20	10.70%	167	89.30%	187	100.00%
Make a once off payment * Nedbank	19	10.16%	168	89.84%	187	100.00%
Make a once off payment * RMB	2	1.07%	185	98.93%	187	100.00%
Make a once off payment * Other	8	4.28%	179	95.72%	187	100.00%
Total	**87**					
Make payments to payment beneficiaries created on your online banking profile						
Make payments to payment beneficiaries created on your online banking profile * FNB	48	25.67%	139	74.33%	187	100.00%
Make payments to payment beneficiaries created on your online banking profile * Standard Bank	34	18.18%	156	81.82%	187	100.00%
Make payments to payment	22	11.76%	168	88.24%	187	100.00%

	Valid		Missing		Total	
Functionalities Utilized Per Banking Application	**N**	**Percent**	**N**	**Percent**	**N**	**Percent**
beneficiaries created on your online banking profile * Nedbank						
Make payments to payment beneficiaries created on your online banking profile * RMB	3	1.60%	187	98.40%	187	100.00%
Make payments to payment beneficiaries created on your online banking profile * Other	11	5.88%	179	94.12%	187	100.00%
Total	**118**					
Add a payment beneficiary						
Add a payment beneficiary * FNB	26	13.90%	161	86.10%	187	100.00%
Add a payment beneficiary * Standard Bank	16	8.56%	171	91.44%	187	100.00%
Add a payment beneficiary * Nedbank	13	6.95%	174	93.05%	187	100.00%
Add a payment beneficiary * RMB	1	0.53%	186	99.47%	187	100.00%
Add a payment beneficiary * Other	11	5.88%	176	94.12%	187	100.00%
Total	**67**					
Send money to any cellphone number						
Send money to any cellphone number * FNB	22	11.76%	165	88.40%	187	100.00%
Send money to any cellphone number * Standard Bank	12	6.42%	175	93.70%	187	100.00%
Send money to any cellphone number * Nedbank	8	4.28%	179	95.80%	187	100.00%
Send money to any cellphone number * RMB	0	0.00%	190	100.00%	187	100.00%
Send money to any cellphone number * Other	6	3.21%	181	96.80%	187	100.00%
Total	**48**					
Create future date payments						
Create future date payments * FNB	5	2.67%	182	97.40%	187	100.00%
Create future date payments * Standard Bank	6	3.21%	181	96.80%	187	100.00%
Create future date payments * Nedbank	2	1.07%	185	98.90%	187	100.00%
Create future date payments * RMB	0	0.00%	190	100.00%	187	100.00%
Create future date payments * Other	3	1.60%	184	98.40%	187	100.00%
Total	**16**					
Make a stop payment						
Make a stop payment * FNB	4	2.14%	183	97.86%	187	100.00%

	Valid		Missing		Total	
Functionalities Utilized Per Banking Application	**N**	**Percent**	**N**	**Percent**	**N**	**Percent**
Make a stop payment * Standard Bank	6	3.21%	181	96.79%	187	100.00%
Make a stop payment * Nedbank	3	1.60%	184	98.40%	187	100.00%
Make a stop payment * RMB	0	0.00%	190	100.00%	187	100.00%
Make a stop payment * Other	1	0.53%	186	99.47%	187	100.00%
Total	**14**					
Set recurring payments						
Set recurring payments * FNB	6	3.21%	181	96.79%	187	100.00%
Set recurring payments * Standard Bank	5	2.67%	182	97.33%	187	100.00%
Set recurring payments * Nedbank	2	1.07%	185	98.93%	187	100.00%
Set recurring payments * RMB	0	0.00%	190	100.00%	187	100.00%
Set recurring payments * Other	2	1.07%	185	98.93%	187	100.00%
Total	**15**					
Perform a Tax/UIF Payments						
Perform a Tax/UIF Payments * FNB	5	2.67%	182	97.40%	187	100.00%
Perform a Tax/UIF Payments * Standard Bank	4	2.14%	183	97.90%	187	100.00%
Perform a Tax/UIF Payments * Nedbank	3	1.60%	184	98.40%	187	100.00%
Perform a Tax/UIF Payments * RMB	0	0.00%	190	100.00%	187	100.00%
Perform a Tax/UIF Payments * Other	1	0.53%	186	99.50%	187	100.00%
Total	**13**					
Transfer funds between accounts						
Transfer funds between accounts * FNB	45	23.70%	142	75.94%	187	100.00%
Transfer funds between accounts * Standard Bank	29	15.30%	158	84.49%	187	100.00%
Transfer funds between accounts * Nedbank	22	11.60%	165	88.24%	187	100.00%
Transfer funds between accounts * RMB	2	1.10%	185	98.93%	187	100.00%
Transfer funds between accounts * Other	11	5.80%	176	94.12%	187	100.00%
Total	**109**					
Create a future dated transfer						
Create a future dated transfer * FNB	5	2.67%	182	97.33%	187	100.00%
Create a future dated transfer * Standard Bank	4	2.14%	183	97.86%	187	100.00%
Create a future dated transfer *	2	1.07%	185	98.93%	187	100.00%

	Valid		Missing		Total	
Functionalities Utilized Per Banking Application	**N**	**Percent**	**N**	**Percent**	**N**	**Percent**
Nedbank						
Create a future dated transfer * RMB	0	0.00%	190	100.00%	187	100.00%
Create a future dated transfer * Other	1	0.53%	186	99.47%	187	100.00%
Total	**12**	**6.30%**				
Set a recurring transfer						
Set a recurring transfer * FNB	3	1.60%	184	98.40%	187	100.00%
Set a recurring transfer * Standard Bank	3	1.60%	184	98.40%	187	100.00%
Set a recurring transfer * Nedbank	1	0.53%	186	99.47%	187	100.00%
Set a recurring transfe * RMB	0	0.00%	190	100.00%	187	100.00%
Set a recurring transfer * Other	1	0.53%	186	99.47%	187	100.00%
Total	**8**					
View Transaction History						
View Transaction History * FNB	36	19.25%	151	80.75%	187	100.00%
View Transaction History * Standard Bank	23	12.30%	164	87.70%	187	100.00%
View Transaction History * Nedbank	21	11.23%	166	88.77%	187	100.00%
View Transaction History * RMB	2	1.07%	185	98.93%	187	100.00%
View Transaction History * Other	10	5.35%	177	94.65%	187	100.00%
Total	**92**					
Perform a Balance Enquiry						
Perform a Balance Enquiry * FNB	44	23.53%	143	76.47%	187	100.00%
Perform a Balance Enquiry * Standard Bank	26	13.90%	161	86.1%	187	100.00%
Perform a Balance Enquiry * Nedbank	24	12.83%	163	87.17%	187	100.00%
Perform a Balance Enquiry * RMB	2	1.07%	185	98.93%	187	100.00%
Perform a Balance Enquiry * Other	14	7.49%	173	92.51%	187	100.00%
Total	**110**					
View Mini Statement						
View Mini Statement * FNB	26	13.9%	161	86.10%	187	100.00%
View Mini Statement * Standard Bank	19	10.16%	168	89.84%	187	100.00%
View Mini Statement * Nedbank	12	6.42%	175	93.58%	187	100.00%
View Mini Statement * RMB	0	0.00%	190	100.00%	187	100.00%
View Mini Statement * Other	8	4.28%	179	95.72%	187	100.00%
Total	**65**					
View Payment History						
View Payment History * FNB	32	17.11%	155	82.89%	187	100.00%

	Valid		Missing		Total	
Functionalities Utilized Per Banking Application	**N**	**Percent**	**N**	**Percent**	**N**	**Percent**
View Payment History * Standard Bank	24	12.83%	163	87.17%	187	100.00%
View Payment History * Nedbank	12	6.42%	175	93.58%	187	100.00%
View Payment History * RMB	2	1.07%	185	98.93%	187	100.00%
View Payment History * Other	8	4.28%	179	95.72%	187	100.00%
Total	**78**					
Search Transactions and Statements						
Search Transactions and Statements * FNB	23	12.30%	164	87.7%	187	100.00%
Search Transactions and Statements * Standard Bank	15	8.02%	172	91.98%	187	100.00%
Search Transactions and Statements * Nedbank	10	5.35%	177	94.65%	187	100.00%
Search Transactions and Statements * RMB	2	1.07%	185	98.93%	187	100.00%
Search Transactions and Statements * Other	6	3.21%	181	96.79%	187	100.00%
Total	**56**					
View Failed Transactions						
View Failed Transactions * FNB	6	3.21	181	96.79	187	100.00%
View Failed Transactions * Standard Bank	5	2.67	182	97.33	187	100.00%
View Failed Transactions * Nedbank	2	1.07	185	98.93	187	100.00%
View Failed Transactions * RMB	0	0.00%	187	100.00%	187	100.00%
View Failed Transactions * Other	4	2.14	183	97.86%	187	100.00%
Total	**17**					
View Graphs that compare state of your accounts						
View Graphs that compare state of your accounts * FNB	5	2.67%	182	97.33%	187	100.00%
View Graphs that compare state of your accounts * Standard Bank	4	2.14%	183	97.86%	187	100.00%
View Graphs that compare state of your accounts * Nedbank	2	1.07%	185	98.93%	187	100.00%
View Graphs that compare state of your accounts * RMB	0	0.00%	190	100.00%	187	100.00%
View Graphs that compare state of your accounts * Other	0	0.00%	190	100.00%	187	100.00%
Total	**11**	**5.80%**				

	Valid		Missing		Total	
Functionalities Utilized Per Banking Application	**N**	**Percent**	**N**	**Percent**	**N**	**Percent**
Receive notifications of account activity						
Receive notifications of account activity * FNB	33	17.65%	154	82.35%	187	100.00%
Receive notifications of account activity * Standard Bank	19	10.16%	168	89.84%	187	100.00%
Receive notifications of account activity * Nedbank	15	8.02%	172	91.98%	187	100.00%
Receive notifications of account activity * RMB	1	0.53%	186	99.47%	187	100.00%
Receive notifications of account activity * Other	10	5.35%	177	94.65%	187	100.00%
Total	**78**	**41.10%**				
Locate nearest ATM or branches						
Locate nearest ATM or branches * FNB	14	7.49%	173	92.51%	187	100.00%
Locate nearest ATM or branches * Standard Bank	11	5.88%	176	94.12%	187	100.00%
Locate nearest ATM or branches * Nedbank	6	3.21%	181	96.79%	187	100.00%
Locate nearest ATM or branches * RMB	2	1.07%	185	98.93%	187	100.00%
Locate nearest ATM or branches * Other	4	2.14%	183	97.86%	187	100.00%
Total	**37**	**19.60%**				
Purchase prepaid electricity, airtime or data						
Purchase prepaid electricity, airtime or data * FNB	29	15.51%	158	84.49%	187	100.00%
Purchase prepaid electricity, airtime or data * Standard Bank	20	10.70%	167	89.30%	187	100.00%
Purchase prepaid electricity, airtime or data * Nedbank	13	6.95%	174	93.05%	187	100.00%
Purchase prepaid electricity, airtime or data * RMB	0	0.00%	187	100.00%	187	100.00%
Purchase prepaid electricity, airtime or data * Other	9	4.81%	178	95.19%	187	100.00%
Total	**71**	**37.30%**				
View current forex rates, commodity indicators and shares						
View current forex rates, commodity indicators and shares * FNB	8	4.28%	179	95.72%	187	100.00%
View current forex rates, commodity indicators and shares * Standard Bank	5	2.67%	182	97.33%	187	100.00%

	Valid		Missing		Total	
Functionalities Utilized Per Banking Application	**N**	**Percent**	**N**	**Percent**	**N**	**Percent**
View current forex rates, commodity indicators and shares * Nedbank	2	1.07%	185	98.93%	187	100.00%
View current forex rates, commodity indicators and shares * RMB	0	0.00%	187	100.00%	187	100.00%
View current forex rates, commodity indicators and shares * Other	6	3.21%	181	96.79%	187	100.00%
Total	**21**	**11.10%**				
Calculate motor finance, home loan or personal loan repayments						
Calculate motor finance, home loan or personal loan repayments * FNB	9	4.81%	178	95.19%	187	100.00%
Calculate motor finance, home loan or personal loan repayments * Standard Bank	5	2.67%	182	97.33%	187	100.00%
Calculate motor finance, home loan or personal loan repayments * Nedbank	5	2.67%	182	97.33%	187	100.00%
Calculate motor finance, home loan or personal loan repayments * RMB	0	0.00%	187	100.00%	187	100.00%
Calculate motor finance, home loan or personal loan repayments * Other	3	1.60%	184	98.40%	187	100.00%
Total	**22**	**11.50%**				
Change Pin/Password						
Change Pin/Password * FNB	14	7.49%	173	92.51%	187	100.00%
Change Pin/Password * Standard Bank	8	4.28%	179	95.72%	187	100.00%
Change Pin/Password * Nedbank	4	2.14%	183	97.86%	187	100.00%
Change Pin/Password * RMB	0	0.00%	187	100.00%	187	100.00%
Change Pin/Password * Other	3	1.60%	184	98.40%	187	100.00%
Total	**29**	**15.30%**				
Contact Bank						
Contact Bank * FNB	13	6.95%	174	93.20%	187	100.00%
Contact Bank * Standard Bank	7	3.74%	180	96.30%	187	100.00%
Contact Bank * Nedbank	5	2.67%	182	97.40%	187	100.00%
Contact Bank * RMB	1	0.53%	186	99.50%	187	100.00%
Contact Bank * Other	4	2.14%	183	97.90%	187	100.00%
Total	**30**	**15.70%**				

Making payments to payment beneficiaries is the most utilised functionality, across all banking applications, whilst setting a recurring transfer is the least used functionality. Performing a balance enquiry, transferring funds between accounts, viewing transaction history and making once off payments are the 2nd, 3rd, 4th and 5th most utilised functionalities respectively.

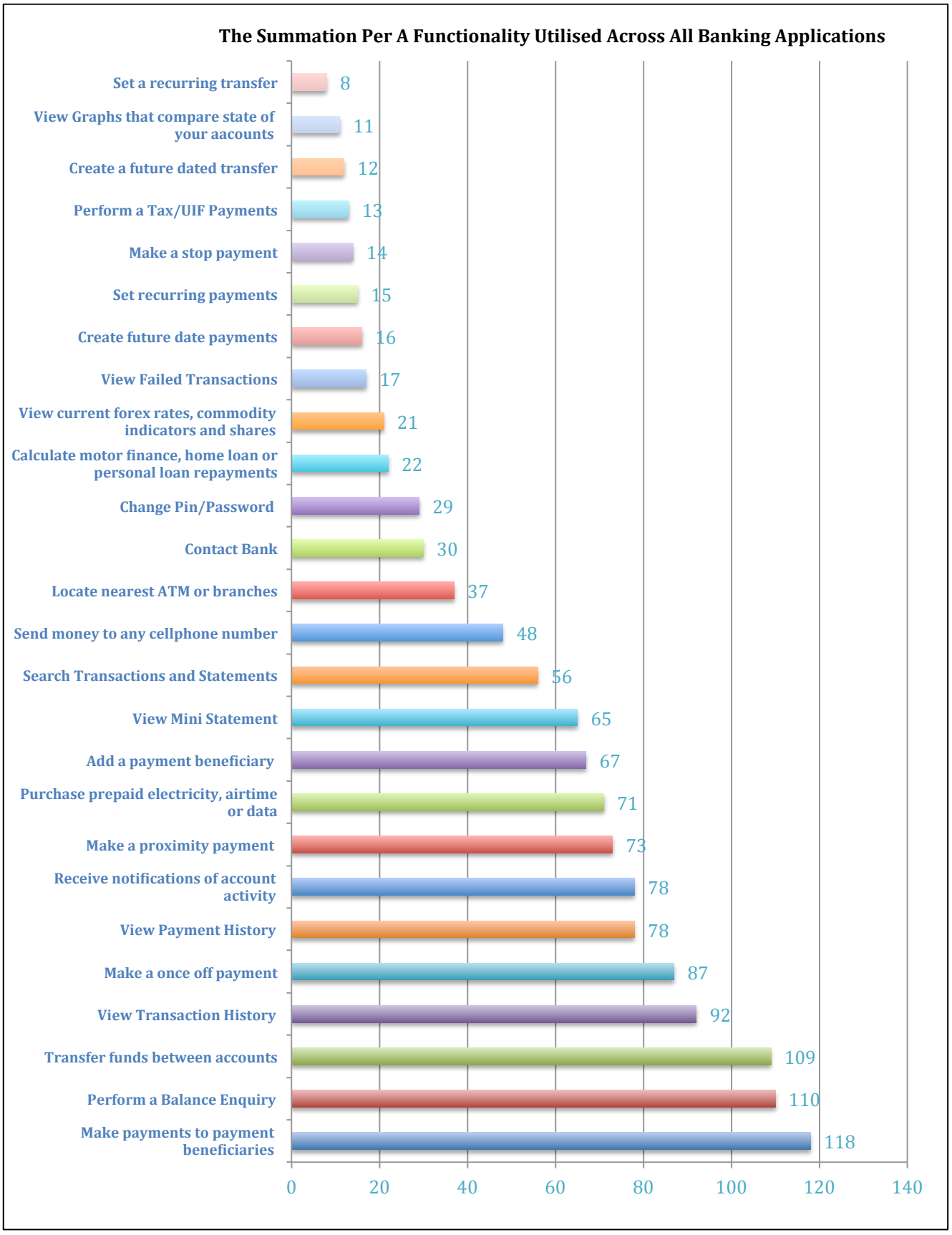

Figure 10: The Summation Per Functionality Across All Banking Application

4.7 Average frequency of functionalities utilised per fortnight

Table 15: Average frequency of functionalities utilised per fortnight

	Valid	Missing	Mean	Std. Deviation	Minimum	Maximum
Average frequency per fortnight- Make a proximity payment (a person to person payment) using the mobile application to find recipients	53.00	134.00	3.43	4.34	0.00	20.00
Average frequency per fortnight- Make a once off payment	66.00	121.00	3.42	4.08	0.00	20.00
Average frequency per fortnight- Make payments to payment beneficiaries created on your online banking profile	90.00	97.00	3.41	3.66	0.00	20.00
Average frequency per fortnight- Add a payment beneficiary	46.00	141.00	2.22	3.46	0.00	20.00
Average frequency per fortnight- Send money to any cellphone number	35.00	152.00	4.31	5.71	0.00	20.00
Average frequency per fortnight- Create future date payments	11.00	176.00	3.36	5.68	0.00	20.00
Average frequency per fortnight- Make a stop payment	9.00	178.00	4.00	6.75	0.00	20.00
Average frequency per fortnight- Set recurring payments	8.00	179.00	4.13	6.56	1.00	20.00
Average frequency per fortnight- Perform a Tax/UIF Payments	8.00	179.00	5.13	7.53	0.00	20.00
Average frequency per fortnight- Transfer funds between accounts	83.00	104.00	3.71	4.13	0.00	20.00

	Valid	Missing	Mean	Std. Deviation	Minimum	Maximum
Average frequency per fortnight- Create a future dated transfer	8.00	179.00	4.50	6.85	1.00	20.00
Average frequency per fortnight- Set a recurring transfer	5.00	182.00	6.20	8.53	0.00	20.00
Average frequency per fortnight- View Transaction History	66.00	121.00	5.33	5.76	0.00	20.00
Average frequency per fortnight- Perform a Balance Enquiry	86.00	101.00	5.14	5.28	0.00	20.00
Average frequency per fortnight- View Mini Statement	55.00	132.00	5.64	6.14	0.00	20.00
Average frequency per fortnight- View Payment History	58.00	129.00	4.29	5.14	0.00	20.00
Average frequency per fortnight- Search transactions and statements	37.00	150.00	4.62	5.29	0.00	20.00
Average frequency per fortnight- View Failed Transactions	13.00	174.00	3.15	5.21	0.00	20.00
Average frequency per fortnight- View graphs that compare state of your accounts	5.00	182.00	7.80	7.09	2.00	20.00
Average frequency per fortnight- Receive notifications of account activity	59.00	128.00	10.22	6.78	0.00	20.00
Average frequency per fortnight- Locate nearest ATM or branches	24.00	163.00	2.75	4.23	0.00	20.00
Average frequency per fortnight- Purchase prepaid electricity, airtime or data	53.00	134.00	4.28	5.14	0.00	20.00

	Valid	Missing	Mean	Std. Deviation	Minimum	Maximum
Average frequency per fortnight- View current forex rates, commodity indicators and shares	15.00	172.00	4.33	5.75	0.00	20.00
Average frequency per fortnight- Calculate motor finance, home loan or personal loan repayments	16.00	171.00	2.88	5.25	0.00	20.00
Average frequency per fortnight- Change Pin/Password	16.00	171.00	1.69	4.92	0.00	20.00
Average frequency per fortnight- Contact Bank	22.00	165.00	4.32	5.79	0.00	20.00

The most frequently received functionality across all banking applications, is **Receive notification of account activity,** notifications were received on average 10.22 times per fortnight. **View graphs that compare state of accounts** was the most performed functionality; respondents used this functionality on average 7.80 times per fortnight. **Set a recurring transfer** was the second most frequently performed functionality; respondents performed this functionality on average 6.20 times per fortnight.

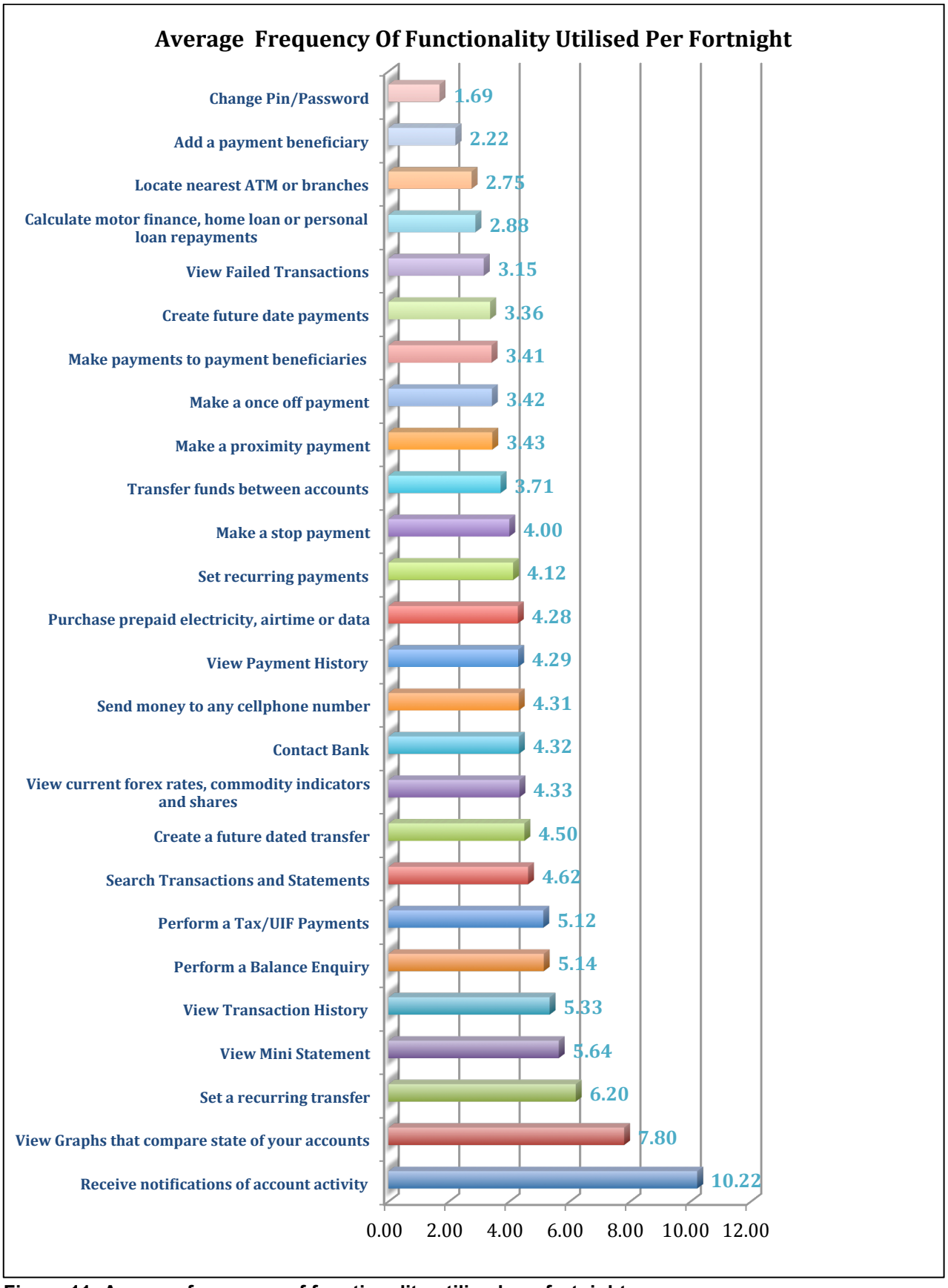

Figure 11: Average frequency of functionality utilised per fortnight

5 DISCUSSION OF RESULTS

5.1 Introduction

This research aims to analyse and evaluate the usage patterns of client-based mobile banking applications in South Africa. South Africa has the third largest number of mobile subscribers in the continent, with a mobile penetration rate of 100.48% among an estimated population of 50 million (Beger & Sinha, 2012)

The large adoption rate of mobile phones enhances the prospect that financial services i.e. mobile banking and payments executed via mobile phones will also take off (Porteous, 2006). “Not only is the penetration of mobile devices into the market continuing at a fast rate, but so is the richness of the functionality that these devices have to offer” (Harris, 2010)

The advent of smartphones and tablets has allowed banks to enhance the delivery of mobile financial services through the development of client based banking applications.

The sections below analyses and evaluates the findings of the results presented in the Research Results.

5.2 Smartphone Demographics

Smartphone sales are continuing to drive mobile device growth. Smartphones accounted for 44.7% year-over-year growth over the 2011 to 2012 period. They reached 144.4 million units in the fist quarter of 2012 (Gupta, Roberta, Toung, Carolina, Sandy, De La Vergne, Lu, Atsuro, & David, 2012). The South African market is following closely on this trend.

Smartphone sales have been rising from a low base. BlackBerry Smartphones lead market penetration in South Africa. BlackBerry is more popular in South Africa than Apple’s iPhone and android devices. Vodacom, a leading South African Cellular Service Provider, reports that there are approximately seven times more BlackBerry

devices on their network (approximately 2 million) than iPhones (around 300,000) and Android smartphones (around 300,000) (Miller, 2012).

Rui Brites, Product Director for BlackBerry, cites that Blackberry's strength in the local market, can be attributed to the device's great features, affordable Internet access, BBM and network efficiency (Miller, 2012).

Globally however the Smartphone sales to End Users by Operating Systems differ. Android accounts for more than half of all smartphone sales (56.1%) in the first quarter of 2012. Anshul Gupta lead researcher at Gartner attributes Android's dominant position in the global marketplace to a strong commoditisation trend on Smartphones based on the Android OS (Gupta et al., 2012).

Table 16: Worldwide Smartphone Sales to End Users by Operating Systems in 1Q12

Worldwide Smartphone Sales to End Users by Operating System in 1Q12 (Thousands of Units)

Operating System	1Q12 Units	1Q12 Market Share (%)	1Q11 Units	1Q11 Market Share (%)
Android	81,067.4	56.1	36,350.1	36.4
iOS	33,120.5	22.9	16,883.2	16.9
Symbian	12,466.9	8.6	27,598.5	27.7
Research In Motion	9,939.3	6.9	13,004.0	13.0
Bada	3,842.2	2.7	1,862.2	1.9
Microsoft	2,712.5	1.9	2,582.1	2.6
Others	1,242.9	0.9	1,495.0	1.5
Total	**144,391.7**	**100.0**	**99,775.0**	**100.0**

Source: Gartner (May 2012)

Table 6: Number of smartphones reveals, that smartphones are gaining prominence. 93.58% of respondents have a smartphone. This is inline with global trends as supported above. Domestically, Table 7:Type of Smartphone Used confirms BlackBerry's (formerly known as Research In Motion) leading position in the South African market. 44.92% of respondents use a BlackBerry device, 24.60% and 21.39% of respondents use an iPhone or Android device respectively. These figures contrast the global trend where Android based smartphones are the dominant smartphone, with Apple's iOS based smartphones and BlackBerry's occupying the 2nd and 4th position respectively.

5.3 Frequency of Internet usage

7.9 million South Africans access the Internet on their cell phones. 2.48 million users out of the total of 7.9 million South Africans access the Internet solely on their cell phones, and do not have access on computers. The remainder of the users, approximately 6.02 million users, access the Internet on computers, laptops and tablet computers. A further 90% of the 6.02 million users also user their cellphone to access the Internet (Goldstruck, 2012c).

Access to mobile banking financial services through the use of smartphone banking applications is dependent on the ability of the smartphone to access the Internet. Table 8: Frequency of Internet usage on mobile phones reveals that 88.77% or respondents have accessed the Internet on their cell phones within the past 7 days and a further 4.81% of respondents have accessed the Internet through the cell phones within past 30 days. Collectively 1.60% of respondents have used the Internet within the last 90 days or longer and only 4.81% of respondents have never accessed the Internet via their mobile phone.

The results suggest that larger portions of people are accessing the Internet more frequently on their cell phones.

5.4 Access Methods of Mobile Banking

Figure 7: Mobile Banking Access Methods, show that most respondents prefer to access mobile banking on their cell phones through a web page on their mobile browsers with 44.39 % of respondents selecting this access method. Mobile banking applications downloaded onto smartphones is gaining prominence as a Mobile Access Method, with 39.57% of respondents selecting this access method.

Arthur Goldstruck managing director of World Wide Worx, states that Internet penetration in South Africa is approaching 20%, and that mass market is embracing digital tools on their mobile phones (South African Press Association, 2012). The rapid proliferation of smartphones in South Africa is driving Internet usage on mobile

phones and could possibly explain the preference of the Web page access method of mobile banking (Gupta et al., 2012).

5.5 Intent to use mobile banking applications

49.20% of respondents as reflected in Table 12: Intent to use Mobile Banking are already users of mobile banking applications, with a further 13.3% of respondents replying that will definitely use mobile banking applications. The probably will not use and the Definitely will not use represent a combined total of 11.23% of the sample.

Possible reasons for non-use could be attributed to intangibility of the service, which prevents customers from being able to evaluate the service in advance (Koenig-Lewis et al., 2010). Koenig-Lewis et al., 2010 cites (Gerrard, P., Cunningham, & Devlin, 2006) on consumer anxiety about security issues and privacy with respect to Internet banking, which could also be applied to be newer banking technologies such as mobile banking applications.

An individual's level of perceived risk is negatively related to their attitude towards using Internet services (Polasik & Wisniewski, 2009). Higher levels of trust in mobile banking service providers will lead to a greater intention on the part of the user to engage in mobile banking transactions (Gu et al., 2009; Masinge, 2010).

Overall the results reinforce the view, that mobile banking applications are used by a large portion of the sample to conduct mobile banking and that a further 13.3% want to use mobile banking applications.

5.6 Mobile banking applications downloaded for Use

Table 13: Mobile Banking Applications downloaded for use and **Figure 9: Mobile Banking Application Downloaded for use**, show that FNB Banking Application is the most downloaded banking application. 35.29% of respondents have downloaded the FNB (Writer, 2013b). Non FNB customers can use the banking application to perform transactions, with the addition of eWallet services (Writer, 2013b). The download rate for the application is approximately 30 000 users per

month having grown from 10 000 to 30 000 downloads per month (Tubbs Bonnie, 2012).

BusinessTech a South African Technology based website that focuses on the intersection of technology and business, reports that on the 23rd January 2013 there were approximately 115 000 downloads of the Nedbank Application since July 2012. (Writer, 2013a). Table 13: Mobile Banking Applications downloaded for use show that 18.18% of respondents have downloaded the Nedbank Banking Application for use.

Standard Bank has seen their Standard Banking App downloaded 7 389 times over 48 hours since it's launch according to Money Web a South African based financial website (Jeanette, 2012). Itumeleng Monale, the head of self-service channels from Standard Bank stated that over 5 000 unique customers registered their devices, some registering more than one device (Jeanette, 2012). **Table 13: Mobile Banking Applications downloaded for use** show that 20.32% of respondents have downloaded the Standard Bank Banking application for use.

Only 3 respondents have downloaded the RMB Banking application and 10.16% of respondent have selected "Other". The inclusion of Other was to cater for institutions that fell outside the 4 Major banking groups **(FNB, Standard Bank, Nedbank and ABSA)**, that have provided the user with a banking application that is available for use. RMB and FNB which are part of the First Rand Group, at the time of conducting the research had an available mobile banking application for their customers to download and use.

ABSA had not yet released a banking application onto the market at the time the research was conducted, and was not included as a choice on the questionnaire.

26.20% **(Table 13: Mobile Banking Applications downloaded for use)** of respondents did not download a mobile banking application to use.

FNB's lead in the number of times that it's application has been downloaded could be attributed to a first mover advantage (i.e they were the first South African bank) to release a mobile banking application onto the market that supported the BlackBerry,

iOS and Android platforms. RMB's banking application followed on the release of the FNB banking application. **Table 13: Mobile Banking Applications downloaded for use** show that only 1.60% of respondents have downloaded the application for use, this could be attributed to demographics of RMB's customer base. They are a private and investment bank that caters for high net worth individuals.

Standard Bank was the third South African bank to release a mobile banking application onto the market. They launched their application in June 2012 (Thomas, 2012).

Nedbank was the fourth South African bank to release a mobile banking application onto the market. It was launched in July 2012. (Writer, 2013a)

5.7 Functionalities utilised across all banking applications

The **Research Methodology in Chapter 3** explained:

1. The typology of functionalities contained in mobile banking applications.
2. The triangulation approach employed in the aggregation of mobile banking functionalities.
3. The subsequent classification of the functionalities contained in mobile banking applications.

The three constructs that were used in the determination of usage patterns were:

1. **Nature of functionality**
2. **Interactivity**
3. **Frequency of use**

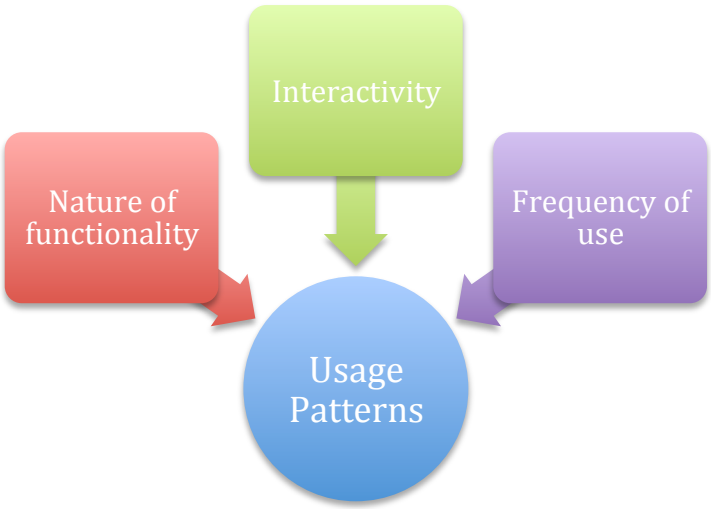

Figure 12: Determinants of Usage Patterns

1. **Nature of functionality**
2. **Interactivity**

Table 17: Typology of Mobile Banking Applications (Trudel et al., 2011)

Nature/Interactivity	***Passive***	***Active***
Transactional	Transpassive	Transactive
Informational	Infopassive	Informactive

Frequency of Use Construct

The Frequency of Use construct was gathered by:

1. Counting the number of times functionality was utilised per a banking application across all banking applications that were available for download. **(Helps understand what functionalities were utilised)**

2. Counting the mean frequency of functionality utilised by a fortnight. **(Helps understand how often said utilised functionalised were utilised per fortnight)**

The tables below incorporates all **3 constructs as determinants of Usage Patterns:**

5.7.1 *Transactive Mobile Banking Functionalities*

Table 17: Distribution of Transactive mobile banking functionality

Transactive	Frequency of Use	
	Total Count Of A Functionality Utilised Per A Banking Application	**Mean Frequency Of A Functionality Utilised Per Fortnight**
Payments Category		
Make a proximity payment (a person to person payment) using the mobile application to find recipients	73	3.43
Make a once off payment	87	3.42
Make payments to payment beneficiaries created on your online banking profile	118	3.41
Send money to any Cellphone number	48	4.31
Create future date payments	16	3.36
Make a stop payment	14	4
Set recurring payments	15	4.13
Perform a Tax/UIF Payment	13	5.13
Total	**384**	**31.19**
Fund Transfers Category		
Transfer funds between accounts	109	3.71
Create a future date transfer	12	4.5
Set a recurring transfer	8	6.2
Total	**129**	**14.41**
Prepaid Purchases Category		
Purchase prepaid electricity, airtime or data	71	4.28
Total	**71**	**4.28**

1. ***Payments Category***

As reflected in **Table 17: The Payments Category** had the highest utilisation of all Transactive categories, with the **Make payments to payment beneficiaries created on your online banking profile**, being the most utilised Transactive Functionality. The **Make payments to payment beneficiaries created on your online banking profile Transactive Functionality** was utilised by 118 respondents who performed the functionality on average 3.41 times per a fortnight. Although this was most utilised functionality it was not the most frequently performed Transactive Functionality. The most frequently performed Transactive functionality was **Perform a Tax/UIF Payment.** This could suggest that the sample incudes a small number of business owner /entrepreneurs that utilise this functionality to make Tax/UIF Payments.

Proximity payments was the second most utilised Transactive functionality, used on average 3.43 per week. **Make a Once Off Payment was the third most** utilised Transactive Functionality, with respondents utilising the functionality on average 3.42 times per fortnight.

Mobile payments are on the rise, by the end of 2012 14 million mobile users in South Africa will have made a total of R7 billion on mobile payments. (Kamhunga, 2012) This is comparative to 120 million of Africa's 760 million mobile phone users who will have made a total of 7 billion on mobile payments (Kamhunga, 2012).

Gartner estimated in 2010 that there were 100 million mobile payment users worldwide. In Kenya and South Africa, the scale of usage exceeds a million active customers (The World Bank, 2012).

Domestically FNB has linked it's open mobile payments service to the FNB Banking App. The bank has made its banking application available for use by non-FNB customers allowing users to buy prepaid airtime, data and prepaid electricity and send money via the application (Writer, 2013c). The inclusion of eWallet services into the banking application and the subsequent accessibility to Non-FNB customers adds strength to the contactless payment domains and will help drive Transactive Functionalities in the Payments Category.

2. ***Funds Transfers Category***

The **Funds Transfers Category** had the second highest utilisation of all Transactive categories, with **Transfer between funds between accounts** being the most utilised Transactive Functionality, performed on average 3.71 times per a fortnight. **Set a recurring transfer is** the least utilised Transactive Functionality in the Funds Transfer Category; only 8 respondents had utilised the functionality, but it was the most frequently executed Transactive functionality across all Transactive Categories with an average execution of 6.2 times per a fortnight.

Fund Transfers between accounts have a higher utilisation ratio in South Africa versus the United States, approximately 58% versus 42% (Aaron, Janna, & Lee, 2012). This could be attributed to a greater portion of the sample having more than one account, or a growing preference to perform this functionality through the use of a mobile banking applications than either through other self-service channels such as ATMs or online banking or service channels such as branches.

3. ***Prepaid Purchases Category***

Prepaid purchases were the third most utilized Transactive functionality. On average prepaid, electricity airtime or data was purchased 4.28 times per a fortnight. The uptake of prepaid electricity meters would increase to 15 million or 16 million units by 2014, up from the current 9 million installed units, with the value of electricity sales estimated to increase from R12 billion to approximately R14 billion according to CEO Mark Levy of JSE listed Blue Label Telecom (Odendaal, 2013).

There is a growing trend for the pinless purchase of airtime and electricity, as prepaid products rose in popularity in an ever –evolving world (Odendaal, 2013). Bret Levy joint CEO and brother of Mark Levy of Blue Label Telecom predicts that 90% of products that companies were able to offer in prepaid form, would be offered as an alternate choice to the post-paid product and at least 90% of consumers would purchase at least one new product through prepaid services (Odendaal, 2013).

The rise of prepaid offerings will help drive prepaid purchases through mobile banking applications, and thus increase the average frequency of utilisation of the functionality.

5.7.2 *Transpassive Mobile Banking Functionalities*

Distribution of Transpassive mobile banking functionality indicated there was no functionality. No transaction can be passively executed.

5.7.3 *Informactive Mobile Banking Functionalities*

Table 18: Distribution of Informactive mobile banking functionality

Informactive	Frequency of Use	
	Total Count Of A Functionality Utilised Per A Banking Application	**Mean Frequency Of A Functionality Utilised Per Fortnight**
Payments Category		
Add a payment beneficiary	67	2.22
Total	**67**	**2.22**
Balance Enquiry Category		
Perform a balance enquiry	110	5.14
View Mini Statement	65	5.64
View Payment History	78	4.29
Search Transactions and Statements	56	4.62
View Failed Transactions	17	3.15
View Graphs that compare state of your accounts	11	7.8
View Transaction History	92	5.33
Total	**429**	**35.97**
Locate ATM, Branch Networks Category		
Locate nearest ATM or nearest branch	37	2.75
Total	**37**	**2.75**

Informactive	Frequency of Use	
	Total Count Of A Functionality Utilised Per A Banking Application	**Mean Frequency Of A Functionality Utilised Per Fortnight**
View current forex rates, commodity indicators and shares Category		
View current forex rates, commodity indicators and shares	21	4.33
Total	**21**	**4.33**
Calculators Category		
Calculate motor finance, home loan or personal loan repayments	22	2.88
Total	**22**	**2.88**
Administration Category		
Change PIN/Password	29	1.69
Contact Bank	30	4.32
Totals	**59**	**6.01**

1. ***Balance Enquiry Category***

The Balance Enquiry Category had the highest the utilisation of all Informactive categories. The **Perform Balance Enquiry Informactive functionality** was utilised by 110 respondents at an average frequency of 5.14 times per a fortnight. **View Transaction History** was utilised by 92 respondents at an average frequency of 5.33 times per fortnight. **View Payment History** was the third highest Informactive functionality in the balance enquiry category utilised by 78 respondents at an average of 4.29 times per a fortnight.

The results suggest that users of mobile banking application are pro actively using mobile banking applications to enquire about their account balances and view their transaction and payment history.

2. ***Payments Category***

Adding a payment beneficiary is the fourth most popular Informactive functionality with a total of 67 respondents using the functionality on average 2.22 times per a fortnight. This suggests that a portion of the sample could be a business owner / entrepreneurs who use the mobile banking application to pay recipients with whom they will likely will do repeat business.

3. ***Locate ATM, Branch Networks Category***

The GPS functionality contained with most smartphones enables banking applications to utilise location-based services. TNS Research has reported that location-based services (LBS) have topped the global league as the mobile feature set to grow the most. TNS has further revealed that 0ver 60% of mobile users that don't yet use location-based services want to use them. According to TNS Research, almost one fifth (19%) of the world's six billion mobile users are already using LBS, with 62% aspiring to do so in the future. (TNS Research, 2012).

37 respondents out 187 (19.79%) respondents have selected that they use Locate ATM, Branch Networks functionality, with respondents using this Informative functionality on average 2.75 times per fortnight.

Projected increases in the future consumption of location-based services could be attributed to:

1. To the increasing availability of Global Positioning System (GPS) chipsets in smartphones. GPS-enabled mobile phones will have grown from 175 million units to 560 million units during the period of 2007 to 2012 (Ilarri, Mena, & Sheth, 2011)
2. Improvements in positioning accuracy to the meter range (Bozzon, Brambilla, Ceri, & Quarteroni, 2011).

Thus it is expected that both the number of people using this informactive functionality and the frequency of use of this informactive functionality will grow.

4. ***View Current Forex Rates, Commodity Indicators and Shares Category***

Smartphones have transformed mobility for traders in financial markets. Traders and scalpers can trade and monitor markets from anywhere in the world (Bannronn, 2013). The increase in mobility can be attributed to the availability of online broker applications available on multiple platforms. These applications allow traders to view real-time streaming quotes, charts and technical indicators (Bannronn, 2013)

The informative functionalities found in built for purpose online broking applications are starting to be ported to mobile banking applications. These functionalities allow bank customers, which are active in the financial markets access to financial information through the banking applications.

Currently only 11.22% of respondents use these informative functionalities on their banking application at an average frequency of 4.33 times per week.

5. ***Calculators Category***

Approximately 11.17% of respondents currently use the **Calculate motor finance, home loan or personal loan repayments Informactive Functionality** at an average frequency of 2.88 times per fortnight. This informactive functionality helps bank customers to calculate home repayments, motor vehicle instalments or personal loan repayments.

6. ***Administration Category***

Within the Administration Category only 29 respondents have used the **Change PIN/Password Informactive Functionality** an average of 1.69 times every fortnight.

Javelin Research and Strategy 5th Annual Mobile Security Report: Mitigating Security Risks Transforms the Mobile Banking Channel Report evaluates security issues encountered by mobile bankers when using three channels: Web browser, mobile application, and SMS texting. Their research has found that 44% of banking consumers, utilise the mobile browser and it is perceived by consumers to be the most secure (Javelin Research and Strategy, 2012). Banking via a downloaded mobile banking application is the second most widely used channel. Banking via a

downloaded mobile banking application is the safest channel for mobile bankers to use, with 25% of consumers using this channel. The report finds that 19% of mobile bankers use the SMS channel, which is the least popular channel (Javelin Research and Strategy, 2012).

5.7.4 *Infopassive Mobile Banking Functionalities*

Table 19: Distribution of Infopassive mobile banking functionality

Infopassive	Frequency of Use	
	Total Count Of A Functionality Utilised Per A Banking Application	**Mean Frequency Of A Functionality Utilised Per Fortnight**
Notifications Category		
Receive notifications of account activity	78	10.22
Total	**78**	**10.22**

1. ***Receive Notifications of account activity***

There is only one functionality contained in the Infopassive category; **Receive notification of account activity.** This functionality commonly referred to as Push Functionality is configured by the user upon installation of the banking application on their mobile device. The user grants the application permission to push notifications to the smartphone.

41.71% of respondents have granted permissions to the mobile banking application to push notifications concerning account activity onto their smartphone. The respondents receive on average 10.22 alerts per a fortnight.

A survey of Mobile Banking consumer experiences by Varolii Corporation had revealed that the most wanted mobile features across all users are notifications of irregular activity (54%), billpay (51%), low-balance alerts (46%), transfers (44%), and remote deposit capture (43%) (Varolii Corporation, 2013).

Nearly 2 in 3 (64%) consumers feel that it is their bank's responsibility to immediately alert them when they have a low balance or insufficient funds to pay a bill. The younger the customer, the stronger the believe in the importance of banks being proactive, nearly 3 in 4 18-to-24 year olds (73%) believe they should hear from their banks, versus 56% of those 55 years or older (Varolii Corporation, 2013).

6 CONCLUSION

6.1 Introduction

This chapter synthesizes the findings of the research. It reviews the research background and objectives, and summarises the research findings. The chapter concludes with evolving and emerging trends that will help drive utilisation and frequency of use.

6.2 Review of Research Background and Objectives

This research attempts to analyse and evaluate the usage patterns of client- based mobile banking applications in South Africa by trying to ascertain what functionalities are performed on mobile banking applications and how often they are performed. This paper attempts to address these questions by building on (Trudel et al., 2011) typology of functionalities performed on mobile banking applications by including a new construct, Frequency of Use in the determination of usage patterns.

The three constructs that were used in the determination of **Usage Patterns:**

1. Interactivity
2. Nature of Functionality
3. Frequency of Use

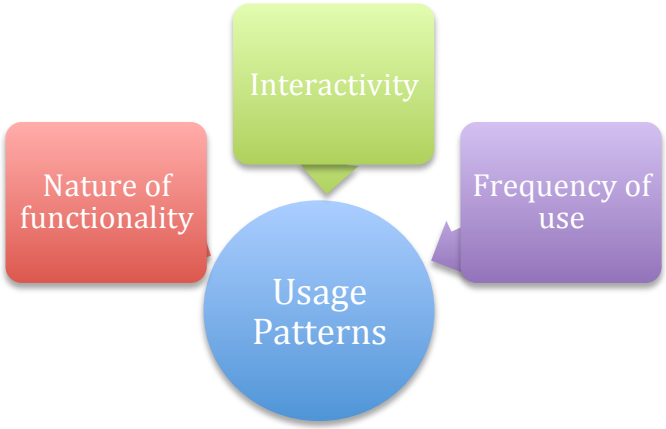

Figure 13: Determinants of Usage Patterns

6.3 Research Findings

Table 19: Usage Patterns of Client Based Mobile Banking Applications

Nature of functionality / Interactivity	Frequency Of Use	
	Sum Of Categorised Functionalities	The sum of Average Categorised Functionalities Utilised Per Fortnight
Informactive		
Total	635	54.16
Transactive		
Total	584	49.88
Infopassive		
Total	78	10.22
Transpassive		
Total	0	0

1. The results show that users of client based banking applications in South African predominantly execute **Informactive type functionalities** through their banking applications. They also utilise **Informactive functionalities** more frequently than any other type of functionality on their banking application consuming Informactive type functionalities at a rate of 54.16 times per a fortnight.
2. **Transactive type functionalities** are the 2nd most executed functionalities on the smartphone banking application. Transactive type functionalities are executed less frequently than Informactive type functionalities 49.88 times per a fortnight versus 54.16 times for Informactive type functionalities.
3. The research has found that client based application users are **active** in their use of functionalities contained within their banking applications.
4. The **Payments Category** contains the most utilised and frequently utilised **Transactive functionalities**.
5. The **Balance Enquiry Category** contains the most utilised and frequently utilised **Informactive functionalities.**

6. There are no **Transpassive Functionalities.** No transactions can be executed passively.
7. There research has found only one category of **Infopassive Type Functionalities, Receive notification of account activity.** This is a passive functionality; users do not execute this functionality. Notifications are pushed to the banking application installed on the smartphone.

The results have highlighted 3 Focus areas that have both high utilisation and frequency of use:

1. Transactive Payments Category
2. Informactive Balance Enquiry Category
3. Infopassive Notifications Category

In the sections below the research explores evolving and emerging trends that will further increase the utilisation and frequency of use of the above functionalities.

6.4 Evolving and Emerging Trends that will help drive Utilisation and Frequency of Use

6.4.1 *Transactive Payments Category*

Technological challenges, limited standardisation, fragmented commercial efforts and lack of a sustainable business model were challenges that contributed to the slow and sporadic adoption of Mobile Payments. Whist these challenges still remain, mobile payments initiatives across the world are growing (Capgemini, 2011)

The total value of mobile payments is expected to top 13 trillion dollars by 2017 (GSMA & ATKearney, 2013). Accenture's Mobile Web Watch 2012 Study has reported that whilst only 16% of smartphone and tablet users are currently using mobile payments services, 74% are aware of such services and an additional 39% indicated they would be interested or plan to use mobile payment applications (Accenture, 2012). ACI Payments Systems projects that the number of people using mobile payments is expected to reach 2.5 billion by 2015. ACI Payment Systems

further project 85% of Point-Of-Sale systems to accept mobile payments by 2016 (ACI Worldwide Inc, 2011).

1. ***Mobile Payment Landscape***

The Mobile Payment Landscape is complex. Numerous schemes exist and overlap. A user's choice of scheme is dependent on numerous factors such as where in the world the user is located, who are where the receipt is, who their favourite retailers are services available from their bank or telecoms providers (ACI Worldwide Inc, 2011).

2. ***P2P (Person to Person Payments) for banked customers***

The inclusion of mobile wallet functionalities embedded in the mobile banking application, enables customers to move to move money from their cheque accounts to recipient through the use of only a mobile number (ACI Worldwide Inc, 2011; Writer, 2013b). The recipients can make use of existing infrastructure such as ATM, to draw the funds or if he is banked at the same institution as the payee, the funds will be transferred into his bank account.

The commoditisation of data and smartphones will help drive adoption rate of mobile banking applications, as smartphones become more prevalent. For the previously under banked customer that may not have used online channels such internet banking to execute P2P payments; the inclusion of mobile wallet functionality embedded in the banking application will allow him to execute payments to individuals of differing banks via their smartphones. This functionality currently available to the under banked through the use of text based services such as M-PESA, is expected to increase in utilisation and frequency as smartphones and banking applications becomes more ubiquitous. (Mobile Money: The economics of M-PESA).

3. *Near Field Communication (NFC)*

NFC brings easier device-to-device communication, reading of other contactless chips and emulation of contactless cards to smartphones, and thus is considered to be a great facilitator for proximity interactions between different devices. NFC can be seen as the fusion of contactless smart card and the mobile phone (Ondrus & Pigneur, 2008).

In Asia, several flourishing contactless schemes have been deployed, and prior research has shown contactless technology to be more efficient than cash for payment transactions. It has also been evaluated to be cheaper and have a greater degree of reliability than standard chip cards, which involve contact between the chip and the reader. Long-term usage has shown that damage could be sustained to the reader due to dust and grease in the standard chip card and reader technology (Ondrus & Pigneur, 2008).

Contactless schemes have been successfully deployed in industries such as transportation, which are dependent on quick service and are transaction dependent (Ondrus & Pigneur, 2008).

Tap and go payments enabled through Near Field Communication (NFC) on mobile devices are starting to achieve widespread penetration. Approximately one in four smartphones shipped in 2012 contained NFC technology. NFC technology has the potential to revolutionise they way buy over the counter. NFC mobile payment technology has been available since early 2011. It is estimated that 25% of Western European and US mobile phone users will pay for goods-in-store using their NFC enabled mobile phone by 2017. This contrast to less that 2% in 2012 (GSMA & ATKearney, 2013).

In South Africa Banking group ABSA has trailed NFC technology on mobile phones in December 2011. The bank has partnered with MasterCard, a global financial service provider to embed MasterCard's proprietary Paypass Tap and Go payment chip on cellular handset's for the trail, enabling trial participants to load funds onto their cellphones through the ABSA website or ATM's (Reporter, 2012).

Arrie Rautenbach, ABSA retail market head claims that ABSA is the first institution to bring NFC capabilities with an EMV (Europay, MasterCard and Visa) card payment application to a handset. The trial paves the way for consumer market utilization of the mobile phone as a payment device using NFC technology (Reporter, 2012).

The commercialisation of NFC technology in South Africa and the subsequent integration into mobile banking applications will help drive increased utilisation and frequency of proximity payments in South Africa.

6.4.2 *Informactive Balance Enquiry Category*

1. ***Personal Financial Management Services (PFM)***

The informactive functionalities contained in the Balance Enquiry Category, allow initiators of the functionality to actively obtain and view information regarding the status of various accounts, account activity, balances, failed transactions, transaction history and payment history.

Personal Financial Management Services can be described as a set of tools that help consumers and small business track and manage their finance, create budgets, categorize and anticipate spending, and analyse both the distribution and performance of their investments (BancVue, 2010).

Thus the informactive functionalities performed under the Informactive Balance Enquiry can be considered a subset of Personal Financial Management Services.

Personal Financial Management (PFM) Services is at the core of consumer's financial world. In South Africa, the National Credit Regulator data show that 26% of South Africa's 36.4 million credit accounts, excluding mortgages were more than 30 days in arrears at the end of March (Stafford, 2012). In South Africa PFM services 22Seven and Moneysmart rely on accessing a user's online bank account with their consent and convert data collected into graphic representation of all account activity on the accounts (Stafford, 2012). CEO Toby Van Zyl of Moneysmart claims that Moneysmart empowers their users to take control of their financial destiny. Bank

account data can be analysed in real time and users become aware of the money is being allocated (Stafford, 2012).

Personal Financial Management tools are not new, the Intuit's Quicken and Microsoft's Money have been around for many years (BancVue, 2010). The integration of Personal Financial Management services into mobile banking applications in the South African market is lacking. South African banks need to develop native solutions to implement PFM services into their banking applications. Generation Y are more involved in managing their financial lives than previous generations (BancVue, 2010).

This holistic view of a consumers spending and investing habits will give banks new opportunities to interact with their account holders (BancVue, 2010). This in turn could increase the opportunities for banks to cross-sell products and services that lead to deeper account holder relationships (BancVue, 2010). The increased quality of information, which will help empower customer decision-making, will subsequently increase both utilisation and frequency of use of informactive functionalities.

6.4.3 *Infopassive Notification Category*

Infopassive notifications are functionalities that are not actively performed by the user. The notifications are automatically pushed to the mobile banking application when activity takes place on the user's account. Increase in volume and frequency of Transactive and Informactive functionality will subsequently cause increases in Infopassive functionality. Notifications to the device through the banking application will increase in volume and frequency as the user actively increase volume and frequency of both Transactive and Informactive functionality.

6.5 Recommendations For Future Research

The focus of this research was on the analysis and usage patterns of client based banking applications. These applications were utilised by customers on their smartphones. Smartphones are constantly evolving, new hardware opens the possibility for banking applications to interface into the capability of the new hardware and thus offer greater functionality within the banking application itself. The emergence of tablets further aids the ability of banks to service their customers through mobile banking applications.

Whilst the study proposed evolving and emerging trends that will help drive utilisation and frequency of use, a more expansive research into evolving and current technology that will help drive both utilisation and frequency of use of mobile banking applications could be conducted.

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APPENDIX A

1. LETTER TO RESPONDENTS

Dear respondent

I am completing an MBA at the University of Witwatersrand Johannesburg (Wits). My MBA thesis is on an analysis into client based banking applications in South Africa. In gathering data for this subject, your input, in the form of a questionnaire will be of great value.

I understand your busy schedule and your participation is voluntary but your contribution to my research will be greatly appreciated.

The questionnaire will not take more than 10 minutes of your time and the outcomes and findings of this research is for academic purposes only. Confidentiality will be observed throughout the thesis process.

Thank you for your kind assistance

Yours Sincerely,

Drushen Naidoo

071 683 6216

2. ACTUAL RESEARCH INSTRUMENT

Questionnaire – Hosted on Qualtrics Website

Mobile Banking Application Usage

A smartphone is a cell phone with features that may enable it to access the web, send e-mails and interact with computers. Smartphones include the iPhone, BlackBerrys as well as Android and Windows Phone powered devices. Smartphones can also download and use applications from sites like the iTunes App Store, BlackBerry App World, Google Play Store and Windows Phone Store

1. Is your mobile phone a smartphone?
   a. Yes
   b. No

2. Which type of smartphone do you have ?
   a. Android
   b. BlackBerry
   c. iPhone
   d. Windows Phone
   e. Other
   f. Don't own a smartphone, own a regular mobile phone

3. When was the last time that you used the Internet on your mobile phone?
   a. In the past 7 days
   b. In the past 30 days
   c. In the past 90 days
   d. More than 12 months ago
   e. Never

Mobile banking uses a mobile phone to access your bank account, credit card account or other financial accounts. This can be done either by accessing your bank's web page through the web browser on your mobile phone, via text messaging or by using an application downloaded to your mobile phone

4. Have you used mobile banking in the past 12 months?
   a. Yes
   b. No

5. How have you accessed mobile banking in the past 12 months? Tick the relevant boxes. If you have answered No to the previous question please leave blank.

Via a web page	Via text messaging	An application downloaded to your mobile phone

6. Do you think you will ever use a mobile banking app?
   a. Already Use
   b. Definitely will use
   c. Probably will use
   d. Probably will not use
   e. Definitely will not use

7. Please select the mobile banking application/s that you have downloaded for use. You can select more than one bank application ,if you use and bank with more than one bank.

   ❑ FNB
   ❑ Standard Bank
   ❑ Nedbank
   ❑ RMB
   ❑ None
   ❑ Other

Display Logic to drive question sequence: If None is Selected, Then Skp to End of Survey.

8. Which functionalities listed below do you use ? Tick the relevant boxes

- ❑ Make a proximity payment (a person to person payment) using the mobile application to find recipients
- ❑ Make a once off payment
- ❑ Make payments to payment beneficiaries created on your online banking profile
- ❑ Add a payment beneficiary
- ❑ Send money to any cellphone number
- ❑ Create future date payments
- ❑ Make a stop payment
- ❑ Set recurring payments
- ❑ Perform a Tax/UIF Payments
- ❑ Transfer funds between accounts
- ❑ Create a future dated transfer
- ❑ Set a recurring transfer
- ❑ View Transaction History
- ❑ Perform a Balance Enquiry
- ❑ View Mini Statement
- ❑ View Payment History
- ❑ Search Transactions and Statements
- ❑ View Failed Transactions
- ❑ View Graphs that compare state of your accounts
- ❑ Receive notifications of account activity
- ❑ Locate nearest ATM or branches
- ❑ Purchase prepaid electricity, airtime or data
- ❑ View current forex rates, commodity indicators and shares
- ❑ Calculate motor finance, home loan or personal loan repayments
- ❑ Change Pin/Password
- ❑ Contact Bank

9. On average how many times per a fortnight (every two weeks) do you, use these functionalities? Use slider to select number.

   Display logic: slider range 0 to 20. Only functionalities selected in the previous question will be displayed question nine

   - ❑ Make a proximity payment (a person to person payment) using the mobile application to find recipients
   - ❑ Make a once off payment
   - ❑ Make payments to payment beneficiaries created on your online banking profile
   - ❑ Add a payment beneficiary
   - ❑ Send money to any cellphone number
   - ❑ Create future date payments
   - ❑ Make a stop payment
   - ❑ Set recurring payments
   - ❑ Perform a Tax/UIF Payments
   - ❑ Transfer funds between accounts
   - ❑ Create a future dated transfer
   - ❑ Set a recurring transfer
   - ❑ View Transaction History
   - ❑ Perform a Balance Enquiry
   - ❑ View Mini Statement
   - ❑ View Payment History
   - ❑ Search Transactions and Statements
   - ❑ View Failed Transactions
   - ❑ View Graphs that compare state of your accounts
   - ❑ Receive notifications of account activity
   - ❑ Locate nearest ATM or branches
   - ❑ Purchase prepaid electricity, airtime or data
   - ❑ View current forex rates, commodity indicators and shares
   - ❑ Calculate motor finance, home loan or personal loan repayments
   - ❑ Change Pin/Password
   - ❑ Contact Bank

Display Logic, last page of survey: Thank You for taking this survey