EFFECT OF TECHNOLOGY BASED FINANCIAL INNOVATIONS ON NON-INTEREST INCOME OF COMMERCIAL BANKS IN KENYA

BY

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DECLARATION

I declare that this research project is my original work and has not been previously published or submitted elsewhere. I also declare that this project contains no material written or published by other people except where due reference is made and author duly acknowledged.

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This project has been submitted for examination with the approval of:

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Sign……………………………………… Date……………………………………
ACKNOWLEDGEMENT

I thank the Almighty for bringing me this far. I would also like to sincerely acknowledge the tireless effort of my supervisor Dr. Mirie Mwangi for his insights and high standards that have enabled me to write this project. Also, I would like to acknowledge my fellow classmates for their moral support. I will be forever grateful.
DEDICATION

I dedicate this project to my family. Without their moral support, tolerance and understanding, this project could not have been possible in my academic journey. I highly appreciate their help.
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# ABBREVIATIONS

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<thead>
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<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ACC</td>
<td>Automated Cheque Clearing</td>
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<td>ANOVA</td>
<td>Analysis of Variance</td>
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<td>ATM</td>
<td>Automated Teller Machine</td>
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<td>CBK</td>
<td>Central Bank of Kenya</td>
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<td>EFT</td>
<td>Electronic Fund Transfer</td>
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<td>FTS</td>
<td>Fund Transfer Systems</td>
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<td>ICT</td>
<td>Information Communication Technology</td>
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<td>KBA</td>
<td>Kenya Bankers Association</td>
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<td>MFI</td>
<td>Microfinance Institution</td>
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<td>NFI</td>
<td>Non-Funded Income</td>
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<td>ROA</td>
<td>Return on Assets</td>
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<td>RTGS</td>
<td>Real Time Gross Settlement</td>
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ABSTRACT

Technology based financial innovation has had a great impact on the financial industry as a whole over the past few decades. It has presented the banking sector with an opportunity to increase their revenue. As such, this study intended to identify the impact of technology based financial innovation on non-interest income in commercial banks in Kenya. To achieve this, the study investigated how the adoption of ATMs and cards, internet and mobile Banking as well as the use of funds transfer systems such as RTGS and EFT have impacted the non-interest income of commercial banks in Kenya. The study adopted a descriptive research design because it allowed the researcher to look into a wide range of data that is obtainable in an effort to explain the phenomenon at hand. It also used secondary data obtained from the Central Bank of Kenya, between the year 2006 and 2016, implying that it was the latest of its kind. Data was analysed using Statistical Packages for Social Sciences (SPSS Version 22) by employing descriptive statistics and multiple regression analysis. Results from this study indicated that indeed financial innovation has a significant effect on non-interest income. It noted that increase in income from use of ATMs, debit and credit cards, mobile banking, online banking applications and income generated from funds transfer systems result to an increase in non-interest Income of commercial banks in Kenya. The study also revealed that the exists a strong significant correlation between income generated from use of cards and ATMs, mobile banking, online banking and funds transfer systems, and the non interest income of commercial banks. The study therefore concluded that technology based financial innovation has a significant effect on the non-interest Income earned by commercial banks in Kenya. It recommends all stakeholders in the banking sector to make investments made towards technology based financial innovation products as a strategy to improve the amount of income they earn from non-interest sources. This is likely to increase their overall earnings given the current interest capping requirements and the expected impairment loss approach to be adopted by the sector in line with the new financial reporting standards.
CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The past few decades have seen a global dynamic change in traditional banking. While this change may be deemed inevitable given the overall effects of globalization, it is largely attributed to technological innovation. This rapid development in technology has made it possible for financial organizations to offer financial services that live up to the expectations of a changing generation (Beck, Chen, Lin & Song, 2016). One of its direct consequences is financial innovation which has not only redefined modern market economies but has also popularised new financial instruments that have thus far offered better lending and borrowing systems and improved payment mechanisms.

According to the International Monetary Fund, financial innovation has resulted to the emergence of vital services that evaluate, allocate and monitor the use of that capital, while at the same time facilitate transactions and risk management. These are basically the most important financial aspects in today’s financial world. These improvements have also resulted to a significant change in the demographics of the operation of commercial banks all over the world. As at 2016, there were 3.6 billion ATM’s across the world. This has increased the amount of income commercial institutions earn from the use of these teller machines. (ATM Benchmarking Study 2016 & Industry Report, 2016). Mobile banking applications have also increased tremendously with most commercial banking institutions on boarding their customers.
It is also important to note that challenges have been experienced as far as moving from traditional banking into a rather fast and sophisticated banking that integrates financial innovation is concerned (Laeven, Levine & Michalopoulos, 2015). This study therefore intends to highlight the relationship between financial innovation and non-interest income. For instance, banks have had to introduce mobile applications and Smart Automatic Teller Machines to replace human tellers, internet banking to eradicate the problem of geographical misfits as well as the emerging digital peer-to-peer banking. All these have had various effects on the way banks earn their non-interest income (Shaikh & Karjaluoto, 2015). To explain this relationship, this study depended on various theories that have been mooted thus far to explain technology based financial innovation. These include the Diffusion of Innovation Theory, Financial Intermediation Theory, Disruptive Innovation Theory and the Market Efficiency Theory of Innovation. These theories explain different aspects of financial innovation and its relationship with commercial banking.

It is evident that an influx of financial needs has been created by this new seamless financial environment that makes it relatively easy and convenient to make transactions. First, the internet has offered a complete overhaul of how individuals and co-operations access financial services. New securities have been provided through this platform, which has greatly facilitated the movement of capital to the most required areas of investment leading to economic growth. Commercial banking is therefore changing, thus the need to understand the relationship between technologies based financial innovation and non-interest income (Beck, Chen, Lin & Song, 2016).
1.1.1 Technology Based Financial Innovation

Technology based financial innovation can be considered as an act that leads to the creation and popularization of new financial systems that are almost entirely based on Information Technology (IT), risk transfer and credit and equity generation (Beck, Chen, Lin & Song, 2016). These new systems are often characterised by reduced cost, lower risks, improved services, increased security and better flow of capital to areas of investment. Its end result is an improved financial service sector that accelerates economic growth.

There are a good number of technology based financial innovations that have been developed. They include ATMs, credit and debit cards, online and mobile banking applications as well as Funds Transfer Systems such as RTGS and EFT. An ATM is basically a computer terminal that comprises of a cash vault and a record keeping system capable of holding records of account information. An individual looking to render the services of an ATM must have a type of credit or debit card that has a chip with their account information as well as their Personal Identification Number (PIN) that will communicate with the ATM computer to allow them to transact (Shaikh & Karjaluoto, 2015). The ATM offers a number of services to its users including the ability to withdraw, deposit, pay utility bills or transfer cash from one geographical location to another electronically. They are widespread, and need not be physically located near a banking institutions. As such, they are largely preferred for their convenience. Banks therefore earn from every transaction done by each and every customer who uses the above mentioned services.
Online banking on the other hand is basically described as accessing banking services via the internet. As such, it is sometimes referred to as internet banking (Yee-Loong Chong, Ooi, Lin & Tan, 2010). Here, all banking services that would otherwise be available in a banking hall are accessible remotely. This includes accessing accounts, checking balances, point of sale purchases as well as transferring large amounts of money via EFT. Mobile banking is also another financial innovation that has taken the financial world by storm. It is a service provided by a commercial bank by allowing customers to conduct financial transactions as if they were physically present in a banking hall while in reality they are using their mobile phones (Shaikh & Karjaluoto, 2015). Unlike the related internet banking, it uses software in the form of an app that is provided by the financial institution to the customer for the sole purpose of transacting.

Finally, Funds Transfer Systems comprise of systems that facilitate the transfer of large amounts of money from one institution to another (Worku, 2010). Examples include RTGS and EFT. RTGS enables the movement of funds from one banking institution to another in such a way that the settlement is in real time i.e. transactions are not subjected to time, they take place instantly. In essence, settlements are completed as soon as they are processed on a one to one basis which eliminates the need for netting with any other transaction at the bank. This has revolutionised transactions that are of high-value and require immediate settlement. On the other hand, EFT is a form of electronic funds transfer that also handles high-value transactions. However, settlements done through this system are not real time and also depend on a network to function (Jack, Suri & Townsend, 2010).
It is important to note that financial innovation’s success largely depends on the nature of the product being advanced. Poor products will not be received well by consumers, especially considering the fact that money is a sensitive topic in the modern world. Secondly, the ability of the product meeting the desired need appropriately is key i.e. if there are risks involved and the appropriateness of the target audience (Laeven, Levine & Michalopoulos, 2015). Finally, the total value of any innovation lies heavily on the capability and reputation of the person or firm implementing it. Clearly, all these three factors put commercial banks on the spotlight.

1.1.2 Non-Interest Income

Traditionally, the main sources of income for financial institutions has been in the form of interests charged on loans and investments in various government and rated securities. This is because the core business of banks is to sell cash and this, in essence, makes money their main asset, and interest their main source of income. However, non-interest income is fast emerging as the sole source of interest given the fact that interest earning sources are often capped by the government or they have a tendency to fluctuate from high to low. Non-Interest income can be defined as creditor income derived from several fees charged upon offering services. These include fees from deposits, transactions from credit and debit cards, inactivity fees, monthly or annual service charge fees as well as insufficient fund fees. These are what generates profits for financial institutions.

Basically, this form of income can also be in the form of asset sales, or penalties that are associated with withdrawals of overdrafts. Fees from the use of ATM’s, credit and debit cards, as well as transactions made over the counter all fall under this category. It should
be noted that the main drivers behind this income is the economic environment. For instance, in order for a financial institution to successfully trade securities or even provide equity financing to an organization, there are certain economic variables that have to be favourable (Williams, 2016).

The movement of both domestic and foreign funds from one market to another has also become a profitable service for financial institutions today. Thanks to technology, money can now be transferred from one place to another regardless of geographical location or time zone differences by use of Electronic Funds Transfer (EFT) as well as Rapid Transfer (Lee, Yang & Chang, 2014). This involves the use of money orders, demand drafts and bankers cheques from one institution to another. All these sources of income have made it possible for financial institutions to be able to break even in a rather competitive financial industry. Moreover, they help the banks remain liquid in today’s environment where default rates among customers is high (Central Bank of Kenya, 2017).

1.1.3 Technology Based Financial Innovation and Non-Interest Income

Financial institutions are looking to diversify their portfolio so much so that they not only depend on interest earned from their sell of money, but also generate significant revenue from non-interest sources of income. As such, financial innovation is of great interest to them. This is because it provides the various avenues through which income can be earned from these non-interest sources (Lee, Yang & Chang, 2014).

It is also true that financial innovation has created a unique competitive position for banks to pursue in a rather competitive financial industry. Additionally, through this
innovation, banks have managed to significantly reduce costs associated with processing, storage, and information transmission as well the well-being of their customers. Banks have also been able to meet financial standards demanded by changing tastes and preferences among customers largely divided by status quo (Williams, 2016).

Financial innovations such as ATMs, credit cards, mobile applications and intermediation technologies have all provided new avenues to earn non-interest income. These have largely replaced traditional banking that required customers to physically visit a branch to order transactions. It has also become the best road to take for financial service consumers because of the convenience, accessibility and instant gratification all at a lower price (Williams, 2016). The internet on the other hand has literally made it possible for banks to convert a personal computer into a personal bank for its customers in virtually any location on earth. This in turn translates to better and improved business for banks.

Despite these advantages, rapid financial innovation can also pose a potential systemic risk. A rapid expansion of financial products that do not have a proven track record often fools investors into ignoring the risks associated with it (Beck, Chen, Lin & Song, 2016). Just like in any other business, when things are doing okay, there is always the likelihood that an invisible risk is lurking behind. This can have drastic consequences especially in periods of economic stress. The 2007 – 2009 World financial crisis serves as a reminder of the possibility of such an occurrence. During the crisis, it was observed that many individuals as well as institutions underestimated the risks that would emerge due to new financial products in the global market. Consequently, key markets for liquidity, such as the interbank lending market were affected.
In conclusion, financial institutions ought to take advantage of this innovation in an effort to maintain a desirable balance in their books. It should also be noted that innovation is extremely rapid in the current financial world, with applications, types of cards and different money transfer systems coming up by the day. Key risk measures should be taken to ensure that they do not venture a product or service that will affect their ability to earn through non-interest income. To enable innovation to continue benefiting future societies, there is need for setting up of prudential regulations aimed at discouraging taking of excessive risk in the future (Williams, 2016).

1.1.4 Commercial Banks in Kenya

Banks can be described as financial institutions that accepts deposits from individuals and institutions and creates credit (Samolyk, 2017). It is through banking that lending activities take place directly or indirectly, mostly through capital markets. Moreover, these institutions are regarded as the most important financial institutions. Due to this importance, therefore, many countries regulate their operations through a centralized institution. Such institutions are required to ensure that the liquid assets that they hold are equated to a part of the current liabilities in their books at any given time. Regulations are necessary because they ensure that an international set of capital standards provide a basis upon which banks will determine their minimum capital requirements (Samolyk, 2017).

The three main acts that regulate the Kenyan banking sector are the Companies Act, the Central Bank of Kenya Act and the Banking Act. In addition the Central Bank issues prudential guidelines to guide the day to day operations of banks, bureaus and micro-
finance institutions. The sector comprises 43 commercial banks, 109 forex bureaus and 15 micro-finance institutions as at the end of December 2016 (Central Bank of Kenya, 2016). As such, this study concentrated on the 43 banks in the land. The Central Bank of Kenya (2016) asserts that thirty (30) of the forty three (43) banks are domestically owned while thirteen (13) are foreign operated. This report also points out that foreign banking institutions accounted for approximately 39% of the banking assets as of end of 2016. It is also important to note that all banks are under an umbrella body, the Kenya Bankers Association (KBA) which works with banks to ensure that the interests of the banks are well represented. The association also provides a platform for addressing sectoral issues, including the grievances of employees or relationship with the government (Central Bank of Kenya, 2016).

There has been a wide range of products offered by banks, high growth levels of assets, profits and customer deposits mainly attributable to technology based financial innovation whose products and services have been received well by many financial service consumers in the country. The banks offer all financial innovation services available to the financial industry. These include ATMs, credit and debit cards, mobile applications and internet banking. They also have financial innovation systems including RTGS, a Kenya Electronic Payment and Settlement System and EFT for large money transfers (Central Bank of Kenya, 2016).

Modern banking systems have largely been globalized through the reduction of global competition, improved telecommunications and advancement in financial technologies. Today, their reach all over the world thanks to these changes. Perhaps the most notable financial innovation of them all is the deposit taking ATMs and cards, online and mobile
banking as well as fund transfer systems that have taken the Kenyan market by storm. Specifically, mobile banking has its roots in the country and has been adopted by all banks in the country. However, alternative financial service providers pose a significant threat to this form of banking in what is fast growing into a financial disruption. On the brighter side, this presents a much needed consumer advantage due to stiff competition.

1.2 Research Problem

While earnings from the cost of borrowing money is important to banks, trends in the financial industry suggest that this form of income alone is not enough to sustain financial institutions economically. In order to break even and sustain the business, these institutions need to look out for additional sources of income (Chen, Huang & Zhang, 2017). These sources include, but are not limited to, non-interest-income. It has since become the primary way in which these institutions generate income even though it is viewed upon as a strategic line-item on the income statement. It is important to note that non-interest income channels entirely comprise technologically based financial innovation. As such, technologically based financial innovation is at the heart of commercial banks’ business as they seek to profit from non-interest income (Beck, Chen, Lin & Song, 2016).

Several global studies have been carried out to elaborate the relationship between technology driven financial innovation and non-interest income. In 2014, Frame and White investigated technological change, financial innovation, and diffusion in the banking sector. They acknowledged that as a result of technological changes, over the past 30 years, the market has witnessed significant developments in commercial banking.
The paper also highlighted the fact that not so much has been brought to light as to the manner and justification for developing financial innovations and how they actually impact a bank’s income, commendable effort has been directed towards uncovering the behaviors of different users of technology based innovations in the financial sector and how these developments affect the welfare of individuals and societies (Frame & White, 2014). Beck, Chen, Lin & Song (2016) also investigated financial innovation and concluded that financial institutions tend to flourish in countries where securities are large and also where the regulatory frameworks are more restricted.

Several local studies have also been done to elaborately explain this relationship. For instance, Gichure, (2015) studied the relationship between non-interest income and financial performance of commercial banks in Kenya. The study concluded that non-interest income positively contributes to the financial performance of commercial banks in Kenya. Based on this conclusion, the study recommended a heightened focus on management and monitoring of non-interest income activities if banks are to register an increase in performance. Kamau, (2014) also investigated the effect of cashless transactions and financial trading income on non-funded income in commercial banks in Kenya. The study revealed that cashless transactions income and financial trading income have a positive effect on non-funded income in commercial banks in Kenya. As such, the study recommends that banks should conduct research on other viable avenues of non-interest income to banks, including the use of ATMs, mobile banking, internet banking and the use of financial innovation systems to generate income.

In as much as these studies have established the correlation between financial performance and technology based innovation, the actual extent to which this innovation
actually affects the financial income banks get has not been brought out clearly. This study intends to bring out this extent by first highlighting the current state of adoption of technology based innovation in commercial banks in Kenya. Moreover, it gave a comparison of the non-interest income from technology based innovation products and non-interest income from other sources like fees and penalties. This showed the difference in income earned by banks from both sources, thereby giving the proportion of income attributed to non-interest sources.

1.3 **Objective of the Study**

1.3.1 **General Objective**

The general objective for this study was to investigate the impact of technology based financial innovation on non-interest income of commercial banks in Kenya.

1.3.2 **Specific Objectives**

The specific objectives were as follows:

i. To investigate the adoption of ATMs, debit and credit cards on the non-interest income of commercial banks in Kenya.

ii. To examine how internet banking has impacted non-interest income of commercial banks in Kenya.

iii. To identify the impact of mobile banking on the non-interest income of commercial banks in Kenya.

iv. To establish how Fund Transfer Systems for example RTGS and EFT have affected the non-interest income of commercial banks in Kenya.
1.4 Value of the Study

This study was set to investigate the impact of technology based financial innovation on non-interest income of commercial banks in Kenya. Results from this study are significant to a number of stakeholders including those in the banking industry, as they look towards making viable decisions regarding non-interest income generating opportunities for their institutions. Results from this study give a sectoral impact of various types of financial innovation has on non-interest income, thus giving all stakeholders; managers, investors and customers alike, the much needed information on how their books are balancing and the drivers of their non-interest income.

Key policy makers on the banking industry can also use information from this study to understand trends in the industry as far as innovation is concerned. Considering the fact that innovation trends are so dynamic, results from this study provide the latest information regarding these trends. This can be used to update the policies already in place or formulate new ones depending on the nature of change.

The study also adds to the vast body of knowledge already in place as far as the banking industry is concerned. More specifically, it has increased the empirical evidence available on the relationship between non-interest income and financial innovation. This information can be used as reference by other scholars interested in this topic. Additionally, other stakeholders, more so customers, can use these results to better understand the banking industry.
CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter discusses the literature review on the impact of technology based financial innovation on non-interest income of commercial banks. This includes the identification and discussion of relevant theories as well as scholarly arguments under which the proposed study was anchored. Finally, it also brings to light some previous studies done based on the variables chosen for this study.

2.2 Theoretical Review

This section identifies and discusses the relevant theories and scholarly arguments that explain the emergence of digital disruption as well as the operations of the banking industry. These include Diffusion of Innovation Theory, Financial Intermediation Theory, Disruptive Innovation Theory and the Market Efficiency Theory of Innovation.

2.2.1 Diffusion of Innovation Theory

This theory was advanced by Rodgers in 1962 to help explain how innovations develop from ideas in an innovator’s mind into a behavioral characteristic among a huge number of people. In essence, the theory is used to explain how an idea is able to gain momentum in time and spread through a specific population. In the long run, people embrace this idea or product into behaviour. Rodgers (2010) describes an innovation as an idea that is perceived to be new from another person’s perspective that has the potential of changing the way things are done. This theory therefore describes how such an idea develops from
its infancy stage into an idea adopted by the entire social system over time (Baskerville, Bunker, Olaisen, Pries-Heje, Larsen & Swanson, 2014). According to Rodgers, individuals tend to adopt things or behaviour that they did not possess previously in an effort directed towards doing those things differently. This therefore means that people adopted any idea as long as they perceive it and believe that it would work in their favour. This is what drives the process of diffusion, in a process described as the Innovation-Decision Process. While discussing the Innovation-Decision model, Kaminski, (2011) identified that the adoption of an innovation is not a single act, but a process that occurs over time.

The very first stage involves the innovators themselves who first come into contact with an idea. These are people who are naturally interested in new ideas and are therefore venturesome in nature (Baskerville, et al., 2017). They introduce the idea to adopters, who are basically the opinion leaders i.e. individuals who are very comfortable adopting the new innovation because they are well aware of the need to change. Once the adopters have been assimilated, they will introduce the new idea to early adopters, who are basically individuals who will receive the new innovation ahead of the average person, who will eventually be the last one to get the idea. The average person includes the late majority, who are skeptical to change and would only adopt new innovation if it works for a majority of the people as well as the laggards who are very skeptical and conservative individuals and are the most difficult to adopt any new innovation. Once the average person is aware, then the process of diffusion of innovation is said to be complete (Baskerville, et al., 2017).
This theory is relevant to this study given its ability to explain the adoption of various financial innovation services and products that exist currently. The relationship between the society and the financial world is characterized by trust. Introducing technology based innovation has proven to have its own challenges as far as its adoption is concerned. As such, this theory is useful in explaining this relationship.

2.2.2 Financial Intermediation Theory

This theory is commonly used to reconcile institutional behaviour as they interact with each other in securities markets. Initially, classical theories of intermediation were basically based on transaction costs and asymmetric information purely for individuals. Contrary to this, modern theories tend to focus more on new and evolved markets for financial futures rather than just individuals or firm. This theory helps to explain this relationship (Iwedi & Igbanibo, 2015).

Intermediaries function to facilitate flow of funds from units with excess to units that are in deficit. Given the risk averse nature of investors as well as the uncertainties about the future, there is need to have an intermediary. Without it, all investors will end up with long-term investments that are not liquid. Additionally, financial intermediaries create specialized financial commodities that are vital to the survival of investors. This is because an intermediary has the ability to sell at prices that are expected to cover both direct costs and opportunity costs incurred in production. An intermediary is also important due to the existence of market imperfections. However, the reality is that markets are characterized by differences of information among both buyers and sellers. This simply means that information asymmetries are much more pronounced such that borrowers have a high level of understanding of the features and quality of the collateral.
they offer, their own level of effort put in work and their credit worthiness better than the providers of funds, while entrepreneurs have quality insights regarding those projects for which they are seeking financing (Greenbaum, Thakor & Boot, 2015).

The researcher found this theory to be relevant in explaining the role of commercial banks in financial intermediary. This is because banks are right in the middle of the interaction between buyers and sellers and it is through this relationship that both interest and non-interest income is generated. As such, this theory is relevant to the study.

2.2.3 Disruptive Innovation Theory

The disruptive innovation theory is a theory developed by Clayton Christensen in 1995. This theory is largely used to describe innovation driven growth. Christensen described disruptive innovation as a process through which an innovative product or service flourishes at the bottom level of a relatively mature market and then relentlessly moves up the market levels, displacing established competitors in the process. This scenario has been attributed to financial innovation that has resulted to traditional commercial banks stiff competition from alternative financial service providers (Christensen, McDonald, Altman & Palmer, 2016).

The theory proposes that disruptive innovations are produced by entrepreneurs and outsiders who are not part of an existing market. Their main aim is to provide alternative options for services offered by leading companies in a specific market. Traditionally, financial services were offered by banks, all over the world. However, thanks to financial innovation, more third party companies are chipping into the financial market providing instant loans, credit and debit cards as well as internet/online banking services. This, in
itself, poses a potential threat to commercial banks, specifically as far as their sources of non-interest income is concerned (Nagy, Schuessler & Dubinsky, 2016).

From the description of the disruptive theory, it is clear that it holds a close relationship with the topic of study. The current commercial banks are in an environment characterized by new entries into the financial market with products and services that appear simple compared what the banks used to offer and this has a direct impact on non-interest income. As such, this theory is relevant in as far as this relationship is concerned.

2.2.4 Market Efficiency Theory of Innovation

This theory, developed by Merton in 1990, discusses the main drivers of financial innovation. The theory asserts that financial innovators are driven mainly by the need to increase efficiency and improve overall social welfare as far as finance is concerned. This is largely because markets are imperfect making it a necessity to have new and better ways of dealing with these imperfections (Siebert, 2017). For instance, making it easier for capital to flow towards the most promising and deserving areas of investment will go a long way in ensuring that the economy is sustained, which in turn improves the living standards and general welfare of the people.

This therefore implies that financial innovation directly affects market efficiency. Financial innovations should be used to point capital towards the right direction so as to increase stability and avoid breakdowns for a smoother investment. It should be noted however that smooth investments pose a danger of an invisible risk lurking in between the success. Investors tend to ignite this risk when things are going well. Financial crises have been witnessed due to this level of ignorance (Siebert, 2017). However, as
highlighted by Merton in this theory, innovations can also serve to create new structures that facilitate sharing, pooling and hedging of risk among commercial banks. These structures also allow the transfer of financial resources from one market to the other and significant reduction of agency costs in transactions, which are all necessary for an ideal financial environment (Siebert, 2017).

This theory is therefore relevant to this study because it helps explain the current financial environment that most commercial banks find themselves in. Locally, commercial banks in Kenya help ensure the efficiency of the financial world. This allows them to generate income from interest and non-interest sources. As such, understanding this theory was vital for this study.

2.3 Determinants of Non-Interest Income

Non-interest income can be defined as that part of a bank's revenue that is not generated by its interest-earning business. Most financial institutions around the world are turning to fee income to bolster their bottom lines. Various factors come into play as far as this kind of income is concerned. These include both internal and external factors. Internal factors that determine non-interest income include asset size, net interest margins and cost-income ratios. External factors on the other hand include economic growth, inflation, technology diversity and stock markets (Hahm, 2008). These are summarised in this section.

2.3.1 Internal Factors

These can be described as the internal factors that affect the ability of banks to determine their non-interest income at the end of a given financial year or period. It is true that
banks have different internal abilities to generate non-interest income (Hahm, 2008). This is determined by factors such as asset size, net interest margins and cost-income ratios. A bank that has a large asset size would have the ability to purchase more financial innovations such as ATMs, which translates into an increased ability to issue more debit and credit cards which increases the amount of income generated from these two avenues. Large assets also imply that banks can procure more online and mobile banking as well as fund transfer systems that would also serve to increase the amount of income they earn from these avenues (Damankah, Anku-Tsede & Amankwaa, 2014).

Additionally, banks that operate on low net interest margins would have a higher non-interest income. However, when this figure is low and positive, then better optimal decisions that enable a better environment for other non-interest avenues to prosper are being made (DeYoung & Rice, 2004).

2.3.2 External Factors

These are factors that are beyond the bank’s control. These include a country’s economic status, inflation and stock exchange prices. When the economy in a country is stable, several factors would result to an improved non-interest income balance. This is because more ATMs, online and internet banking applications, as well as fund transfer systems would be in action since the more transactions would be taking place (DeYoung & Rice, 2004). This translates to more income earned through these avenues. A stable inflation also implies that the institutions are at the centre of a healthy economic environment that allows more people to undertake business, which translates into more income from these sources. Finally, a well-developed stock market banks tend to earn more non-interest income because economic activity would increase. When this happens, businesses as well
as consumers borrow more funds for investing and financing their personal consumption in form of purchases. The opposite is also true, i.e. low economic activity, low confidence from investors and consumers thus low levels of borrowing (DeYoung & Rice, 2004).

2.4 Empirical Studies

Various studies have been conducted to illustrate the relationship between financial innovation and non-interest income. This section highlighted some of them:

Globally, studies have been conducted to demonstrate this relationship. In 2014, Frame and White investigated technological change, financial innovation, and diffusion in the banking sector. They acknowledged that as a result of technological changes, over the past 30 years, the market has witnessed significant developments in commercial banking. The importance of financial systems in economies has also grown. The paper also highlighted the fact that not so much has been brought to light as to the manner and justification for developing financial innovations and how they actually impact a bank’s income, commendable effort has been directed towards uncovering the behaviors of different users of technology based innovations in the financial sector and how these developments affect the welfare of individuals and societies (Frame & White, 2014).

Laev ing, Levine & Michalopoulos (2015) investigated the relationship between endogenous growth and financial innovation. Their study sought to establish whether financial innovation was necessary for growth to occur. Findings revealed that indeed, financial innovation is important. This is because it spearheaded entrepreneur’s need to
earn profits by inventing better goods and services. They also suggested that empirical studies are consistent with this conclusion.

Beck, Chen, Lin & Song (2016) conducted a study to establish the ups and downs of financial innovation to financial institutions. They collected data from thirty-two countries between 1996 and 2010. Through the assessment of financial innovation vis-à-vis bank growth and fragility, the study established that indeed growth in banks can be attributed to financial innovation. Additionally, they asserted that the effects of financial innovation are felt the most in countries with tight regulations as well as large securities markets. Thy therefore concluded that financial innovation leads to an overall economic growth because it gives banking institutions and other industries the ability to create new opportunities for growth.

Locally, Okiro & Ndung’u (2013) conducted a study to highlight the impact mobile banking has had on the performance of financial institutions in Kenya. The study acknowledges that financial innovation has for some time been the backbone of financial institutions. Specifically, the adoption of mobile and internet banking has become the most commonly used forms of financial innovation in the country across thirty institutions. These are mostly used to withdraw cash. As such, financial institutions have witnessed an increase in the amount of cash flow through their newly adopted systems. This has since improved the amount of income they earn through the provision of these financial services.

Mwangi (2014) investigated the effect of financial innovations on non-funded income of commercial banks in Kenya. The study mainly focused on product innovation and
financial services innovation in the then 43 commercial banks in Kenya (CBK, 2011). Secondary data was collected between 2009 and 2013 and analysed it using SPSS. The study established that there existed strong significance, positive correlation between financial innovation and non-funded income (NFI) in commercial banks. It also concluded that the adoption of these financial innovations had improved commercial banks income level and further improved their operations and earnings by increasing level of Non-Funded Income. This study also concluded that commercial banks investing in financial innovations such as online banking has increased non-funded income to a great extent.

Mwinzi (2014) also investigated the effect of financial innovation on economic growth in Kenya. The objective of the research was to empirically examine the link between financial innovations and economic growth by assessing the effect of increasing financial innovations in Kenya on financial sector development, the extent to which changes in regulation and increasing rollout of new products such as mobile money payment systems, mobile banking and RTGS affect the economic growth and prosperity in Kenya. The study concluded that it is true that the effect of financial innovation is positive as far as its relationship with economic development is concerned. However, innovations such as RTGS and mobile banking have insignificant effects on financial deepening in Kenya. (Mwinzi, 2014).

Ngari and Muiruri (2014) also investigated how financial innovations have affected the performance of commercial banks in Kenya. It sought to identify how credit cards, mobile banking, the internet and agency banking influence performance. The study found that some banks in Kenya had adopted some financial innovations such as credit cards,
mobile, internet and agency banking. Additionally, these financial innovations had great impact on the financial performance of the banks.

Mugane (2015) also conducted a study to identify the effect of financial innovations on the financial performance of commercial banks in Kenya. The study used an explanatory research design and the population comprised 43 commercial banks. Mugane (2015) also collected primary data and used ordinary linear regression model to analyse the relationship. The findings indicated that there is a negative and significant relationship between product innovation and return on assets (ROA), which was the main performance measurement unit. The relationship between service innovation and ROA and also organizational innovation and ROA was also found to be positive and significant. Based on the findings, the study therefore concluded that commercial banks in Kenya experienced unsteady trends in ROA despite the fact that more financial innovations were taking place in the sector. The study also concluded that the relationship between product innovation and financial performance of commercial banks is negative and significant (Mugane, 2015).

2.5 Conceptual Framework

The conceptual framework adopted by this study was used to relate the independent and the dependent variable. The only dependent variable was non-interest income while four independent variables namely Income from Fund transfer Systems, Income from Mobile Banking, Income from ATMs, Credit and Debit Cards and Income from Internet Banking was investigated. It is expected that all the four independent variables have a positive effect on non-interest income. This is because besides being the major sources of non-
interest income, they are the most common technological based financial innovations adopted by commercial banks in Kenya today.

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Dependent Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income from ATMs, Credit and Debit Cards</td>
<td>Non-Interest Income</td>
</tr>
<tr>
<td>Income from Mobile Banking</td>
<td>Total income generated from non-interest sources</td>
</tr>
<tr>
<td>Income from Internet Banking</td>
<td></td>
</tr>
<tr>
<td>Income from Fund Transfer Systems</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2.1 Conceptual Framework

2.6 Summary of Literature Review

In conclusion, this section highlighted four key theories that are related to the topic of study. These include the Diffusion of Innovation Theory, Financial Intermediation Theory, Disruptive Innovation Theory and the Market Efficiency Theory of Innovation. The diffusion innovation theory brings out the manner in which financial innovations have been adopted throughout the world. The financial intermediation theory on the other hand brings out the importance of having financial intermediaries while the disruptive innovation theory emphasizes on the need to control financial innovation lest banks lose their valuable source of non-interest income. Finally, the market efficiency innovation theory brings to light the importance of financial innovation as far as the efficiency of markets is concerned.
This chapter also discussed the relationship between various types financial innovation theories such as ATMs, online and internet banking as well as fund transfer systems. Finally, a detailed empirical review on previous studies conducted on the topic of study was also conducted. As such, the knowledge gap that previous studies recommended in their areas of further study was clearly brought out.
CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the research methodology that was adopted by the study. This includes the research design, target population, data collection and processing, pre-diagnostic tests and the data analysis.

3.2 Research Design

The research design that this study adopted was descriptive in nature and focused on understanding the effect of technology based financial innovation on the non-interest income of commercial banks in Kenya. Studies that adopt a descriptive research design are often set to determine, describe or identify what is (Lewis, 2004). This allows the researcher to look into every form of data that is obtainable in an effort to explain the phenomenon at hand. This therefore makes it possible to collect data that has a significant numerical element attached to it.

3.3 Target Population

The 43 commercial banks registered under the Central Bank of Kenya (CBK, 2016) formed the target population for this study. Considering this small number, this study was a census.
3.4 Data Collection

Secondary data was the primary focus of this study, and focused on the period between 2006 and 2016. This was obtained from the Central Bank of Kenya’s as well as the World Bank Development Indicators’ websites. This data was then cleaned by ensuring that all the correct values are represented in each period of the study.

3.5 Diagnostic Tests

These are tests that were carried out to ensure that the data collected is well modelled and whose analysis would yield statistically significant results. This largely involved conducting normality test. This includes the analysis of mean, median, mode, standard deviation, kurtosis and skewness.

3.6 Data Analysis

The process of data analysis then proceeded using SPSS version 22. Descriptive analysis was used to describe the nature of the data collected, while a multiple regression model was developed and a multiple regression analysis conducted to illustrate the relationship between the independent and dependent variables. The multiple regression model took the following format;

\[ Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \varepsilon \]

Where Y= Non-Interest Income (Amount of Income from Non-interest sources)

\[ X_1= \text{Income generated from ATMs and Debit/Credit Cards} \]

\[ X_2= \text{Income generated from Online Banking} \]
X₃= Income generated from Mobile Banking

X₄= Income generated from Funds Transfer System

β₀ - Constant

β₁ - coefficient for Income generated from ATMs

β₂ - coefficient for Income generated from Online Banking

β₃ - coefficient for Income generated from Mobile Banking

β₄ - coefficient for Income generated from Funds Transfer System

ε- Error term

3.7 Tests of Significance

Finally, in order to test for significance, this study employed t-tests, and f-tests as applicable. These tests were able to determine whether sampled data is consistent with the hypothesized distribution.
CHAPTER FOUR

DATA ANALYSIS AND INTERPRETATION

4.1 Introduction

In this chapter, the results obtained from the analysis of data and its interpretation were presented. The section first describes the statistics of all the variables in the estimable model and then goes further to establish their time series properties. The model is then estimated and post estimation tests conducted.

4.2 Descriptive Statistics and Diagnostic Tests

Before estimating the variables in the model, it is prudent to carry out a preliminary inspection of the data series being investigated. This allows the researcher to ascertain the statistical properties of the data such as mean, standard deviation and kurtosis before performing any econometric analysis. Table 4.1 presents the analysis of these measures for all the variables in the model.

Table 4.1 Descriptive Statistics

<table>
<thead>
<tr>
<th>STATS</th>
<th>LNNIR</th>
<th>LNATMC</th>
<th>LNOB</th>
<th>LNMB</th>
<th>LNFTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>10.68438</td>
<td>9.213267</td>
<td>8.819385</td>
<td>9.099199</td>
<td>9.303525</td>
</tr>
<tr>
<td>SD</td>
<td>0.2064778</td>
<td>0.1579206</td>
<td>0.7304205</td>
<td>0.9103051</td>
<td>0.1338899</td>
</tr>
<tr>
<td>Skewness</td>
<td>-.5175217</td>
<td>.2817132</td>
<td>-.5779967</td>
<td>-1.243264</td>
<td>.141089</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>2.042922</td>
<td>3.523124</td>
<td>1.644199</td>
<td>3.052213</td>
<td>2.189833</td>
</tr>
</tbody>
</table>
It was observed that the values of the mean and median values are almost identical, and the values of skewness are very close to zero. This implied that the variables are normally distributed. It is important to note however that non-interest income, online banking as well as mobile banking variables are negatively skewed, implying that their distributions have long left tails. However, income from ATM’s and cards as well as funds transfer systems is positively skewed implying that their distributions have longer right tails than left ones. On the other hand, relatively small standard deviations observed for all the variables implies that they are not dispersed significantly from their mean values. Finally, kurtosis statistic, which measures sharpness of the peak of a frequency-distribution curve, indicated that all the variables are platykurtic. This means that their distributions are flatter than a normal distribution, with a wider peak. This is because their values are less than 3.

4.3 Trend Analysis

The study also analyzed the graphs of the four independent variables to detect the movements in the value of the variables over time and to analyze the causes of such movements.
Figure 4.1 Trend Analysis

Figure 4.1 indicates that all the variables have a constant trend, with values staying relatively closer to each other. As indicated in the four trend lines, there has been a steady increase in the amount of income earned from ATM’s and cards, mobile banking, online banking and funds transfer systems. The trend lines are also smooth, implying that this rise is steady and predictable, further suggesting that the data follows a normal distribution.
### 4.4 Correlation Test Results

The researcher also conducted correlation tests to establish the relationship between the variables included in the study. Results are summarised in Table 4.2

**Table 4.2 Correlation Test Results**

<table>
<thead>
<tr>
<th></th>
<th>LNNIR</th>
<th>LNATMC</th>
<th>LNOB</th>
<th>LNMB</th>
<th>LNFTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LNNIR</strong></td>
<td>Pearson Correlation</td>
<td>1</td>
<td>.805**</td>
<td>.594**</td>
<td>.514**</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.001</td>
<td>.001</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>44</td>
<td>44</td>
<td>44</td>
<td>44</td>
</tr>
<tr>
<td><strong>LNATMC</strong></td>
<td>Pearson Correlation</td>
<td>.805**</td>
<td>1</td>
<td>.381**</td>
<td>.255</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.001</td>
<td>.000</td>
<td>.875</td>
<td>.078</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>44</td>
<td>44</td>
<td>44</td>
<td>44</td>
</tr>
<tr>
<td><strong>LNOB</strong></td>
<td>Pearson Correlation</td>
<td>.594**</td>
<td>.381**</td>
<td>1</td>
<td>.231</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.001</td>
<td>.000</td>
<td>.909</td>
<td>.101</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>44</td>
<td>44</td>
<td>44</td>
<td>44</td>
</tr>
<tr>
<td><strong>LNMB</strong></td>
<td>Pearson Correlation</td>
<td>.514**</td>
<td>.255</td>
<td>.231</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td>.875</td>
<td>.909</td>
<td>.080</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>44</td>
<td>44</td>
<td>44</td>
<td>44</td>
</tr>
<tr>
<td><strong>LNFTS</strong></td>
<td>Pearson Correlation</td>
<td>.651**</td>
<td>.244*</td>
<td>.301</td>
<td>.431*</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td>.078</td>
<td>.101</td>
<td>.080</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>44</td>
<td>44</td>
<td>44</td>
<td>44</td>
</tr>
</tbody>
</table>

**-. Correlation is significant at the 0.01 level (2-tailed).**
Results from the study indicate that there is a very strong positive relationship between Non-Interest Income and amount of funds from ATM’s and cards as indicated by a correlation coefficient of 0.805 (p=0.001). Its relationship with income from online banking is positive and relatively strong as indicated by a correlation coefficient of 0.594 (p=0.001), similar to that of mobile banking (0.514, p=0.000). Finally, its relationship with income from funds transfer system is equally strong and positive as indicated by a coefficient of 0.651 (p=0.000). The correlation coefficients between the independent variables indicate a weak but positive relationship which rules out the possibility of multi-correlation.

4.5 Unit Root Tests

A basic assumption of the Classical Linear Regression model asserts that variables should have a constant mean, variance and the covariance between the values of two time periods should be zero. Violation of this assumption leads to spurious regression. To avoid this short fall, the unit root test was conducted on the variables to ascertain whether they are stationarity or non-stationary. Augmented Dickey-Fuller (ADF) tests were employed by the study. If a variable is stationary at level, i.e. without running any differencing, then it is said to be integrated of order zero or I (0) and if it becomes stationary after differencing, then the variable is said to be an I (d) variable, where d represents the number of times it has been differenced. The null hypothesis for this test is that the variables are stationary. It is also important to note that the study selected the lag length of the ADF test based on the Akaike Information Criterion (AIC) (McMillan and Schumacher, 2014). These results are as displayed in Table 4.3
Table 4.3 Unit Root Tests

<table>
<thead>
<tr>
<th>Variable</th>
<th>Test statistic Z(t) at level</th>
<th>Test statistic Z(t) after First Order of Differencing</th>
<th>Test statistic Z(t) after Second Order of Differencing</th>
<th>Critical value Z(t)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1%</td>
</tr>
<tr>
<td>LNNIR</td>
<td>-1.577</td>
<td>-2.212</td>
<td>-4.189*</td>
<td>-3.750</td>
</tr>
<tr>
<td>LNATMC</td>
<td>-1.731</td>
<td>-2.653</td>
<td>-3.829*</td>
<td>-3.750</td>
</tr>
<tr>
<td>LNMB</td>
<td>-1.329</td>
<td>-2.099</td>
<td>-4.587*</td>
<td>-3.750</td>
</tr>
<tr>
<td>LNOB</td>
<td>-3.019</td>
<td>-1.252</td>
<td>-4.368*</td>
<td>-3.750</td>
</tr>
<tr>
<td>LNFTS</td>
<td>-1.050</td>
<td>-4.085</td>
<td>-4.548*</td>
<td>-3.750</td>
</tr>
</tbody>
</table>

Table 4.3 indicates the test statistic results after first order of differencing and second order differencing. It was observed that at first order differencing, the null hypothesis that each of the time series variables has a unit root was not rejected at order zero (I(0)) since their ADF test statistic values are less than critical values at the 1%, 5% and 10% level of significance. Similarly, upon first order differencing, ADF test statistic values indicated that the null hypothesis that each of the time series variables has a unit root cannot be rejected at first differencing (I(1)) because they were less than the critical values at the 1%, 5% and 10%. However, upon second differencing, the null hypothesis that each of the time series variables has a unit root was rejected because all the ADF test statistic values were greater than the critical values. This shows that all the variables under investigation are individually integrated of order two I(2).
4.6  Cointegration Tests

To test for co-integration, the study used Johansen tests. If the residuals are stationary, then it means that the variables are co-integrated. Table 4.4 indicates the results.

Table 4.4 Johansen Cointegration Tests

<table>
<thead>
<tr>
<th>Maximum Rank</th>
<th>Trace statistic</th>
<th>5% critical value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>27.8252</td>
<td>13.38</td>
</tr>
<tr>
<td>1</td>
<td>0.1685*</td>
<td>8.45</td>
</tr>
</tbody>
</table>

Table 4.4 indicates that the test statistics are based on a model with two lags and a constant trend. Also in the table, the test statistics and their critical values of the null hypotheses of no cointegration and one or fewer cointegrating equations are presented. Johansen’s testing procedure starts with the test for zero cointegrating equations and then accepts the first null hypothesis that is not rejected. From the information contained in the table, the study failed to reject the null hypothesis that there was no cointegration. This implies that there was no cointegration in the variables and thus a VAR would be fitted.

4.7  Regression Model Coefficients

The study conducted multiple regression analysis whose result is presented by the coefficient Table 4.5.
### Table 4.5 Regression Model Coefficients

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>-.661</td>
<td>3.015</td>
<td>-0.22</td>
</tr>
<tr>
<td></td>
<td>LNATMC</td>
<td>1.268</td>
<td>.464</td>
<td>1.469</td>
</tr>
<tr>
<td></td>
<td>LNOB</td>
<td>.272</td>
<td>.107</td>
<td>.261</td>
</tr>
<tr>
<td></td>
<td>LNMB</td>
<td>.146</td>
<td>.071</td>
<td>.245</td>
</tr>
<tr>
<td></td>
<td>LNFTS</td>
<td>.365</td>
<td>.058</td>
<td>.237</td>
</tr>
</tbody>
</table>

a. Dependent Variable: LNNIR

From table 4.5, the following regression equation is derived;

\[
LNNIR = -0.66 + 1.267 \times LNATMC + 0.272 \times LNMB + 0.146 \times LNOB + 0.365 \times LNFTS
\]

Where LNNIR = Natural log of Non-Interest Income

LNATMC = Natural log of Income generated from ATMs and Debit/Credit Cards

LNMB = Natural log of Income generated from Online Banking

LNOB = Natural log of Income generated from Mobile Banking

LNFTS = Natural log of Income generated from Funds Transfer System
This equation has coefficient values next to each technology-based financial innovation product used by banks to earn income. Its interpretation is as follows;

Coefficient for LNATMC= 1.267 implies that holding LNMB, LNOB and LNFTS constant, a 1% increase in the income generated from ATM’s and cards will translate into a 1.267% increase in Non-Interest Income of commercial banks.

Coefficient for LNMB= 0.272 implies that holding LNATMC, LNOB and LNFTS constant, then a 1% increase in income generated from mobile banking will translate to a 0.272% increase in Non-Interest Income of commercial banks.

Coefficient for LNOB= 0.146 implies that holding LNATMC, LNMB and LNFTS constant, a 1% increase in income generated from online banking will translate to an increase in Non-Interest Income by 0.146%.

Coefficient for LNFTS=0.365 implies that holding LNATMC, LNMB and LNOB constant, a 1% increase in income generated from funds transfer systems will result to an increase in Non-Interest Income of banks by 0.365%.

It is also important to note that the study established that the positive effect each technology based financial innovation product has on Non-Interest Income is statistically significant as indicated by P>t values of 0.009, 0.016, 0.046 and 0.001 for ATM’s and Cards, mobile and internet banking and finally funds transfer system respectively. This is because each of these significant values are less than 0.05.

4.8 Model Summary Results

The model summary table 4.6 indicates the r-square obtained from the study.
Table 4.6 Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.740a</td>
<td>.548</td>
<td>.502</td>
<td>.145761002183951</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), LNFTS, LNMB, LNATMC, LNOB

An R-Square of 0.548 implies that approximately 54.8% of Non-Interest Income is explained by the income generated from technology-based financial innovation products comprising ATMs and cards, mobile banking, internet banking and funds transfer system.

4.9 ANOVA Test Results

ANOVA test was conducted to establish whether the regression line was a good fit. This is an F test that is based on the null hypothesis that the regression model omitted variables and that all the variables included have coefficients that are not significantly different from zero. The alternative hypothesis on the other hand is that the model has no omitted variables and that their coefficients are significantly different from zero.

Table 4.7 ANOVA Results

<table>
<thead>
<tr>
<th>ANOVAa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

a. Dependent Variable: LNNIR

b. Predictors: (Constant), LNFTS, LNMB, LNATMC, LNOB
Table 4.7 indicates that the model had no omitted variables and that their coefficients are significantly different from zero as indicated by a significant calculated F value of 11.821 which is statistically significant as indicated by p=0.000<0.05. This implies that the regression line result is a line of good fit.

4.10 Discussion of Research Findings

This section presents the discussion of the results as obtained by the study whose aim was to investigate the effect of technology based financial innovation on non-interest income of commercial banks in Kenya. Data on the amount of income earned by commercial banks from financial innovations such as ATM’s and cards, online banking, mobile banking and funds transfer systems was collected from 2006 to 2016. These formed the independent variables of the study. The dependent variable comprised of the annual amount of non-interest income earned by commercial banks over the same time period. The values of the dependent and the independent variables were converted into percentages by getting their natural logarithms. Upon analyzing this data, the study revealed the following about the relationship between technology based financial innovations and non-interest income;

The analysis of this data revealed that a 1% increase in income from ATMs and cards results to a 1.26% increase in Non-Interest Income as indicated by a regression coefficient value of 1.26. This is to mean that an increase in the income generated from ATM’s and cards positively affect the total amount of non-interest income earned by commercial banks in Kenya. These results are in line with what Laerving, Levine & Michalopoulos (2015) found while investigating the relationship between endogenous
growth and financial innovation. They noted that financial innovation products such as ATM’s and debit as well as credit cards that were invented as a result play a vital role in the amount of income they generate, thus spurring growth of banks.

On mobile banking the study found that a 1% increase in income generated from mobile banking will translate to a 0.272% increase in Non-Interest Income of commercial banks. Furthermore, this increase was found to be statistically significant as indicated by a p level for the t-test conducted of 0.016, which is less than 0.05. Mwangi (2014) also concluded that mobile banking positively affects the non-interest income of commercial banks in his study on the effect of financial innovations on non-funded income of commercial banks in Kenya.

The study also found that a 1% increase in income generated from online banking translates to an increase in Non-Interest Income by 0.146%. This increase is equally statistically significant as indicated by a p value of 0.046<0.05. A study such as those conducted by Ngari & Muiruri (2014) made a similar conclusion that adopting technology based financial innovation products increased the amount of non-interest income commercial banks earn in Kenya.

The study found that a 1% increase in income generated from funds transfer systems will result to an increase in Non-Interest Income of banks by 0.365%. Similarly, this increase was statistically significant as indicated by a p value of 0.001<0.05. Looking at Mwinzi (2014) findings, it was revealed that funds transfer systems such as RTGS and EFT have revolutionised the transfer of funds between banks, making it very efficient to the economy.
CHAPTER FIVE
SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This section presents the summary, conclusion and recommendations made by the study. The summary of the findings was presented as indicated in Chapter 4 while conclusions and recommendations are based on them. The study also highlights what makes it unique by comparing the findings with what other related studies have found.

5.2 Summary of Findings

This study was set to investigate the effect of technology based financial innovation on non-interest income of commercial banks in Kenya. In order to achieve this, the study focused on four main products of technology based financial innovation in the banking industry, which include ATM’s and cards, mobile banking, internet banking and funds transfer systems. Based on a descriptive research design, the incomes generated from each and every product was then compared and its effect on non-interest income analyzed. The researcher collected secondary data from Central Bank of Kenya, which summarized the performance of all the 43 commercial banks between the years 2006 and 2016.

Descriptive statistics were conducted to establish the nature of data collected. This included analyzing the mean, median, standard deviation, skewness and kurtosis. The results obtained indicated that the data followed a normal distribution since the mean and median values were significantly the same while relatively low levels of standard
deviation indicated that the observations had no significant variations from the mean. Trend analysis further strengthen this claim as it was established that values did not change significantly over time and thus the data was normal.

Correlation test analysis revealed that there existed a strong relationship between non-interest income and technology based financial innovation. This was demonstrated by the existence of a strong relationship between Non-Interest Income and amount of funds from ATM’s and cards as indicated by a correlation coefficient of 0.805 (p=0.001). Furthermore, its relationship with income from online banking is positive and relatively strong as indicated by a correlation coefficient of 0.594 (p=0.001), so is its relationship with mobile banking with a coefficient of 0.514 (p=0.000). Finally, its relationship with income from funds transfer system is equally strong and positive as indicated by a coefficient of 0.651 (p=0.000). All these relationships are statistically significant as indicated by their corresponding p values which are all less than 0.05.

Regression analysis conducted revealed beta values for the amount of income generated from ATMs and cards as 1.268, implying that a 1% increase in this income would increase non-interest income by 1.268% holding all other factors constant. It was also revealed that holding all other factors constant, a 1% increase in income generated from mobile banking will translate to a 0.272% increase in Non-Interest Income of commercial banks. Equally, holding all other factors constant, a 1% increase in income generated from online banking will translate to an increase in Non-Interest Income by 0.146% and finally a 1% increase in income generated from funds transfer systems will result to an increase in Non-Interest Income of banks by 0.365% holding all other factors constant.
The model summary revealed an $r$-square of 0.548 implying that 54.8% of the independent variables explain the dependent variables. It is equally important to note that the model was a good fit as indicated by a significant calculated F value of 11.821 which is statistically significant as indicated by $p=0.000<0.05$.

5.3 Conclusion

Based on the findings, this study concludes that technology based financial innovations have a significant effect on the Non-Interest Income earned by commercial banks in Kenya. This is because upon investigating how Technology Based Financial Innovation products, including ATM’s, online banking, mobile banking and Fund Transfer Systems affect the non interest of commercial banks in Kenya, the study concluded that an increase in the amount of income generated from these products positively and significantly affects Non-Interest Income.

Financial innovations associated with ATM’s and cards have been adopted by virtually all commercial banks in Kenya. This study attributes this to the fact that it found that an increase in the amount of income generated from ATM’s and cards significantly increase the amount of non-interest income earned. It is also evident that online and mobile banking platforms have had a significant increase in their usage right from their inception. As indicated by the study, an increase in each of their incomes results to a significant increase in the amount of income generated from non-interest sources. Finally, regarding Funds Transfer Systems, the study also concluded that the amount of income they generate is statistically significant to the amount of non-interest income generated.
This study is unique in the sense that the above mentioned conclusion is based on the analysis of the most recent data available on non-interest income and the amount of income generated from the most used forms of technology-based financial innovation products. Moreover, the study has provided a comprehensive analysis of the effect of four different technology triggered products, as opposed to the single product approach that most other studies have provided.

5.4 Recommendation

Based on the conclusion, the study therefore recommends all stakeholders in banks to take any investments made towards technology based financial innovation products as a strategy to improve the amount of income they earn from non-interest sources. This comes at a time when technology and finance are merging so much so that the traditional branched banking system is slowly being replaced by digital banking. Soon, the banking industry will be taken over by these financial innovations, which will generate majority of non-interest income for them.

More specifically, the study recommends stakeholders of commercial banks to invest in ATM’s and cards such as the debit and credit cards in an effort to earn more income through them. An increase in the number of ATM locations, addition of more security features to the cards and promotion of plastic money transactions in the market would translate to an increase in demand for these cards. With this demand satisfied, commercial banks are bound to have a significant improvement in their non-income interest since the higher number of ATM’s and cards will facilitate an increase in the number of transactions that take place which in turn translates to an increase in the
amount of fees collected from these transactions. An investment in this technology based financial innovation is therefore critical.

An investment in mobile and online banking platforms is also highly recommended by this study. The usage of these alternative banking platforms has been increasing over the years as indicated by a steady increase in the amount of income generated from them. This study found that an increase in this income has a statistically and significant effect on non-interest income earned, making an investment towards it critical. Mobile and online banking services appeal most to the youthful population who form a major demographic that banks are targeting. This population is on the move, technologically empowered and rely on hand held devices and internet to run their lives.

Finally, the study also found a significant positive effect on the amount of income earned from funds transfer systems such as RTGS and EFT. This therefore implies that an investment in this technology based financial innovation is highly recommended by the study as it would lead to a significant increase in non-interest income earned by commercial banks.

5.5 Limitations of the Study

Several limitations can be noted in this study. First, the findings of this study are only limited to the data collected between the years 2006 and 2016. Although this meant that the study provided the most recent trends as far as the relationship between non-interest Income and technology based financial innovation is concerned, this is a limitation to those who would be interested in results from a longer time period.
Secondly, this study was based on secondary data sourced from Central Bank of Kenya, which collates the information from all banks. However, specific data like number of transactions, deposits or fees charged by every commercial bank would have been more helpful in analyzing the level of adoption of the technology based innovations across different banks. Moreover, primary data sourced from key stakeholders in the industry through techniques like in depth interviews would have gone a long way in qualifying the quantitative secondary data collected.

The study also considered only four technology based financial innovations in its analysis. It is important to note that there are other sources of non-interest income that are technology based and have just been incorporated by commercial banks such as funds collecting devices for example mobile VISA, Pesa Link and dedicated applications for diaspora banking. Funds collected from their use also forms part of non-interest income not considered by this study.

5.6 Area for Further Research

The study recommends future studies to consider a different time frame for purposes of comparing results. Studies can therefore be framed using the same topic but covering more than 10 years. This will provide the researcher more data points that can further test the accuracy of the regression model used.

Further, this study focused on secondary data from the Central Bank of Kenya. Future studies can incorporate primary data sourced from interviewing different stakeholders from the commercial banks, Kenya Bankers Association and the Central Bank in order to qualify the quantitative data collected. Primary data would provide more insight into
bank specific challenges or opportunities that are hindering or driving the current level of adoption of technology and the subsequent use of technology based financial innovations.

Lastly, this study concentrated on the overall technology based innovations like mobile banking and internet banking. Further studies can go further to look at the individual components of each of these innovations like use of mobile apps, Pesa Link and diaspora banking in order to arrive at more specific effects of these products on the non interest income of commercial banks in Kenya.
REFERENCES


APPENDICES

APPENDIX I: LIST OF COMMERCIAL BANKS IN KENYA

1. ABC Bank (Kenya)
2. Bank of Africa
3. Bank of Baroda
4. Bank of India
5. Barclays Bank of Kenya
6. Chase Bank Kenya (In Receivership)
7. Citibank
8. Commercial Bank of Africa
9. Consolidated Bank of Kenya
10. Cooperative Bank of Kenya
11. Credit Bank
12. Development Bank of Kenya
13. Diamond Trust Bank
14. Dubai Islamic Bank
15. Ecobank Kenya
16. Equity Bank
17. Family Bank
18. First Community Bank
19. Giro Commercial Bank
20. Guaranty Trust Bank Kenya
21. Guardian Bank
22. Gulf African Bank
23. Habib Bank AG Zurich
24. Housing Finance Company of Kenya
25. I&M Bank
26. Imperial Bank Kenya (In receivership)
27. Jamii Bora Bank
28. KCB Bank
29. Mayfair Bank
30. Middle East Bank Kenya
32. NIC Bank
33. Oriental Commercial Bank
34. Paramount Universal Bank
35. Prime Bank (Kenya)
36. SBM Bank Kenya Limited
37. Sidian Bank
38. Spire Bank
39. Stanbic Bank Kenya
40. Standard Chartered Kenya
41. Trans National Bank Kenya
42. United Bank for Africa
43. Victoria Commercial Bank

Source: CBK (2016)
APPENDIX II: DATA COLLECTION FORM

Non-Interest Income from Technology Based Innovations

(Figures in Millions of Kenya Shillings)

<table>
<thead>
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<th>Year</th>
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<th>Mobile Banking</th>
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Source: (Adapted from CBK, 2016)