

**EFFECT OF FINANCIAL INNOVATION ON THE FINANCIAL  
PERFORMANCE OF COMMERCIAL BANKS IN KENYA**

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**D61/87237/2016**

**A RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE  
REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF  
BUSINESS ADMINISTRATION, SCHOOL OF BUSINESS,  
UNIVERSITY OF NAIROBI**

**2018**

**DECLARATION**

I declare that this research project is my own work and it has not been submitted for any degree or examination in any other university.

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This research project has been submitted for examination with my approval as the University Supervisor.

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## **DEDICATION**

This research is dedicated to my spouse Sospeter and my daughter Triana for their love, backing and inspiration throughout the entire period of the course. Additional dedication goes to my parents for their sacrifice in educating me and for coaching me the discipline and importance of hard work from a tender age.

## **ACKNOWLEDGEMENTS**

The undertaking and completion of this research work was made possible by a number of people, to whom I am profoundly grateful. I am particularly indebted to my supervisor Dr. Lishenga for his guidance and encouragement in the course of the research. Appreciation goes to the lecturers of the School of Business of the University of Nairobi, who faithfully imparted their knowledge and skills throughout the course.

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## **ABBREVIATIONS AND ACRONYMS**

NSE Nairobi Securities Exchange

ROA Return on Assets

CBK Central Bank of Kenya

ATM Automated Teller Machine

R&D Research and Development

CDS Central Depository System

## ABSTRACT

This study aimed to examine the influence of financial innovations on the financial performance of commercial banks in Kenya. This research used descriptive design since helped in the description of the phenomena under study. The study population encompassed the 43 registered Kenyan commercial banks CBK (2016). This research relied on the secondary data sourced from the printed financial reports in the websites of the commercial banks because the secondary data is readily available. Secondary data was collected, coded and tabulated according to each dependent and independent variable and analyzed using the descriptive statistics in terms of the mean values. For the appropriateness of data for the key assumptions of classical linear regression model the following diagnostic test was carried out; Kurtosis as well as Skewness of the distribution of data was used to test for normality, multicollinearity was established by variance inflation factor and correlation coefficient, heteroscedasticity was measured by the weighted generalized least square to establish the relationship. An F- test at 5% significance level was done to determine how strong the model is, and the influence of financial innovation on the financial performance of commercial banks. The objective of the research aimed at establishing the influence of financial innovation on the financial performance in Kenyan Commercial Banks. The section was important to understand how the Kenyan Commercial Banks performed due to changes in their financial innovation. The study evaluated the impact of changes in intangible asset ratios and financial expenditure on research and development as an indicator of financial innovation with organizational size being the control variable and correlated the changes with the changes on ROA. The analysis on the aggregate summary the average intangible asset ratio, return on assets, and R&D ratio with the organizational size measured in terms of log of total assets being the control variable for the Commercial Banks in Kenya for the 10-year period. The research was a comparative study that compares the performance of the Kenyan Commercial Banks and financial innovation. A trend analysis of the growth rate of financial performance indicators was undertaken to establish the change in financial performance and correlated with the changes in Research and Development and growth in intangible assets for Commercial Banks in Kenya. The variables measured included changes Intangible asset ratio, total changes in ROA, changes in Research and Development ratio and change in size of individual organization for Commercial Banks in Kenya. A comparison of the mean and annual growth rates financial performance in comparison with Research and Development ratio for appropriate was undertaken to determine the change in financial performance. The study findings indicate that because of the improvement in financial innovation; financial performance of the Kenyan Commercial Banks have improved. Chi-square test was employed to establish the degree and nature of link between independent variable and the dependent variable. The chi-square test and the regression suggested that the variables in the model are key in establishing the financial performance of Kenyan Commercial Banks. The results indicate that improvement in financial innovation positively enhances finance performance therefore, we conclude that an improvement in financial innovation enhances the financial performance of Kenyan Commercial Banks.

## **CHAPTER ONE: INTRODUCTION**

### **1.1 Background of the Study**

Bhattacharyya and Nanda (2000) describes financial innovation as a result of unanticipated variation in customer requirements as well as preferences, tax regime, regulatory impulses and technology which results to the unexpected development in the formation of financial products and instruments. Commercial banks globally are faced with risks and they include credits risks, interest rate risks and exchange rate risks and this has necessitated the need for commercial banks to explore alternative ways to mitigate these risks and innovation is among the major means of coping with risks faced by commercial banks. The ideal behind financial innovation is the minimization of the costs of transactions by the commercial banks and also to remain competitive in the business environment since the customers are informed lot in the market because of the availability of the information.

The theories related to innovation include; innovation diffusion theory (Rogers, 2001) and according to this theory, new skills and concepts are recognized, they spread into the external environment, social cognitive theory (Davis and Luthans, 1981) which concluded that every individual can be innovative if given a chance to interact with the external environment, resource based theory (Penrose, 1959) which states that innovation is achieved by the bundle of resources owned by the business entity and transaction cost innovation theory (Hicks, 1982) which concluded that innovation by any business entity is aimed at reducing the costs of transactions because it ensures that the information is

quickly absorbed by different kinds of players in the sector and this is evident in the security prices of any business organization in particular commercial banks.

In china, Yin and Zhengzheng (2010) concluded that financial innovation specifically technological innovation has resulted to a significant change in the manner in which the banking business is undertaken evidenced by Chinese banks move from the conventional business process approach and the general credit processes to retail model. In India, according to Pooja and Singh (2009) internet banks were bigger, with enhanced profitability, had a higher quality of asset, reduced administrative expense and had enhanced efficiency relative to non- internet banks. E- Banking led to better long –term cost saving strategies as well as more satisfied customers (Siam 2006).

### **1.1.1 Financial Innovation**

Financial innovation refers to new products development or improvement of the existing products. It also involves the adoption of new processes and services by business entities (Beaney, 2005). Expansion into new market territories, making more strategic decisions and restructuring the management team are some of the main activities that prove financial innovation has indeed taken place. Examples of financial innovation include; product-based innovations, process-based innovations and institutional based innovations.

Institutional innovation involves the modernization of the financial systems. From the traditional financial systems owing to stiff competition in the commercial sector, there is

the need for modern financial systems to speed up the work and this is achieved through the increase in the volume of transactions performed one major example of institutional innovation is the agency banking which has been adopted by many commercial banks in Kenya. Bank agents are composed of outlets and are controlled by mobile networks which aid to process the transactions of the customers. Bank agents are tasked with ensuring the customer transactions are executed on behalf of the banks.

Process innovations focuses on the introduction of business processes incurred by a business organization and are aimed at efficient resources utilization and expansion of markets to gain competitive advantage. Many commercial banks have adopted office automation which is aimed at elimination of duplication of duties by the banking staff and this greatly improves the output by the commercial banks also in this category include E-banking which is mainly performed by the ATMs and mobile phones. This has enabled fast and convenient access to banking services in the industry at low cost.

Product innovations have been launched by many commercial banks in Kenya for example Mshwari and M-Pesa. The idea behind the introduction of these services is to cover wider geographical area and to gain competitive advantage because of the need to change the business operations to cope with ever changing business processes. Mshwari was the idea of commercial bank of Africa and Safaricom Limited and in this platform, customers are able to save and borrow when they need funds. Mobile banking is also a key in the provision of basic banking transactions for example customers are able to

deposit money into their various accounts by the help of the mobile phones and also withdrawals from their accounts.

In this study, we used intangible assets ratio and expenditure on Research and Development ratio as a measure of financial innovation. Intangible assets are those assets on the statement of financial position, which cannot be seen or touched. These consist of patents, trademarks, know-how and goodwill. Intangible asset ratio is measured by dividing intangible assets by total assets. Research and development (R&D) refer to actions geared towards introduction, innovation, and improvement of products and process. R&D ratio is given through dividing R&D expenditure by total expenditure. Bank Size will be the control variable measured as the log total asset.

### **1.1.2 Financial Performance**

Any business entity is in the world of business to prosper to greater heights. Prosperity of any entity normally relates to its performance in monetary terms. Business entities can gauge the survival of the businesses by analyzing their overall output in monetary terms to determine how they have effectively and efficiently employed their resources to maximize the returns for the shareholders. For the business entities to know their worth in terms of growth they can employ either modern performance measures or traditional measures to measure the performance by employing comparative methodologies or historical measures to ensure the returns for the stakeholders are maximized. Therefore, the financial performance can be assessed through the efficiency, effectiveness and adaptability (Elly, 2012).

The financial performance measures the companies' operation policies in monetary regards. The outcomes are shown in the companies' profitability ratios, liquidity ratios and gearing measures. Majority of business entities have always used profit as the basis for business prosperity. However, the real determinant of business growth is how efficiently the business entities have been in the employment of the capital in the business. Due to the shortcomings in the traditional approaches, the experts in the finance field devised the profitability ratios to measure the financial performance (Wood, 1998).

### **1.1.3 Financial Innovations and Financial Performance**

Financial innovation is a key in financial institutions performance. Commercial banks are adopting them to achieve a competitive advantage above peers in the fierce market. Some are going ahead and copying the financial innovations in the industry to remain relevant in the customer markets. Generally, financial innovations are contributing greatly to financial performance of commercial banks translating to good margins, high profits and tremendous positive growth of the commercial banks. Further, Financial innovation has led to greater efficiency and diversification of financial services and this has led to increased productivity, and general advancement in the banking industry and the economy at large. Due to financial innovation, convenience is achieved since the commercial bank customers are able to access the services any time for example they can bank their monies, ATM transactions is also performed easily and in the process the profits of commercial banks increase as a result of increased sales.



According to the transaction cost innovation theory (Hicks, 1982), innovation is aimed at reducing transaction costs which will translate to improved financial performance. Costs are reduced because it ensures that the information is quickly absorbed by different kinds of players in the sector and this is evident in the security prices of any business organization in particular commercial banks. One of the major financial innovations is the derivatives market which is aimed at reducing risks by the commercial banks. When commercial banks trade in derivatives, transaction costs and agency costs are reduced and thus the financial health is achieved.

#### **1.1.4 Commercial Banks in Kenya**

As indicated by CBK (2016) the aggregate number of registered Kenyan commercial banks is 43. The Central Bank of Kenya has the key regulation mandate. They are governed by the CBK Act, the Company's Act and the Banking Act in Kenya. Their operations are checked by the CBK. According to the CBK (2016) the banking industry revealed resilience in its national as well as regional ventures, with the sector's aggregate assets base increasing by about 5.8 percent to from Kshs 3.5 trillion in 2015 to Kshs 3.7 trillion. The sectors equity base also grew by 10.5 percent to Kshs 598 billion in 2016 from Kshs 541 billion in 2015. The sector worked with CBK to enhance and clarify regulatory guidance on key areas among them including integrity of ICT systems, disclosure, governance and improved asset quality.

Majority of commercial banks in Kenya have adopted financial innovations which are to enable them to gain competitive advantage. Financial innovation has greatly reduced the

operational costs of commercial banks in Kenya and has attracted new customers thus the market share of the commercial banks which have embraced innovation has greatly improved.

## **1.2 Research Problem**

Financial innovation is of a great concern for many commercial banks globally. It is a strategic tool adopted by majority of commercial banks to rebuild the financial systems in the world which had failed. The adoption of financial innovation by commercial banks has been evidenced as a main factor to remain competitive. The adoption and implementation of financial innovations by commercial banks are on the rise and the number stands at over in 1M according to latest survey on the adoption of technology by commercial banks in the world.

Financial innovations in the banking industry have played a key role especially in Kenyan banking industry. Due to adverse effects of strict regulations of the commercial banks by the regulatory authority, there was need to look for ways by commercial banks to operate effectively without any restrictions hence the need for new products, services and processes to deal with the strict regulations to satisfy the customer needs.

Acharya (2011) in his research explored the influence of financial innovation on the financial performance of microfinance institutions in India between 2001 and 2009. The study focused on 112 microfinance corporations in India and secondary data was used to analyze financial innovations and financial performance. In the analysis of the study,

descriptive statistics was used. According to the study findings, financial innovations played a significant part in the profitability of the microfinance institutions in India. The institutions which adopted the financial innovations posted higher profits compared to the institutions which had not adopted financial innovations. He concluded that financial innovation improved the financial performance of Indian microfinance organizations.

Kanyi (2015) did a study to explore the impact of financial innovations on the financial performance of Kenyan financial corporations from 2009 to 2014. The study population was 150 financial establishments. Sample of the study was 15 financial institutions. The findings of the study were that the financial institutions which had adopted innovations performed poorly. One contributing factor to this dismal performance was high default rates as a result of mobile transactions. According to him, innovations had a negative influence on the financial performance of financial corporations.

Earlier researches on financial innovations presented varied opinions about the actual influence of financial innovations on the financial performance of commercial banks. According to some studies, those banks which adopted financial innovations their financial performance greatly improved. However, some studies have sharply defined and have argued that financial innovations were insignificant with regards to the financial performance of commercial banks. However, in most of the researches the sample Intangible asset ratio was limited, or the variables are correlated. Therefore, this study attempts to answer this research question: what is the effect of financial innovation on the financial performance of Kenyan commercial banks?

### **1.3 Research Objective**

The aim of this research is to investigate the effect of financial innovations on the financial performance of commercial banks in Kenya.

### **1.4 Value of the Study**

This research will add to the developing literature in the academic research by acting as empirical reference on financial innovation studies for academic scholars who are interested in researching on financial innovations. The scholars will add to the growing empirical literature on financial innovations. It will act as the source of literature.

The study was significant to banking sector on the need of being innovative since financial innovation is an essential aspect in determining the effectiveness of a number of financial institutions.

It will act as a basis for making investment decisions by investors. Investors will always want to invest in the commercial banks which are more innovative since they are capable of maximizing the wealth of the shareholders.

## **CHAPTER TWO: LITERATURE REVIEW**

### **2.1 Introduction**

This section covers the highlights on the theoretical and empirical reviews related to financial innovations, determining factors of commercial banks financial performance, conceptual framework as well as summary of literature review.

### **2.2 Theoretical Review**

The concepts related to financial innovations include, the transaction cost innovation theory (Hicks, 1982), Social cognitive theory (Davis and Luthans, 1981) and innovation diffusion theory (Rogers, 2001).

#### **2.2.1 Innovation Diffusion Theory**

Innovation entails creating new technologies. The changes in technology has forced changes in the business environment in terms of the operations to counter stiff competition hence innovation is required to remain competitive. According to innovation diffusion theory, new skills and concepts once recognized, they spread into the external environment and the society at large (Rogers, 2001). Innovation is for strategic decisions for many business entities to gain competitive advantage and can also be for personal benefits. The adoption of innovation is influenced by how technology is and its compatibility with the business operations and the advantages from the adopted technology. Business entities can either adopt a new technology or it can be adopted in the second time after being adopted by the earlier business organizations.

Innovation has greatly affected business organizations in the positive way. Since it lowers the transaction costs business entities incur especially in processing the financial transactions. The minimization of transaction costs will ensure the gain from the newest products and services created by the financial institutions. There will also be easy and accessibility of information for various business entities so that informed decisions are made. Due to stiff competition in the financial sector, different players have been forced to be innovative by coming up with new products, ideas and services to gain competitive advantage. However, Kim (2010) argued that technology is adopted by managers who have their own selfish interest.

### **2.2.2 Social Cognitive Theory**

According to social cognitive theory, every individual can be innovative if offered a chance to freely interact with the external environment. This is based on the fact that the way human beings behave is key in any business environment. Therefore, the management of any business organization has a duty in recognizing and promoting any entrepreneurial skills which seem promising. By promoting the entrepreneurial skills, innovation is advanced. It is the duty of the management of the business entities to continually identify the factors which has capabilities to transform entrepreneurial activities due to the competitiveness of the current business environment hence the need for innovation.

The theory of social cognitive puts more emphasis on the importance of external environment due to its effect on human behavior because it influences innovation it

emphasis. Intangible asset ratios on the significance of the development of human skills which is determined by the behavior of human beings and factors in the environment. The external environment determines the behaviors, and actions of individuals. According to this theory, individuals have the capacities to change the environment and become innovative only if they are supported and recognized. Commercial banks have a duty to provide requisite support to its staff in order to support creativity and innovativeness. Individuals should also take advantage of innovative skills they are endowed with in order to improve the performance.

### **2.2.3 Transaction Cost Innovation Theory**

In relation to this concept, innovation is meant to reduce the transaction costs incurred by the business entities (Hicks, 1982). This is evident when the CDs were introduced to replace the manual trading system since they reduce the transaction costs in the trading of securities. This also ensured safe custody of securities in electronic accounts. This ensured trade without a share certificate. Due to the improved services, the business entities are able to earn more profits and this is the core mandate of any business entity to ensure costs are minimized and profits are maximized.

### **2.3 Determinants of Financial Performance of Commercial Banks**

A determinant is a factor that decisively affects the nature or outcome of something Frank (1989). Financial performance aims at assessing how well companies can prudently utilize their assets to maximize on the profits within a given period of time. Financial

performance is determined by; asset quality, capital adequacy, management efficiency and bank Intangible asset ratio.

### **2.3.1 Asset Quality**

According to Myers (2005) assets are economic endowment by business entities and they provide the benefits in the future. The future cash flows are the resultant benefits which arise from the forecasted operations. On conversion of the asset into cash, positive future cash flows will rise. Commercial bank assets include its current assets, fixed assets, long-term investments loans which comprise short term and long-term loans. Loans are important assets of commercial banks because they have a connection with their financial performance. Prudent management of loans will positively impact the financial performance in terms of the profitability by ensuring lower default rates. The lower the default rate, the higher the financial performance.

### **2.3.2 Capital Adequacy**

Capital is what the owners of a business entity can claim (Wood, 1988). This is the total amount individuals put into banks to support them during the times of financial crisis. Enough capital in the banks will prevent the banks from financial distress. According to Altman, (1954) financial distress begins when the firm is not able to meet schedule of payments or when cash flow projection indicate that it will soon collapse. The firm is unable to pay its debt. Due to the rise of the Kenyan commercial banks going under receivership, the CBK which is the regulator, has set a minimum capital required for the banks to operate in so that during the financial crisis the depositors are protected against



the loss of their money. Capital adequacy evaluates how strong the commercial banks are internally. If the capital adequacy is high, the financial performance is high and vice versa.

### **2.3.3 Management Efficiency**

According to Johnson (2005), management efficiency signifies a situation where by the resources are prudently applied to maximize the output levels. management efficiency aims at the reduction of the use of available resources by maximizing the returns for example stock waste to improve efficiency and sharing of duties for example chief executive officer can equally act as the managing director. Operational efficiency deals with the management of the operating expenses.

The management should ensure resources are deployed efficiently, operating costs are minimized, and profit is maximized. Management efficiency is measured by proxy Management ratio calculated by dividing the operating expenses with the total assets of an entity. The higher the proxy management ratio the greater the financial performance, management efficiency therefore improves the financial performance of the commercial banks.

### **2.3.4 Bank Intangible asset ratio**

Commercial banks normally depend on Interest income as the key source of the income and are majorly from the loans advanced. The loan book will also determine the financial performance of the commercial banks. It is the responsibility of the banks to control the

deposits since they have ultimate effect on the banks performance. Banks should ensure cost effective strategies are put in place since they translate to improved performance. When banks are large in Intangible asset ratio, they are advantageous since they can access large amounts of deposits unlike smaller banks hence good financial performance (Myers, 2005).

## **2.4 Empirical Review**

An analysis of empirical literature reveals conflicting outcome about the result of mobile lending on the financial performance of the firms concerned. According to the early empirical literature, mobile lending impacted positively on the financial performance. However, other empirical works concluded that there was no significant change in the firm's financial performance as an effect of the introduction of the mobile lending.

Gitau (2013) did a research to explore the impact of financial innovation on the financial performance of Kenyan commercial banks from 2006 to 2011. A total of 30 commercial banks were considered for the study. However, 12 commercial banks were used a study sample. The study utilized secondary data available from the commercial banks' websites. The study majorly focused on the process innovation component. While financial performance was measured by return on equity. The study also employed a linear regression model in the analysis. The study concluded that, financial innovation improved the financial performance of the commercial banks.

Sewing et al (2014) investigated the link between innovation and financial performance of small as well as medium Intangible asset ratio entities in China. The period of the research was between 2009 and 2013. The study employed secondary data as well as primary data for the 159 small and medium enterprises. The study employed the multiple linear regressions in the analysis. Financial performance was measured by return on investment and innovation was measured by the number of mobile money transfer services. From their study, they concluded that innovation was insignificant on the financial performance of the SMEs.

Nyathira (2015) carried out a study to examine the impact of innovations on the profitability of Kenyan commercial banks between 2005 and 2013. A study sample of 24 commercial banks was taken. Secondary data picked from the Nairobi Securities Exchange was relied on for the analysis. To analyze the degree of the correlation between the innovation and the financial performance from the research findings linear regression model was used. Commercial banks which had adopted innovations performed better.

Momanyi (2017) innovations positively impacted the financial performance of Kenyan commercial banks following a survey on innovations and their effect on the financial performance from 2010 to 2016. He used a total of 58 Kenyan commercial banks and the sample of the research was 10 registered Kenyan commercial banks. Secondary data was collected from the NSE for analysis by employing multiple linear regression model which was to test for the relationships of innovations and financial performance. He argued that,

for commercial banks to remain competitive, they must continue to be creative and innovative.

Keru (2014) did a study to examine the influence of financial innovation on the financial performance of Kenyan commercial banks between 2007 and 2013. The study was centered on the effect of mobile banking on the profitability of the commercial bank group. He measured the financial innovation by the number of mobile phone transactions and financial performance by the profit margin. The findings were that mobile banking had no substantial influence on the financial performance of commercial banks.

Momanyi (2015) did a research on the impact of innovations on the risk management of commercial banks in Nairobi County. A sample of 16 commercial banks in Nairobi County from 2009 to 2013 was used. Secondary data collected from the companies' websites was used. The research also applied a simple linear regression model in the study. The findings were that innovations like mobile lending has led to exposing commercial banks to risks such as credit risks where customers end up defaulting on repayment of mobile loans. He concluded that innovation had a negative impact on the financial performance of the commercial banks.

Mabrouk (2011) did a study on the influence of financial innovation on the profitability of banks in Pakistan in the context of Iraj Commercial Bank. The study majorly looked into the effect of the effect of the automated teller machine on the performance of commercial banks and mobile money services. The study measured the financial

performance by ROA and financial innovation through the amount automated teller machines and the number of mobile phone transactions. He concluded that financial innovations improved the financial performance.

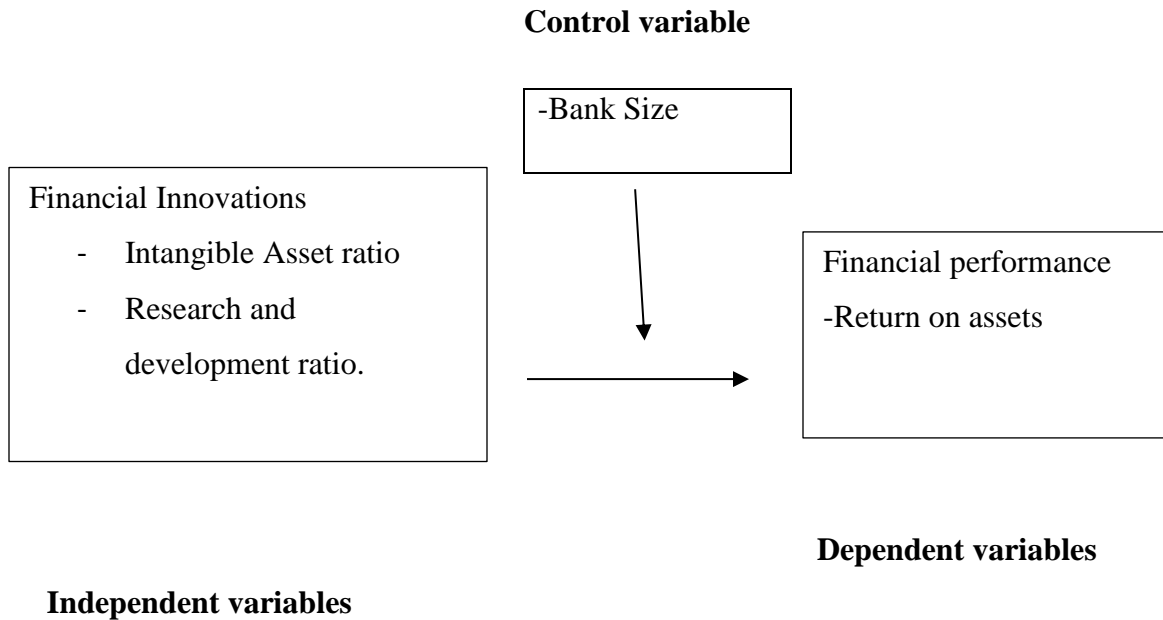
Study to explore the effect of financial innovation on the financial performance of commercial banks in Pakistan from 1999 to 2009. This was a 10-year study period which targeted 300 commercial banks in Pakistan. However, the researcher selected 93 commercial banks for the study. Secondary data from the published financial reports was used in the study by computing the return on the investment in determining the financial performance. The research similarly used the linear regression model in the analysis. They ascertained that financial innovation subjected the commercial banks to liquidity risks which in turn negatively affected their financial performance.

Ofoegbu (2010) did a study to explore the impact of product innovation which focused on the telephone banking on the financial performance of Nigerian commercial banks from 2000 to 2008 for the 210 commercial banks in Nigeria. The sample for the study was 83 commercial banks in Nigeria. Secondary data was obtained to measure the relationship of the variables under research. The study used linear regression model. The finding showed that the profits of the commercial banks increased after the adoption of mobile banking. The banks suffered high default rates which negatively affected the financial performance. He concluded that productive innovation had a negative impact on the financial performance.

Acharya (2011) conducted a research to ascertain the influence of financial innovation on the financial performance of microfinance corporations in India between 2001 and 2009. The study focused on 112 microfinance institutions in India and secondary data was used to analyze financial innovations and financial performance. In the analysis of the study, descriptive statistics was used. According to the study findings, financial innovations played a significant part in the profitability of the microfinance institutions in India. The institutions which adopted the financial innovations posted higher profits compared to the institutions which had not adopted financial innovations. He concluded that financial innovation improved the financial performance of the microfinance corporations in India.

From the findings of the studies, researchers come up with different results on the influence of financial innovations on the financial performance among different business entities. Some studies concluded that financial innovations indeed improved the financial performance of the entities involved in this strategy. Some studies however, proved that financial innovation was insignificant on the financial performance. Therefore, this research is undertaken to unearth the truth on the impact of financial innovations on the financial performance of the business entities.

## 2.5 Conceptual Framework



**Figure 2.1: Conceptual Framework**

## 2.6 Summary of Literature Review

The literature review includes the theories highlighted and they include, innovation diffusion theory (Rogers, 2001), social cognitive theory (Davis and Luthans, 1981) and transaction cost innovation theory (Hicks, 1982). Determinants of financial performance of commercial banks were discussed as well and they include, corporate governance, macroeconomic factors, liquidity, management efficiency and capital adequacy, empirical review which include Gitau (2013), Sewang et al. (2014), Nyathira (2015), Keru (2014), Momanyi (2015), Mabrouk (2011), Mahamood and Malik (2011), Ofoegbu (2010) and Acharya (2011) and the conceptual framework. From the literature reviewed, the sample Intangible asset ratio used in some research was too small; the period of study was short and some research lack the analytical model. This study will therefore aim to

address those research gaps on the effect of financial innovations on the financial performance of Kenyan commercial banks



## **CHAPTER THREE: RESEARCH METHODOLOGY**

### **3.1 Introduction**

This part looks at the research methodology employed in carrying out the research. They include the research design, population, sample, data collection, validity and data analysis.

### **3.2 Research Design**

Research design entails the methods used to conduct the research. This study utilized the descriptive design since helped in the description of the phenomena under study. To gather information about the present state of affairs of the phenomenon with regards to state of affairs in a situation this design type is highly applicable. It is also applicable in the relationship research which evaluates the link between variables. This research design summarizes the various variables under the study.

### **3.3 Population**

A population entails a collection of items to be investigated Mugenda (2005). The population of this research entailed the 43 registered Kenyan commercial banks (CBK, 2016).

### **3.4 Data Collection**

This study utilized the secondary data sourced from the printed financial reports in the websites of the commercial banks because the secondary data is readily available.

### 3.5 Data Analysis

Mugenda (2005) defined data analysis as the process that entails bringing order as well as meaning to the gathered information. Secondary data was collected, coded and tabulated according to each dependent and independent variable and analyzed using the descriptive statistics in terms of the mean values.

Multiple linear regression model was used;

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \mu$$

Where:

Y = Financial performance of commercial banks, determined by the ROA, calculated through dividing net profits by total assets.

$\beta_0$  = Free term of the equation. It refers to the value of dependent variable when all other independent variables are zero (0).

$\beta_1, \beta_2$  = Coefficients of independent variables and they measure the responsiveness of Y to unit change in variable x.

X1 = Intangible asset ratio, measured by dividing intangible assets by total assets

X2 = Research and Development ratio, measured by dividing R&D expenditure by total expenditure.

X3 = Bank size, measured as log total asset

$\mu$  = Error term

### **3.6 Diagnostic Tests**

For the data to be consistent with the basic assumptions of classical linear regression model the following diagnostic test was carried out; Kurtosis and Skewness of the distribution of data was used to test for normality, multicollinearity was tested by variance inflation factor and correlation coefficient, heteroscedasticity was measured by the weighted generalized least square to establish the relationship.

### **3.7 Test of Significance**

An F- test at 5% significance level was performed to determine how strong the model is, and the influence of financial innovation on the financial performance of commercial banks.

## **CHAPTER FOUR: DATA ANALYSIS, RESULTS AND DISCUSSION**

### **4.1 Introduction**

This part provides how the data gathered is analyzed and also provides an interpretation of such analytical outcomes and turns the findings into useful research information that can be used to make informed business decisions. The analytical process has been guided by the research methodology outlined in chapter three. The research data was gathered exclusively through secondary data.

### **4.2 Descriptive Statistics**

The study aimed at assessing the influence of financial innovation on the financial performance of Kenyan Commercial Banks. A summary statistic of the research variables was generated from the data analysis focusing on the financial performance indicators for the period of 10 years. The section was important since it enabled correlation analysis to be undertaken so as to understand how the Commercial Banks in Kenya performed as a result of financial innovation. The analysis is the aggregate summary the average intangible asset ratio, return on assets, Research and Development ratio with the organizational size measured in terms of natural log of total assets being the control variable for Kenyan Commercial Banks for the period of 10 years. This is important because this study was a comparative study that compares the performance of the Kenyan Commercial Banks with financial innovation measured in terms of growth in intangible asset ratio and expenditure in R&D.

The section was important to understand how the Kenyan Commercial Banks performed owing to financial innovation. The analysis is the aggregate summary the average intangible asset ratio, return on assets, Research and Development ratio with the organizational size measured in terms of log of total assets for Kenyan Commercial Banks for the 10-year period. This is important because this study was a comparative study that compares the performance of the Kenyan Commercial Banks with financial innovation.

**Table 4.1 Kenya’s Banking Industry Summary Statistics**

	Intangible asset ratio	Size (Log of Total Assets)	Return on Assets	Research and Development ratio
Mean	0.055	26.244	0.035	0.07
Standard Deviation	0.0076	0.063	0.018	0.034
Kurtosis	0.13	0.13	-0.31	0.09
Skewness	-0.44	0.93	-0.84	-1.72
Range	0.061	1.55	0.079	0.104
Minimum	0.026	25.32	-0.0134	0.034
Maximum	0.087	26.87	0.0656	0.138
Count	400	400	400	400

The findings indicate that the average annual intangible asset ratio measured in terms of ratio of intangible asset to total assets for the Kenyan Commercial Banks for the period of 10 years was 5.5% and a standard deviation of 0.0076, while the average annual return on assets for Kenyan Commercial Banks for the 10-year period was 3.5% with a standard deviation of 0.018. The average annual Research and Development ratio for Kenyan Commercial Banks for the 10-year period was 7% with a standard deviation of 0.034. The average annual size of individual organizations measured using the natural log of total assets for Kenyan Commercial Banks for the 10-year period was 26.44 with a standard deviation of 0.063 which is equal to an estimated average asset base of shs 240 billion held by each commercial bank

#### **4.2.1 Trend Analysis of Industry Averages**

A trend analysis of the growth rate of financial performance indicators was undertaken to establish the change in financial performance for Kenyan Commercial Banks.

**Table 4.2 The Banking industry Trend Analysis**

<b>Growth rate in ROA (Year)</b>	<b>Intangible asset ratio</b>	<b>Return on Assets</b>	<b>Organizational size</b>	<b>R&amp;D ratio</b>
1-2	2%	4%	2%	2%
2-3	5%	5%	2%	1%
3-4	3%	4%	1%	1%
4-5	6%	-1%	2%	1%
5-6	8%	2%	2%	4%
6-7	9%	2%	2%	3%
7-8	8%	2%	2%	2%
8-9	6%	0%	2%	2%
9-10	5%	2%	1%	1%
Mean rate	6%	2%	3%	2%

The findings indicate that the average annual growth rate in intangible asset ratio of the Commercial Banks in Kenya for the ten-year period increased by 6% annually while the average annual growth rate in ROA for the Commercial Banks in Kenya for the ten-year period increased by an average of 2% annually. The average annual growth rate in Research and Development ratio for the Kenyan Commercial Banks for the ten-year

period increased at an average rate of 2% annually and the annual growth rate of organizational size was 3% per annum

#### **4.3 Effect of Financial Innovation on Financial Performance**

To ascertain this chi-square test and a comparative analysis of the trends in financial performance for the 10-year period in comparison with the financial innovation measured in terms of Research and Development ratio. This was done using annual financial performance indicators of changes specifically measuring total changes in return on assets, in comparison to changes in financial innovation measured in terms of changes in Research and Development and intangible asset ratios with organizational size being the control variable measured as the log of total assets. For the assessment of the link between financial innovation and financial performance correlation analysis was undertaken. The independent variable (financial innovation) was correlated against the dependent variables' financial performance indicators. The findings and summarized and presented in the tables below.



**Table 4.3 Correlation Analysis**

	Research and Development ratio	Intangible assets	ROA	Organizational Size
R&D Ratio	1			
Intangible assets	0.099	1		
ROA	0.087	0.089	1	
Organizational Size	0.077	0.075	-0.023	1

Findings in table 4.2 above suggest that a strong positive link existed between financial performance and the financial innovation. This implies that an increase in the Research and Development ratio results in an almost proportional increase on ROA by Kenyan Commercial Banks. The findings indicate that a strong positive correlation of 0.099 existed between Research and Development ratio and Intangible assets, which implies that investment in R&D results in improvement in intangible asset ratio. The results suggest that a strong positive link of 0.087 existed between Research and Development ratio and ROA. This is because investment in R&D results in reduction of elimination of earning assets. There is also a strong positive correlation between research and development and organizational size as well as organizational size and intangible assets.

#### **4.3.1 Chi-square Test**

The study established the link between financial innovation and financial performance of Kenyan Commercial Banks using chi-square. The Chi-Square test is usually used to

determine whether an association or a relationship between two study variables drawn from a sample is likely to reflect a real association between these two study variables in the population or if difference exists between the two variables. It thus tests the probability (p-value) that the seen link between the two variables has happened by chance, i.e. as a result of sampling error

**Table 4.4 Chi Square-Tests**

	<b>Value</b>	<b>Df</b>	<b>Asymp. Sig. (2-sided)</b>
Pearson Chi-Square	27.926a	21	0.041
Likelihood Ratio	25.463	21	0.042
N of Valid Cases	400		

According to the findings in the above table, the significance figure was 0.041, which shows that there was a statistically significant the impact of financial innovation on financial performance of Kenyan Commercial Banks. This is because the significance figure was less than 0.05 ( $p \leq 0.05$ ).

#### **4.4 Regression Analysis**

A regression model was employed to measure the influence of financial innovation on the performance of Commercial Banks in Kenya. The dependent variable is financial performance of the Kenyan Commercial Banks whereas the independent variable is

financial innovation. The analytical model was utilized for the analysis of the effect of the dependent as well as independent variables is:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon$$

Where

$Y$  = financial performance (ROA)

$X_1$  = Intangible asset ratio (Intangible assets/Total Assets)

$X_2$  = Research and Development ratio

$X_3$  = Organization size measured as the log of total assets

$\alpha$  = Constant

$\varepsilon$  = error term

The dependent variable is financial performance of the Commercial Banks in Kenya while the independent variables is financial innovation. Coefficient of determination describes the extent to which changes in the dependent variable are able to be explained by the change in the independent variables or the percentage of variation in the dependent variable that is explained by all the four independent variables. The research used statistical package for social sciences (SPSS V 21.0) to code, enter as well as evaluate the extents of the multiple regressions.

**Table 4.5: Model Summary**

**Relation between financial innovation and financial performance**

Model Summary

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*Regression Statistics*

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Multiple R	0.18
R Square	0.17
Adjusted R Square	0.165
Standard Error	0.09
Observations	400

---

The R-Squared is basically employed in assessing show fit. R-square is 1 less the proportion of lingering changeability. R-squared is a statistical assesses the closeness of data to the fitted line of regression. It is similarly called the coefficient of determination, or the coefficient of multiple determination for multiple regression. 16.5 % of the financial performance of the Kenyan Commercial Banks may possibly be attributed to the consolidated impact of the indicator elements.

**Table 4.6 Summary of One-Way ANOVA**

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**ANOVA**

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	<i>Df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	70	0.00089	0.000034	3.7879	0.041
Residual	330	0.00035	0.000032		
Total	400	0.00124			

---

The research utilized One-way ANOVA to establish the significance of the regression model from which 0.041 probability value was determined. This suggests that the regression link was highly substantial in calculating the manner in which financial innovation affect financial performance of Kenyan Commercial Banks. The F calculated at 5% level of significance was 3.7879. Because F determined is higher than the F critical it signifies that the whole model was substantial.

**Table 4.7 Regression Coefficients results**

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	0.523	0.107	5.817	0.04	0.397	0.837
Intangible assets	0.167	0.097	7.459	0.03	-0.27	0.117
R&D ratio	0.147	0.687	6.982	0.02	-1.56	1.257
Organization size	-0.0034	0.392	5.902	0.05	-1.67	2.37

The regression equation determined was;

$$Y = 0.523 + 0.167X^1 + 0.147X^2 - 0.0034X^3 + e$$

This regression equation has determined that with every other factor held constant (no of financial innovation) financial performance would be 0.523. The results presented similarly indicate that taking at zero every other independent variable, unit rise in Intangible assets would result in a rise in ROA by 0.167. A unit increase in Research and Development ratio would result in a rise in ROA by 0.147. A unit increase in organizational size would lead to reduction in organizational performance (ROA) by 0.0034. This therefore implies that increase in financial innovation enhances the financial performance of the Kenyan Commercial Banks and therefore we conclude that Improvement in financial innovation positively enhances the financial performance of Kenyan Commercial Banks.

#### **4.5 Interpretation of the Findings**

With regards to this regression model, the research determined that improvement in financial innovation enhances the financial Performance of Kenyan Commercial Banks. The studied independent variables describe a significant 9% of the improvement in financial performance of as denoted by adjusted  $R^2$  (0.165). Hence this implies that the independent variables contribute 16.5% of improvement in financial performance while other aspects as well as random variations not explored in this study contributes 83.5% of the financial performance.

This finding concur with a study by Momanyi (2017) which concluded innovations positively impacted the financial performance of Kenyan commercial banks following a survey on innovations and their effect on the financial performance from 2010 to 2016. He used a total of 58 Kenyan commercial banks and the sample of the research was 10 registered Kenyan commercial banks. Secondary data was collected from the NSE for analysis by employing multiple linear regression model which was to test for the relationships of innovations and financial performance. He argued that, for commercial banks to remain competitive, they must continue to be creative and innovative.

## **CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS**

### **5.1 Introduction**

This part gives a summary, conclusions, and recommendations of the research. The section summarizes the major findings; it draws the conclusions and notes the recommendations from the findings of the study. It further outlines the limitations of the research and gives references for others studies.

### **5.2 Summary of the Findings**

The study aimed at establishing the impact of financial innovation on the financial performance in Kenyan Commercial Banks. The section was key to understanding how the Kenyan Commercial Banks performed due to changes in their financial innovation. The study evaluated in the impact of changes in intangible asset ratios and financial expenditure on R&D as an indicator of financial innovation, with organizational size measured as the log of total assets and correlated the changes in ROA. The analysis on the aggregate summary the average intangible asset ratio, return on assets, and Research and Development ratio for the Kenyan Commercial Banks for the 10-year period.

The study was a comparative study that compares the performance of the Kenyan Commercial Banks by way of financial innovation. A trend analysis of the growth rate of financial performance indicators was undertaken to establish the change in financial performance and correlated with the changes in Research and Development and growth



in intangible assets for Commercial Banks in ROA and changes in Research and Development ratio for Commercial Banks in Kenya with organizational size measured as the log of total assets.

A comparison of the mean and annual growth rates financial performance in comparison with Research and Development ratio for Kenyan Commercial Banks was undertaken to determine the change in financial performance. The study findings indicate that because of the improvement in financial innovation; financial performance of the Kenyan Commercial Banks have improved.

### **5.3 Conclusions**

Chi-square test was employed in evaluation of the degree and nature of association between independent variable and the dependent variable. The regression and the chi-square test implied that the variables under the model are key in establishing the financial performance of Kenyan Commercial Banks. The results indicate that improvement in financial innovation positively enhances finance performance therefore, we conclude that an improvement in financial innovation enhances the financial performance of Commercial Banks in Kenya.

#### **5.4 Recommendations of the Study**

This research found that financial innovation has a substantial influence on financial performance of Kenyan Commercial Banks. The research therefore suggests that organizations/commercial banks ought to ensure that they continually invest in research and development for purposes of seeking competitive advantages that result in efficiency, reduction of unearning assets and thus better asset utilization. This is because existing literature indicate. this implies that firms should seek to acquire strategic resources such as soft wares programmers and technologies that increase efficiency

This is because an organization's resource competences have a substantial effect on its performance. Technological resource disposal for an organization is an aspect that can enable an organization to survive turbulent economic environment. As such, an organization must partake innovative strategies that could enable it organize resources that could be exploited for the profitability of its operations (Lee, 2001). Only physical resources inadequate to make the most of profits (Greco, Cricelli and Grimaldi, 2013). A second form of resources, intangible assets, which comprise for instance information technology software and goodwill are critical for organizational success.

The banking sector is experiencing a quick as well as major changes because of the all-inescapable impact of Information Technology (IT) and amazing improvements in the innovation in areas of communications and information systems. such systems have fundamentally changed the conventional methods for banking and enabled banks to save

on resources and enhance efficiencies. Commercial banks should utilize the latest innovations to furnish their clients with better services that fit to their necessities. Management in Kenya banking industry is encountering change because of changes in customer needs, conduct, information, and aggressive development due to globalization, liberalization and other technological changes.

Subsequently it is necessary for banks to establish a principle of persistent customer relationship management, learning, client research as well as business innovation. Markets and client requests are evolving. Contenders exercises are changing as well and along these banks need to revolutionize their methodologies. This is the motivation behind why the banking sector needs to enable their frameworks become productive as well as compelling.

Managing banking is no more a business identified with just cash exchanges it is presently seen as business identified with data on budgetary exchanges. Advanced CRM programming has allowed eminence administration attainable as well as productive. CRM is additionally reforming the business sector. Through giving itemized client narratives, coordinated administration, and estimating data, these apparatuses enable the sales representative to be consultative and to include more an incentive than previously. Innovative adjustments are therefore necessary bank's data framework ventures and activities with its business methodology.

Within the banking industry, a number of banks carry out their operations by way of networks which allows fast transactions between banks, therefore clients are able to easily use services for instance credit and debit cards. Computers are not anymore used for efficiency in operations but to enhance customer services. Financial organizations depend on collecting, processing, evaluating, as well as giving out information with the aim of meeting customers' needs. As such banks ought to embrace an information processing technology that is automated. Services comprise: automated teller machines, tele-banking, smart cards home banking as well as internet banking among others.

Such services by financial institutions result in time saving, enhanced storage capacity, money saving, enhanced data accuracy, as well as safeguarding data security. Consumer e-banking should also be enhanced to enable provision of twenty-four hours banking services as well as enhanced productivity, convenient as well as swift banking, reduced cost banking, virtual banking among others. Transformation has been seen in the service delivery to clients as a result technological transformation.

### **5.5 Limitations of the Study**

Since it was a census survey research using secondary data; data collection was extremely tedious and time consuming. The time period for the conduction of the research was limited thereby an exhaustive and comprehensive research could not be conducted. The study, however, minimized these by conducting in-depth analysis that significantly covers the shortcomings of the study. Additionally, it was tedious gathering

data as well as evaluation since it was relatively raw. Also, data presentation in the various organizations was diverse thereby difficulty in computation.

It was difficult to access secondary data due to strict confidentiality exhibited by most organizations. The annual financial statements are also prepared under the fundamental assumptions and concepts which are subjective and therefore not be consistently applied particularly in terms of provisions and estimates. Lastly, majority of the financial statements are reaffirmed in the previous years hence misstatements of the material of the performance of the firm can lead to adjustment of the previous year's and this may not be revealed to the public. This means that the depicted pattern may have an effect on the correlation created.

#### **5.6 Recommended Areas of Further Research**

Other studies on the resources of competitive advantages for Commercial Banks in Kenya should be undertaken in order to establish management practices that lead to better organizational performance. Other studies on the effect of fiscal policy adjustments of on the performance of the Kenyan Commercial Banks. Given the turbulent nature of the business environment, for example technology, risks and uncertainties, it will be appropriate to mirror this research after a period of ten years and examine the influence of financial innovation on performance. The fact that this study limited itself to Commercial Banks in Kenya; I suggest that comparative study should be undertaken in

other sectors to assess whether there are any similarities or differences from the results of this study. These results will be useful in benchmarking with other sectors.

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## **APPENDICES**

### **APPENDIX I: LIST OF COMMERCIAL BANKS IN KENYA**

1. ABC Bank
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. Kenya Commercial Bank
29. Mayfair Bank
30. Middle East Bank Kenya
31. National Bank of Kenya
32. NIC Bank
33. Oriental Commercial Bank
34. Paramount Universal Bank
35. Prime Bank
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

**APPENDIX II: DATA TEMPLATE**

<b>Intangible asset ratio</b>	<b>Log of total assets</b>	<b>ROA</b>	<b>R&amp;D ratio</b>
0.087	27.071	0.045	0.080
0.087	27.071	0.045	0.072
0.087	27.071	0.045	0.069
0.045	26.521	0.045	0.083
0.045	26.521	0.045	0.080
0.049	33.767	0.045	0.071
0.049	33.767	0.045	0.069
0.049	33.767	0.045	0.067
0.073	30.085	0.045	0.082
0.039	29.128	0.045	0.078
0.087	29.128	0.045	0.074
0.039	29.128	0.045	0.073
0.073	30.085	0.045	0.073
0.073	30.085	0.045	0.072
0.039	29.128	0.045	0.069
0.088	30.324	0.044	0.077
0.044	26.019	0.044	0.066
0.044	26.019	0.044	0.063
0.044	26.019	0.044	0.045
0.086	30.802	0.044	0.075

0.072	18.175	0.044	0.066
0.072	18.175	0.044	0.065
0.048	24.823	0.043	0.079
0.084	30.802	0.043	0.076
0.085	30.085	0.043	0.076
0.042	33.481	0.043	0.071
0.048	24.823	0.043	0.063
0.084	30.085	0.043	0.075
0.087	21.762	0.043	0.080
0.080	30.324	0.043	0.079
0.087	21.762	0.043	0.076
0.049	23.628	0.043	0.071
0.087	21.762	0.043	0.066
0.049	23.628	0.043	0.066
0.087	21.762	0.043	0.066
0.049	23.628	0.043	0.040
0.039	28.889	0.042	0.092
0.087	27.215	0.042	0.082
0.041	28.411	0.042	0.081
0.087	16.190	0.042	0.080
0.087	27.215	0.042	0.077
0.087	27.215	0.042	0.074
0.041	28.411	0.042	0.073

0.041	28.411	0.042	0.069
0.039	28.889	0.042	0.067
0.087	16.190	0.042	0.065
0.041	29.128	0.042	0.062
0.087	16.190	0.042	0.041
0.039	28.889	0.042	0.040
0.043	28.889	0.042	0.074
0.074	32.261	0.042	0.068
0.074	32.261	0.042	0.066
0.074	32.261	0.042	0.062
0.041	28.698	0.042	0.072
0.041	28.698	0.042	0.071
0.041	28.698	0.042	0.068
0.089	26.737	0.042	0.079
0.044	27.215	0.042	0.072
0.045	26.497	0.041	0.076
0.045	26.497	0.041	0.072
0.045	26.497	0.041	0.072
0.044	23.436	0.041	0.082
0.044	23.436	0.041	0.074
0.044	23.436	0.041	0.069
0.044	24.823	0.041	0.077
0.047	28.506	0.041	0.070

0.047	28.506	0.041	0.069
0.047	28.506	0.041	0.067
0.044	24.823	0.041	0.066
0.047	28.506	0.041	0.064
0.048	23.628	0.041	0.064
0.044	24.823	0.041	0.062
0.048	23.628	0.041	0.060
0.047	28.506	0.041	0.056
0.048	23.628	0.041	0.034
0.078	24.010	0.041	0.086
0.064	24.010	0.041	0.075
0.078	24.010	0.041	0.071
0.078	24.010	0.041	0.066
0.064	24.010	0.041	0.066
0.087	24.010	0.041	0.065
0.042	28.889	0.041	0.089
0.042	28.889	0.041	0.076
0.042	28.889	0.041	0.072
0.042	28.889	0.041	0.071
0.042	28.889	0.041	0.066
0.046	28.171	0.041	0.066
0.074	17.936	0.040	0.077
0.074	17.936	0.040	0.069



0.074	17.936	0.040	0.056
0.044	26.497	0.040	0.083
0.042	25.541	0.040	0.080
0.044	26.497	0.040	0.077
0.044	26.497	0.040	0.077
0.044	26.497	0.040	0.072
0.042	25.541	0.040	0.070
0.049	24.584	0.040	0.070
0.049	24.584	0.040	0.070
0.042	25.541	0.040	0.065
0.072	26.210	0.040	0.080
0.072	26.210	0.040	0.080
0.086	24.823	0.040	0.078
0.086	24.823	0.040	0.078
0.086	24.823	0.040	0.064
0.072	26.210	0.040	0.033
0.041	30.396	0.040	0.072
0.041	30.396	0.040	0.069
0.041	30.396	0.040	0.063
0.048	25.063	0.040	0.085
0.046	25.541	0.040	0.080
0.085	26.976	0.040	0.080
0.047	24.823	0.040	0.080

0.045	25.063	0.040	0.080
0.088	24.584	0.040	0.078
0.047	26.976	0.040	0.078
0.044	24.106	0.040	0.078
0.047	24.823	0.040	0.078
0.088	24.584	0.040	0.077
0.048	25.063	0.040	0.075
0.046	25.541	0.040	0.072
0.044	24.106	0.040	0.072
0.044	24.345	0.040	0.072
0.043	26.019	0.040	0.071
0.044	24.106	0.040	0.071
0.046	25.541	0.040	0.070
0.047	26.976	0.040	0.069
0.047	26.976	0.040	0.068
0.043	26.019	0.040	0.066
0.045	25.063	0.040	0.066
0.046	25.541	0.040	0.066
0.088	24.584	0.040	0.066
0.044	24.345	0.040	0.066
0.047	26.976	0.040	0.065
0.048	25.063	0.040	0.065
0.047	24.823	0.040	0.065

0.085	26.976	0.040	0.063
0.047	26.976	0.040	0.055
0.043	26.019	0.040	0.053
0.044	24.345	0.040	0.050
0.045	25.063	0.040	0.033
0.085	26.976	0.040	0.032
0.044	26.880	0.039	0.083
0.044	26.880	0.039	0.079
0.044	26.880	0.039	0.072
0.041	29.391	0.039	0.080
0.068	27.071	0.039	0.079
0.068	27.071	0.039	0.077
0.049	18.653	0.039	0.077
0.041	29.391	0.039	0.077
0.041	29.391	0.039	0.069
0.049	18.653	0.039	0.069
0.049	18.653	0.039	0.068
0.068	27.071	0.039	0.066
0.072	18.175	0.039	0.064
0.089	26.258	0.039	0.092
0.087	28.506	0.039	0.087
0.049	24.584	0.039	0.083
0.049	24.584	0.039	0.079

0.087	28.506	0.039	0.078
0.046	24.345	0.039	0.077
0.089	26.258	0.039	0.072
0.046	24.345	0.039	0.070
0.088	28.650	0.039	0.069
0.046	24.345	0.039	0.069
0.089	26.258	0.039	0.068
0.047	26.497	0.039	0.065
0.087	28.506	0.039	0.063
0.089	26.258	0.039	0.047
0.048	23.628	0.039	0.083
0.049	23.628	0.039	0.080
0.049	23.628	0.039	0.076
0.049	23.628	0.039	0.070
0.048	23.628	0.039	0.068
0.042	23.628	0.038	0.083
0.045	24.345	0.038	0.080
0.045	24.345	0.038	0.074
0.043	27.932	0.038	0.072
0.046	24.823	0.038	0.072
0.041	25.780	0.038	0.069
0.041	25.780	0.038	0.069
0.046	24.823	0.038	0.068

0.046	24.823	0.038	0.066
0.043	27.932	0.038	0.066
0.042	23.628	0.038	0.064
0.045	24.345	0.038	0.062
0.043	27.932	0.038	0.047
0.041	25.780	0.038	0.042
0.042	23.628	0.038	0.035
0.044	24.823	0.038	0.080
0.046	24.345	0.038	0.079
0.040	24.584	0.038	0.078
0.044	24.106	0.038	0.078
0.044	24.823	0.038	0.074
0.044	24.823	0.038	0.072
0.046	24.345	0.038	0.072
0.046	24.345	0.038	0.072
0.044	24.823	0.038	0.071
0.046	26.976	0.038	0.070
0.040	24.584	0.038	0.069
0.040	24.584	0.038	0.066
0.046	26.976	0.038	0.063
0.044	24.106	0.038	0.063
0.044	24.106	0.038	0.050
0.046	26.976	0.038	0.036

0.041	23.628	0.037	0.090
0.085	32.189	0.037	0.084
0.046	24.584	0.037	0.083
0.047	25.063	0.037	0.082
0.046	25.063	0.037	0.082
0.047	23.628	0.037	0.081
0.046	24.584	0.037	0.079
0.047	23.628	0.037	0.079
0.085	32.189	0.037	0.076
0.047	23.628	0.037	0.075
0.041	23.628	0.037	0.073
0.046	24.584	0.037	0.072
0.046	25.063	0.037	0.069
0.041	23.628	0.037	0.069
0.046	25.063	0.037	0.068
0.041	23.628	0.037	0.067
0.041	23.628	0.037	0.066
0.085	32.189	0.037	0.065
0.047	25.063	0.037	0.063
0.046	25.063	0.037	0.063
0.047	25.063	0.037	0.047
0.050	25.302	0.037	0.088
0.043	24.823	0.037	0.086

0.046	26.976	0.037	0.083
0.049	25.780	0.037	0.081
0.046	26.976	0.037	0.080
0.043	24.823	0.037	0.080
0.049	25.780	0.037	0.079
0.050	25.302	0.037	0.078
0.049	24.106	0.037	0.077
0.078	33.767	0.037	0.075
0.078	33.767	0.037	0.074
0.049	25.780	0.037	0.072
0.049	24.106	0.037	0.072
0.043	24.823	0.037	0.070
0.049	24.106	0.037	0.070
0.046	26.976	0.037	0.070
0.049	25.541	0.037	0.068
0.046	24.345	0.037	0.068
0.087	26.976	0.037	0.066
0.046	24.345	0.037	0.066
0.050	25.302	0.037	0.063
0.046	24.823	0.037	0.063
0.078	33.767	0.037	0.063
0.049	25.541	0.037	0.060
0.046	24.823	0.037	0.041

0.046	24.345	0.037	0.033
0.046	24.823	0.037	0.032
0.044	24.584	0.037	0.092
0.044	24.584	0.037	0.084
0.041	29.606	0.037	0.083
0.046	24.584	0.037	0.080
0.044	24.584	0.037	0.079
0.041	29.606	0.037	0.079
0.047	27.932	0.037	0.077
0.041	27.215	0.037	0.076
0.047	24.345	0.037	0.075
0.047	24.345	0.037	0.073
0.047	24.345	0.037	0.072
0.048	24.584	0.037	0.072
0.046	24.584	0.037	0.072
0.044	24.584	0.037	0.072
0.043	25.541	0.037	0.069
0.048	24.584	0.037	0.068
0.047	27.932	0.037	0.066
0.047	27.932	0.037	0.066
0.043	25.541	0.037	0.066
0.048	24.584	0.037	0.066
0.043	25.541	0.037	0.065



0.048	24.584	0.037	0.065
0.041	29.606	0.037	0.064
0.041	29.606	0.037	0.063
0.041	27.215	0.037	0.063
0.048	24.584	0.037	0.063
0.041	27.215	0.037	0.050
0.041	27.215	0.037	0.047
0.048	24.584	0.037	0.041
0.046	24.584	0.037	0.035
0.048	26.258	0.036	0.087
0.047	23.628	0.036	0.080
0.047	23.628	0.036	0.078
0.047	23.628	0.036	0.074
0.048	26.258	0.036	0.072
0.047	24.106	0.036	0.071
0.049	24.345	0.036	0.069
0.049	24.345	0.036	0.066
0.049	24.345	0.036	0.050
0.047	24.106	0.036	0.033
0.044	25.302	0.036	0.085
0.048	24.584	0.036	0.081
0.048	24.584	0.036	0.074
0.049	23.628	0.036	0.072

0.044	25.302	0.036	0.068
0.048	24.584	0.036	0.064
0.049	23.628	0.036	0.056
0.044	25.302	0.036	0.055
0.049	24.106	0.036	0.092
0.049	24.345	0.036	0.089
0.049	25.541	0.036	0.084
0.049	24.345	0.036	0.080
0.049	24.345	0.036	0.079
0.049	23.867	0.036	0.078
0.047	23.389	0.036	0.078
0.049	24.345	0.036	0.077
0.049	24.345	0.036	0.076
0.043	23.628	0.036	0.073
0.049	23.867	0.036	0.067
0.048	23.867	0.036	0.066
0.047	23.389	0.036	0.066
0.049	24.106	0.036	0.066
0.048	23.867	0.036	0.066
0.049	25.541	0.036	0.064
0.043	23.628	0.036	0.063
0.043	23.628	0.036	0.053
0.048	23.867	0.036	0.042

0.049	24.345	0.036	0.036
0.049	25.541	0.036	0.034
0.044	23.197	0.035	0.085
0.044	23.197	0.035	0.080
0.044	23.197	0.035	0.063
0.039	32.524	0.033	0.062
0.047	24.345	0.032	0.069
0.043	35.853	0.031	0.077
0.043	35.853	0.031	0.072
0.043	35.853	0.031	0.072
0.045	25.780	0.028	0.080
0.045	30.085	0.028	0.077
0.045	30.085	0.028	0.066
0.045	30.085	0.028	0.063
0.044	31.161	0.026	0.073
0.044	31.161	0.026	0.071
0.044	31.161	0.026	0.066
0.045	29.535	0.025	0.080
0.045	29.535	0.025	0.067
0.045	29.535	0.025	0.066
0.044	19.371	0.023	0.078
0.044	19.371	0.023	0.069
0.044	19.371	0.023	0.066

0.045	16.023	0.023	0.080
0.045	16.023	0.023	0.069
0.045	16.023	0.023	0.054
0.085	33.098	0.020	0.080
0.085	33.098	0.020	0.075
0.085	33.098	0.020	0.066
0.039	12.890	0.019	0.072
0.039	12.890	0.019	0.064
0.039	12.890	0.019	0.063
0.074	29.606	0.018	0.090
0.089	29.941	0.018	0.089
0.089	29.941	0.018	0.076
0.074	29.606	0.018	0.066
0.074	29.606	0.018	0.063
0.089	29.941	0.018	0.062
0.082	32.524	0.017	0.090
0.086	26.258	0.016	0.076
0.086	26.258	0.016	0.066
0.086	26.258	0.016	0.063
0.088	26.880	0.016	0.071
0.088	26.880	0.016	0.069
0.088	26.880	0.016	0.068
0.068	26.139	0.013	0.072

0.068	26.139	0.013	0.066
0.068	26.139	0.013	0.066
0.086	30.085	0.012	0.085
0.086	30.085	0.012	0.081
0.086	30.085	0.012	0.066
0.080	34.437	0.012	0.062
0.082	32.763	0.012	0.080
0.082	32.763	0.012	0.075
0.082	32.763	0.012	0.066
0.071	30.085	0.012	0.088
0.071	30.085	0.012	0.084
0.071	30.085	0.012	0.035
0.047	27.932	0.011	0.083
0.047	27.932	0.011	0.077
0.047	27.932	0.011	0.075
0.045	35.776	0.011	0.080
0.079	32.763	0.011	0.080
0.045	35.776	0.011	0.072
0.045	35.776	0.011	0.065
0.045	27.621	0.011	0.084
0.045	27.621	0.011	0.077
0.045	27.621	0.011	0.032
0.086	29.606	0.011	0.080

0.086	29.606	0.011	0.073
0.086	29.606	0.011	0.062
0.040	30.085	0.010	0.080
0.087	30.802	0.010	0.079
0.084	35.155	0.010	0.079
0.088	30.085	0.010	0.077
0.040	30.085	0.010	0.071
0.087	30.802	0.010	0.070
0.045	26.521	0.010	0.070
0.040	30.085	0.010	0.069
0.087	30.802	0.010	0.065
0.003	26.244	0.001	0.006