THE EFFECTS OF FINANCIAL INNOVATIONS ON CREDIT RISK MANAGEMENT OF COMMERCIAL BANKS IN KENYA

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DECLARATION

This research project is my original work and has not been presented for award of any degree in any university.

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DEDICATION

I dedicate this study to my dear family members, my wife and children for all the

support they gave me all the time as I prepared and worked on this project.

ABSTRACT

Various profit making firm and institutions would seek the investment that have lower risk and uncertainties with a large magnitude of returns. In Kenya, financial institutions encounter major risks in rendering their services. The study adopted descriptive research design. In seeking to establish the effects of financial innovations on credit risk management of commercial banks in Kenya, this study utilised the population of which comprises of 43 Commercial banks in Kenya. This study sought to collect secondary data for the period between 2003 -2013. The data was collected from the relevant documentations and official records like the Financial Products Report and the Risk Manuals of the selected commercial banks. The measure for credit risk management was Non- Performing Loans Ratio (NPLR).The data collected from the annual reports of the banks was analyzed using multiple regression analysis. The regression output was obtained using Statistical Package for Social Sciences (SPSS version 18). In this study, multiple regression model with three independent variables. Financial innovation was measured and quantified in term of its variables. Findings revealed that financial innovations have a positive effect on credit risk management of commercial banks. Among the bank financial innovations: institution, product and process innovations. This finding is supported by the coefficient of determination which shows that the 40.4% of the variations in bank nonperforming loan ratio are explained by banks' financial innovations. The influence of bank financial innovations on income are also statistically significant ($p < .001$) hence justifies the aforementioned relationship. This means that the influence is not by chance

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ABBREVIATIONS

ANBERD   -   Analytical Business Enterprise Research Development Database

ANOVA   -   Analysis of Variance

ATMs   -   Automated Teller Machines

BIS   -   Bank of International Settlement

CAR   -   Capital Adequacy Ratio

CBK   -   Central Bank of Kenya

CBO   -   Collateralized Bond Obligations

CDO   -   Collateralized Debt Obligation

CDS   -   Credit Default Swap

CRB   -   Credit Reference Bureaus

CLN   -   Credit Linked Notes

CTS   -   Cheque Truncation System

DD   -   Distance to Default

EDF   -   Expected Default Frequency

GDP   -   Gross Domestic Product

HPR   -   Holding Period

LPC   -   Loan Connector

NI   -   Net Income

NPL   -   Non- performing Loan

NPLPR   -   Non- performing Loans Ratio

OECD   -   Organisation for Economic Co-operation and Development

RTGS   -   Real Time Gross Settlement

RWAs   -   Risk Weighted Assets

S &P   -   Standard and Poor

SPSS   -   Statistical Package for Social Sciences

SQRT   -   Square Root

VAR   -   Value at Risk

WSJT   -   Wall Street Journal Index

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CHAPTER ONE

INTRODUCTION

1.1Background of the Study

Financial innovation is the act of creating and then popularizing new financial instruments, as well as new financial technologies, institutions and markets. The innovation is divided into product or process variants, with product innovations exemplified by new derivative contracts, new corporate securities or new forms of pooled investment products, and process improvements typified by new means of distributing securities, processing transactions or pricing transactions. Financial innovations are at the centre of the debate on how to shape the future global financial system (Mesler, 2003).

The dominant view prior to the crisis of 2007-2009 was that financial innovations are beneficial for the financial system. The experience of the crisis led loan at least partial reassessment of this view. Many policy makers now argue that the use of financial innovations needs to be restricted or prohibited. There is also general concern that financial innovations, while beneficial under normal economic conditions, may amplify shocks in times of crisis. Whether this concern is justified depends on why and how these innovations are used in the financial system. If, for instance, the innovations are employed by financial institutions to improve risk measurement and risk control, they may serve to insulate the financial system against negative shocks (Dziobek, 1998).

Financial institutions are exposed to a variety of risks among them; interest rate risk, foreign exchange risk, political risk, market risk, liquidity risk, operational risk and

credit risk (Yusuf, 2003; Cooperman, Gardener and Mills, 2000). In some instances, financial institutions have approved decisions that are not vetted; there have been cases of loan defaults and nonperforming loans, massive extension of credit and directed lending. Policies to minimize on the negative effects have focused on mergers in banks and NBFIs, better banking practices but stringent lending, review of laws to be in line with the global standards, well capitalized banks which are expected to be profitable, liquid banks that are able to meet the demands of their depositors, and maintenance of required cash levels with the central bank which means less cash is available for lending (Central Bank Annual Report, 2004). This has led to reduced interest income for the Kenyan banks and by extension reduction in profits (De Young and Roland, 2001; Dziobek, 1998; Van Deventer and Mesler, 2003). Innovation in banking and other depository markets has been progressing at a rapid pace for at least a quarter of a century. The initial developments primarily affected Kenyan banks industry and their corporate customers. By the end of the 1970s, however, it involved all depository institutions and a number of non-depository and even nonfinancial firms, and household as well as business customers.

1.1.1 Financial Innovation

Financial innovation is the act of creating and then popularizing new financial instruments, as well as new financial technologies, institutions and markets. Financial innovation comprises of product innovation, process innovation, institutional innovation and market innovation (Davies, 1997). Institutional innovations refer to changes in business structure, establishment of new types of financial intermediaries, or changes in the legal and supervisory framework. Examples of institutional innovations in Kenya include: introduction of Credit referencing Bureaus, Mobile banking, commercial banks getting into investment banking services, banks offering

insurance services on behalf of insurance companies, Islamic banking and agency banking.

Product innovation is exemplified by new derivative contracts, new corporate securities or new forms of pooled investment products, Among the main product innovations include; credit cards, debit cards, Business Club concept, Personal unsecured loans, Money transfer services and Products tailored to favour certain groups; Diva, X bank accounts of Standard Chartered. Products invention is done though the ongoing research and development of new products, services or ideas which are more flexible and tailor made to satisfy customers. Product innovations specific to financial institutions, all focus towards providing a wider range of financial products and intermediation options. These innovations give a launching pad and a competitive edge to financial institutions. For instance flexible savings facilities, loans to farmers, students, business people, asset financing among others. Likewise, there are also different accounts for short-term and long-term saving/investments (Holt, 2002).

Process innovations include the introduction of new business processes leading to increased efficiency and market expansion. Among the main process innovations include; office automation, use of computers in accounting systems and client data management software, Electronic banking (taking the form of ATMs, Internet Banking and telephone transaction) , Real Time Gross Settlement (RTGS), and (CTS) Cheque Truncation System. All these aim at reducing transaction costs, time, maintaining clients and better portfolio management to increase the overall firm's success. Process innovation will continue to be very important to financial institutions growth for the reason that without excellence process innovation, other innovations

was impossible to implement. (Davies, 1997).Marketing innovation is the implementation of a new marketing method involving significant changes in products design or packaging product placement, product promotion or pricing.

An important question about business investment in innovation today is whether the expected financial benefits can be realized. Many studies attempt to evaluate the impacts of investing in innovation. Tufano (2003) proposed that impacts should be observed at each strategic business unit level. They use two-stage analysis to determine the value of investment in innovation: intermediate and high level output variables for measuring the innovation contribution. They analyzed intermediate-level variables based on factors such as innovation utilization, inventory turnover, quality, price, and new products, while high level variables or final performance variables are measured by market share and return on assets. They also suggest that innovation value should be measured at the process level at which innovation is implemented.

1.1.2 Credit Risk Management

Credit risk is the possibility that the actual return on an investment or loan extended will deviate from that, which was expected (Conford, 2000). Coyle (2000) defines credit risk as losses from the refusal or inability of credit customers to pay what is owed in full and on time. The main sources of credit risk include, limited institutional capacity, inappropriate credit policies, volatile interest rates, poor management, inappropriate laws, low capital and liquidity levels, directed lending, massive licensing of banks, poor loan underwriting, reckless lending, poor credit assessment, no non-executive directors, poor loan underwriting, laxity in credit assessment, poor lending practices, government interference and inadequate supervision by the central

bank. Banks assume credit risk when they act as intermediaries of funds and credit risk management lies at the heart of the Kenyan banking industry.

Credit risk management is defined as identification, measurement, monitoring and control of risk arising from the possibility of default in loan repayments (Early, 1996; Coyle, 2000). The goal of credit risk management is to maximize a bank's risk-adjusted rate of return by maintaining credit risk exposure within acceptable parameters. Bank need to manage the credit risk inherent in the entire portfolio as well as the risk in individual credit risk and other risks. The effective management of credit risk is a critical component of a comprehensive approach to risk management and essential to the long-term success of any banking organizations. To accomplish credit risk management duties and responsibilities the institution must understand its financial analysis, loan documentations, servicing, loan covenants and environmental analysis. It must also maintain sound records on the credit performance of its portfolios of risky assets because any change in underwriting; laws and regulations can significantly alter its loan loss experience (Kennetha and Thygerson, 1995).

To minimize these risks, it is necessary for the financial system to have; well-capitalized banks, service to a wide range of customers, sharing of information about borrowers, stabilization of interest rates, reduction in non-performing loans, increased bank deposits and increased credit extended to borrowers. Loan defaults and nonperforming loans need to be reduced (Mercurio, and Brigo, 2007). Credit risk is more difficult to measure because data on both default and recovery rates are not extensive, credit returns are highly skewed and fat tailed and longer term time horizon and higher confidence levels are used in measuring credit risks. These are problems in

measuring credit risk that have inspired the development of several sophisticated models and commercial software products for measuring portfolio credit risk (Haim and Thierry, 2005).

1.1.3 Financial Innovations and Credit Risk Management

Financial innovation widens the range of instruments available for risk management, and enables various types of risk to be managed and shifted optimally to those who have a greater ability and/or willingness to absorb risk. The wider range of financial instruments now available has become an integral part of risk management, both for the suppliers of financial services and their customers (Graham, 2000).Credit risk management is defined as identification, measurement, monitoring and control of risk arising from the possibility of default in loan repayments (Early, 1996; Coyle, 2000)

Financial innovation such as Cheque truncation is a newly introduced cheque clearing system, which involves clearing and settlement between banks, based on images and associated electronic payment data, without the physical exchange of the cheques. Also the RTGS system which is a type of funds transfers mechanism where transfer of money takes place from one bank to another on real time and Gross basis. Real time means the transactions are processed as they are received. Gross settlement means the transactions are settled on one to one basis without batching with any other transaction. RTGS system is primarily for large value transactions. As soon as transactions are remitted by the paying bank they are credited in the receiving bank.

In Kenya, the banks are moving to acquire stock brokerage and investment banks to get involved in the stock market activity. Credit Reference Bureaus complement the central role played by banks and other financial institutions in extending financial

services within an economy. CRBs help lenders make faster and more accurate credit decisions. They collect, manage and disseminate customer information to lenders with in a provided regulatory framework – in Kenya, the Banking (Credit Reference Bureau) Regulations, 2008 which was operationalised effective 2nd February 2009. Credit histories not only provide necessary input for credit underwriting, but also allow borrowers to take their credit history from one financial institution to another, thereby making lending markets more competitive and, in the end, more affordable. Credit bureaus assist in making credit accessible to more people, and enabling lenders and businesses reduce risk and fraud. Sharing of information between financial institutions in respect of customer credit behaviour, banks are thus likely to slowly compete out brokerage firms because they have more cash and they are better managed than brokerage firms. Banks in Kenya are also offering insurance services on behalf of insurance companies (www.centralbankofkenya.go.ke). Another recent institutional innovation is the introduction of the Islamic Banking which is guided by Islamic law or Islamic Sharia Law.

Financial innovations such as credit derivatives used by banks increases the credit supply to large firms and lowers corporate loan spreads on average. A credit derivative refers to instruments and techniques designed to separate and then transfer the credit risk. The most common credit derivatives includes; credit default swap (CDS), total return swap, credit linked notes (CLN) collateralized debt obligation (CDO) and collateralized bond obligations (CBO). Firms with higher default risk face higher loan spreads after they become traded in the CDS market. This effect is driven by reduced incentives for banks to monitor the default risk of these firms. Credit derivatives may provide benefits that can be passed on to borrowers if banks use these

instruments to hedge credit risk. Credit derivatives can also increase borrowers risk if the transfer of risk leads to incentive problems at banks. For example, a risk managing bank may reduce exposures arising from their lending business by buying protection but at the same time source credit risks on underrepresented risks through a sale of protection.

A study carried by dataset was based on loan-level information from the LPC DealScan database and bank-level information from the Call Reports covering the period from 1997 to 2009. The principal result from regression analysis found that, after controlling for lender, loan and bank characteristics, banks' gross positions in credit derivatives were significantly negatively related to the loan spread they charge to the average corporate borrower. By contrast, banks' net positions in credit derivatives do not display any association with loan spreads. This result provides support for the risk management channel but was inconsistent with the other channels through which credit derivatives could affect loan pricing. The effect was robust - in particular it was still present when the study controlled for the use of other derivatives and takes into account various endogeneity concerns. The effect is larger for borrowers that are more likely to be actively traded in credit derivative markets. The estimates for firms that were rated investment grade imply that a one-standard deviation increase in the banks- gross credit derivative position lowers the loan spread by 18%. The study also found that the risk management benefits extend to firms that were unlikely to be traded in the credit derivative market. Credit derivatives allow banks to transfer risk exposures to third parties by hedging exposures through the purchase of protection. This may reduce banks incentives to screen and monitor borrowers (Morrison, 2005).

Financial innovations such as those available in ATMs, phone banking, Internet banking, debit cards, credit cards, agency banking and smartcard applications are taking place at an overwhelmingly fast pace in the global banking industry. Technological developments, particularly the increasing availability of low cost computing power and communications, have played an important supporting role in facilitating the adoption of more rigorous credit risk management; implementation of some of these new approaches still has a long way to go for the bulk of banks. The likely acceleration of change in credit risk management in banks is viewed as an inevitable response to an environment where competition in the provision of financial services is increasing and, thus, need for banks and financial institutions to identify new and profitable business opportunities and properly measure the associated risks, is growing (Mercurio, and Brigo, 2007). Inevitably, as banks improve their ability to assess risk and return associated with their various activities, the nature and relative sizes of the implicit internal subsidies was becoming more transparent.

1.1.4 Commercial Banks in Kenya

A commercial bank is a profit-seeking business firm, dealing in money and credit. It is a financial institution dealing in money in the sense that it accepts deposits of money from the public to keep them in its custody for safety. It also deals in credit, whereby it creates credit by making advances out of the funds received as deposits to needy people. It thus, functions as a mobilizer of saving in the economy. There are various categories of commercial banks such as deposit banks, industrial banks, savings banks, agricultural banks, exchange banks, and miscellaneous banks (Fabozzi et al 2009).

The commercial banks have faced difficulties over the years for a multitude of reasons; the major cause of serious financial problems continues to be directly related to credit standards for borrowers, poor portfolio risk management or lack of attention to changes in the economic circumstances and competitive climate (Central Bank Annual Supervision Report, 2000). The credit decisions are be based on a thorough evaluation of the risk conditions of the lending and the characteristics of the borrower. Much of this information is gathered during loan documentation. The bank should however go beyond information provided by the borrower and seek additional information from third parties like credit rating agencies and credit reference bureaus (Simson and Hempel, 1999).Numerous approaches have been developed for incorporating risk into decision-making process by commercial banks in Kenya. They range from relatively simple methods, such as the use of subjective or informal approaches, to fairly complex ones such as the use of computerized simulation models (Montes-Negret, 1998; CBK Annual Supervision Report, 2000). According to Saunders (1996), banks need to gather adequate information about potential customers to be able to calibrate the credit risk exposure. The information gathered will guide the bank in assessing the probability of borrower default and price the loan accordingly.

1.2 Research Problem

All profit making firm and institutions would seek the investment that have lower risk and uncertainties with a large magnitude of returns. Financial institutions in Kenya encounter major risks in rendering their services. In some cases, some financial institution collapse as a consequence of lacking effective and efficient strategies to hedge or reduce risk to a reasonable level (Davies, 1997).The very nature of the banking business in Kenya is so sensitive because more than 85% of their liability is

deposits from depositors (Saunders and Cornett, 2005). Banks use these deposits to generate credit for their borrowers, which in fact is a revenue generating activity for most banks. This credit creation process exposes the banks to high default risk which might lead to financial distress including bankruptcy. In Kenya, financial institutions risk management frameworks ensure effectiveness in risk management for the financial products and processes within the bank's risk appetite. However, the risk management framework cannot be static due to the rapid development of financial products and the evolving of the strategies that primarily address the new financial products. In other words, financial innovations in the financial market are piling pressure on the risk management framework of commercial banks and other financial institutions.

Kenyan Banks carry out their credit risk management as a measure of administering credit to borrowers. This is done by having a well developed credit mechanism and procedure, that is to say, credit appraisal, training of staff and setting credit standards and terms to offset the possibility for risks. However, despite the efforts made to address the poor credit risk management, Kenyan banks still have difficulties resulting from the credit risk management processes undertaken and changes in customer base. Financial innovation widens the range of instruments available for risk management, and would enables various types of risks encountered by these banks be managed and shifted optimally to those who have a greater ability and/or willingness to absorb these risks.

Several studies have been done to examine the role played by financial innovation in managing risk among the Kenyan banking industry. Waweru (2012) carried out a

study on the effects of financial innovations on risk management in Kenya. The findings of the study indicated that total new current accounts, total new savings accounts, credit reference bureaus and automated trading system at the stock exchange had a positive correlation with the overall risk management framework for commercial banks. Nyathira (2012) carried out a research on financial innovation and its effects on financial performance among commercial banks in Kenya. Study results indicated that financial innovation indeed contributes to and is positively correlated to financial performance in the banking sector particularly that of commercial banks. This is further supported by high uptake of more efficient financial systems for risk management in substitution for the less efficient traditional systems.

Lerner (2006) investigated the origins of innovation in US financial Service firms between 1990 and 2002; He identified two sources -Wall Street Journal Index (WSJI) from Wall Street articles as an innovation indicator and Factiva Database. Of the total 20916 observations or entries in the journal only 651 items meet the required criteria for innovations. The distribution was further reclassified into various panels and industry of innovators. The analysis focused on the nature of the financial institutions that undertake the innovations. He estimated both pool and random effects panel data models under different specifications (e.g. negative binomial, poisson). He found out that smaller firms account for a disproportionate share of the innovations, as do less profitable firms though their profitability increases significantly in subsequent years. Older, less leveraged firms and those located in regions with more financial innovation were found out to be more innovative.

From the discussion above, it is clear that financial innovation can either impact positively or negatively on risk management in the banking industry. Most of the local studies have leaned heavily on the effects of financial innovation on risk management among Kenyan banks (Nyathira, 2012; Waweru, 2012). These studies did not establish effects of financial innovation on specifically credit risk management on Kenyan banks, leading to a puzzle that this study is seeking to unearth. This was addressed by answering the following research question: What is the effect of financial innovations on credit risk management of commercial banks in Kenya?

1.3 Research Objective

To establish the effects of financial innovation on credit risk management of commercial banks in Kenya.

1.4 Value of the Study

The knowledge on the impact of financial innovation on risk management was of help to Kenyan banks in understanding the current status of innovation in the global market and helps these banks in developing products and also controls to avert the negative impact of financial innovation and be in a position to take full advantage of the opportunities it avails. The study will also offer a sacrificial benefit to the scholars and researchers in that they was able to expand their knowledge on financial innovation and how it can contribute to credit risk management. The study will also be useful to researches as a secondary data to review their literature.

To the General Public who would like to like to know more about innovations so as to build on their existing knowledge would find this material very important in the area of financial innovations. The study findings will enable the Customers and Clients to

appreciate the impact that innovation has brought in redesigning how banks operate in the market today as compared to the olden days. The public will also benefit from the credit risk management by Kenyan Banks. It is the public who will enjoy the improved services of the financial institution. Also the financial institution was in position to lend their services to the public at a reduced costs and interest. Due to reduced risk, most financial institution was in a position to expand their services and establish more branches. The banks has become more accessible thus numerous benefits among the general public.

Government receives a great number of benefits, incentives and income from the financial institution. Tax is a major source of income the Kenyan government relies on. The government levies a considerable amount of tax from financial institution; hence if these financial institutions grow by opening more branches as a result of credit risk management, the government will receive more and more taxes. The study will also contribute to theory through providing more insight into ways in which companies can use financial innovation to gain competitive advantage despite the dynamic business environment. It will also identify areas that need further study and were used by students and researchers to come up with more theory on the subject of financial innovations and credit risk management.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews relevant literature from previous studies that have been carried out on the effects of financial innovation on credit risk management. Financial innovation remains one of the most reviewed topics in literature; especially as it effects on all kind of economies cannot be overlooked. This chapter focuses on two substantive literature aspects, first, the theoretical reviews of conceptual theories advanced in the field of financial innovation. Second the empirical review for evidences about financial innovation and its effects on credit risk management in various financial institutions in the world.

2.2 Theoretical Review

Assessing and managing credit risk of financial assets has been a major area of interest and concern to academics, practitioners, and regulators. There three widely used approaches to credit risk modelling in practice; statistical analysis based credit scoring approach, reduced form approach of Jarrow and structural approach originated with Black and Scholes (1973) and Merton (1974).

2.2.1 Information Asymmetry Theory

Information asymmetry describes the condition in which relevant information is not known to all parties involved in an undertaking. Information asymmetry has been used widely to explain a variety of concepts including those in different market situations. It causes markets to become inefficient and forces market participants to

take risks because it is assumed that information that is provided is always inadequate and untimely. In financial markets, information asymmetry arises between borrowers and lenders because borrowers generally know more about their projects than lenders do. Information asymmetry entails absence of accurate, timely, complete, quantity and quality information about the borrowers' ability and willingness to pay back the loan (Bebczuk, 2003).

According to Kenneth and Adrian (1997), the bank's decision to lend is often complicated by inadequate and inaccurate information. In the quest to screen out borrowers likely to default, banks need information. Although banks demand that borrowers disclose all the required information, borrowers often conceal information that is likely to work in their disfavour. According to Scholtens et al, 1999, access to credit is not only attributable to size but instead it is the result of problems associated with the availability of information through which borrowers' applications for credit can be evaluated. Information asymmetry complicates the screening of borrowers and increases administrative costs through increased information search costs. When the information asymmetry between the lender and the borrower is bridged, borrowers can improve their access to bank credit.

Information asymmetry poses two challenges of adverse selection and moral hazard. Adverse selection assumes that there are qualitatively different types of credit applicants. In comparison with high quality applicants, low quality applicants are unable to use the borrowed money for valuable investments and will thus have a relatively high chance of default on the loan. Banks therefore, prefer to select high

quality applicants and the major way of examining a potential borrower is by analyzing all available information.

Moral hazard as applied in lending and borrowing relationship implies that the client to whom a loan has been extended controls the money of the bank. The client may use the money for a different purpose and not consider the stakes of the bank. Banks therefore try to closely monitor their clients as all principals do with their agents. Monitoring, however, requires some guarantee that proper information was provided. But if the repayment condition is not fulfilled the client may not be inclined to inform the bank adequately (Bebczuk, 2003).

2.2.2 Value at Risk Theory

This is a technique used to estimate the probability of portfolio losses based on the statistical analysis of historical price trends and volatilities. Value at risk is commonly used by banks, security firms and companies that are involved in trading energy and other commodities. VAR is able to measure risk while it happens and is an important consideration when firms make trading or hedging decision.

According to Jorion (2001), VaR measure the worst expected loss over a given horizon under normal market conditions at a given level of confidence. For instance, a bank might say that the daily VaR of its trading portfolio is $1 million at 99 percent confidence level. In other words, under normal market conditions, only one percent of time the daily loss will exceed $1 million (Jorion, 2001). More formally, VaR describes the quartile of the projected distribution of gains and losses over the target horizon .If c are selected confidence level, VaR corresponds to 1-c lower tail level.

2.2.3 KMV Credit Monitor Model

Outstanding also is the KMV credit Monitor Model. In recent years, following the pioneering work on options by Merton, Black, and Scholes, it is now recognized that when a firm raises funds either by issuing bonds or by increasing bank loans, it holds a very valuable default or repayment option (Black and Scholes, 1973; Merton, 1974). The KMV Model is a credit monitor model that helps to solve the lending problems of banks and further look at the repayment incentive problem. To try resolving the problems, the KMV Model uses the structural relationship between the volatility of a firm's asset and the volatility of the firm's equity. The KMV Corporation (purchased by Moody's in 2002) has turned this relatively simple idea into a credit-monitoring model now used by most of the large US banks to determine the Expected Default Frequency (EDF) that is the probability of default of large corporations (KMV Corporation, 1994).

The expected default frequency reflects the probability that the market value of the firm's assets will fall below the promised repayments on debt liabilities in one year. If the value of a firm's assets falls below its debt liabilities, it can be viewed as being economically insolvent. Simulations by the KMV have shown that this model outperforms both accounting-based models and S&P ratings. The relevant net worth of a firm is therefore the market value of the firm's assets minus the firm's default point.

A firm will default when its market net worth reaches zero. The KMV's empirical EDF is an overall statistics that can be calculated for every possible distance to default (DD) using data either aggregated or segmented by industry or region. To find the EDF for any particular firm at any point in time, one must look at the firm's EDF as

implied by its calculated DD. As a firm's DD fluctuates, so do its EDF. For firm's that are actively traded, it would be possible in theory to update the EDF every few minutes. Critics: The KMV EDF Model has been criticized on the basis that they are not true probabilities of default. This is reflected in the poor results obtained using KMV empirical EDFs in order to replicate risky bond prices (Black and Scholes, 1973; Merton, 1974).

2.2.4 Credit Scoring Model

Credit scoring models use data on observed borrower characteristics either to calculate the probability of default or to borrowers into different default risk classes (Saunders and Cornett, 2007). Prominent amongst the credit scoring models is the Altman's Z-Score. The Z-score formula for predicting Bankruptcy of Altman (1968) is a multivariate formula for measurement of the financial health of a company and a powerful diagnostic tool that forecast the probability of a company entering bankruptcy within a two year period with a proven accuracy of 75-80%.

Critics: Use of this model is criticized for discriminating only among three borrower behaviour; high, indeterminate, and low default risk. Secondly, that there is no obvious economic reason to expect that the weights in the Z-Score model – or, more generally, the weights in any credit-scoring model- was constant over any but very short periods. Thirdly the problem is that these models ignore important, hard to quantify factors (such as macroeconomic factors) that may play a crucial role in the default or no-default decision (Atlman, 1968).

2.3 Determinants of Credit Risk Management in Commercial Banks

Banks performance with regards to credit risk depends on various internal and external factors. Internal factors are bank specific determinants and the external factors are the determinants related to economic environment (Naceur and Omran, 2011). Macroeconomic determinants are perceived to bear the greatest impact on firms' creditworthiness. According to Figlewski, Frydman and Liang, (2012) macroeconomic determinants are categorized into three. The first being general macroeconomic determinants such as inflation and unemployment rates, second being directional determinants such as GDP and thirdly, market conditions determinants such as interest rates and stock market index. Favourable macroeconomic conditions relate to reducing non-performing loans in banks hence lower credit risk. During economic recessions, probability of default increase thus increasing the level of nonperforming loans.

2.3.1 External Factors
2.3.1.1 Directional Determinants

GDP growth rate is a macro determinant of banks performance. On economic booms, incomes are high and portfolio at risk is minimal. On recession's times, income is constraints and borrowers priorities on basic expenses at the expense of their credit obligations. There exist an inverse relationship between GDP and NPL (Vazquez, Tabak and Sauto, 2012).Conversely, to the above exposition on GDP, researches show a positive relationship of inflation, unemployment and interest rate on NPL. High tendencies of credit risk go along with high inflation, unemployment and interest rates. These variables frustrate the borrower's ability to borrow and at the same time increase the cost of borrowing (Derbali, 2011).

The unemployment rate provides additional macroeconomic variable affecting credit risk. An increase in unemployment rate carries a negative influence to the household's income and therefore frustrating their ability to service their debt obligations. Unemployment also affects firms through drop of effective demand of their production. This combined effect of joblessness on firms and households directly affects economic activity and similarly the credit portfolio

2.3.1.2 Market Conditions Determinants

Stock market index is another key determinant of credit risk in commercial banks. The rise and fall of the stock index reflect correlates to the levels of disposable income available for investing. Similar to growth domestic product, stock index determinant carries an inverse relationship to the quality of loan portfolio. Where stock return rises it implies ability to pay debt obligations is boosted thus reducing credit risk (Wong, Wong, and Leung, 2010).

Interest rates form the basis of financial intermediation. Banks facilitate mobilizations of deposits by offering depositors a price on their savings. These pooled funds are thereafter diversified by sector lending as a means to mitigate risk of loan defaults (Ngugi, 2001). Long term interest rates on lending affect the price borrowers pay on their financial obligations. The higher the price on interest the more likely the borrower will be unable to fully satisfy his obligations to service debt. Interest rate being macroeconomic variable is influenced by the regulatory authority such as central banks on its fiscal and monetary policy formulation. Its carries and direct relationship to credit risk. The higher the price the more likely the loan will be defaulted and vice versa (Aver, 2008).

2.3.2 Internal Factors

Internal credit risk determinants relates to management inefficiencies within the commercial banks. Poor credit management practices are mainly characterized agency conflict on insider lending, unbalanced sectarian lending, speculative lending among others. This has been a phenomenon in major countries such as Mexico, Venezuela, Zimbabwe and Kenya especially in the late 1990s. Management inefficiencies in as a factor affecting credit risk in financial institution is measured on efficiency ratio on banks (ration of total cost to total revenue). The higher the ratio the higher the credit risk and vice versa.

Credit policy on lending should explicitly outline procedures on credit appraisal, approval, monitoring and recovery. The quality of Management and in a financial institution bears an inversely relationship to credit risk. Inadequate governance structures lead to increased risk on loan quality. Management inadequacy can be measured by analyzing the efficiency ratio of commercial banks over a period of time. The measure of the efficiency ratio amounts to total cost over total revenue of financial institution.

2.4 Empirical Review

This chapter reviews the literature from previous studies and the works of the other scholars. This was used to compare with the finding of this study and establish the variations and similarities between this study findings and what literature says. As noted by Frame and White (2002), profit-seeking enterprises and individuals are constantly seeking new and improved products, processes and organisational structures that will not only give them greater profits, but reduce their costs of production and better satisfy their customer demands. Whereas the need for better risk management has been the main driving force behind the recent wave in innovation in

more advanced markets, He noted that this was not the case in Zambia. The drive towards financial innovation in Zambia was largely attributed to the need to maintain profitability. However, rapid growth if does not commensurate with improvements in risk management systems would pose a threat to financial system stability. He concluded that financial stability depends largely on the adequacy of risk measurement and management systems of financial institutions. Lack of effective and/or failure of risk management systems by the large banks or a number of smaller ones would threaten not only the solvency of the concerned institutions but also the health of the whole system.

Lerner (2006) investigated the origins of innovation in US financial Service firms between 1990 and 2002; He identified two sources -Wall Street Journal Index (WSJI) from Wall Street articles as an innovation indicator and Factiva Database. Of the total 20916 observations or entries in the journal only 651 items meet the required criteria for innovations. The distribution was further reclassified into various panels and industry of innovators. The analysis focused on the nature of the financial institutions that undertake the innovations. He estimated both pool and random effects panel data models under different specifications (e.g. negative binomial, poisson). He found out that smaller firms account for a disproportionate share of the innovations, as do less profitable firms though their profitability increases significantly in subsequent years. Older, less leveraged firms and those located in regions with more financial innovation were found out to be more innovative.

Mwangi (2007) carried out a study on factors influencing financial innovation of companies listed at Nairobi Stock Exchange. The objective of the study was to

explain the macro-environmental and micro-environmental factors influencing financial innovation in Kenya's securities market. The population used in this study was 48 companies listed on the Nairobi Stock Exchange in 2005. An exploratory survey was conducted between September 2005 and March 2006, of which 31 respondents were involved. The data was analyzed using descriptive statistics. Based on regulatory factor, the finding concluded that Kenyan laws protecting investors was the major factor influencing financial innovation. Mwangi also observed that the absence of automated trading systems as a technological factor was found to influence financial innovations regularly. Finally he argued that global financial competition and integration had an influence on financial innovation with increased financial competition amongst financial institutions influencing financial innovation the most.

Ochola (2009) conducted a study of the relationship between credit risk management and non- performing loans. The objective of the study was to establish the degree of effect of employing different credit management techniques on the level of non-performing loans. In assessing this, the study sought to establish the relationship between credit risk and management and non- performing loans by pursuing a survey in the Kenyan banking sector. The research found that in Kenyan setup, a combination of intensive credit risk management by the banks coupled with close supervision by Central Bank has greatly enhanced the decline of non- performing loans ratio in the banking sector. Analyzing the asset quality of the financial sector for 2003 to 2008, the ratio of gross non- performing loans to gross loans declined from a high 35% in 2003 to a low of 9.23% in 2008. The decline of this ratio confirms a close relationship between non- performing loans and credit risk management.

Muasya (2009) analyzed the impact of non- performing loans on the performance of the banking sector in Kenya in the time of global financial crises. The findings confirmed that non- performing loans do affect commercial banks in Kenya. Further analysis of individual banks with more than Ksh 25 billion worth of asset indicated that while the impacts are negative, the magnitude of non- performing loans to both interest income and profitability are not adverse for 7 of the 13 analyzed banks and that asset quality of the whole banking sector has been improving to settle at 7.17%.

Kamotho (2009) carried out a study on Mobile Phone Banking: Usage experiences in Kenya. The study cover the two main dominant mobile banking service providers- Safaricom and Zain - during the three year period 2006-2008, from inception with total outlets of 8000 agents. This number tripled compared to 876 branches and 1424 ATM for commercial banks (CBK, 2008). The study was informed by a quantitative survey on M-Banking services and demand. Kamotho; observed that competition triggers innovation and creativity. Continuous innovation not only yield new products but rather promotes efficiently in the performance of activities. Hence lowering the transaction cost. Contrary to popular wisdom that mobile phone money services are meant for funds transfer and remittances, his findings concluded that 96% of the respondents used the M-banking service as form of funds storage.

Wanjira (2010) studied the relationship between non- performing loans management practices and financial performance of commercial banks in Kenya. The study concluded that there is a need for commercial banks to adopt non-performing loans management practices. Such practices include ensuring sufficient collaterals, limiting lending to various kinds of businesses, loan securitization, ensuring clear assessment

framework of lending facilities and use of procedures in solving on problematic loans among others. The study further concluded that there was a positive relationship between nonperforming loans management practices and the financial performance of commercial banks in Kenya which implies that the adoption of non- performing loans management practices leads to improved financial performance of commercial banks in Kenya.

Piazza (2010) in his study found that financial innovation has increased diversification opportunities and lowered investment costs, but has not reduced the relative cost of active (informed) investment strategies relative to passive (less informed) strategies. He noted that an economy with linear production technologies, some more risky than others. Investors can use low quality public information or collect high quality, but costly, private information which helps to avoid excessively risky investments. He also noted that financial innovation lowers the incentives for private information collection and deteriorates public information: the economy invests more often in excessively risky technologies.

Waweru (2012) carried out a study on the effects of financial innovations on risk management among commercial banks in Kenya, Secondary data was collected from risk manual, financial products reports and audited financial reports of 18 commercial banks that made were selected to represent the 43 commercial banks in Kenya. Data was analyzed using SPSS through correlation analysis, regression analysis ad autocorrelation techniques were used to analyse the data. The study concluded that that financial innovations have exposed commercial banks in Kenya to various risks including credit risk, liquidity risk, strategic risk, interest rate risks, country risk,

compliance risk and reputational risk and all these risks should therefore inform overall risk management of the institutions through a realistic risk index factor at any one period. The researcher recommends more robust risk mitigation practices and policies to ensure that all elements of risk are captured in the risk index factors of commercial banks. The findings of the study also indicated that total new current accounts, total new savings accounts, credit reference bureaus and automated trading system at the stock exchange had a positive correlation with the overall risk management framework for commercial banks. On the other hand mobile banking and real time gross settlements had a negative correlation with the risk management framework

Nyathira (2012) carried out a research on financial innovation and its effects on financial performance of commercial bank in Kenya. The causal research design was used to carry out this study. The population of study was all the 43 commercial banks in Kenya as at 30th June, 2012. The study used secondary data from published central banks' annual reports. The independent variable was financial innovations unique to commercial banks while dependent variable was consolidated financial performance of all banks. Study results indicated that financial innovation indeed contributes to and is positively correlated to financial performance in the banking sector particularly that of commercial banks. This is further supported by high uptake of more efficient financial systems in substitution for the less efficient traditional systems.

Beck (2012) carried out a study on the bright and the dark sides of financial innovation in China. Data was collected on R & D expenditure in the financial intermediation industry from analytical Business Enterprise Research Development

database (ANBERD) of the OECD. The finding concluded that Countries where financial institutions spend more on financial innovation are better able to translate growth opportunities into GDP per capita growth and are better placed in risk management. He also noted that in countries where banks spend more on financial innovation, they are also more fragile. This relationship is especially strong for banks with smaller market shares, banks with faster asset growth and banks with higher shares of non-traditional intermediation activities. This higher fragility is due to higher profit volatility of banks in countries with higher levels of financial innovation.

2.5 Summary of Literature Review

This chapter reviews relevant literature from previous studies that have been carried out on the effects of financial innovation on risk management. Financial innovation remains one of the most reviewed topics in literature; especially as it effects on all kind of economies cannot be overlooked. This chapter focuses on two substantive literature aspects, first, the theoretical reviews of conceptual theories advanced in the field of financial innovation. These theories include; capital adequacy model, credit scoring model, KMV credit monitor model and Information Asymmetry Theory. Second the empirical review for evidences about financial innovation and its effects on credit risk management in various financial institutions in the world.

From the above literature, it is clear that financial innovation can either impact positively or negatively on risk management. Information asymmetry is one of the theories that have come out clearly in support of the study. Information asymmetry describes the condition in which relevant information is not known to all parties involved in an undertaking. It causes markets to become inefficient and forces market participants to take risks because it is assumed that information that is provided is

always inadequate and untimely. This problem can be addressed by embracing financial innovations such as credit reference bureaus. Also the theoretical review has discussed the models on credit risk management. Critique of some of these models was addressed by the study, for example critique for the credit scoring model of ignoring important, hard to quantify factors (such as macroeconomic factors) that may play a crucial role in the default or no-default decision. Risk management framework cannot be static due to the rapid development of financial products and the evolving of the strategies that primarily address the new financial products. In other words, financial innovations in the financial market are piling pressure on the risk management framework of commercial banks and other financial institutions. Most of the local studies have leaned heavily on the effects of financial innovation on risk management. Most of the studies concluded that financial innovations contribute to risk management among the financial institutions. These studies did not establish effects of financial innovation specifically on credit risk management, leading to a puzzle that this study is seeking to unearth.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter provides the methods that were used to address the objectives and research problem. It also provides the research design, the target population, sample design, data collection, and finally data analysis techniques.

3.1 Research Design

The study used descriptive research design to examine the effects of financial innovation on credit risk management among commercial Banks in Kenya. According to Cooper and Schindler (2001), a descriptive study is structured with clearly stated investigative objective. The design allowed the researcher to make a speculation on the basis of the literature and any other earlier evidence as to what to expect the findings of the research to be. The analysis of the data collected then supported or disproved the research proposition.

3.2 Population

According to Mugenda (2003) a population is a group of individuals, events, or objects having a common observable characteristic. Sim and Wright (2000) define population as the collection of cases in which the researcher is ultimately interested, and to which he or she was wishing to make generalization. The population of this study comprised of 43 Commercial banks in Kenya.

3.3 Data Collection

This study sought to collect secondary data for the period between 2003 -2013. The data was collected from the relevant documentations and official records like the

Financial Products Report and the Risk Manuals of the selected commercial banks. The data collection tools enabled a trade-off between cost, speed, accuracy, detail, comprehensiveness, response rate, clarity and anonymity which are useful for validity and reliability. The measure for credit risk management was Non- Performing Loans Ratio (NPLR) calculated as Non-performing Loans/Total Loans

3.4 Data Analysis

The data was collected from the CBK website of the banks was analyzed using multiple regression analysis: the relation of one dependant variable to multiple independent variables. The regression output was obtained using Statistical Package for Social Sciences (SPSS version 18).

3.4.1 Model

In this study, multiple regression model with three independent variables. The measure for credit risk management was NPLR (Non-performing Loans/Total Loans) and for financial innovations were Institutional, Product and Process Innovation. The dependent variable for this study was Non-Performing Loan Ratio (NPLR). NPLR was used because it indicates credit risk management resulted from financial innovation. NPLR indicates how banks manage their credit risk because it defines the proportion of NPLR amount in relation to TL amount. NPLR is defined as NPLs divided by TLs.

Financial innovation was measured and quantified in term of its variables which was Institutional, Product and Process Innovation; Institutional innovation was measured using, credit reference bureaus, stock brokerage, investment banking and insurance services, Product Innovation was measured by credit derivatives. Process Innovation

was measured through Real Time Gross Settlement (RTGS), Cheque Truncation System (CTS). The multivariate regression model employed is presented below:

Where: $NPLR = \alpha + \beta_2 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon$...

Y -   NPLR

ε -   the constant term;

b   -   the coefficient of the function;

X -   the value of independent variables

X_1 - represent the Institutional Innovations that measured by credit reference bureaus, stock brokerage and investment banking

X_2 - represent the Product Innovation that measured by credit derivatives, credit cards and debit cards

X_3 - represent the Process Innovations measured by Real Time Gross Settlement (RTGS), Cheque Truncation System (CTS),

ε -   the disturbance or error term

Operationalization of the variables

Research objectives	Type of the variable	Indicator of the variable	Measurement of the variable	Data collection method	Level of analysis
The effects of financial innovation on credit risk management of commercial banks of Kenya	Dependent variable	Credit risk management	Nonperforming loan ratio	Secondary source	Descriptive
	Independent variable	Process innovation	RTGS, CTS	Secondary source	Descriptive
	Independent variable	Institutional innovation	Credit reference bureaus, mobile banking, stock brokerage and investment banking	Secondary source	Descriptive
	Independent variable	Product innovation	Credit derivatives such as CDS, CLN, CBO, CDO etc. Credit cards, Debit cards	Secondary source	Descriptive

It is regression function which determines the relation of X (X_1, X_2, and X_3) to Y (NPLR). α is the constant term and β is the coefficient of the function (β represents the independent contributions of each independent variable to the prediction of the dependent variable), it is the value for the regression equation to predict the variances in dependent variable from the independent variables. This means that if β coefficient of X is negative; the variable affect NPLR negatively: one unit increase in X will

decrease the NPLR by the coefficient amount. In the same way, if the β coefficient of X is positive, NPLR increases by the coefficient amount. α is the constant value which NPLR is predicted to have when X equal to zero (if X=0 then α =NPLR). Finally, ε is the disturbance or error term, which expresses the effect of all other variables (variables that are not included in the function but could have effect on NPLR) except for the independent variables on the dependent variable that we use in the function. The significance of the financial innovation on credit risk management was analysed using the regression analysis SPSS output. Test of significance include coefficient of correlation (R), coefficient of determination (R-squared), t-test and ANOVA.

CHAPTER FOUR:

DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents analysis and findings of the study as set out in the research methodology. The study findings are presented as an evaluation of the relationship between financial innovations and credit risk management of commercial banks in Kenya. The data was from the banks' audited financial statements on the transaction volumes of: real time gross settlement (RTGS), cheque truncation system (CTS), credit reference bureaus, mobile banking, stock brokerage, investment banking and insurance services, credit cards and debit cards.

4.2 Response Rate

The data was gathered from 43 commercial banks that were registered by 2013. Due to availability of the annual financial results, data was obtained from all the banks making a response rate of 100%. The response rate is commendable and surpasses the 70% recommended by Mugenda (Mugenda and Mugenda, 2003). This owed to the Banking Act, 2010, requirement that all the commercial banks registered in Kenya, file their annual financial statement with CBK and in such a format as prescribed by the later.

According to the findings, 70% of the institutions had adopted process innovation, 16% of the institutions had adopted product innovation and 14% of the institutions had adopted institutional innovation. This implies that the most adopted innovation strategy was the process innovation. This had enabled the banks to serve more clients within a shorter time

4.3 Descriptive Statistics

Table 4.1 gives the summary statistics of the main variables that have been included in the model including: minimum, maximum, mean, standard deviation, skewness and kurtosis.

Table 4.1: Descriptive Statistics

	Credit Risk Management (NPLR) in %	Institutional Innovations In millions	Product Innovation In millions	Process Innovations In millions
Mean	6.86	12,802,007	12,802,628	9,241,854
Median	8613	138163,101	13,7568, 02	11, 337,0
Std. Deviation	5.58	12,337,034	4,274,096	14,796,698
Minimum	0.00	348,328	77,200	492,434
Maximum	27.45	52,614,656	21,920,674	69,619,452

The findings indicated that credit risk management as measured by non-performing loan ratio (NPLR) had a mean of 6.86 and standard deviation of 5.58. This shows that the commercial banks had nonperforming loans of Ksh0.0686 for every shilling lent out. A maximum value of 27.45 shows that some banks incurred as high as Ksh0.2745 default of every shilling lent. A high variance depicts high variability in the data.

Institutional Innovations was measured as the aggregate of transaction volume regarding credit reference bureaus, mobile banking, stock brokerage, investment banking and insurance services. The study produced a mean value of Ksh12, 802,007,000,000 transactions were conducted through the aforementioned means. The minimum and maximum values of Ksh348, 328,000,000 and Ksh52, 614,656,000,000

were established respectively. This depicts that on average transactions valued at Ksh12,802,007,000,000 were facilitated through institutional innovations.

Product innovations were measured by transaction income through credit derivatives, credit cards and debit cards. Product innovation had a mean of Ksh12,802,628,000,000. This depicts that transactions of similar value were facilitated by product innovations. This had a standard deviation value of Ksh4,274,096,000,000 and maximum value of Ksh21, 920,674,000,000 depicting variability in product innovations from one bank to the next.

Process innovations were measured through transaction income values of real time gross settlement (RTGS) and cheque truncation system (CTS). Process innovation had a mean of Ksh9,241,854,000,0000 standard deviation value of Ksh14, 796,698,000,000. This illustrates that on average, transactions worth Ksh9,241,854,000,000 were facilitated through process innovations. This value had a maximum value of Ksh69, 619,452,000,000.

4.4 Correlation Analysis

Table 4.2: Correlation Matrix

	Credit Risk Management (NPLR)	Institutional Innovations	Product Innovation	Process Innovations
Credit risk management (NPLR)	1			
Institutional Innovations	.584**	1		
Product Innovation	.455*	.160	1	
Process Innovations	.332*	.197	.189	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The findings indicated that at the commercial banks during the period 2009-2013 the financial innovations that had a positive correlation with the credit risk management as indicated by nonperforming loans ratio. Institutional Innovations had a good and positive linear relationship with nonperforming loans ratio (R = 0.584). This was significant at 95% confidence level given a p-value of $p < .001$. Product innovation had a positive and significant relationship with non-performing loans ratio (R = 0.455; p = .033). Process innovation had a positive and significant relationship with non-performing loans ratio (R = 0.332; p = .030).

4.5 Regression Model

In addition to the above analysis, the researcher conducted a multiple regression analysis so as to test relationship among variables (independent). The researcher applied the statistical package for social sciences (SPSS) aid in the computation of the measurements of the multiple regressions for the study.

Table 4.3: Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
.636[a]	.404	.357	4.51148

a. Predictors: (Constant), Process Innovations, Product Innovation, Institutional Innovations

b. Dependent Variable: Credit Risk Management (NPLR)

Coefficient of determination explains the extent to which changes in the dependent variable can be explained by the change in the independent variables or the percentage of variation in the dependent variable that is explained by all the three independent variables (institution, product and process innovations). The results produced a collection value of 0.636. A coefficient of determination value of 0.404 was produced. Thus, the independent variables that were studied, explain 40.4% of the relationship between financial innovations and credit risk management. This therefore means that there are other factors not studied which contributes 59.6% of the relationship between financial innovations and credit risk management in banks.

The study also used Durbin Watson (DW) test to check that the residuals of the models were not auto correlated since independence of the residuals is one of the basic hypotheses of regression analysis. Being that the DW statistics were close to the prescribed value of 2.0 (that is, 2.083) for residual independence, it can be concluded that there was no autocorrelation.

Table 4.4: ANOVA Model

	Sum of Squares	df	Mean Square	F	Sig.
Regression	525.280	3	175.093	8.603	.000b
Residual	773.431	38	20.353		
Total	1298.711	41			

a. Dependent Variable: Credit Risk Management (NPLR)

b. Predictors: (Constant), Process Innovations, Product Innovation, Institutional Innovations. Analysis of Variance (ANOVA) was used to make simultaneous comparisons between two or more means; thus, testing whether a significant relation exists between variables (dependent and independent variables). This helps in bringing out the significance of the regression model. From the ANOVA Model the analysis of variance and the F statistic value of 8.603 at $p < .001$. This indicates that the model has a probability of less than 0.1% of giving false prediction.

Table 4.6 also shows a high margin of error in using the model coefficients.

Table 4.5: Regression Coefficient

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	5.324	4.669		4.536	.000
Institutional Innovations	1.029	.731	0.749	4.145	.002
Product Innovation	1.293	.705	0.925	1.835	.004
Process Innovations	2.188	.835	1.045	-.225	.017

a. Dependent Variable: Credit Risk Management (NPLR)

b. In order to determine the relationship between the credit risk management and financial innovations in banks, the researcher conducted a multiple regression analysis. From the resultant regression model become:

$$NPLR = 5.324 + 1.029*X_1 + 1.293*X_2 + 2.188*X_3$$

From the model, when other factors (institutional, product and process innovations) are at zero, the credit risk management as measured by nonperforming loans ratio become 5.324. Holding product and process innovations constant, a unit increase in institutional innovations would lead to 1.029 increase in nonperforming loans ratio.

Holding other factors (institutional and process innovations) constant, a unit increase in product innovations would lead to a 1.293 increase in nonperforming loans ratio. Furthermore, holding institutional and product innovations constant, a unit increase in process innovations would lead to a 2.188 increase in nonperforming loans ratio.

4.6 Discussion of Research Findings

The findings indicated that at the commercial banks during the period 2009-2013 the financial innovations that had a positive correlation with the credit risk management as indicated by nonperforming loans ratio. Institutional Innovations had a good and positive linear relationship with nonperforming loans ratio (R = 0.584). This was significant at 95% confidence level given a p-value of $p < .001$. Product innovation had a positive and significant relationship with non-performing loans ratio (R = 0.455; $p = .033$). Process innovation had a positive and significant relationship with non-performing loans ratio (R = 0.332; $p = .030$). Therefore, this research confirms that there is need to manage risks across all functions of the commercial banks including the collection of deposits through current and savings accounts because they ultimately contribute to the credit risk factor of the organisations.

The findings indicated that credit risk management as measured by non-performing loan ratio (NPLR) had a mean of 6.86 and standard deviation of 5.58. This shows that the commercial banks had nonperforming loans of Ksh0.0686 for every shilling lent out. A maximum value of 27.45 shows that some banks incurred as high as Ksh0.2745 default of every shilling lent. A high variance depicts high variability in the data. An analysis on the relationship between the financial innovations and credit risk management of commercial banks established that, there was a positive relationship between real time gross settlement and cheque truncation system, credit reference bureaus credit card and debit card on credit risk management. The study found out that financial innovations improved the growth of commercial banks in terms of credit offered. Majority of the commercial banks studied revealed that there was increased growth of credit and earnings from the year 2003 to 2013. The reported

credit and deposits growth in over the period covered can be attributed to these financial innovations.

The study also found a positive relationship between efficiency and process and Technological innovations in commercial banks in Kenya clearly indicating that effective process and improvement in technology enhances commercial banks to perform very much effective and efficiently thus influencing the credit risk management of commercial banks in Kenya. The study results have been looking at the absolute values indicated that process innovations have a greater weight when it comes to determining the credit risk management of commercial banks in Kenya. .

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This study investigated the effect of financial innovations on credit risk management of commercial banks in Kenya. Bank financial innovations ranged from; debit and credit cards, mobile banking, electronic funds transfer, real time gross settlement, cheque truncation system, credit reference bureaus, stock brokerage, investment banking, bancassurance among others. Credit risk management was indicated by non-performing loans ratio. This chapter summarizes the findings of the study and makes conclusions upon which recommendations are drawn. Suggestions for further study are also captured as a way of filling the gaps identified in the study.

5.2 Summary of the Findings

The findings indicated that credit risk management as measured by non-performing loan ratio (NPLR) had a mean of 6.86 and standard deviation of 5.58. This shows that the commercial banks had nonperforming loans of Ksh0.0686 for every shilling lent out. Product innovations were measured by transaction income through credit derivatives, credit cards and debit cards. Product innovation had a mean of Ksh12,802,628,000,000. This depicts that transactions of similar value were facilitated by product innovations. This had a standard deviation value of Ksh4,274,096,000,000 and maximum value of Ksh21, 920,674,000,000 depicting variability in product innovations from one bank to the next. Process innovations were measured through transaction income values of real time gross settlement (RTGS) and cheque truncation system (CTS). Process innovation had a mean of

Ksh9,241,854,000,0000 standard deviation value of Ksh14, 796,698,000,000. This illustrates that on average, transactions worth Ksh9,241,854,000,000 were facilitated through process innovations. This value had a maximum value of Ksh69, 619,452,000,000.

The findings also revealed that financial innovations have a positive influence on nonperforming loan ratio of commercial banks. Among the bank financial innovations: institution, product and process innovations. This finding is supported by the coefficient of determination which shows that the 40.4% of the variations in bank nonperforming loan ratio are explained by banks' financial innovations. The influence of bank financial an innovation on income is also statistically significant ($p < .001$) hence justifies the aforementioned relationship. This means that the influence is not by chance.

5.3 Conclusion

Based on the findings of the study, it can be concluded that bank financial innovations positively influence credit risk management of commercial banks. The adoption of innovations by commercial banks has a high potential of improving financial performance and hence better returns to the shareholders. The versatility of innovations has made their adoption rate to be high among both the banks and their customers. It could have been challenging if the adoption was only with either the banks or the customers. Banks in Kenya have continued to perform well even when other sectors of the economy show lagged performance. This can be explained by the use of financial innovations which have enabled banks to start getting income and collecting loan repayment thus minimizing their credit risk.

5.4 Recommendations

The recommendations are based on the findings on the objectives of the study. Banks should continue investing in financial innovation delivery channels because they are able to control their administrative costs towards loan recovery much better than the traditional brick and mortar ways. The volume of transactions that can be processed on channels like the internet and mobile are high as compared to delivering such transactions using manual processes. This helps to minimize the cost per unit in processing, monitoring and effecting loan repayments.

The government should provide incentives for research and development to research scientists who would continue to invest their time and skills in discovering more bank financial innovations. This owes to the importance of financial institutions as a mean of intermediation which would be negated by high credit risk. It is recommended that the government also pursues a strategy to provide incentives for technology transfer from more developed economies in order to promote the adoption of world class innovations.

Mobile phones and internet have been found to have a major influence in delivering technology driven banking services. It is recommended that commercial banks continue to create sustainable business linkages and collaborations with mobile phone service providers as well as the internet service providers. Banks should leverage on mobile phones in monitoring and effecting loan repayments at the convenience of the customers.

5.5 Limitations of the Study

The study relied on secondary data collected from audited financial statements and risk manuals of the sampled commercial banks. Therefore, the integrity of the findings is affected by the accuracy and reliability of the financial statements, financial products reports and risk manuals of the respective commercial banks.

The study also faced the challenge of getting some detailed data because of confidentiality reasons which made the data collection very difficult since most of the commercial banks could not provide the critical information that was required because of fear that competitors could use the information for their own gains. Another challenge to the study was time as this was an academic work which had to be completed within a limited period of time; this made the research work difficult.

The study also focused on the concept of financial innovation as a key contributor to credit risk management of commercial banks although there are other factors that contribute to credit risk management of commercial banks whose effect could not be disregarded from the financial innovations.

5.6 Suggestions for Further Research

This study did not include all bank innovations and a further study is recommended to include innovations like agency banking, securitization and credit guarantees and their influence on the financial performance of commercial banks. A more detailed study can be conducted to establish whether the adoption of financial innovations contributed to financial deepening in Kenya.

The researcher suggests a similar study be conducted through a survey of the MFIs. Micro finance sector has received attention of banks and mobile money operator hence this sector is experiencing a transformation because of taking up larger roles in the economy and recognizing that it is a viable business practice. Micro Finance Institutions (MFIs) therefore must innovate and go beyond the micro loans to make this sector more profitable and sustainable This will allow for a comparison of the findings to come up with recommendations that be applicable to all the players in the lending business in Kenya

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APPENDICES

Appendix I: Licensed Commercial Banks in Kenya as 31st December, 2013

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

Source: CBK Website

Appendix II: Descriptive Data

Bank	Non-Performing Loan Ratio	Institutional Innovations (Natural Logarithm of institutional innovation)	Product Innovation (Natural Logarithm of product innovation)	Process Innovations (Natural Logarithm of process innovation)
Kenya Commercial Bank	7.53	17.661	16.868	18.057
Equity Bank	4.21	16.819	15.657	17.607
Co-operative Bank of Kenya	4.83	17.463	15.574	17.426
Standard Chartered Bank	1.45	16.787	15.611	16.972
CFC Stanbic Bank	2.28	16.892	16.227	17.266
Barclays Bank of Kenya	5.28	16.527	15.088	17.555
NIC Bank	3.44	17.085	15.182	15.879
Commercial Bank of Africa	4.04	16.976	15.324	16.340
Diamond Trust	1.27	17.307	14.218	16.248
I&M Bank	1.80	17.172	14.910	15.623
Citibank	0.57	15.937	12.469	15.864
Chase Bank	2.43	16.451	10.761	15.875
Bank of Africa	2.14	16.472	13.771	15.257
Bank of Baroda	4.11	16.757	13.472	14.502
National Bank of Kenya	6.92	16.622	16.100	16.514
Prime Bank	3.30	16.723	14.397	14.967
Housing Finance	6.87	16.188	13.542	15.073
Imperial Bank	4.60	16.603	11.740	15.538
Ecobank	11.66	15.975	15.009	15.865
Family Bank	8.43	15.230	13.907	15.946
Bank of India	2.11	16.269	12.897	14.051
ABC Bank	4.08	15.625	13.219	14.685
Consolidated Bank	10.96	15.339	13.960	15.075
Equatorial Commercial Bank	11.43	15.449	12.100	14.523
Gulf African Bank	3.58	14.175	10.979	14.940
Development Bank of Kenya	13.27	15.144	13.078	13.667
GT Bank Kenya	5.68	15.999	14.171	15.050
Giro Commercial Bank	3.74	15.613	****	13.868
Fidelity Commercial Bank	6.67	15.724	14.286	14.269
Guardian Bank	10.66	15.571	12.940	13.863
Victoria Commercial Bank	0.00	15.035	12.814	13.551
First Community Bank	8.32	13.628	12.736	14.718
Habib A.G. Zurich	3.26	14.641	12.999	13.665
K-Rep Bank	13.12	14.335	12.702	15.355
Trans-National Bank	14.64	14.347	12.291	14.104
Paramount Universal Bank	12.85	15.035	13.416	13.352
Habib Bank Ltd	4.79	14.017	12.361	13.092

Credit Bank	10.25	14.748	12.951	13.784
Oriental Commercial Bank	12.18	14.767	12.816	13.458
Middle East Bank	4.62	14.478	13.186	13.573
Jamii Bora Bank	21.14	11.470	12.714	13.718
UBA Kenya Bank	2.94	12.595	12.346	13.751
Dubai Bank	27.45	12.922	13.340	13.852