

**EFFECT OF DIGITAL FINANCIAL INNOVATION ON ECONOMIC
GROWTH IN KENYA**

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DECLARATION

This research project is my original work and has not been presented in this or any other University.

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D61/6150/2017

This research project has been submitted for presentation with my approval as university Supervisor

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DEDICATION

I dedicate this project to my Mother and my siblings.

ACKNOWLEDGMENT

I have an exceptional appreciation to God the almighty for the precious grace of life and sound health that He granted me throughout this Project. I wish to acknowledge the priceless support and inspiration of my siblings in writing this paper.

I extend my appreciation to my supervisor Dr. Winnie Nyamute for her valuable insights, critique and time that has gone into the preparation of this document.

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LIST OF ABBREVIATIONS

ADF – Augmented Dickey-Fuller

ARDL – Autoregressive Distributed Lag

ATM – Automated Teller Machine

CBK – Central Bank of Kenya

CRB – Credit Reference Bureau

GDP - Gross Domestic Product

GNP - Gross National Product

ICT – Information Communication and Technology

KNBS – Kenya National Bureau of Statistics

LM – Lagrange Multiplier

OCS - Over the Counter Services

RTGS – Real Time Gross Settlement

VAR – Vector Autoregressive

WEF – World Economic Forum

ABSTRACT

There is scarcity in the empirical works that points out the contribution of digital financial innovation on economic development and those have been done don't directly relate financial innovation to economic growth. Notable research conducted in regard to financial advancement seem to concentrate on banks and their impact on these financial institutions but not to the economy. This has denied the government and the investors very vital information regarding this critical area of financial innovation to economic development. The survey aimed to assess the impact of electronic financial innovation on Kenya's economic growth. The aim was to be achieved by analyzing the proxies of electronic innovation and their impact on the economy of Kenya. Such variables included the volume of mobile money transfer, the value of electronic mobile transfer and the volume of internet banking transactions. The study used descriptive structure and focussed on the information from reputable sources. Quarterly data was collected for a span of 10years, making the total number of observations to be 40. An array of approaches were used in the analysis ranging from correlation, descriptive analysis to ordinary least square regression. The model registered a 0.992 R square indicating a good fit. The model also had a 842 F value and a 0.000 P value which indicated that it could be used to generalize the population parameter. The portion slope factor for the quantity of electronic payment transactions was 0.8821, while the value of digital payment transactions was 0.217, the portion slope figure for the internet money transfer volume was 0.5431. The study concludes that all digital financial innovation variables contribute positively to Kenya's economy's expansion. This research recommends that the government should prioritize building the information, communication and technology infrastructure that would support Electronic and money wiring services among the banks in Kenya. Secondly, banks should strive to invest in efficient mobile money transfer systems and platforms. This would enable them to be competitively placed and increase their transaction volume, which will consequently spillover to the economy.

CHAPTER ONE: INTRODUCTION

1.1 Background of the study

Classical economists have acknowledged that banks play an important role in economic development. Bagehot (1873) was among the first proponents of this school of thought and underscored the critical contribution of financial institutions in accelerating growth. However, there were certain conditions that had to be met in this endeavor among them being inclusion of technology and the need for constant innovation by the financial institutions. On the same note, there is a need for innovation because of the stiff competition in the banking sector tries their best to outsmart each other to remain competitive in the field. Innovation is the utmost bet of ensuring that businesses stay afloat and sustain its growth and consequently, the growth of the economy. (Ozili, 2017). Schumpeter (1934) postulated that it's only through innovation that banks can develop and provide financial inclusion. The same has been echoed by recent scholars who assert that financial innovation models the populations' knowledge of the financial system and thereby catapulting the economy. (Claessens et al, 2001).

Innovation has highly dominated in the modern world transforming the organization's operation environment both internal and external and fostering them to grow and develop. Financial institutions have witnessed rapid transformation in systems, processes, products and governance increasing competition and leading to superior customer service (Bhargava, 2018). The financial sector in Kenya consists of commercial banks, microfinance banks, savings and cooperatives societies as well as insurance banks. Rapid improvement in technology in the financial sector has completely altered the financial

services in Kenya by the creation of numerous new financial instruments making it an area of high interest to researchers (Faye, 2018).

Merton (1992) described financial innovation as a process that is ongoing and that once it has been initiated it will always spiral to a new one. The starting point of financial innovation will form a building block of the next one, and thus it is a continuous process. It is through this argument; technology advancement has given birth to digital innovation. With the digital innovation financial institutions have smoothed and made quick flow of income to entrepreneurs increasing economic growth in Kenya. Digital Financial innovation have highly developed the banking system which has made them increase their income, liquidity, funding of investments as well as lowering operation costs and mitigate risks. The introduction of mobile banking, internet and agent banking has highly promoted entrepreneurship by capital making expansion so as to drive capital sufficiency for investors.

Digital innovation has catalyzed major processes and cultural transformation in Africa driving most of the organizations to treat information technology not as a cost center or service function but as a business enabler and alert response to competitive threats. For the last two decades, Kenya has witnessed rapid change and expansion in financial innovation leading to digitalization of most of the financial processes and systems which has created high competition prompting the CBK to thoroughly regulate them. The modern advanced technology has seen financial institutions go digital making their services effective and at low cost. In Kenya, the need to cut the long queues, transaction errors and high insecurity are other factors leading to digital innovation adoption. With the main objective to maximize profit, these financial institutions have played as “the gear to economic growth”

by developing customer-friendly products that have completely changed the well-being of the society making the Kenyan environment investment-friendly leading to economic development. Products like ATMs have reduced Over Counter Services (OCS) lowering the operation costs of these institutions (Kemboi, 2018).

1.1.1 Digital Financial Innovations

Digital monetary innovation is the course by which a novel financial technique is devised and how it disrupts the entire financial system and market. The introduced technique aids in solving the financial hitches and provides a mechanism of fast access and completion of transactions (Lerner & Tufano, 2011). Digital innovation involves application of digital tools and digital infrastructure to the existing information system tools to develop exceptional opportunities to other sectors which are beyond financial services like transport, education, energy and communication through very powerful means by opening up processes and systems which are user friendly and cost-effective (Lin, Geng & Whinston, 2001).

In finance, digital innovation has become very broad concept which through technology advancement has changed the way financial services are delivered opening room for more financial institutions in the market creating high competition. Digital finance includes the use of the internet and use of mobile money leading to branchless banking which has led to creation of wrappers and digital currencies like Cryptocurrencies and Bitcoin. Zekos (2004) contends that financial innovation comprises e-payment, e-money, e-banking, e-trading, e-broking, e-mortgage, and e-insurance. E-finance, also called digital finance or cyber finance, is described as the most promising area of e-commerce and as a driving force that is changing the landscape of the finance industry.

1.1.2 Economic Growth

Romer (2008) describes the growth of an economy as its aggregate expansion and increased mass production through manufacturing and provision of services in the economy. Growth of the economy is a critical indicator of a country's economic success and demonstrates where it stands in relation with other nations or their previous times. Economic growth is characterized by a proliferation in various variables in the economy such as, consumption, savings, government expenditure and net exports. It is mostly driven by capital accumulation, technological advancement, and employment (Romer, 2008).

According to Loayza and Soto (2002), it is the main duty of the government to ensure that the economy grows, however, it might be heavily burdened and thus resort to ways that might distort the market equilibrium such as increasing tax rates to raise more revenue. Therefore, the role of economic growth requires a holistic approach where all the agents play a key role in ensuring its sustainability and vibrancy (Romer, 2008). Players in key sectors of the economy namely, manufacturing, construction, insurance, and finance participate in the process of attaining national prosperity (Ayres, Robert, Warr, and Benjamin, 2006).

Economic literature provides various approaches for measuring economic growth, they are the national expenditure accounting approach and income accounting approach (Romer, 2008). The expenditure approach measures the aggregate consumption levels ranging from government expenditure to household expenditures including transfer payments, while the income approach measures all that households and the governments earn including transfer income (Romer, 2008). Other scholars have pointed out that economic growth can also be measured by comparing the average income levels between the current and previous

periods, a measure commonly referred to as Gross Domestic product Per capita, while others just consider the change in the general Gross Domestic Product.

1.1.3 Digital Financial Innovation and Economic Growth

Technological progress and growth in the economy are said to be linked positively because the economy is able to grow through new product innovation and entrepreneurship. This was supported by Miller (1986) who highlighted the crucial part undertaken by innovation and invention in the financial sector, an assertion that was later on supported by Merton (1992) who described the inventions as recipes of economic growth. Tufano (1995) describes digital financial innovation as the primary driver to the entire economic industry leading to economic growth because it's through quick income availability resources are availed.

Tufano (2003) argues that, financial innovation has shaped the economic scenery since time immemorial despite it being confined to the last few decades. All Companies should remain competitive in a growing economy and they need the right digital framework and strategies in this era of many technological changes which is prompting them to be innovative. Digital technological advances in financial services has enhanced cross-border trade in financial services and developed industrial structure in financial sector opening up income sources.

According to a 2014 World Bank dubbed digital dividend, digital finance has contributed to immense access to financial services and financial inclusion by extension. This has been exacerbated by the ubiquity of mobile phones across the globe and more so in African developing countries. For instance, in Kenya, the high increase in mobile phone owners and the rapid transformation to the digital mobile MPESA systems which has led to mobile

banking and ease payments of bills has highly contributed to savings, quick capital accumulation and growth of micro-enterprises which most governments see them as the foundations of industrial development.

Innovation promotes growth and transforms how organizations operate which should be in line with the changes in the environments, be it internal or external. The financial market has currently faced fundamental changes which are based on numerous digital innovations in products, Services, systems, processes and governance. Investment in ICT has made financial institutions to effectively meet customer service satisfaction and have also been able to cover a wide range of customers with the ICT network by delivering value added products which are user friendly. This has made them take a very vital part in the economy through resource mobilization, allocation and distribution promoting rapid economic growth.

1.1.4 Kenyan Economy

According to Makur (2014), commercial banks in Kenya have continuously been innovating new products and governance to improve their business records. The pace of change in the banking industry in Kenya is alarming making them to catch up with the global dynamic competitive environment. Information technology is being used as the critical force for transforming the banking sector by invention of new digital products such as ATMs, electronic banking, Mobile banking, M-shwari by Safaricom and M-Borrowing (Kopa) by Commercial banks. Transactions worth millions of dollars can take place electronically in seconds by pressing a single button (Castells 2001). EFT is widespread in all the banks and for payment transactions, funds are transferred digitally from one bank account to the billing clients` bank after the transaction is done. The inception of Credit

Reference Bureau facilitated easier provision of financial details of previous transactions conducted by individuals and in particular potential borrowers and it allows institutions to digitally access creditworthiness of their customers lowering their credit risk.

Kenya has industry-based economy maintaining an open trade system with the current major industries being agriculture, tourism, manufacturing, energy and financial services. The country is becoming investment-friendly streamlining foreign and local investments. As of September 2018, it is projected that Kenya's economy has a positive growth of about 6 percent of GDP growth, led by expansion in trade, telecommunications, construction and agriculture. The growth is also supported by a vast pool of highly educated professionals dominated by high level of IT innovation among the youth and also in financial sector. The interest capping on 14th September 2016 enacted by CBK became operational following exploitation of SMEs by Financial Institutions; however, emerging effects, to adverse effects of the law to the SMEs, Financial Institutions and the Kenyan Economy. The Kenyan high government debt is said to be a factor to the economy because of over-taxation to the investors forcing some of them to exit from the market.

According to Levin (2010), a high growth rate witnessed in developing countries is enhanced by financial innovation where venture capitalists have a digital platform to screen entrepreneurs and make informed decisions on how to fund them. Kenya is among the developing countries and with high competition and globalization; banks have been able to offer services for 24 hours with the main drawbacks being security factors. Many customers in Kenya have shifted from cash-based transactions to financial digital transactions which are said to be a tremendous boost to the Kenyan economy.

Litan (2010) argues that financial innovation has transformed how finance works. Many people in Kenya are using the MPESA to buy airtime and pre-paid electricity reducing Person to Person conduct purchases saving time and resources. The digital financial innovation in Kenya has completely transformed the economy and the welfare of the society and it can be referred to as “the muscular system of the Kenyan economy” which stretches to all other organs “the other sectors”. It has led to rapid development of financial and non financial institutions, resource mobilization and capital accumulation which has increased investment opportunities opening up job opportunities in both formal and informal sectors. Mobile and E-banking have rapidly increased supported by mobile phone usage which has significantly gone up by 80% over the past decade showing high potential to benefit the consumer and producer welfare as well as the broader economic development. Mpesa has saved over the Counter time of depositing and withdrawing money increasing privacy, mobile money malleability, banking, borrowing and also access to cheap financial services helping people to reduce poverty and boost economic growth.

1.2 Research Problem

Finance being Capital is the key factor of production in all economic ventures coming before labor and land (Laeven et al., 2015). With the fast dynamic changing economic environment dominated by high competition, globalization and economic changes create the significance necessity for innovation. With the main objective to maximize profit, financial institutions mostly the banks have served as “the gear to economic growth” by developing powerful customer-friendly products which seem to “roll the wheel” of the well-being of the society making the Kenyan environment investment-friendly leading to rapid economic development (Kemboi, 2018)

The empirical literature that has identified the significance of electronic financial creativity to an economy's development are limited and does not directly link the financial sector's success to economic growth. A tone of research conducted in regard to financial innovation seem to concentrate on banks and their impact on these financial institutions but not on the economy. This has denied the government and the investors very vital information regarding this critical area of financial invention to the Kenya's economic activity (Kenya Association of Bankers, 2017).

Empirical literature that have attempted to connect digital financial innovation and the performance of the economy are scarce. This is particularly the case in Africa and in particular Kenya. The literature review has established that studies reviewed have produced conflicting results, a study by Owusu and Odhiambo (2014) found a strong effect on financial innovation which applauds economic growth. A study by Loayza, Ouazad, and Ranciere (2017) noted that there was an increasing correlation between digital financialisation and economic growth, but an inverse short-run relation. Similarly, a study by Adu-Asave and Aboagye (2014) established an increasing long-run connection and a negative short-run associations. However, the variation of result can be associated with the measurement of financial innovation in their studies, for instance, Owusu and Odhiambo (2014), used broad money M2 to measure financial innovation, a measure which is the most suited for money supply (Levine, 2015); while Adu-Asave and Aboagye (2014) used time deposits (M3) A measure used for financial development as a proxy for financial innovation (Aghion and Howitt, 2009).

Studies in Kenya have focused primarily on the relation between modern finance and the growth prospects of banks.; Ngumi (2013), Ngari and Muiruri (2014), Muthinja (2018), and Muhammad and Mungai (2019). It is Mwinzi (2014) who attempted to carry out research that linked financial innovation and the economic progress in Kenya.

Research utilized data from 2008 to 2013, a period considered too short to make valid inferences (Greene, 2009). Additionally, the study was conducted in the year 2014 and therefore considered to be relatively old considering the dynamic nature of the variable at hand. It is against this background, this document attempted to address the statement of what type of relationship exist between digital financial innovation on Kenya's economic growth?

1.3 Research Objectives

To assess the implications of electronic modern finance on Kenya's economic growth.

1.4 Value of the Study

The results of this research can be applied by policymakers who are in the area of financial system like CBK to act as a way to digitally improve financial inclusion to foster economic development by developing flexible policies which boost innovation to the sector.

To the general public, this study will help them understand that Digital Financial Innovation is an engine of economic empowerment with how way it has tremendously transformed their social welfare by helping them enrich their household well-being as well as broadening the ecosystem. This will help them to highly nurture the financial digital system.

It will also be used by the Academies, scholars, and researchers to provide literary materials in area of digital financial innovation and also for further conceptual studies. To them it will act as a reference on the discipline of digital financial innovation and for more empirical results on the relation in both electronic modern finance and economic expansion.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The chapter criticizes Kenya's economy's literature on electronic modern finance. It will look at theoretical and empirical literature analysis and also the conceptual model.

2.2 Theoretical Literature Review

This segment highlights the theoretical ideas applicable to the study.

2.2.1 Classical Economic Theory

Discussions about the free market economy were first brought about by Adam Smith (1876). He proposed for the invincible hand in the economic set-up, where the economy was to be left to work without government intervention, that the market forces and the interaction of price mechanism should be left to bring about equilibrium in the economy. The classical economic theory is built on the premise of the Laissez-Faire economic market. Where there is little government control, and firms and households can make their own independent decisions regarding the economy. This is vital in ensuring that resources are allocated according to the wishes of businesses and individuals in the economy.

Bagehot (1873), in his classical works of Lombard Street, underscored the vital importance of the essence of the banking industry in the economic development. He put across the various circumstances that banks could accelerate growth through innovation and identifying and funding potential investments. This proposition was later on advanced by Schumpeter (1912), who argued that the banker, therefore, is not so much predominantly the broker in the commodity purchasing power as a producer of this commodity. He emphasized that the services that are provided by financial intermediaries which include,

project evaluation, saving mobilization, risk management, monitoring managers as well as simplifying transactions are key ingredient for the technological innovation and therefore, the growth of the economy.

Levine (1993) in a study on the impact of the creation of the financial sector on economic progress, presents cross-country evidence utilizing data on eighty nations from the years spanning between 1961-1989, the results of his findings are consistent with Schumpeter's proposition. He established that the various variables of financial development have a strong connection with economic development, capital accrual, and enhancements in the efficiency of employing the physical capital. Further, the various standards of financial development are seen to be highly related to future projections of economic growth.

2.2.2 Keynesian Economic Theory

Keynes (1930) in his book “Treatise of Money” presented the arguments that show the important financial sector's contribution in the development of a nation’s economy. Using an analogy, he presented bank credit as a pavement along which the manufacturing process passes, he also continued by saying that if bankers understood their duty, they would provide facilities to the levels that are sufficient to provide full employment of productive powers of the society. In the same regard, Robinson (1952) postulated that fiscal advancement is a by product of economic progress, and whenever there is enterprise development finance will just follow. Both arguments, however, recognize the role of the current institutional structure, which in many cases is exogenous. The Keynesian model acknowledges the fact that the government has to spend in order to boost the economy during recession, however, similar to classical economists he recognizes that consumer spending and business investment also play a pivotal role in stirring economic growth.

Keynesian theories have always focused on immediate responses to economic problems, thus the policy they seem to advocate is focused on the short-term needs of the economy. In times of economic downturn (recession/depression), firms and households usually lack resources to address immediate constraints facing them. In this case, it's the government that is perceived as the only force to end the meltdown through fiscal and monetary policies, which boosts the aggregate demand and thereby increasing the level of output.

In the Keynesian model, it is the extension in public spending that brings about financial deepening and inclusion, as money is injected into the economy. This is further supported by Shaw (1973) and McKinnon (1973), who posited that when the government allocates credit efficiently and equitably, it would lead to a well-functioning of financial institution and market which provides opportunities for everyone in the economy thus stimulating investment in the economy and alleviating poverty. They concluded by stating, it is through the advancement of the financial sector and improving access to finance that economic growth can accelerate and income inequality reduced.

2.2.3 Solow Growth Model

Robert Solow created the Solow growth model in 1956 in his book titled "A Contribution to the Theory of Economic Growth". The theory was built on the premise of neoclassical economics however, these models failed to factor in the role played by technological progress in the growth and development of economies. Solow growth model postulates that other than the two common factors of production, namely, labor and capital; technology too is a critical factor input in production. The argument for this is that; population and labor supply grow at a constant rate, while capital intensity is dependent on the rate of growth of labor and the dependence of these two variables in production process would

only mean that output also grows at a constant rate, and in some cases at a slightly lower rate. Therefore, there is need for adoption of technology in the production process. The theory views technological advancement in the production of goods, provision of services and business processes as a critical force needed to drive economic growth. In the model, it posits that technological advancement leads to efficiency in the production and delivery of services which leads to high productivity of output.

The proponents of the Solow growth model have augmented the model to link technological progress in financial sector to economic growth. Meyer-Foulkes, Aghion and Howitt (2005) extend the model to explain the mechanism over which financial innovation accelerates economic growth. They asserted that there is a bidirectional association between technological progress and financial system, as technology spurs the growth of financial system and vice versa. When financial systems develop as a result of technology, it leads to the frequency in which financial systems avail money to innovative entrepreneurs in the economy, and thus economic development. Goetzamann (2009) in support of the model opines that, due to the intertemporal nature of the model, technological progress in the financial sector would facilitate diverse and wide range of transactions to the existing, new and future entrepreneurs. Similarly, Aghion and Howitt (2009) commend the theory as it captures the element of technological progress and augments it with their model to include financial development as an exogenous variable.

The model is useful to this study as it highlights how the technological development in the financial industry is a contributing factor in economic development. The model is also useful in outlining the other critical factors in assessing economic development among them labor and wealth creation.

2.3 Determinants of Economic Growth

This segment emphasises the factors critical to considering an economy's growth.

2.3.1 Digital Financial Innovation

Empirical and theoretical results indicate that financial innovation and economic growth are strongly related. De Koker and Jentzsch (2013) working on firm-level dataset found out that effective financial systems ease the financial restraints that firms face. Recent studies have also shown that financial deepening promotes income inclusion and alleviates poverty and thus it serves to benefit the poor (WEF, 2015). Merritt (2011) established that financial innovation brings about a reduction in transaction costs and a wider distribution of capital across the economy, this enables the new private sector business models that will aid in addressing other key development priorities. Additionally, financial innovation through mobile money transfer can improve the effectiveness of government transfer payments, which in turn provides efficiency in government spending Cecchetti and Kharroubi (2013). The research expected a plus sign in the coefficient of the proxies for digital financial innovation.

2.3.2 Investment

Economic theories inter alia, Keynesian theory (1936), Harrod-Domar (1950), and Solow growth model (1956), have explained the critical role that capital accumulation plays in the growth of an economy. Investment is described as the increase in capital stock or simply put, capital formation. According to Modigliani and Miller (1980), capital formation reflects the investment in the stock market as well as investment in the economy. They assert that, for an economy to grow, it must channel its income from consumption to capital formation.

The Keynesian (1936) theory identifies the mechanisms through which capital formation leads to an increase in output; the theory posits that whenever individuals earn their income, part of it goes into saving and part into consumption depending on the individual's marginal propensity to either save or consume. Keynes asserts that an economy that has a higher propensity to save has higher economic growth because the savings are channeled to capital accumulation through investment. The study expected a linear link of fixed capital formation and economic growth.

2.3.3 Inflation Rate

Economic theories suggest that unemployment is a crucial factor in economic development. It is highlighted as the main macroeconomic problem that governments need to deal with. Inflation is described as the general and persistent increase in the overall price of commodities (Makiw, 2011). The high inflation rate signifies an overall rise in prices and this can contribute to the deterioration of the economy because people will not be able to afford the products killing the aggregate demand. The consumer price index is used to calculate inflation (Romer, 2012). This analysis predicted a minus sign between economic growth and inflation.

2.4 Empirical Literature

Baltagi, Demetriades, and Law (2009), performed a panel data analysis in well economically established and developing Nations, in their study, they established that positive impact of GDP growth is mostly applicable in economies that have poor institutional framework, such as weak or nonexistence financial regulation, or in economies that have an extremely high inflation. The study indicates that the positive impact on growth of GDP is unique to all countries or regions.

Loayza, Ouazad, and Ranciere (2017) did a study on the effects of financial innovation and the growth of GDP in Europe Countries. The study established a positive long-term relationship between long-term financial innovation and GDP growth and a short-term inverse relationship. Tee and Ong (2016), did a study on European nations to evaluate the effects of adapting cashless payment on growth of the economy. They used data from five European countries (Austria, France, Belgium, Portugal and Germany) from 2000 to 2012. They used cheque payments, electronic money, card payment and telegraphic transfer as a proxy of cashless payments. They found out that positive effects of cashless transactions occur on long-term but not short-term economic prosperity.

Narrowing down to Africa, Owusu and Odhiambo (2014) investigated the influence of banking development on GDP Expansion in Nigeria. Research used the Autoregressive Distributed Lag approach (ARDL) approach on data spanning from 1990 to 2013. The study established that financial sustainability has a strong long-term impact on GDP expansion. However, the study used money circulation in the economy (M2) as a default for financial advancement, a measure that is more suitable for financial intensification than for financial innovation. (Levine, 2015).

Similarly, Tyavambiza and Nyangara (2015) did a report on the financial innovation on economic growth partnership in Zimbabwe. The study used Granger's causality model and found a unidirectional causality of GDP growth for modern finance. Nevertheless, analysis has shown that financial technology has a positive effect on economic development, economic growth has no influence on modern finance. The study used liquid liability (M3) as a measure for technological innovation in finance, a principle considered closely related to the provision of money than to financial development (Aghion & Howitt, 2009).

Adu-Asave and Aboagye (2014), did a report on the financial innovation-economic development partnership in Ghana. In the study, the analysis used the Vector Autoregressive (VAR) method and the Granger causality framework. Study found that financial technology had a strong and important long-term impact on GDP growth. The study also established a negative and significant short-run coefficient of financial innovation. These results are conflicting.

Bara and Mudzingiri (2016) did a study in Zimbabwe on whether there is a correlation between technological innovation in finance and economic expansion?. They tested data for the period 1980-2013, the study reveals that long-term growth powered by technological advancement in finance provides a causal correlation in financial innovation and economic expansion in Zimbabwe..

In Kenya, Mwinzi (2014) did a project on technological advancement in finance and how it impacts economic growth of Kenya. By using Real Time Gross Settlement (RTGS) and Cheque Clearance as proxies to financial innovation and employment of Ordinary Least Square, the study found that financial technology had a significant impact on GDP-based economic development. The study however only used 5 years to measure the effect. The problem of using five years is that it is considered a short time to make valid inferences on economic growth as it cannot capture the long-run effects on growth (Greene, 2011).

Nyasimie (2016), examined the effect of mobile payment transaction facilities on Kenya's economic development. The target population accessible was for 7 years or 28 quarters; 2007 to 2015. She used a census methodology because the mobile money transfer existence by then was short. The findings showed that mobile payment transaction-on-economic growth is indirectly associated through increased economic deepening, financial inclusion

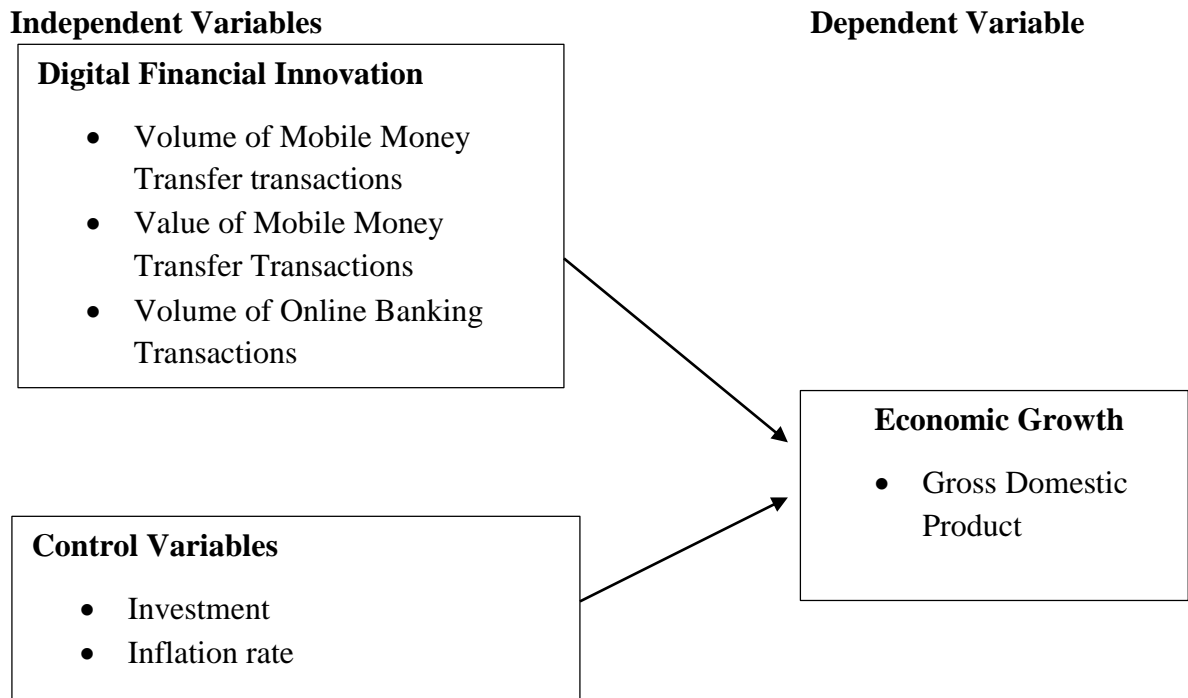
and employment opportunities. The study, however, used questionnaire items to measure economic growth and failed to establish a direct link between the variables.

Nato (2017), did a survey on the influence of the nexus between financial technology and economic expansion in Kenya. The research used the Maximum Likelihood Estimation approach to try to determine this effect. The research obtained positive coefficient of financial innovation and showed that financial technology does have a significant impact on Kenya's productivity growth. The study tried to use an indirect mechanism that links economic growth and financial innovation and therefore it would be hard to trace the actual effect.

2.5 Conceptual Framework

A conceptual framework is a tool that shows the potential relationship between a set of independent variables on a dependent variable. This study conceived that electronic financial technology, based on the value of money transferred through mobile payment, the volume of mobile money transfer and the size of internet banking transactions, impact Kenya's economic growth. Using the Economic output (GDP), economic activity was calculated and it was the dependent factor. Other variables that are likely to influence economic growth are inflation and investment; these two variables were included as control parameters in the model.

The conceptual model is shown in Figure 2.1.



Source: *Author, 2019*

Figure 2.1: Conceptual Model

2.6 Summary of Literature Review

The chapter has reviewed theoretical and empirical literature, as well as providing a conceptual model for the study. Three theories have been reviewed with the aim of identifying the key variables that affect economic growth and also establishing a possible nexus between financial innovation on economic growth. These theories are Classical economic theory, Keynesian economic theory, and Solow growth model. From the theories, the study has conceptualized, digital financial innovation and investment to be the major components that impact a country's economic expansion. The study will consider inflation rate because it affects the purchasing power of an economy.

The study also went ahead to review closely related literature to the concepts in the study. First of all, there is little quantitative literature on the correlation between virtual financial technology and economic expansion, notably, in Africa and in particular, Kenya. The literature review has established that studies reviewed have produced conflicting results, the Owusu-Odhiambo study (2014) identified a positive correlation between productivity growth and technological advancement in finance., while the study by Adu-Asave and Aboagye (2014) established a positive long-term and negative short-term correlation. However, the variation of results could be ascribed to the measurement of financial innovation used, for instance, Tyavambize and Nyagara (2015), used M2 to measure financial innovation, a measure which is most suited for money supply (Levine, 2015). While Adu-Asave and Aboagye (2014) used M3 as a proxy for financial innovation a measure used for financial development (Aghion and Howitt, 2009).

Studies conducted in Kenya have mainly focused on the association between financial innovation on the banks' financial performance, notably among them; Ngumi (2013), Ngari and Muiruri (2014), Muthinja (2018), and Muhammad and Mungai (2019). Mwinzi (2014) attempted to study the effect on financial creativity on Kenya's productivity growth. This research analysed data from 2008 to 2013, a period considered too short to make valid inferences (Greene, 2009). Additionally, the study was conducted in the year 2014 and therefore considered to be relatively old considering the dynamic nature of the variable at hand. The desire to undertake this study was informed solely by the above-mentioned voids in the study and discusses the main goal of analyzing the overall impact of digital financial creativity on Kenya's economic activity using data from 2009 to 2018.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

The section describes the methods used to perform the thesis which includes: study design, data sources, evaluation, and diagnostic tests for pre- and post-model estimation.

3.2 Research Design

This is a strategic plan that is employed in investigating the association between the variables under a study intending to address the goals of that study (Cooper & Schindler, 2001). The research seeks to use the descriptive research design; it is a framework that contains a number of approaches that can be used to explain causality between the variables (Mugenda & Mugenda, 2003). A descriptive research design is useful in this study because it can be used on a wide range of data and can present data in many forms including graphics, tables, and figures (Kothari, 2004).

3.3 Population

Population relates to a set of people, topics or artifacts with a specific feature to which study seeks to achieve research results (Kothari, 2004). The population of the sample was all financial institutions in Kenya which are currently 43. Since the study intended to use aggregate data, the population constituted the sample size making census the appropriate sampling method. The study's area was Kenya. Using aggregate national data, the research used a 10 year duration that is, from 2009 to 2018. The period was chosen because it was in 2008 when mobile money transfer became vibrant in Kenya with the inception of MPESA.

3.4 Data Collection

All the figures used in the study were gathered from secondary sources 2009 to 2018, Kenya's quarterly time series data was used. The data on the variables selected for the study were sourced from the database of various agencies. Data for mobile money transfer volume, value, and that of internet banking transfer were taken from Central Bank of Kenya's website. Inflation rate and investment data were taken from the website of the Kenya National Bureau of Statistics (KNBS) which publishes Kenya's economic survey report, unemployment and investment data yearly.

3.5 Diagnostic Test

3.5.1 Pre-estimation Diagnostic Tests

The survey analyzed data from quarterly time series over 10 years. Time series results are not recorded as the mean and variability are not always consistent over the duration. Therefore, it will be necessary to execute test for stationarity to establish if unit root is present or absent. The research employed the Augmented Dickey-Fuller procedure together with the Philips Perron test for this purpose. The two approaches have been selected for the sake of robustness.

3.5.2 Post-estimation Diagnostic Tests

Timeseries analyses are mainly based on the Ordinary Least Square assumptions which if violated they are likely to lead to serious econometric problems such as biased and inconsistent estimates. The study carried out tests for heteroscedasticity and autocorrelation to examine the viability of the model. Heteroscedasticity refers to an econometric situation that arises where the variability of the error term variance is fitful. It

results in breach of Ordinary Least Square (OLS) which needs the error term to have a constant variance; this is likely to lead to inefficient regression predictions. The study used Breusch–Pagan test for heteroscedasticity.

On the other hand, Autocorrelation is an econometric problem that arises when two successive error terms seem to be correlated, a situation also referred to as serial correlation. Ordinary least square requires that error terms in a time series be independent of each other as this would lead to biased and inconsistent estimates rendering the inferences invalid. The study used the Breusch-Godfrey LM test for autocorrelation.

3.6 Data Analysis

The relationship between digital financial innovation and Kenya’s economy was specified using a time series model so as to relate the independent variables; mobile money transfer volume, mobile money transfer value, the volume of web banking transactions, investment and GDP dependent inflation rates. A time series model is considered important for analysis of this study as time-series data is collected quarterly over a period of 10 years.

The estimated model was specified using equation 3.1

$$LnGDP_{it} = \beta_0 + \beta_1 lnX_{1t} + \beta_{2i} lnX_{2t} + \beta_{3i} X_{3t} + \beta_{4i} X_{4t} + \beta_{5i} lnX_{5t} + \varepsilon_{it} \dots \dots \dots 3.1$$

Where:

t=Number of years in the study, which is 10 years

$LnGDP_{it}$ = Natural log of GDP

lnX_{1t} =The natural log of mobile money transfer volume

lnX_{2t} =The natural log of the mobile money transfer value

$\ln X_{3t}$ = The natural log of the volume of internet banking transaction

X_{4t} = Inflation rate

$\ln X_{5t}$ = The natural log of investment

β_{1i} , β_{2i} , β_{3i} , and β_{4i} are partial slope coefficients

3.7 Test for Significance

This study intended to use inferential statistical approaches to explain whether the explanation of the relationship between the variables under study is explained by chance or have scientific backing. The study used confidence intervals of 99 and 95 percent. The acceptable P-values that informed rejection of the null were those that were less than 0.05.

3.8 Operationalization of Variables

The measurement, sources and expected sign of variables are presented in Table 3.1

Table 3.1: Operationalization of Variables

Variable	Measurement	Source	Expected Sign
GDP	It was measured by summing up the total of total consumption, investment, government expenditure, and net exports.	KNBS (Economic Indicator Survey)	
Mobile Money transfer Volume	Was measured using the total number of digital transactions Millions	CBK, (Bank annual supervision report)	+
The mobile money transfer value	Was measured using the monetary value of all the mobile money transactions in Billion Kenya shillings	The CBK, (Bank annual supervision report)	+
The volume of internet banking transaction	Was measured using the monetary value of all internet banking transactions in thousands	CBK, (Bank annual supervision report)	+
Inflation rate	It was measured by the CPI	KNBS, (Economic Indicator Survey)	-
Investment	It was measured using the fixed capital formation, an indicator used by the KNBS to measure the level of investment. Measured in Billion	Kenya National Bureau of Statistics, (Economic Indicator Survey)	+

CHAPTER FOUR: DATA ANALYSIS, FINDING, AND INTERPRETATION

4.1 Introduction

This section provides and an indepth results of the study. This provides descriptive statistics on average, standard deviation, skewedness and kurtosis. The chapter also gives the outcome of the correlation analysis, unit root test, the regression model as well as post estimation diagnostic tests.

4.2 Descriptive statistics

It is the inception point of analysis and forms the basis of the empirical analysis. It is critical as it enables the researcher to get the general feel of the data, that is; it helps in identifying any form of anomaly or the presence of outliers in the data. Descriptive statistics are useful in giving a summary of the data and the variables which act as a guide for empirical analysis (Cooper & Schindler, 2001). In light of this, the study applied the measures of central tendency and dispersion used to provide the summary statistics of the parameters used during the analysis. The results are reported in Table 4.1.

Table 4.1: Descriptive Statistics

Variables	N	Mean	Standard Deviation	Skewness	Kurtosis
GDP	40	950.756	149.591.8	0.0915	1.9902
Volume of mobile transfer	40	236.3287	164.842	0.3743	2.1873
Value of mobile transfer	40	549.6747	298.6187	0.0561	1.6814
Internet Banking transactions	40	616.943	365.881	0.2391	1.7829
Inflation rate	40	8.17325	3.702982	0.2239	2.2661
Investment level	40	54.4204	27.59955	0.1312	2.1444

The table above shows the results for descriptive statistics. The research interval covered 40 total observations from Quarter 1 2009 to Quarter 4 2018. The 40 quarters average GDP price was Ksh 950.7 billion, the average value for the amount of mobile money transfers was Kshs 236,32 million, the average volume for mobile money transfers was Kshs 549,67 billion, the average volume for internet banking payments was Kshs 616,943 million, the average for inflation was 8.1%, while the average for investment was Kshs 54.5 billion.

Standard deviation is a function of how the data has spread out of the average. A lower standard deviation statistic is needed as it indicates that the average have not widely spread. The standard deviation for GDP was Kshs 149.591.8 billion and the volume of mobile banking transfer was Kshs 164.842 million, Kshs 298.6187 billion for the amount of mobile banking, 365,881 for the size of internet banking transactions, 3.702,982 for the standard deviation of the inflation rate and Kshs 27.59955 billion for investments. All the standard deviation figures are less than the value of the mean indicating that the data is not widely spread out. Additionally, this is a confirmation that there are no outliers in the data.

Skewness is an asymmetry indicator and it indicates how the mean has spread from the median. Explaining the information structure is important. This is advantageous to be distorted in absolute terms by a factor lower than 1. It shows the data is either not skewed or moderately skewed. The skewness coefficient for GDP is 0.0915, that for the volume of mobile money transfer is 0.3743, that for the value of mobile money transfer is 0.056, that for the volume of internet banking transactions is 0.2391, that for inflation is 0.2239, whereas that for the level of aggregate investment is 0.1312. From the above, it can be seen that both parameters have a coefficient of skewedness of less than 1 and are all neutral an indicator that the information are biased to the positive side. This supports the normal distribution of the results.

Kurtosis measures a tail's heaviness relative to normal distribution. Kurtosis is important to explain the presence of data outliers and to show the data's tail. In absolute terms, it is better to have a kurtosis coefficient of less than 3 as it indicates that the information has a light tail and therefore implies normal distribution. The Kurtosis factor of GDP is 1.9902, that for the volume of mobile money transmission is 2.1873, the value of mobile money transfer is 1.6814, the volume of internet banking activity is 1.7829, the rate of inflation is 2.2661, while the average level of investment is 2.1444. The coefficients are below 3, indicating the information are tailed correctly. This further confirms the usual distribution of the data.

4.3 Correlation Analysis

Refers to the two variables monotonic link. It is measured by means of a coefficient showing the degree of linear association between two variables. The differential varies from -1 to + 1, where values belonging to 1 mean a strong and positive association, and tending to -1 indicate a strong and negative correlation. While 0 values which in absolute terms tend to be zero mean weak correlation. The study follows the methodology of Pearson to examine correlation as the information are usually transmitted. The outcome is shown in the table below.

Table 4.2: Correlation Matrix

	GDP	Volume of mobile transfer	Value of mobile transfer	Internet Banking transaction	Inflation rate	Investment level
GDP	1					
Volume of mobile transfer	0.8547 (0.000)	1				
Value of mobile transfer	0.9875 (0.000)	0.8749 (0.000)	1			
Internet Banking transaction	0.9786 (0.0000)	0.8653 (0.000)	0.9853 (0.000)	1		
Inflation rate	-0.4881 (0.000)	-0.3855 (0.0014)	-0.4379 (0.047)	-0.4612 (0.0027)	1	
Investment level	0.8732 (0.000)	0.7365 (0.000)	0.8358 (0.000)	0.8585 (0.000)	-0.3692 (0.0191)	1

Note: The values in parenthesis are P-value

The table above indicates the outcome of the association test that is derived using Pearson's method of correlation. The relationship between GDP and mobile money transfer volume has a coefficient of correlation of 0.8575 and is significant at 1%. This means a strong, linear relationship exists between GDP and the volume of mobile money transfer. The

association coefficient between mobile money transfer value and GDP is 0.9875, which suggests a significant positive association between the two variables.

The correlation coefficient between online banking transaction volume and GDP was calculated to be 0.9786 and is important at 1%. This shows a strong, linear connection between the two variables. The coefficient of correlation for inflation-to-GDP relationship was found to be -0.4881 and significant at 1 percent. The result shows a negative relationship between inflation rate and GDP, but this connection is relatively weak. Eventually, total investment and GDP have a coefficient of association of 0.8732, these effects are important at 1 million. It indicates a consistent and strong relationship between the two variables.

4.4 Pre-estimation Test

4.4.1 Unit Root Test

This is important when it comes to modeling time series as it helps to avoid possible spurious regression cases. This study used the approach of Phillips Perron and the Augmented Dickey-Fuller to look into the root of the unit. Because of robustness, the two methods were used. The system root test results are shown in the table below.

Table 4.3: Unit Root Results

Variables	ADF Test Z(t)		PP test Z(t)		Order of Integration
	At level	First Difference	At level	First Difference	
GDP	-0.830	-5.499	-0.827	-5.481	I (1)
lnX1	-1.941	-10.032	-2.054	-10.032	I (1)
lnX2	-6.726	-	-8.214	-	I (0)
lnX3	-2.859	-	-3.682	-	I (0)
lnX4	-2.275	-5.016	-2.587	-5.685	I (1)
lnX5	-0.089	-7.718	-1.967	-7.785	I(1)

The table above shows the root unit result that is obtained using the Augmented Dickey-Fuller and Philips Perron Procedures. The two examinations have a null hypothesis that these series contain unit root while the alternative hypothesis states that there is no unit root in the series. From the results of the research GDP, the volume of mobile banking transfer, inflation rate and the level of aggregate investments have high MacKinnon P-values which means that we reject the null hypothesis and conclude that the variables contain unit root, after differentiating the data, they become movable and are therefore said to be integrated of the first order . The value of mobile banking transfer and the value of internet banking transactions, on the other hand, are movable in levels.

4.5 Regression Analysis

We used the analysis of linear regression, the natural log of GDP, the volume of mobile banking transfer, inflation rate and the level of aggregate investment in the model in their first difference, while the natural logs of mobile money transfer and the volume of internet

banking were used at their level. Tables 4.4 and 4.5 show the results of the regression analysis.

Table 4.4: Model Summary

Source	SS	df	MS	F	P-value
Model	0.9813	4	0.1963	F(4, 35) = 842.00	0.000
Residual	0.0793	35	0.0002		
Total	0.9893	39	0.0254		

The table above displays the summary of estimated model. The 842.00 F statistical value with a P-value of 0.000 results shows that the model can be used reliably to predict the dependent variable. The coefficients in regression analysis are shown in Table 4.5 below.

Table 4.5: Regression Analysis Results

Variables	Coefficients	Standard Errors	T-statistic	P-value
Constant	5.4063	0.03846	140.59	0.000
Log of Volume of mobile transfer	0.8821	0.12933	6.80	0.000
Log of Value of mobile transfer	0.2172	0.0273	7.95	0.000
Log of Internet Banking transaction	0.4531	0.19427	-2.33	0.026
Log of Inflation rate	-0.1708	0.07779	-2.2	0.035
Log of Investment	0.1107	0.00796	13.91	0.000
R-squared	0.9920			
Adj R-squared	0.9908			
Root MSE	0.01527			

The table above displays the regression model's result. The determination ratio, R squared is 0.9920, which means that the variance of 99.20 percent of GDP is due to internal variables. Such findings show a good match for the prototype. The outcomes in the regression model below can be fixed as indicated:

$$\begin{aligned} \ln GDP_{it} = & 5.4 + 0.8821 \ln X_{1t} + 0.2172 \ln X_{2t} + 0.4531 X_{3t} - 0.1708 X_{4t} \\ & + 0.1107 \ln X_{5t} \end{aligned}$$

$\ln GDP_{it}$ = natural log of Gross Domestic Product

$\ln X_{1t}$ = the natural log of mobile money transfer volume

$\ln X_{2t}$ = the natural log of the mobile money transfer value

$\ln X_{3t}$ = the natural log of the volume of internet banking transaction

X_{4t} = Inflation rate

$\ln X_{5t}$ = the natural log of investment

β_{1i} , β_{2i} , β_{3i} , and β_{4i} are partial slope coefficients

The y-intercept is 5.4, which indicates that the GDP log is 5.4 independently of the model's independent variables. The partial slope coefficient of mobile money volume transactions is 0.8821, an improvement in mobile money transaction size would result in an increase of 0.8 million in GDP. The coefficient for the quantity of mobile money transfer is 0.2172, a one percent change in the amount of mobile money transfer results in a rise in GDP by 0.2 billion. The slope factor of internet banking volume is 0.4531, a one percent change in internet banking size will result in an increase in GDP of 0.4531 million. The approximate inflation slope equation is -0.1708, a percentage increase in the inflation rate corresponds

to a GDP decrease of 0.1708. Ultimately, the investment rate slope ratio is 0.1107, an increase in investment level of one percent corresponds to an improvement in GDP by 0.11 percent.

4.6 Post-estimation Diagnostic Tests

These tests are performed to ensure that the model is strong. Autocorrelation test for Lagrange multiplier and heteroscedasticity test for Breusch-Godfrey. The results will be shown in the table below.

Table 4.6: Post Estimation Tests

Test	Coefficient
Breusch-Godfrey LM test for autocorrelation	Chi ² = 1.707 Prob > chi2 = 0.1914
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity	Chi ² = 1.22 Prob > chi2 = 0.2699

The table above shows the results for diagnostic post-estimation tests. Tests carried out were the autocorrelation analysis for Breusch-Godfrey LM. For this experiment, the null hypothesis claims that no serial correlation exists while the alternate hypothesis notes that a serial correlation exists in the form of mistake. From the findings, the Chi-square coefficient is 1.707 and the P-value is 0.1914, which means that at any statistical level it is not significant. Thus, we acknowledge the null hypothesis of no serial linkage and conclude that the model does not run counter to OLS's assumption of autocorrelation.

In contrast, to check heteroscedasticity, the study conducted the Breusch-Pagan / Cook-Weisberg. The Chi-square coefficient obtained for the experiment is 1.22 while the P-value is 0.2699, thereby acknowledging the null hypothesis and suggesting that there is a continuous variation of the error variable in the design. Consequently, this design does not break the principle of continuous variation in the Ordinary Least Square.

4.7 Interpretation and Discussion of Results

The natural log coefficient for mobile transfer size is 0.882, which is statistically significant at a significance level of 1 percent. Such results suggest that a rise in the volume of mobile money payments by 10 percent will result in a GDP shift of 8.2 percent. The results are based on the research by Loayza, Ouazad, and Rancieue (2017) who find that the size of mobile money transfers has an effect on GDP. This effect can be linked to the fact that mobile money transfer increases flexibility in allocating and sharing certain assets of finance and energy. Capital resource distribution enables new revenue streams in the private sector to help address other key growth priorities.

The proportional variance for the transfer value of mobile cash is 0.2172, this rate is statistically significant at 1%. The study suggests that an increase in the price of mobile banking transfer by 10 percent resulted in a 2.1 percent increase in GDP rates in Kenya. The statement was compatible with the research of Cecchetti and Kharroubi (2013), who established that the importance of mobile money transfer is to raise a country's GDP rate. The rationale for this is that financial institutions have some transactional charges on every mobile transaction that adds up to their net income and therefore a tax on the government, leading to an increase in GDP levels.

The coefficient for the volume of internet banking transactions is 0.4531, and 5 percent is significant. These results show that a 10 percent increase in the volume of internet banking transactions would result in a 4.5 percent increase in GDP. The results are in line with Merrit's (2011) research, which claimed that online banking offers a smooth way to transfer cash locally and globally. This facilitates economic growth by remittances. Internet banking can also make a contribution to economic development by enhancing the efficiency of state transfer payments, which in turn makes public spending more efficient.

These findings have emerged as expected, the partial gradient for the inflation rate log - 0.1708. The coefficient is significant at 5% and it indicates that a 10% rise in the inflation rate would contribute to a 1.7% fall in the GDP level. These findings prove Romer's (2012) claim that a high rate of inflation means an overall price rise, and this can contribute to the deterioration of the economic system as people won't be able to buy or rent the products and thus reduce economic activity.

The partial gradient for the log of aggregate level of investment is 0.1107, and significant at 1 percent. This result shows that a 10 percent increase in the level of aggregate investment will lead to a rise of 1.1 percent in the GDP levels and vice versa. The results align with the Keynesian hypothesis that investment leads to a rise in capital accumulation in the economy leading to increased levels of economy.

CHAPTER FIVE: SUMMARY, CONCLUSION, AND RECOMMENDATION

5.1 Introduction

The section includes a concise description of the results gathered by descriptive statistics as well as study of regression. It also presents the purpose-based conclusion of the research. This section offers suggestions for policies and proposed fields for future research as well.

5.2 Summary of Findings

The study aims to evaluate the effect of electronic financial innovation on Kenya's economic growth. Through evaluating the dimensions of technological development and their effects on Kenya's economic growth, this goal was to be accomplished. Such parameters include: transactions of mobile money transfer size and amount and also the volume of internet banking. The research employed an explanatory research design. The analysis used CBK and KNBS information from secondary sources. Quarterly data collected for a span of 10, resulting in a total of 40 observations. The results were evaluated using descriptive statistics, analysis of correlation and analysis of regression.

Distinct tests were performed to ensure the model was robust so that the projections were deliberate and consistent. The research, therefore, conducted a pre-estimation test to determine if the root of the unit was present in the data. The study used for robustness purposes the Augmented Dicke-Fuller procedure and the Phillips Perron procedure. The study found that the real GDP log, the natural log of inflation, the natural investment log, and the natural log of the volume of mobile transactions to be constant after the first

discrepancy. The study concluded a stationary rate of the size of internet banking transfers and the amount of mobile banking transfer.

In the regression analysis, the magnitude of mobile banking transfer have a linear and considerable partial gradient, the same was true for the value of mobile money transfer and the size of online banking transactions. The inflation rate had a negative coefficient of correlation and a partial slope coefficient of regression analysis among the control variables. The investment correlation coefficient was positive and significant, as was the positive and significant partial slope coefficient for investment rate.

Eventually, a post-estimation analysis was carried out by the study. The autocorrelation analysis for Breusch-Godfrey LM and the heteroscedasticity check for Breusch-Pagan was carried out. The research found that there was no autocorrelation and variation of the term of error providing. Therefore it can be inferred that the design is strong.

5.3 Conclusion and Recommendation

Based on the above discussions and research findings, we conclude that the study has achieved the objective of determining the impact of digital financial innovation on Kenya's economic growth. The study conceptualized that variable electronic innovation affects economic development.

We can infer in the observations that the volume of mobile banking transfer has a linear effect on economic development in Kenya. Such results are in line with the Schumpeter (2012) argument that the volume of mobile money transfer leads to economic growth as it raises individuals buying power in the country and correlates to productivity growth.

It can also be inferred that the value digital transfer of money has a positive influence on Kenya's economic development. Banks enforce exchange charges based on the total transaction, the higher the transaction volume, the higher the fees. This contributes to the banks ' revenue. This is correlated with GDP growth as it increases the value of tax that banks charge.

Finally, the study concludes that the volume of internet transactions has a positive effect on the economic growth in Kenya. These findings agree with empirical findings and the theoretical underpinnings of the study. Internet banking has eased the transfer of funds in recent years, it has facilitated international remittances as well as the effectiveness of government transfer payments, which in turn provides efficiency in government spending.

The study suggests that the government should prioritize the creation of information, interaction and software networks that would help digital and mobile money transfer banking in Kenya, based on the findings. The report further advises that banks will aim to invest in efficient systems and networks for mobile money transfer. This would allow them to compete and increase their volume of transactions, thus spilling into the economy.

5.4 Limitation of the Study

This study focuses on a 10-year period that may be detrimental in assessing whether a country's electronic financial technology has a short-term and long-term impact on its GDP. It will be reasonable to use a duration of more than 10 years to determine whether the effect is temporary or permanent.

However, certain non-bank organizations were not included in the study. Such as microfinance institutions like SACCOs.

Time and monetary limitations rendered conducting primary data challenging for the analysis. As a consequence, the analysis was restricted to the available information, so on a variety of points, there was no space for clarification and transparency. The condition would have been implemented by using primary research.

Topography has also been another limiting factor in this study, as most banks in Kenya are currently pursuing markets outside boundaries. Banks are participating in the states of Central Africa and the nations of the East African Group. In order to cater for extra banks working outside Kenyan borders, a larger scope should be used.

In the regression analysis, the study focused on a static model and therefore could not take into account the lags in the effect of the different independent variables on the dependent variables. Some variables require rather sometimes for their impact on other variables to be noticed, and this study did not take this into account as it used a method of linear regression.

5.5 Suggested Areas of Future Studies

In this research, a 10-year period was used, limiting the methodologies that could be applied to the data. A future study should try to cover a longer period of study.

The study was based on Kenyan commercial banks' digital financial innovation. Future research on microfinance institutions and Saccos should be repeated and expanded. It is because these two are directed at alleviating poverty and reaching out to the economically disadvantaged wider population while giving the country a comprehensive view of electronic financial innovation.

A future study should use raw data to gather insights from key players in the electronic finance and creativity field. This could help to shed further light on the subject of the study and draw more realistic findings as a result.

Furthermore, the study prescribes new research on online banking and the profitability of East African banks due to the recent expansion of activities over and above the Kenyan borders. Since assessing the effect of mobile banking in the countries where these banks have entered will be important.

A future study using a vibrant model of regression. The consequence of this is that it will enable the research take into account the lag effect of predictor variables on dependent variables. This will be important in determining the precise time it takes to influence the dependent variable for the independent variables.

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APPENDICES

Appendix I: Data Collection Sheet

	GDP	Volume of mobile transfer	Value of mobile transfer	Internet Banking transaction	Inflation rate	Investment level
2009						
2010						
2011						
2012						
2013						
2014						
2015						
2016						
2017						
2018						

Appendix II: Data

Year	Quarter	Investment (billions)	Vol-trans	Valtrans	Inflation	Internet banking	GDP (millions)
2009	Q1	30.5223	34.824	89.5814	16.56	69792	702855
2009	Q2	33.5794	44.813	109.0019	16.72	68486	711723
2009	Q3	31.9682	52.2793	126.3844	14.35	73203	722388
2009	Q4	31.9676	25.8659	148.4438	11.42	179256	726699
2010	Q1	30.3594	64.9612	154.4847	8.64	198930	739896
2010	Q2	41.1123	72.4255	167.9924	6.32	221982	761606
2010	Q3	39.3188	83.184	191.81	5.03	228830	790837
2010	Q4	42.9693	90.4755	217.9328	4.12	254975	809998
2011	Q1	46.1246	89.481	240.766	3.93	266059	840308
2011	Q2	37.1198	103.5933	273.1038	5.2	298343	850185
2011	Q3	48.2956	116.4895	315.7494	7.88	332634	869176
2011	Q4	43.3152	123.4344	339.531	11.49	344497	893293
2012	Q1	30.7605	127.7824	356.844	15.1	349959	844810
2012	Q2	34.0309	140.1918	369.783	16.5	379796	848021
2012	Q3	31.1504	147.99	391.35	15.27	400508	862288
2012	Q4	32.0705	161.41	426.83	12.04	437862	885777
2013	Q1	28.4183	159.27	418.225	8.2	423326	899423
2013	Q2	30.5914	176.3693	453.879	5.61	495787	908648
2013	Q3	30.0352	190.85	496.45	4.44	515598	919529
2013	Q4	26.1627	206.1078	533.005	5.05	543176	927229
2014	Q1	42.1351	206.627	543.97	6.01	564055	939434
2014	Q2	47.1256	220.6715	574.706	6.58	607222	958984
2014	Q3	38.1703	234.5386	614.053	7.19	644255	970391
2014	Q4	42.7722	249.498	639.065	7.08	709808	977161
2015	Q1	46.6121	328.9344	650.508	6.74	766315	996800
2015	Q2	48.8552	265.4766	671.819	6.69	734339	1008995
2015	Q3	55.1247	284.4385	734.524	6.54	791857	1028345
2015	Q4	62.5255	311.52	759.248	6.31	832449	1036837
2016	Q1	64.1911	304.358	773.142	6.77	826050	1050653

2016	Q2	68.2778	319.669	818.733	6.72	892067	1069434
2016	Q3	71.6487	863.138	863.138	6.44	992669	1081790
2016	Q4	77.6597	369.731	900.092	6.48	1263543	1096625
2017	Q1	79.5086	372.861	899.052	6.26	1122003	1106413
2017	Q2	85.5716	387.237	912.674	7.2	1127054	1116581
2017	Q3	91.5831	377.207	896.151	8.21	1011662	1129637
2017	Q4	97.2636	405.87	930.597	8.33	1130315	1154496
2018	Q1	103.8587	464.084	1054.857	7.79	1047024	1177035
2018	Q2	110.4276	438.592	1008.927	6.24	1158185	1189430
2018	Q3	118.0575	420.422	959.64	4.95	1167860	1203943
2018	Q4	125.5734	416.475	960.946	4.53	1205998	1222573