

**EFFECT OF FINANCIAL INNOVATION ON ECONOMIC
GROWTH: A CASE OF MOBILE TELEPHONY FIRMS IN
KENYA**

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DECLARATION

This research project is my original work and has not been submitted to any other university or institution of higher learning for examination.

Signed 

Date 29/11/2021

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This research project report has been forwarded for examination with my approval as the university supervisor.

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DEDICATION

In loving memory of my dear mum.

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ACRONYMS AND ABBREVIATIONS

ARDL	Autoregressive Distributed Lag
ASEAN	Association of Southeast Asian Nations
CAK	Communications Authority of Kenya
CBK	Central Bank of Kenya
FDI	Foreign Direct Investments
FIN-TECH	Financial Technology
FSD	Financial Sector Deepening
GDP	Gross Domestic Product
GSM	Global System for Mobile Communication
ICT	Information, Communication & Technology
KIPRA	Kenya Institute for Public Policy Research and Analysis
KNBS	Kenya National Bureau of Statistics
OECD	Organization for Economic Cooperation and Development
P2P	Person to Person
PLC	Public Limited Company
R & D	Research and Development
SACCO	Savings and Credit Co-operative
SIM	Subscriber Identification Module
SPSS	Statistical Package for Social Sciences
UNESCO	United Nations Educational, Scientific and Cultural Organization
USSD	Unstructured Supplementary Service Data

ABSTRACT

The study investigated the effect of financial innovation on economic growth: a case of mobile telephony firms in Kenya. The key research concern was whether financial innovations by these firms could have an impact on Kenya's economy. Financial innovation was determined through mobile banking, mobile money transfer and mobile money agency, whereas interest rate and public expenditure were control variables for the study. Secondary data was obtained from repositories from Central Bank of Kenya, Communications Authority of Kenya and Kenya National Bureau of Statistics. The data covered the last 10 years, 2011 to 2020. The descriptive data analysis computed the mean, standard deviation, skewness and kurtosis of the data. In order to visualize the data changes over time, trend analysis was employed by representing the data graphically. Correlation analysis on the other hand assessed the level of association between financial innovation measures and economic growth as measured by percentage change in GDP. Regression analysis was used to determine whether financial innovations influence economic growth. Significant findings emerged. Mobile banking ($r=0.472$, $p=0.006$), Interest rate ($r=-0.316$, $p=0.004$) and public expenditure ($r=.435$, $p=0.013$) are significantly associated with economic growth. The regression results indicated that mobile banking is one of the financial innovation proxies that enhance economic growth ($\beta=0.233$, $p=0.000$). Interest rates significantly suppress economic growth ($\beta= -.157$, $p=0.015$), while public expenditure supports economic growth to a significant extent ($\beta= 0.201$, $p=0.034$). Thus financial innovation tools are potential drivers for economic growth in Kenya. The significant variables in the study account for 18.9% ($R^2=0.189$) of Kenya's Economic fluctuations. The study suggests that mobile telephony firms in Kenya should scale up their operations in mobile banking, mobile money transfer and mobile money agency services to spur growth. There is also need for more budgetary allocations to the ICT sector by giving incentives to innovators in the mobile telephony sector.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

According to Omwanza and Jagongo (2019), innovation refers to the manner in which firms design, lead or dominate in devising goods and services that are new to them. It could be in different forms such innovation in terms of process improvement, product enhancement, marketing improvement and R&D (research and development). Financial innovation entails the designing of new financial services and products and may also include institutional inventions. Most of these new products and processes could easily spur economic growth and development in aspects such as capital investments and financial productivity (Shehzad, Zaman, Kocak and Ferreira, 2021). Arner, Barberis and Buckley (2016) mention that the financial crunch in the year 2008 was the main motivation for fin-tech (financial technology) to do away with traditional financial services and advance better alternatives and options.

Various theories are relevant for this study. The Constraint-induced financial innovation theory Silber (1983), which maintains that innovations are key to achievement of the goal of profit maximization by firms. He argues that there are limitations towards attainment of this goal and so firms should be able to overcome them by being innovative. The Transaction Cost Innovation theory, Hick and Niehans (1983), brings out the correlation between financial innovation and cost efficiency. They argue that the end result of financial innovation is to reduce financial transaction costs. The Diffusion of Innovation theory, Rodgers (1995), describes how new financial inventions spread among the key market players, while the theory of Economic Development (Schumpeter, 1911) describes how innovation diffuses and ultimately affects economic growth.

The mobile telephony sector in Kenya dates back to the year 1999 when Safaricom public limited company (PLC) and Celtel (now Airtel Kenya Ltd) began operations. In 2008, Telkom Orange Ltd and Essar Telecom Kenya also joined the market. Novel mobile financial services were initiated by Safaricom PLC. The company dominated the sector by offering a monetary transfer facility through the M-pesa service in 2007 when it was

launched. The main drive behind this invention was that most Kenyans did not have formal bank accounts (Central Bank of Kenya, 2015). These telecom companies have emerged as fin-tech hotbeds and are using inexpensive and accessible technology to reach unbanked customers. This study took a keen focus on mobile telephony firms in Kenya because it is one of the leading sectors in matters of financial innovation.

1.1.1 Financial Innovation

This refers to the invention of new financial products, processes, services or institutions. Ho (2006) defines financial innovation as the advent of new financial products and services, organizational form or new processes, for a more advanced and complete financial market, which reduces costs and risks, and provides efficient services that meet the particular needs of participants in a financial system. Financial innovation is essential because it improves on efficiency by reducing costs, saves on time and improves customer convenience. All these have an effect on individual firm performance and ultimately the greater economy. Bara and Mudzingiri (2016) allege that financial innovation has transformed and rationalized banking services globally and led to growth of economies. It also has led to the tremendous growth of mobile computer, enhanced communication and improved mobile payment systems (Jonker, 2019) and (Kou, 2019)

Mobile banking (m-banking) is one of the key financial innovation instruments. It refers to a web-based interface where mobile phone devices are used remotely and primarily as the channel to make transactions between different bank accounts, and customers can access services such as balance enquiries, statement requests or make inter-account transactions (Odhiambo, 2013). Mobile money transfer is the process of transferring funds through a mobile device. The model transforms of a mobile network operator's messaging network into a subscriber identification module (SIM), where the monetary transaction takes place entirely within the telecom's network facility (Odhiambo, 2013). Mobile agency services are also key instruments of financial innovation where an agent acts on behalf of a telecom company. Most of these services are usually provided using unstructured supplementary service data (USSD), which is an infrastructural protocol used by the global system for mobile communication (GSM) to communicate with the mobile network operator's computer.

Most studies show that measuring innovation is beneficial to organizations, governments and economies. For example regulators can know which sectors are innovating more than others (Heffernan, Maggie & Fu, 2008). A common and ancient method used to measure innovative activities according to the Organization for Economic Cooperation and Development (OECD, 1963) and the United Nations Educational, Scientific and Cultural Organization (UNESCO, 1968) is by using R&D data. This remains the key measure of innovation inputs because of its definition, which can be handled differently by users to their own advantage (OECD, 2012). Magaju (2017) measures innovation using the revenues generated from the new inventions, while Muyoka (2012) supports the use of new products launched, new processes and new institutions. In this study, financial innovation is measured in terms of the number of mobile money accounts, number of mobile money subscriptions and volume of agent cash in cash out; for the mobile banking, mobile money transfer, and the mobile money agency variables respectively.

1.1.2 Economic Growth

Economic growth represents the accumulated growth in national income over time. It is the increase in real gross domestic product (GDP), that is, increase in the value of goods and services produced in an economy. It is the increase in real GDP or GDP per capita (per person), with the outcome being increase in national product. Haller (2012) posits that although there is no universally accepted definition for economic growth, most economists agree that it represents the quantitative increase of national income per capita. In a wider sense therefore, it would represent an increased production capacity and growth in national wealth. Growth of an economy denotes increase in GDP, gross national product (GNP) and national income (NI). All these measures, according to Haller (2012), can be expressed in both absolute and relative size. The rate of economic growth represents the annual increase in real GDP as a percentage.

Economic growth is a nexus of economic development, which simply reflects how this growth impacts on living standards. Economic growth improves quality of life through job creation due to enhanced productivity. It also creates competitive markets, builds stable macroeconomic environments through open trade and investment, and enables human development. All these drive towards improving the quality of lives. Past research papers

show a strong evidence that rapid and sustained growth is the single most feasible way of reducing poverty. The phenomena of economic growth and poverty is best explained in the pioneer works of Kuznets (1955), which embraces the ‘trickle down’ approach where growth is automatically considered to flow to the poor. Economic growth in terms of GDP can be measured in three ways: using output method where the total value of goods and services produces is assessed; expenditure method where the total value of goods and services bought is considered, and income approach, which takes into account the total value of income generated in an economy. This study uses the output approach.

1.1.3 Financial Innovation and Economic Growth

The Transaction Cost Innovation theory (Hicks and Niehans, 1983) argues that the main purpose of innovation is to reduce transaction costs, which may boost firm and industry performance, leading to economic progress. The Constraint-induced Financial Innovation theory (Silber, 1983) summarizes the reason for innovation as the achievement of the goal of profit maximization, and that firms are faced with certain constraints that lead them to innovate. An external constraint such as competition may be one of the stimuli for firms to innovate. The theory of Economic Development (Schumpeter, 1911) integrates entrepreneurship and innovation to economic growth. The theory further outlines that economic growth dynamics such as competition lead to innovation, and that close business rivals will imitate the innovation, leading to more investments. This increase in investment levels he argues, leads to economic boom. This proposition is closely related to the Diffusion of Innovation theory (Rodgers, 1995), which shows how new inventions begin from a single point and gets concentrated in a given market segment.

Various studies show that diffusion of innovations have increased financial deepening as they are seen to extremely improve the performance of the financial services sector {Financial Sector Deepening (FSD), 2019}. Laeven, Levine and Michalopoulos (2015) also assert that financial innovation is a key driver for financial deepening and economic development, while Glauco and Kyaw (2009) try to show that given diffusion of new technology, foreign direct investments can have a direct impact on the sectors of the economy where these funds have been allocated, and an indirect impact on the overall economy. Bahrini and Qaffas (2019) conclude that information and networking

technologies such as cell phones, internet and broadband penetration are key components of economic growth. Shehzad, Zaman, Jose, Kocak and Ferreira (2021) also add that financial innovation accelerates economic development through expansion of financial services, capital investment and effective financial intermediation.

1.1.4 Mobile Telephony Firms in Kenya

According to CAK (2019), the current registered mobile network operators that offer financial services are Safaricom PLC, Airtel Networks Kenya Limited, Telkom Kenya Limited, Mobikash, Mobile Pay Limited and Finserve Limited. The most eminent mobile financial services include M-Pesa by Safaricom PLC, Airtel Money by Airtel Networks Kenya Ltd, Telkom Kenya's T-Kash, Tangaza by Mobile Pay Ltd, Equitel from Finserve Kenya Ltd and Mobikash. M-Pesa currently dominates the sector with about 82% in market share. Airtel Money enjoys about 11.3%, while Equitel money has 5.8%. T-Kash and Tangaza each only have a paltry 0.5% and 0.3% respectively CAK (2019). It is worth mentioning that Equitel Money, a subsidiary of Equity Bank runs a virtual mobile network under Finserve Kenya Ltd, with holistic mobile money and telecom infrastructural services.

Mobile money services by Kenyan telecoms have improved access to financial services. This exponentially contributed to the use of non-financial institutions from 7.5% in 2006 to 32.9% of the bankable population by 2013 (FinAccess, 2013). The desirability of these services has mainly been attributed to their broad reach all over Kenya, including in remote rural communities. FinAccess (2019), CBK (2019) and KNBS (2019) reports show that financial inclusion grew from about 15% in 2006 to 44% in 2019. The telecoms sector in Kenya is on endless mode when it comes to innovation. For example, wallet to wallet interoperability of P2P (Person to Person) mobile money transfer was introduced recently in 2019 to help customers from different service providers to send and receive money directly into their mobile wallets, thereby increasing consumer choice and industry competitiveness.

1.2 Research Problem

Access to financial products and services such as loans, savings, and payment for goods and services can possibly enhance economic growth. World Bank (2020) reports that financial innovation enhances the performance of the financial services sector. The Kenya Institute for Public Policy Research and Analysis (KIPRA), (2020) outlines the main barriers to financial inclusion as remote proximity to financial service providers, excessive documentation, financial literacy and the cost of accessing these services. Mobile telephony firms have over the years tried to bridge some of these gaps by introducing user friendly and convenient financial innovation tools such as mobile money transfer and mobile money agency services. It is however unclear how these financial innovations by telecoms impact on the general economic growth because one, growth in most African countries is mainly sustained by agriculture and natural resources (KIPRA, 2020) and (Mlachila & Park 2013), and it is rarely linked to financial innovation (especially by mobile telephony firms); and two, there is still about 17% of Kenya's population which is excluded from formal financial inclusion (KIPRA, 2020), and it is not clear how this could impact on economic growth. This translates to about 10 Million Kenyans who have been left out of formal banking systems, hence a study is in dire need to determine if this scenario could affect economic growth.

Additionally, only few studies relate financial innovation to economic performance, with scholars such as Magaju (2017) studying the subject but at micro-level for telecommunication firms. Most empirical studies also show varying views. For instance, Nazir and Tan (2020) show how financial innovation contributes immensely to economic growth, Nyasimi (2016) posts an indirect relationship, while Bara and Mudzingiri (2016) show a bi-directional relationship between the two and conclude that this relationship may vary according to the variables that measure financial innovation. This study therefore investigates the relationship between innovation and growth, with the objective of answering the research question: What is the effect of financial innovation on economic growth: A case of mobile telephony firms in Kenya.

1.3 Research Objective

The objective of this study is to examine the effect of financial innovation on economic growth: A case of mobile telephony firms in Kenya.

1.4 Value of the Study

This study will contribute to knowledge in the theory of finance by advancing the hypothesis of financial innovation and if it could affect economic growth. These concepts have widely been studied but there still exist gaps to explain their correlation. This study will therefore add some new understanding in the area, hence help to broaden the existing body of knowledge.

This study also aims to encourage telecommunication companies to meet customers' needs by offering them the various commercial solutions through financial innovation. The findings of the study will enable the managers of companies to make informed decisions on matters financial innovation, which will result to perpetual growth for the individual firms, the telecommunications sector, and the overall economy. It will encourage mobile telecoms to undertake rapid investment in financial innovation tools if the sector is found to be an important contributor to the economic growth of Kenya. They will have the stimuli to identify the areas of opportunity and weaknesses, and work towards achieving their organizational goals, hence also contribute to the greater economy.

Policy makers such as government and regulating agencies may use this study to inform their tax policies and regulatory frameworks. Financial regulators such as the Central Bank of Kenya may consider the need to license telecom companies as financial services providers and hence supervise their activities and operations the same way they supervise the activities of licensed financial institutions. The Kenyan telecommunications industry regulator (Communications Authority of Kenya, CAK) may find this study to be of value and encourage telecoms to take up leading positions in matters financial innovation if the variables of this study are found to have a significant relationship. This will be geared towards improving financial inclusion, and sustaining economic growth with the intent to achieve Kenya's Vision 2030.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter outlines a summary of theoretical information and literature from other studies on the topics related to this study's research problem.

2.2 Theoretical Framework

The theories that underpin this study include Constraint-induced Financial Innovation theory, Transaction Cost innovation theory, the theory of Economic Development and the Diffusion of Innovation theory.

2.2.1 Constraint-induced Financial Innovation Theory

This theory was advanced by American economist Silber (1983), and outlines profit maximization as the main reason for financial innovation. He argued that in the pursuit of this goal, firms may face some constraints or restrictions which may either be internal such as self-imposed restraints like management or leadership style; or external, for example government-imposed or market-imposed constraints. He defined a constraint as anything that hinders progress. According to this theory, these constraints and limitations decrease the efficiency of financial institutions, and so firms go all out to eliminate them. His theory therefore aimed at providing a basis for introducing financial innovation as a way of minimizing constraint costs. Another economist, Schumpeter (1934) had earlier on emphasized the role of entrepreneurs in seeking opportunities for inventions to generate value and achieve the goal of profit maximization.

Tufano (2003) further postulates that, financial innovation helps to correct some kind of market inefficiency or imperfection. For instance, given a management style that leads to agency conflicts, then this innovation can improve the alignment of interest, or if markets are inefficient or have other limitations, innovation can increase opportunities by diversifying risk. One of the main weakness of this theory however according to Achieng, Karani and Tabitha (2015) is that it overly explains financial innovation in adversity and fails to express the concept in the context of liberal finance. This theory is relevant to this study because its main proposition is that financial innovation drives and enhances

profitability and growth, which may ultimately affect industry performance and influence economic growth.

2.2.2 Transaction Cost Innovation Theory

This theory was advanced by Hicks and Niehans (1983). They argued that the main motive for financial innovation is to shrink transaction costs, whose effect they maintained, is to improve the performance of the financial services sector. Most innovations are geared towards cost efficiency on the side of both the service provider and the customers. Reduced operations costs on the side of the service provider would translate to profit maximization, while clients would be enticed to stay if the transaction costs are low and the innovation gives them convenience in accessing the services. Gorton and Metrick (2010) attribute financial innovation to reasons such as cost reduction, tax advantages and decline in moral hazards; and transparency and customization. Heffernan, Maggie and Fu (2008) describe financial innovation as the advent of a new or better product or process that minimizes the cost of producing financial products.

Merton (1992) examined the future outlook of financial innovation and how it could lower costs of capital, reduce financial risks and improve financial intermediation. Finnerty and Emery (2002) also compiled an explanatory list of critical factors for innovation. The compilation covered consumer type financial instruments, securities, financial processes and financial strategies based on tax benefits, reduction of transaction and agency cost, minimization of risk of volatility in interest rates, and increase in liquidity. The Transaction Cost Innovation theory is relevant to this study because reduced costs have an effect on profitability for individual firms, hence may influence industry and country economic performance. The main criticism of the theory however is that it focuses on cost minimization and neglects the role of social relationships in economic transactions.

2.2.3 Theory of Economic Development

This theory is the brainchild of American economist Schumpeter (1911). It tries to show the way in which economic growth and business cycle dynamics are integrated. The central argument of the theory embeds entrepreneurship and growth, with entrepreneurship being entrenched to innovation. The Schumpeterian point of view was that business cycles are the end products of economic development dynamics such as competition. He argued that

competition steers innovation, which begets imitators. This action of copying a rival's innovation idea he further argues, attracts investments and ultimately leads to a boom. When the innovation gets saturated in the market and the original innovator's profit advantage is eliminated, the sector shrinks as investment moves elsewhere, until the next disruptive innovation which awakes the cycle once again. The theory provides a framework that shows the two dynamics (growth and cycles) are mutually influencing of each other.

The main criticism to this theory, which was also unraveled by the proponent himself, is that it was not useful during the great depression because even entrepreneurs failed to jump-start the economy. Schumpeter (1939) attributed this to ponderous and unlovely business cycles. In this later additions to the theory, he molded the creative destruction concept, which promoted the transformation of the economic structure through destruction of old behaviors and plans, and the creation of new ideas by entrepreneurs. This concept has however also been criticized for being complex as the outcome of a liquidation process and the reallocation of productive resources during a recession, and particularly a depression phase can have adverse economic effects in the short run (Legrand & Hageman, 2017). The theory is relevant to this study because it analyzes the key issues around innovation and economic growth, which are the major variables in this study.

2.2.4 Diffusion of Innovation Theory

Rodgers (1995) explains the manner in which financial innovation and ideas flow across populations through market or non-market channels, or through organizations. He describes how innovations are passed from an individual to another through the process of diffusion. Essentially, society adopts to new innovation by following leads from the first mover(s). Omwanza and Jagongo (2019) opine that innovations are very influential in attaining development and sustainability, and should therefore be embraced by firms in order to boost their performance and that of the economy altogether. The novel M-pesa service by Safaricom PLC was able to diffuse into the Kenyan market as other competitors took the challenge to keep up with competition. Through technological development, new inventions diffuse to other players in the industry (Tidd, 2006). Intense marketing is then done to be able to guarantee a larger market share for the inventor, before the other firms also sequentially adopt the technology.

The main weakness of the theory however is that, it fails to provide a framework that can help explain or predict the extent and rate at which diffusion occurs (Kiplagat & Tibbs, 2018). It may therefore be difficult for a regulator for instance, to determine how fast the rest of industry players catch up with a new invention, save for time factor only. The theory is important and relevant to this study as it helps to show how financial innovations pioneered by an entity spread and get concentrated in the market, and how this ultimately affects the performance of firms in the financial services sector, and the broader economy. The faster the diffusion of these innovations the better it will be for the industry players because most studies show that fin-tech increases convenience and reduces transaction costs.

2.3 Determinants of Economic Growth

Economic growth may be determined by financial innovation or other macro factors. Determining what produces higher income for an economy is what qualifies as a determinant of economic growth. These are further discussed in this section.

2.3.1 Financial Innovation

The financial services sector has over the years experienced rapid innovations, giving rise to reduced information asymmetry between clients and service providers. Financial innovators have a leading edge and are well compensated for their efforts according to Frame and White (2004). Some of the first mover advantages they obtain include cost savings, patent and licensing rights and increase in market share. This could generally improve the innovator's performance and that of the financial services sector in general, especially where there is rapid diffusion of innovation. Tufano (1989) finds out that investment banks that created new products charged lower prices in the long run than their competitors. Bracking and Sachikonye (2010) maintain that technology and financial innovation have smoothened the flow of remittances, which may augur well for an economy especially in terms of incomes, liquidity, funding and investments.

According to Schrieder and Heidhues (1995), the different types of financial innovation are financial system innovation, financial institution innovation, process innovation and product innovation. The first two categories would mainly relate to financial institutions, systems and markets; while process and product innovation could include telecoms. Batiz-

Lazo and Woldesenbet (2006) advise that a dissimilarity between product and process innovation is important as the implementation of each type of innovation has its own individuality and effect on performance. They argued that product innovations are market-oriented while process innovations are more internally-focused and efficiency driven. Product innovations are meant to meet the user market's need while process innovations are geared towards improving an organization's efficiency. Various literature such as Lumpkin (2010) and Streimikiene (2014) all come around to a general consensus that these financial innovation tools promote economic growth.

2.3.2 Interest Rates

Interest rates determine prices for financial assets and products. Low interest rates for instance make borrowing cheaper, encourages consumers to spend and drives investment by both firms and consumer households. This is because borrowers are left with more disposable income to spend and invest. High interest rates on the other hand make an economy to be rather sluggish. Various theoretical concepts help to explain the relationship between interest rates and economic growth. Tobin's Q model (Tobin, 1969) shows how interest rate cuts lead to increase in stock prices, eventually heightening investments, and hence output (GDP). Other models however show that interest rate has a varied effect on output. The theory of Irreversible Investment in (Bertola & Caballero, 1994) shows how an interest rate hike has a positive effect on output on one hand and an adverse effect on the other. This adverse effect on output is because of increased borrowing costs, while the positive influence on output is due to increasing investment activity in the present period, because economic agents expect further increase in interest rates.

2.3.3 Public Expenditure

Most theoretical literature presume a positive relationship between government spending and economic growth, for example the Keynesian framework which underlines the prominence of government expenditure in stimulating economic growth; and Wagner's law (Wagner, 1958), which transposes these two variables and tries to underscore the fact that economic growth is a principal determinant of public expenditure, and not the other way round. Wu, Tang and Lin (2010) support both of these theoretical views, and contend that there is a bi-directional relationship between government spending and economic growth,

so the relationship could go either way. On the contrary, many empirical literature show different opinions as regards these two variables. Verma and Arora (2010); and Ray and Ray (2012) disapprove of the existence of a relationship between public expenditure and economic growth. Boldeanu and Tache (2015) conclude that most government expenditure have a negative influence on economic growth.

Ahuja and Pandit (2020) argue that governments use public expenditure as an operative policy tool to sustain growth. Budgetary expansion increases private sector spending and this brings a multiplier effect to the economy. This could however be a double-edged sword according to Ahmad and Loganathan (2015) because increase in public expenditure could translate into increase in taxes or government borrowing, leading to reduced levels of disposable income for consumers, hence bringing about lower public consumption. These outcomes eventually contribute to the crowding out effect in an economy. Public expenditure may be measured in terms of the budgetary allocation to various spending units of government, and how the funds allocated have been used.

2.3.4 International Trade Components

Boldeanu and Constantinescu (2015) outline foreign trade components as imports, exports, trade restrictions and foreign direct investments (FDIs). These can be measured in aggregate values for example in terms of volume of exports, volume of imports or volume of trade. Many studies have considered international trade as one of the key ingredients for economic growth. Tekin (2012) finds that a rise in exports has a positive effect on economic growth. Al-Raimony (2011) argues that increase in real export leads to economic growth while real import growth may not positively influence the economy. This is also supported by Abu-Eideh (2014). Simut and Mester (2014) identify a direct causality relationship between exports, trade openness and economic growth. Openness or minimal trade restrictions may influence economic growth through channels such as foreign direct investment, technology and human capital transfers. Mihut and Lutas (2014) also find that the level of openness and human capital are positively associated with economic growth. Singh (2011) however argues that there is a negative relationship between the two variables.

2.3.5 Exchange Rates

Exchange rate is the price of a currency in relation to another. When a currency is devalued, imports become more expensive and exports more competitive. This could lead to increased demand for domestic goods and services, and give rise to inflation in the long run, but boost economic growth in the short term. Previous studies on exchange rate volatility and its possible effects on economic growth have often produced mixed results. Bargueli, Ben-Salha and Zmami (2018) explain that while exchange rate volatility may be considered to be a shock absorber for an economy, it may sometimes be associated with higher macroeconomic volatility through determinants of economic activity such as international trade and investment. Exchange rate is also not the only stand-alone determinant for economic growth as there are other intervening variables such as financial development (Aghion, Bachetta, Ranciere & Rogoff, 2009). Furthermore, Miles (2006) submits two conduits whereby exchange rates may affect economic growth. One through lower currency risk hence low interest rates, stimulating investment and growth. Two through a common currency, by reducing transaction costs associated with foreign trade.

2.3.6 Human Capital

Human capital refers to the set of skills, knowledge, ability and expertise of a country's workforce. A highly skilled work force would hypothetically lead to high levels of economic growth because of efficient production. Dixit, Suarav, Mandal, Sawhney and Singh (2017) state that most developed economies were fostered by a skilled work force. The most notable measure for human capital is the level of training and education. Behrman, Ross and Sabot (2008) take years of education as proxy for human capital. Other numerous studies also find that higher levels of education yield more human capital, and hence the more prospects for economic growth. Technology and innovation, which are key elements in growth economics is also influenced by human capital. As outlined by Funke and Strulik (2000), less developed countries can catch up on the first world nations through technological progress, which is strongly influenced by human capital stock.

2.4 Empirical Review

Khan, Fareed, Salameh and Hussain (2021) analyzed the impact of financial innovation and sustainable economic growth on the credit risk of ASEAN banks (Association of

Southeast Asian Nations). A sample of 4 ASEAN countries were selected from 2011-2018. Data was analyzed using a panel-corrected standard error (PCSE) approach. Findings showed both the two study variables contribute immensely to credit risk. The study recommended that policy makers and relevant authorities in the ASEAN countries ought to pay keen attention to the fact that financial innovation can positively impact the economy if adopted, and that they should encourage it by increasing money supply, as it was proven that these innovations are suitable for the credit risks of ASEAN banks.

Nazir and Tan (2020) studied financial innovation and its effect on the economy of China, India and Pakistan. They considered this relationship over the period 1970-2016 and used autoregressive distributed lag (ARDL) bound testing and Granger's causality based error correlation model in data analysis. They established that there was a positive and statistically significant relationship between financial innovation and the economic growth of the three countries. This goes a long way to show how big an impact innovation can have on the economy, since it is singular firms that make industries and ultimately make the whole eco-system of an economy.

Tahir *et al* (2018) determined the quantity and impact of innovative methods of payments used in Pakistan using an efficiency ratio. They used secondary data from the State Bank of Pakistan and covered the period from 2007-2016. The results revealed there was a significant positive relation of transactions on the web using the efficiency ratio. The study was therefore able to show that financial innovation can have a positive impact on methods of payment. This may have a ripple effect and be the ultimate determinant of financial performance of an entity and economy of a country in the long run.

Aayale (2017) studied the impact of financial innovation on the financial industry's performance, with a keen focus on how financial innovation could affect the economic performance of G6 nations (Italy, Britain, Germany, Japan, France and USA); and another set of nations (BRIC nations- including Brazil, Russia, India, China and South Africa), representing almost half of the world's population. Panel data for the period 1991-2014 was analyzed using a multiple regression model. Findings showed that financial innovation is significant in explaining the economic performance of these countries.

Bara and Mudzingiri (2016) sought to empirically establish if there is a causal relationship between financial innovation and economic growth, in Zimbabwe. Financial time series data for the period 1980-2013 was tested using the ARDL bounds tests and Granger's causality tests. The study found that financial innovation has a relationship to economic growth, and varies depending on the variable that measures financial innovation. They also found out that a bi-directional causality exists between the two variables after excluding financial development. The study recommended for the implementation of policies that enhance economic growth, alongside vigorous financial innovation practice.

Michael (2019) undertook a survey to establish the impact of digital financial innovation on economic growth in Kenya. The proxies of financial innovation used in the study were the volumes of mobile money transfer, the value of electronic mobile transfer and the volume of internet banking transactions. The study surveyed all 43 banks in Kenya for the period 2009-2018. Using a descriptive structure, secondary data was collected from KNBS and CBK databases. The study found that the digital financial innovation variables made a positive contribution to the economy. The recommendation of the study was for government to prioritize the development of a good ICT infrastructure to support digital finance by banks in Kenya; and also for banks to invest in proper and efficient digital systems to increase their transaction volumes, and contribute positively to the economy.

Mutua (2018) embarked on a study to establish the effect of financial innovation on financial inclusion in Kenya. He adopted a descriptive statistics model and used secondary instruments to collect data for the period 2008-2017. He used Pearson's correlation statistic and regression model for data analysis and measured financial inclusion using the number of deposit accounts in financial institutions. Study results showed a strong positive correlation. The regression model showed an overall indication that financial innovation improves financial inclusion. The study therefore concluded that financial innovation has a significant effect on financial inclusion, and recommended that all key players in the financial services space ought to have an understanding of the financially excluded population and how best to incorporate them.

Magaju (2017) studied the relationship between financial innovation and financial performance of telecommunication companies in Kenya. She used secondary tools for data

collection from the period 2007-2016. She surveyed four telecom companies, obtained secondary data and used a multiple regression model to analyze the variables. Her study found a positive significant relationship between financial innovation and financial performance, and recommended for management of the telecom companies to continue investing in financial technology.

Michelle (2016) studied the effects of digital finance on financial inclusion in the banking industry in Kenya, measuring financial inclusion using credit penetration. The study used descriptive statistics, with the target population being 44 banks in Kenya and one mortgaging institution, and taking a sample of 13 banking institutions. Secondary data was used and analyzed using regression and correlation analysis via statistical package for social sciences (SPSS). Findings indicated an insignificant negative relationship between the study variables. The study conclusion therefore was that digital finance did not have any correlation on financial inclusion in the banking industry because banks mainly adopt digital financial services to help them lower transaction costs and not enhance financial inclusion. The recommendation from the study was that banks ought to create more awareness on digital financial services and lower costs so as to encourage the usage of these digital services.

Nyasimi (2016) undertook to study the effects of mobile money transfer services on economic growth in Kenya. The study used an explanatory research design to establish cause and effect between the two variables. She used secondary instruments to analyze data obtained for the period 2007-2015 and used a general survey technique. Both regression and time series analysis showed that there was no co-integration between mobile money transfer services and economic growth. The study found an indirect relationship between the variables and recommended for policy makers to take serious consideration of mobile money transfer services when drafting policies.

Mwinzi (2014) sought to determine the effect of financial innovation on economic growth in Kenya. He obtained secondary data for the period 2008-2013 and analyzed it using a regression model, with SPSS being used to manipulate the data. The study concluded that financial innovation has a positive but insignificant effect on economic growth, and recommended for policy makers to put more effort to enhance financial innovation in

Kenya, and relook at the approach of financial innovation penetration in order to enhance financial deepening.

2.5 Summary of Literature Review and Research Gaps

The above literature gives a summarized detail of some of the theoretical and empirical studies done by scholars in the past. The four theories reviewed namely the Constraint-induced financial innovation theory, the Transaction Cost Innovation theory, the theory of Economic Development and the Diffusion of innovation theory all provide an important anchorage to this study as they help explain in detail various propositions about financial innovation and economic growth, and the possible nexus between them. The empirical studies on the other hand show in great detail the study objectives, research methodology, findings and recommendations by various scholars in the past.

Some of the empirical studies reviewed show some conceptual differences and rather try to bring an indirect relation between financial innovation and economic growth. Studies such as Mutua (2018) and Michelle (2016) try to bring out the relationship between these variables through use of financial inclusion as a proxy for economic growth. Many empirical studies have hypothesized a positive relationship between financial innovation and general economic growth. Evidence from the empirical studies reviewed however show lack of common consensus.

Nazir and Tan (2020); and Aayale (2017), for example, find a positive significant relationship between these variables; Bara and Mudzingiri (2016) reveal there is a causality relationship, which is bi-directional; Nyasimi (2016) discovers an indirect relationship, and Mwinzi (2014) unravels a positive but insignificant relationship. The variations in these findings may possibly be attributed to the different measurement proxies for financial innovation by these scholars. For example, Bara and Mudzingiri (2016) operationalize independent variables as ratio of broad money to narrow money; and growth in financial development, while Mwinzi (2014) has mobile money transfer, real-time gross settlement (RTGS) transfer and check clearing system transfers. All these studies also focused on the economy as whole without isolating a single sector for research.

There are vast studies which examine the relationship between financial innovation and economic growth, and which are linked to certain sectors of the economy. Studies such as Khan, Fareed, Salameh and Hussain (2021); Tahir *et al* (2018), Aayale (2017) and Michael (2019) try to show how financial innovation affects economic growth, for the financial services sector. Magaju (2017) however shows the relationship between financial innovation by telecoms, but with performance being measured at micro-economic level. These gaps herein discussed are the stimulus for this study, which sought to study the effect of financial innovation on economic performance, given mobile telephony firms in Kenya. In summary, the above literature review hasn't shown clearly how financial innovation in terms of mobile banking, mobile money transfer and mobile money agency could affect economic growth.

2.6 Conceptual Framework

This can be described as a visualizer which is drawn to show links between study variables. In this research it will shows links between financial innovation and economic growth.

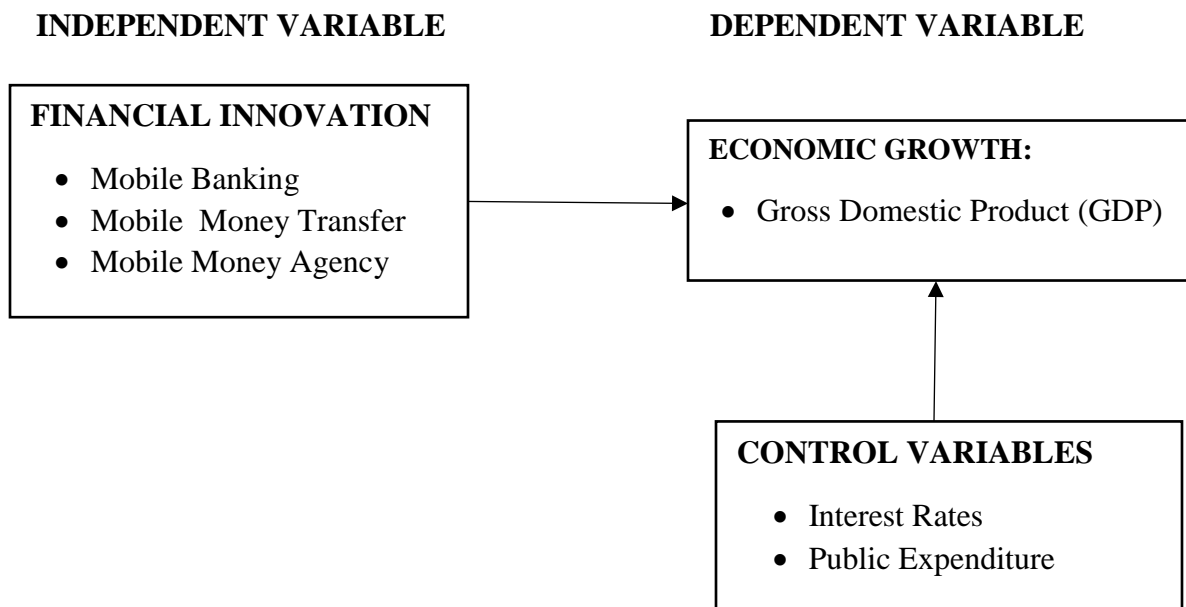


Figure 2. 1 Conceptual Framework
 Source: Author, 2021

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter covers the research design, study population, data collection and data analysis.

3.2 Research Design

A research design is the structure of research methods and techniques to be used so as to meet the objectives of a research. This study will use a descriptive research design. Kothari (2004) explains a descriptive research design as that which portrays precisely the characteristics of a particular situation, group or individual. Another reason for adopting a descriptive research design is that it facilitates data collection without interfering with their natural settings (Mugenda & Mugenda, 2003). It also makes references to the past and draws inferences for future phenomena.

3.3 Study Population

According to Tarsi and Tuff (2012), this refers to the sum of individuals present in a subjectively chosen geographic range. The population however could be individuals, objects or elements that are to be observed and determined. The population for this study consists of the six mobile telecom companies in Kenya that offer mobile financial services (CAK, 2020). Census survey technique was used since the study population is considerably small. Tarsi and Tuff (2012) state that a census is a full count of every individual or element in a population.

3.4 Data Collection

This study used secondary quantitative data. This is data which is collected from studies and publications by other researchers (Dawson, 2009). This study heavily relied on documentary sources as follows: Data on financial innovation obtained from the CAK reports, the regulator for the Kenyan telecommunications industry, and also from other regulatory bodies such as the CBK. Data on GDP, interest rates and public expenditure obtained from the Kenya National Bureau of Statistics (KNBS) database and CBK reports. The panel data covers 10 years (from 2011-2020), obtained on quarterly basis. This period is significant to the study because it is the period which Kenya has continued to experience

a surge in financial innovation(s) and its diffusion in the telecom industry. It is also part of the period during which the world experienced a global pandemic (COVID-19) that affected businesses operations and economies.

3.5 Data Analysis

Data has been evaluated using inferential statistics, i.e. regression and correlation analysis. Descriptive analysis has also been applied through statistical tools such as the mean, standard deviation and skewness. These have been used to analyze data for the 10 year period that this study covers. The regression model for the study thus is:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$$

Where, Y- Dependent Variable (Economic Growth)

X₁- Mobile Banking

X₂- Mobile Money Transfer

X₃- Mobile Money Agency

X₄- Interest Rates

X₅- Public Expenditure

α - Regression Constant

β - Regression Coefficient

ε - Error Term

3.5.1 Operationalization of Variables

Table 3. 1: Operationalization of Variables

	Variable	Measure	Empirical Study / Source
Y	Economic Growth	Gross Domestic Product (GDP)	KNBS (2020)
X ₁	Mobile Banking	Number of Mobile Accounts	CBK (2020)
X ₂	Mobile Money Transfer	Mobile Money Subscriptions	CAK (2019)
X ₃	Mobile Money Agency	Volume of Agent Cash in Cash out	CBK (2020)
X ₄	Interest Rates	CBK Interest Rates	CBK (2020)
X ₅	Public Expenditure	Actual Value of Public Expenditure	CBK (2020)

Source: Author, 2021

3.5.2 Diagnostic Tests

Some statistical assumptions may need to hold for any empirical study, including normality and linearity. These statistical assumptions may however face potential violations such as when there are outliers in the data set, unequal population variance or lack of independence for observations (especially those that are obtained over time), or when two identical variables are used in the regression model . These violations may result in incorrect results in data analysis.

Normality assumes that the residuals used in data analysis are normally distributed and are somewhat symmetric around the mean. This study assessed normality using a histogram of residuals. Linearity on the other hand refers to the straight line relationship between the variables, and is plotted using a scatter diagram. For multicollinearity, which occurs when there is high correlation between the predictor variables, variance inflation factor (VIF) is used, which should be less than 10. A plot of residuals versus the dependent variable is used for data outliers (heteroscedasticity).

3.5.3 Significance Tests

According to Moore, Notz and Flinger (2013), a test of significance is a type of statistical inference that is used to evaluate the evidence (data) about some claim (hypothesis), given a certain population. The results of the significance tests are expressed in terms of a probability that measures how well the data and the claim agree. This study used 95% confidence level and 5% significant level to evaluate the data that was obtained. F-test has been used for the overall significance of the regression model (goodness of fit) and t-test for the individual regression coefficients.

CHAPTER FOUR: DATA ANALYSIS, FINDINGS AND DISCUSSION

4.1 Introduction

This chapter presents the analysis of results for data obtained from CBK, KNBS and CAK databases, to determine the effect of financial innovation on economic growth, a case of mobile telephony firms in Kenya, for the period 2011-2020. The chapter is organized into two main sections. The first section is the descriptive analysis in which the mean and standard deviation are discussed. The second section presents the inferential statistics in which the regression and correlation analysis are used to answer the research questions.

4.2 Descriptive Statistics

Table 4. 1 Descriptive Statistics Results of Study Variables, 2012 to 2020

	Minimum Statistic	Maximum Statistic	Mean Statistic	Std. Deviation Statistic	Skewness		Kurtosis	
					Statistic	Std. Error	Statistic	Std. Error
GDP	.26	1.46	1.0508	.35458	-1.420	.717	2.953	1.400
Mobile Banking	9.98	118.79	58.3672	40.72543	.536	.717	-1.255	1.400
Mobile Money Transfer	-.99	22.75	5.2749	7.22485	2.029	.717	4.931	1.400
Mobile Money Agency	24.22	216.84	158.9219	63.06348	-1.389	.717	1.642	1.400
Interest Rates	7.23	15.75	9.7708	2.31954	2.135	.687	5.673	1.334
Public Expenditure	1.80	33.47	16.4976	10.30954	.460	.845	1.796	1.741

In the nine-year period, 2012 to 2020, the average change in GDP is 1.05% with a standard deviation of 0.354%. The minimum change is 0.26% and maximum is 1.46%. The results indicate significant volatility in economic growth during the 9 years under consideration.

The change shows a negative skew from the mean indicating there were many observations below the mean

During the study period, the number of mobile banking accounts averaged 58.367M with a standard deviation of 40.72543M. The number of mobile bank accounts is also a negative skew from the mean indicating a higher number of observations below the mean.

The mean for mobile money transfer in the period of study is 5.2749M (SD=7.22485). The minimum change in the number of mobile money subscriptions is -9.9M while the maximum is 22.75M. The data is positively skewed, indicating that there are more observations above the mean.

The mean of mobile money agency in terms of agency volume of cash in cash out is 158.9219M (SD=63.063); the minimum recorded change is 24.2M and maximum is 216.84M. The data is negatively skewed, an indication of large number of observations below the mean.

The mean interest rate in the 2012- 2020 period is 9.78% with a standard deviation of 2.32%. A rise in interest rates discourages investment; it makes firms and consumers less willing to take out risky investments and purchases. Therefore, higher interest rates will tend to reduce consumer spending and investment.

The trend of the variables for the 10 year period is also assessed using graphical approach to have an overview of general movements not captured by the mean and standard deviation. The plot of the total GDP for the 10 year period is shown in figure 4.1

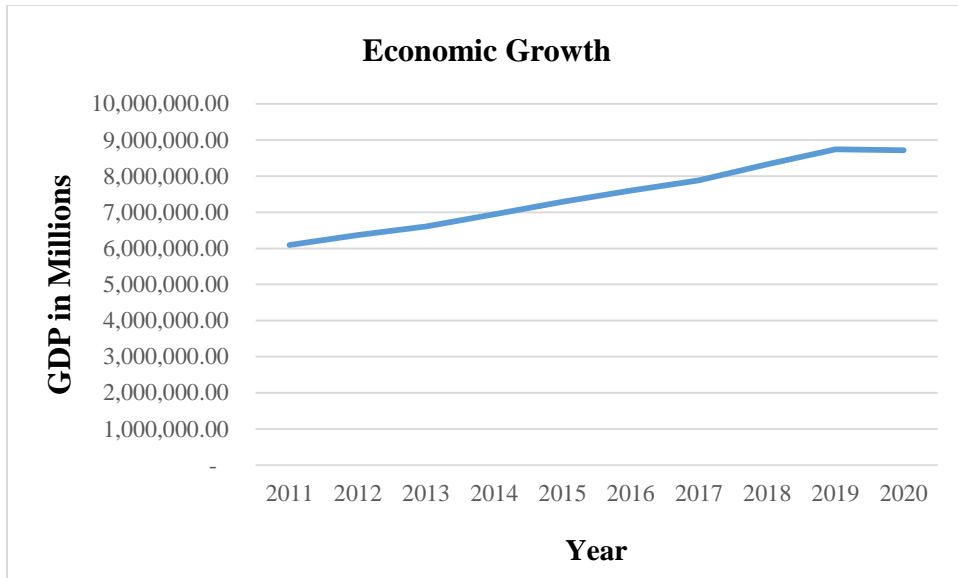


Figure 4. 1 Kenya’s Total GDP 2011 to 2020

GDP data was differenced to make it stationary such that it has an invariant mean, which is important in studying the movement of the variable around the mean. The result is shown in Figure 4.2, and indicates that the year to year percentage change has been in the range of 1.19% in 2012 to 0.255 % in 2020, with the highest change recorded in 2018 (1.46%), and a further decline in 2019 (1.02%).

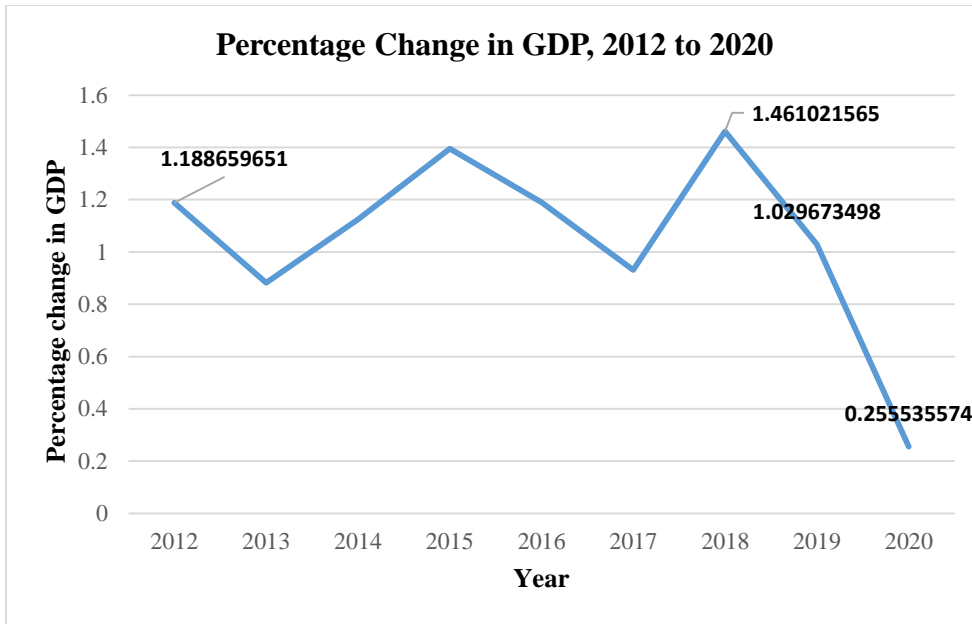


Figure 4. 2: Percentage Change in GDP, 2012 to 2020

Trend results for mobile banking as shown in figure 4.3 indicate a sustained increase in the number of mobile money accounts.

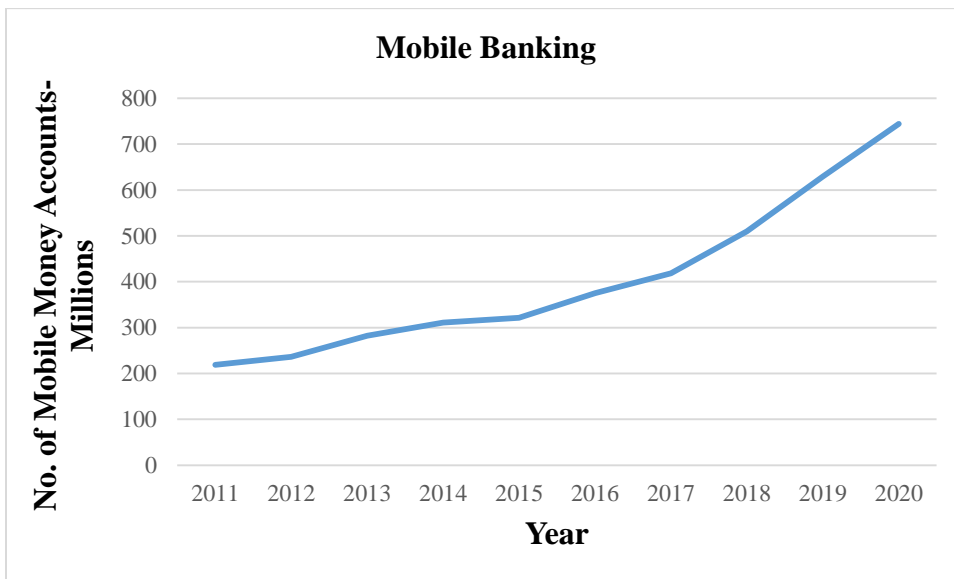


Figure 4. 3: Total Mobile Money Accounts, 2011 to 2020

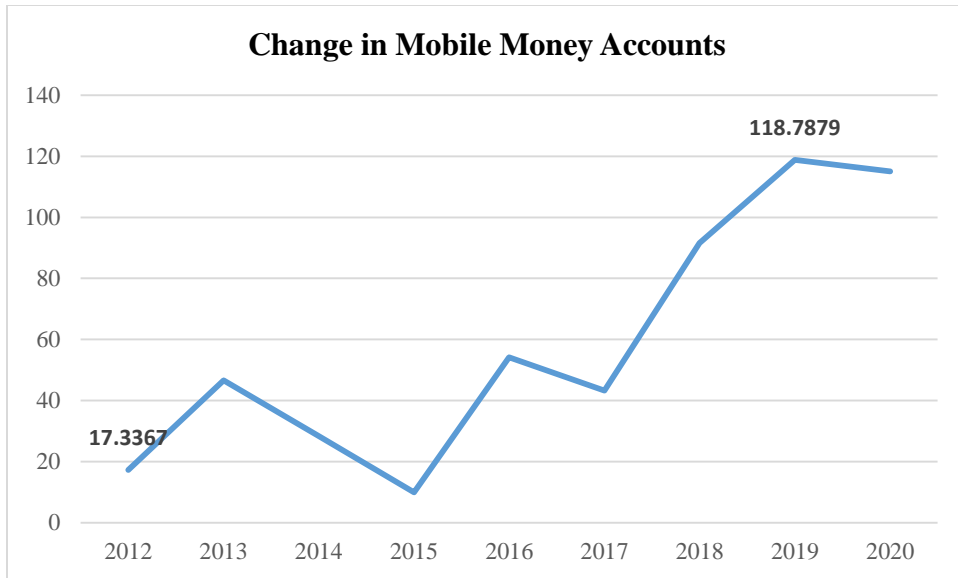


Figure 4. 4: Change in Mobile Money Accounts, 2012 to 2020

Figure 4.4 shows the change in number of mobile money accounts during the period

Mobile money transfer has generally been rising each year. The period 2011 to 2013 recorded the fastest growth in mobile money subscriptions. However, the negative effects of the 2017 election and the 2019/20 COVID shock are noticeable by a dip in subscriptions, and then the trend continues to flatten.

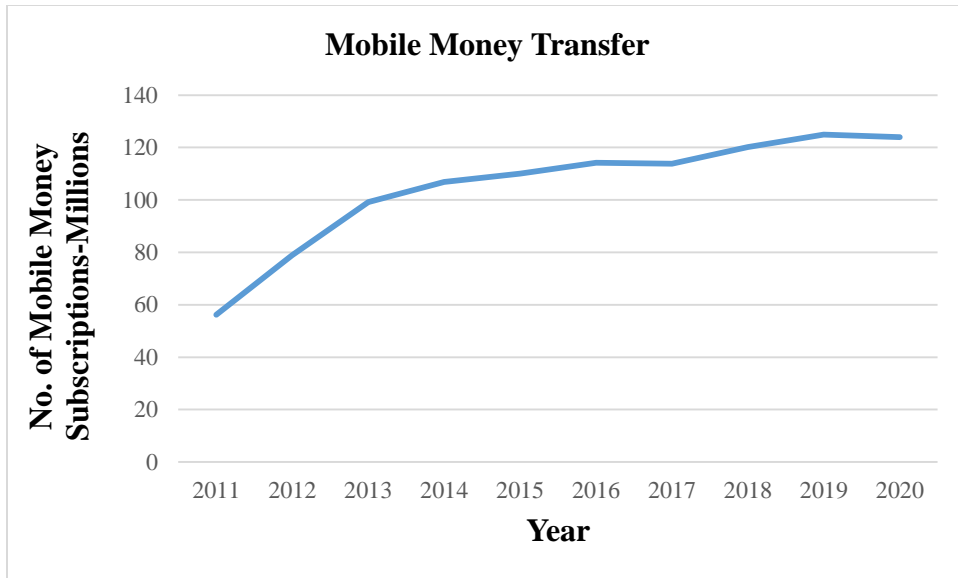


Figure 4. 5: Mobile Money Subscriptions, 2011 to 2020

As shown in figure 4.6, mobile money agency also recorded an upward trend.

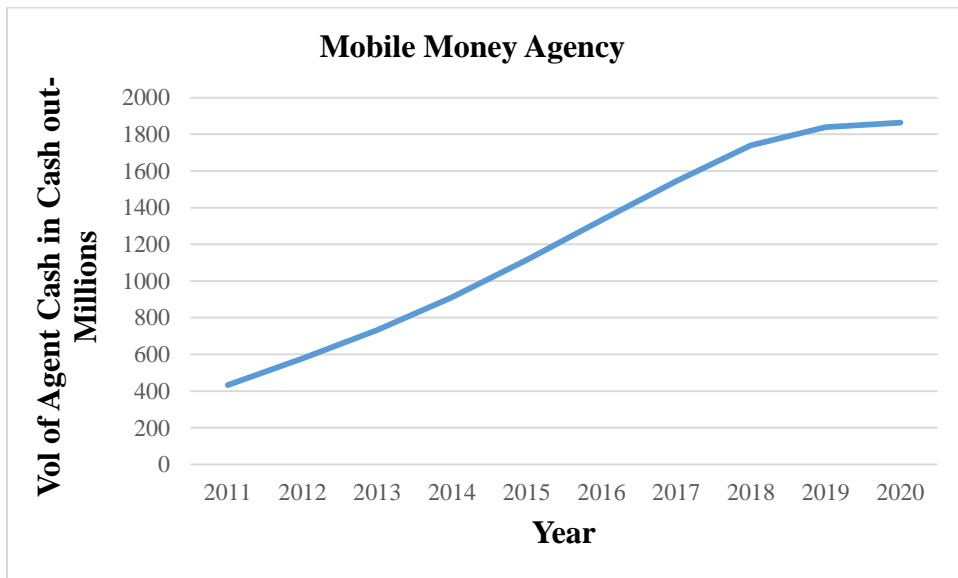


Figure 4. 6 Total Volume of Agent Cash in Cash out

Figure 4.7 however shows that this trend is not constant. There is growth rate between 2012 (144.376) and 2016 (216.8375), then the rate deepens steadily from 2018 up to 2020.

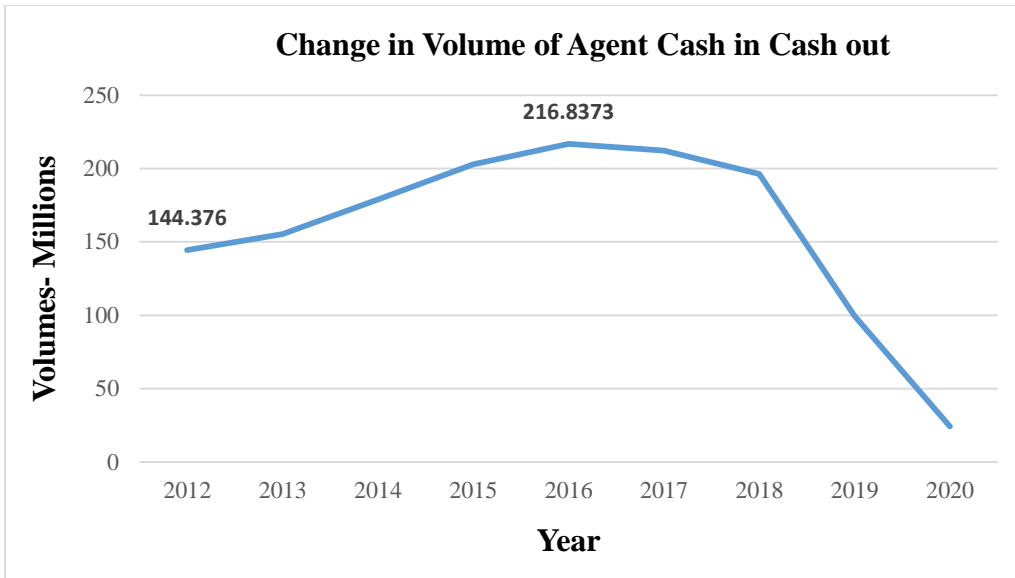


Figure 4. 7 Change in Volume of Agent Cash in Cash out, 2012 to 2020

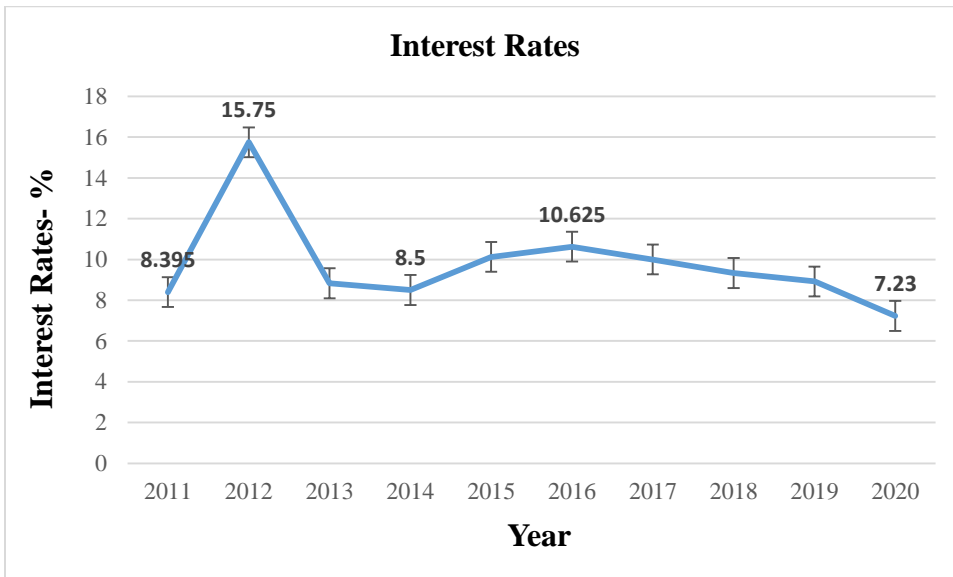


Figure 4. 8 Interest Rates

The interest rates hit a highest pick of 15.755% in 2012 but dropped in 2013, and further dropping in 2014 to a low of 8.5%, before increasing slightly in 2016 (10.65%). It then decreases to 7.23 in 2020.

Kenya's total public expenditure has been on the steady increase, and this increase rate was highest in the 2014 to 2015 period. In 2011 the expenditure was 1.2 Trillion but by 2017, a period of six years, the figure grew by more than two and half times 3.025970 Trillion.

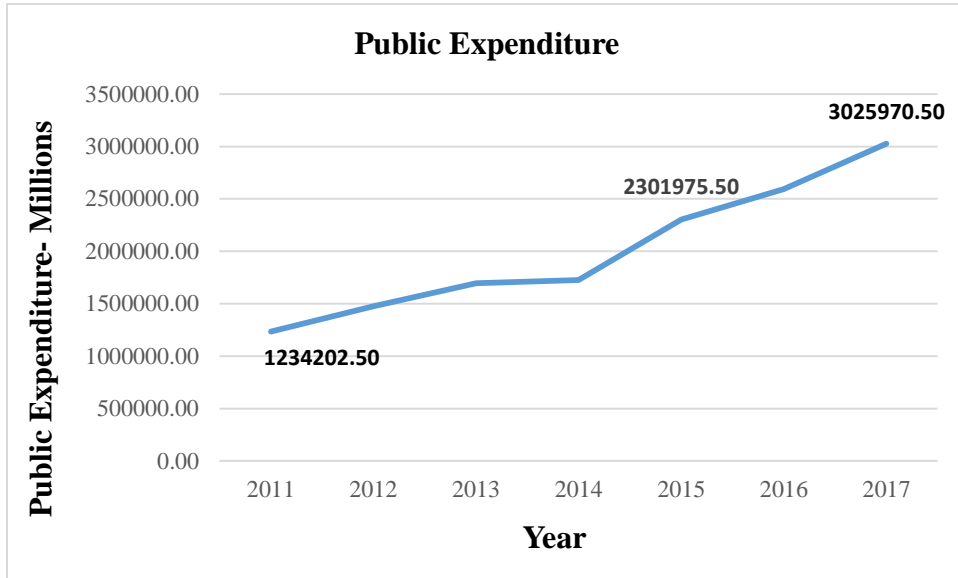


Figure 4. 9: Total Public Expenditure

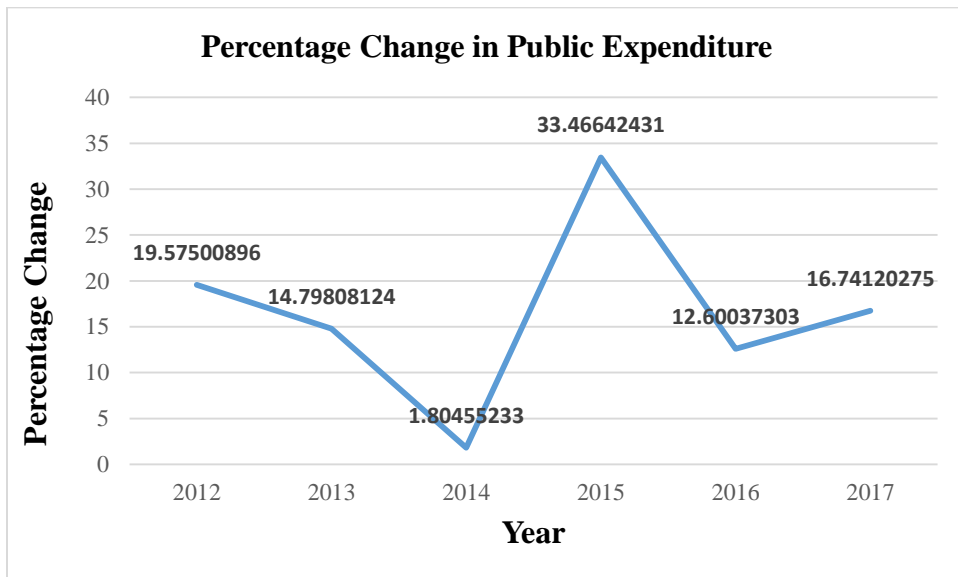


Figure 4. 10: Percentage Change in Public Expenditure, 2012 -2017

4.3 Correlation Analysis

Correlation analysis assesses the association between variables. It shows how movement in one variable is similar or different to a movement in another variable.

Table 4.2: The Pearson's Moment Correlation Matrix Results of Study Variables

Correlation		GDP	Mobile Banking	Mobile Money Transfer	Mobile Money Agency	Interest Rates	Public Expenditure
GDP	Pearson Correlation	1					
	Sig. (2-tailed)						
Mobile Banking	Pearson Correlation	.472	1				
	Sig. (2-tailed)	.006	.				
Mobile Money Transfer	Pearson Correlation	.340	.708	1			
	Sig. (2-tailed)	.510	.115				
Mobile Money Agency	Pearson Correlation	.286	-.182	-.082	1		
	Sig. (2-tailed)	.582	.730	.877			
Interest Rates	Pearson Correlation	-.316	.466	.686	.346	1	
	Sig. (2-tailed)	.004	.351	.132	.502		
Public Expenditure	Pearson Correlation	.435	.306	.599	.408	-.843*	1
	Sig. (2-tailed)	.013	.0100	.209	.422	.035	

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

Economic variables tend to increase overtime and correlating absolute values gives unauthentic correlation results. The correlated year-to-year change values results are shown in table 4.2. From the results it is observed that change in GDP in the 2011 to 2020 period is positively and moderately correlated with mobile banking, which is also a significant predictor of GDP ($r=0.472$, $p=.0006<0.05$). Mobile money transfer and mobile money agency are positively associated with GDP but the correlation is weak. However, contrary to study expectation, the relationship is not significant at 0.05 significance level. Interest Rate ($r=-0.316$, $p=0.004<0.05$) and public expenditure ($r=0.435$, $p=0.013<0.05$). The

correlation between GDP and interest rate is negative and is weak, hence it suggests that when interest is high the GDP is low. The data supports the view that these factors are associated with economic growth in terms of GDP. Public expenditure has a positive and moderate correlation with GDP.

4.4 Regression Analysis

The predictive power of the model is assessed by the R square and the F ratio. An R square close to 1.000 suggests a high predictive power of dependent variable from the independent variables in the model. The R square in the model is 0.189 as shown in table 4.3, an indication that the three significant predictors account for 18.9% of the variations in GDP growth in Kenya. By being able to predict 18.9% of GDP growth, the results are substantial given that only three factors are involved in this study and yet GDP growth is an interplay of multiple factors.

Table 4. 3: Effect of Financial Innovation on Economic Growth; Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.507 ^a	.257	.189	1.150

Table 4. 4: Effect of Financial Innovation on Economic Growth; ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.282	3	.761	.576	.656 ^b
	Residual	6.607	5	1.321		
	Total	8.889	8			

a. Dependent Variable: GDP growth

Table 4. 5: Effect of Financial Innovations on Economic Growth; Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	2.917	1.674		1.742	.180
Mobile Banking	.233	.052	.251	4.510	.000
Mobile Money Transfer	1.500	.986	.949	1.521	.226
Mobile Money Agency	.167	.569	-.137	.293	.789
Interest Rates	-.217	.525	-.157	-3.557	.015
Public Expenditure	.222	.180	.201	3.703	.034

a. Dependent Variable: GDP growth

All the five independent variables were fed into the regression model as predictors of GDP growth. From the regression coefficient results, Table 4.5, three variables showed a significant influence on GDP. Mobile banking is a significant predictor of GDP Growth in Kenya, (Standardized, $\beta=0.233$, $p=0.000$) indicating the critical role mobile banking plays in transforming the Kenyan economy.

From the coefficient result, it is expected that an increase in mobile banking by 100%, will record a 23.3% growth in GDP. However, mobile money transfer and mobile money agency data shows that they each do not significantly influence GDP growth. Their regression coefficient showed p values greater than 0.05 thus, indicating no significant influence.

It is also confirmed that interest rate has a significant negative influence on the GDP (standardized, $\beta= -.157$, $p=0.015$), indicating the importance of putting up enablers of low interest rates in the country if Kenya has to attain growth. It is expected that an increase in

interest rate by 100% will suppress the GDP by a massive 15.7 percent, thus slugging economic growth. Public expenditure also showed significant influence on GDP growth ($\beta= 0.201, p=0.034$)

4.4.1 Diagnostic Tests for Statistical Assumptions

Under the normality assumption, it is required that the residuals are normally distributed. A plot of the histogram is one of the techniques of assessing this assumption. To achieve this, a multiple regression is run with all the independent variables. The residuals histogram is then plotted. Following this procedure, the plot shown in figure 4.11 is obtained. It follows the shape of a normal distribution thus depicting that the normality assumption is met. The Q-Q plots also shows that most points are on the line, an indication of normality of residuals.

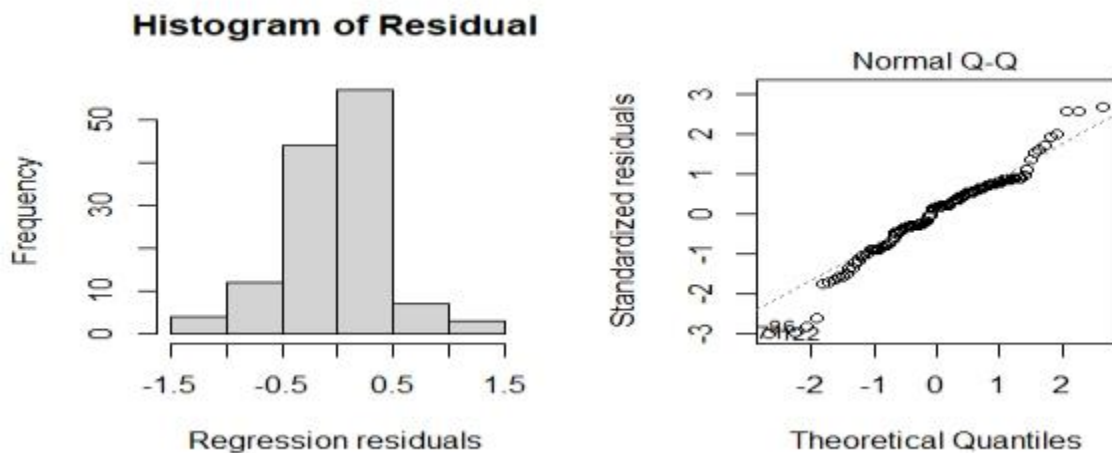


Figure 4. 11: Histogram of Residual and Q-Q plot to test for normality assumption

Under linearity assumption, it is required that the relationship between the dependent variable in the model and the dependent variable is linear. The analysis of the plots of residuals is used to test the assumption, in particular, a scatter plot of regression residuals against predicted values. The residuals should be evenly distributed below and above the regression line to demonstrate the linearity.

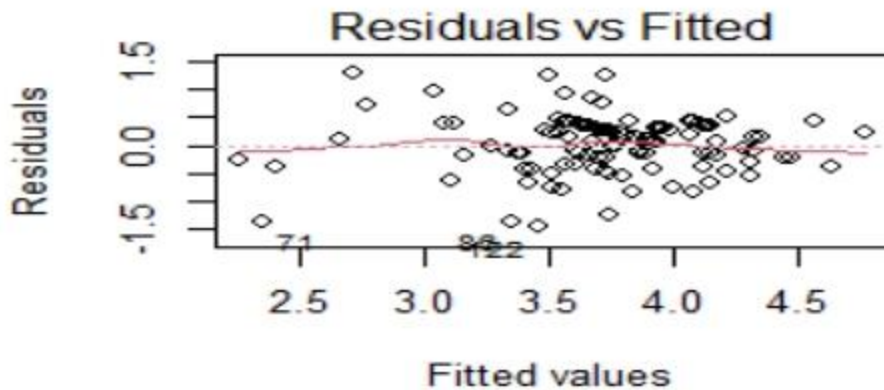


Figure 4.12 : Residual vs Fitted values to test for linearity and heteroscedasticity

Heteroscedasticity (constant variance); under this assumption, it is assumed that the errors are constant along all values of the dependent variable. A plot of regression residuals against the predicted values is used to check for this assumption. The errors should not show any pattern of funneling out for the assumption to be met. The results in figure 4.12 shows that the errors are not funneled out, indicating that the constant variance assumption is not significantly violated.

The multicollinearity assumption states that independent variables should not be highly correlated, otherwise they could inflate the regression coefficient estimates. The correlation matrix of independent variables helps in identifying multicollinearity. The data used does not suffer from multicollinearity issues because variance inflation factor (VIF) values are all less than 10, an indication of no significant multicollinearity.

Table 4. 6: VIF Test for Multicollinearity

Regression coefficient

Model	Collinearity Statistics		
	Tolerance	VIF	Comment
1 Economic Growth	.796	1.256	No multicollinearity
Mobile banking	.736	1.358	No multicollinearity
Money transfer	.705	1.417	No multicollinearity
Agency	.736	1.358	No multicollinearity
Interest rate	.725	1.380	No multicollinearity
Expenditure	0.726	1.377	No multicollinearity

a. Dependent Variable: GDP

4.5 Discussion of Findings

The study found out that mobile banking, mobile money transfer and mobile money agency all have a positive relationship with economic growth in Kenya. Public expenditure was also seen to have a positive relation with economic growth while interest rates depict a negative association. All the study variables were also found to have a significant influence on economic growth except mobile money transfer and mobile money agency, which proved to be insignificant.

This goes to show that financial innovation and economic growth can be associated with each other, as also espoused by Laeven, Levine and Michalopoulos (2015), who assert that financial innovation is a key driver for financial deepening and economic growth. Of the three financial innovation proxies, mobile banking is seen to be a significant influencer of economic growth. Most mobile banking platforms in Kenya are as a result of partnerships between mobile telephony firms and financial institutions such as banks. This study finds that this association is good for economic growth. Mobile money transfer and mobile money agency have a positive but insignificant relationship with economic growth,

indicating that there could be other factors, other than these two that significantly affect growth.

The diffusion of innovation theory (Rogers, 1995), which is also closely annexed to the theory of economic Development (Schumpeter, 1911) try to show how innovation and growth could be linked. This study covered the period from 2011 to 2020; which is an interesting period because the first mobile financial service was rolled out around 2007, and the descriptive statistics from this study show an upward trend for mobile financial inventions, indicating that these innovations have been able to diffuse into the Kenyan market through the years, hence begetting imitators from the sector, and ultimately leading to increased investments by mobile telephony firms, and spurring economic growth.

Public expenditure significantly influences and predicts growth according to study results, while interest rates show a significant negative relationship. When interest rate are low, this tend to slow down the economy. There is less spending, investments and savings, and all of these tend to slow down the economy. Descriptive results from this study also show the negative effects of COVID-19 on Kenya's economy as most trend analysis for the variables of this study all seemed to deepen from around 2019, or flattening during this period of the pandemic.

CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This section includes a concise summary of the study findings from descriptive analysis and correlation. It also comprises of the conclusion of this purpose-driven research, recommendations for future policy and research direction, and finally the limitations of the study.

5.2 Summary of Findings

The study investigated the effect of financial innovation on economic growth in Kenya: the case of mobile telephony firms. The underlying motivation was to find out if innovations like mobile banking, mobile money transfers and mobile money agency are significant drivers of Kenya's economic growth. Secondary data, obtained from the CBK, CAK and KNBS databases covering the period 2011 to 2020 was used for this study. Descriptive and trend analysis of the data reveal significant outcomes on the GDP for the study period.

The change in GDP remained erratic at a mean of 1.05%, a maximum of 1.46% and a minimum of 0.26%. The latest GDP results show an increase of only 0.25% (2020) which means a lot has to be done to attain the projected target of 1.80% in 2022 and 1.6% in 2023, and financial innovation should be a key input for this. The descriptive results of mobile banking, a proxy of innovations, also revealed significant findings.

Data confirmed the research views that mobile banking, interest rate and public expenditure are associated with GDP growth in Kenya. The three factors influence the growth of GDP to a significant extent, collectively accounting for 18.7 % of growth.

5.3 Conclusion

This study hypothesized that financial innovation affects economic growth. Based on the above summary of findings, we can conclude that the study was able to meet its objective.

The study found a positive relationship between GDP, mobile banking and public expenditure; and a negative but significant relationship for interest rates. This implies that

a vibrant economy is closely associated with financial innovation in terms of increase in mobile banking; and is also generally influenced by increase in public expenditure, but with low interest rates prevalence. This suggests that low interest rates reduce financial costs such as borrowing costs, which leaves borrowers with more disposable income to spend and invest, hence the ripple effect is a boom in economy.

The study also found a positive but insignificant relationship between economic growth and mobile money transfer and mobile money agency services. This implies that the number of mobile money transfer subscriptions and the volume of cash in cash out by mobile money agents could likely influence GDP if there was increase in volume of transaction for both variables.

5.4 Recommendations

The study suggests for mobile telephony firms in Kenya to scale up their operations in mobile banking, mobile money transfer and mobile money agency services as these are seen to have a positive relationship to economic growth in terms of GDP. The findings of this study should therefore be used by managers of mobile telecoms in Kenya to help them make more informed decision in matters financial innovation, so that they are guaranteed perpetual growth for both the individual telecom firms and the broader economic ecosystem. The firms should continue to partner with financial institutions as one of the proxies of financial innovation, mobile banking, which is mostly a result of strategic alliances between firms from the two sectors, was seen to be an important contributor to economic growth.

The study also recommends that government makes more budgetary allocations to the ICT sector, as public expenditure has also been found to have a positive influence on economic growth, for example by giving incentives to innovators in the mobile telephony sector. This is to encourage mobile telephony firms in the country to invest more in financial tools will help them grow, and simultaneously also spur economic growth through increased public spending. Policy makers and regulators of the telecommunications industry may also use this study to encourage mobile telephony firms to be first movers in financial innovation, to be able to attain desired levels of economic growth for the country, and move towards achievement of Vision 2030 for Kenya.

5.5 Limitations of the Study

The study focused on a 10-year period for panel data analysis. This may be detrimental for this study's objective because the period may not have provided sufficient data to analyze the effects of financial innovation in terms of mobile money transfer and mobile money agency, the two variables that were found to have an insignificant relationship with economic growth.

Some data on the variables could also not be easily obtained, for example complete data on public expenditure which was not fully available on the CBK website.

Another inherent limitation of the study is that not all mobile telephony firms have extensive mobile banking, mobile money transfer and mobile agency services, with the market leader, Safaricom PLC, taking a huge chunk of the mobile money services sector.

5.6 Suggestions for Further Research

The study period for this research covered 10 years. Future research in the same area could cover longer periods to be able to accurately determine the relationship between financial innovation and economic growth.

Future research on financial innovation and its effect on economic growth could be expanded to include financial institutions because they are numerous and their effect on economic growth, given financial innovation, may be more significant.

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APPENDICES

Appendix I: Mobile Telephony Firms in Kenya.

1	Safaricom PLC
2	Airtel Networks Kenya Limited
3	Telkom Kenya Limited
4	Mobikash
5	Mobile Pay Limited
6	Finserve Limited

Source: CAK (2019)

Appendix II: Secondary Data Collection Sheet

YEAR	GROSS DOMESTIC PRODUCT (GDP) (SH)	MOBILE BANKING (No. of mobile money accounts)	MOBILE MONEY TRANSFER (No. of mobile money subscriptions)	MOBILE MONEY AGENCY (Vol. of agent cash in cash out)	INTEREST RATES (%) (CBK rates)	PUBLIC EXPENDITURE (SH) (Actual Expenditure)
2011						
2012						
2013						
2014						
2015						
2016						
2017						
2018						
2019						
2020						

Appendix III: Data

Year	Quarter	GDP (millions)	No. of mobile money accounts (millions)	No. of mobile money subscriptions (millions)	Vol. of agent cash in cash out (millions)	Interest Rates (%)	Public Expenditure (millions)
2011	1	1,501,464.00	55.8126	18.42	116.4895	6.5	319,225.00
2011	2	1,512,220.00	57.8607	18.98	123.4344	15.17	999,296.00
2011	3	1,527,277.00	51.0482	1.41	89.481	5.83	1,483,466.00
2011	4	1,548,587.00	53.8281	17.4	103.5933	6.08	2,134,823.00
2012	1	1,565,450.00	58.67	19.319	147.99	15.33	428,509.00
2012	2	1,579,088.00	61.33	21.14	161.41	11.67	1,217,938.00
2012	3	1,603,190.00	56.8664	18.99	127.7824	18	1,765,935.00
2012	4	1,620,971.00	59.0199	19.51	140.1918	18	2,490,809.00
2013	1	1,626,387.00	72.11	25.11	190.85	8.5	410,065.00
2013	2	1,646,446.00	74.6563	26.016	206.1078	8.5	1,215,803.00
2013	3	1,661,933.00	65.5497	23.269	159.27	9.5	2,023,817.00
2013	4	1,677,156.00	70.2385	24.84	176.3693	8.83	3,127,065.00
2014	1	1,707,778.00	78.859	27.48	234.5386	8.5	451,776.00
2014	2	1,736,082.00	76.1917	26.02	249.498	8.5	1,477,570.00
2014	3	1,748,492.00	78.0812	26.75	206.627	8.5	1,953,087.00
2014	4	1,751,490.00	77.8835	26.61	220.6715	8.5	3,016,607.00
2015	1	1,789,015.00	81.0999	28.78	284.4385	11.5	470,502.00
2015	2	1,819,036.00	84.2457	26.75	311.52	11.5	1,775,811.00
2015	3	1,832,748.00	76.543	26.79	252.7416	8.5	2,762,155.00
2015	4	1,848,329.00	79.1065	27.74	265.4766	9	4,199,434.00
2016	1	1,856,064.00	98.528	31.09	337.256	10.17	626,918.00
2016	2	1,889,426.00	103.275	32	369.731	10	2,159,063.00
2016	3	1,915,765.00	89.2826	24.83	304.358	11.5	2,986,288.00
2016	4	1,935,051.00	84.12	26.31	319.669	10.83	4,595,863.00
2017	1	1,950,539.00	105.448	28.19	377.207	10	597,766.00
2017	2	1,949,847.00	109.7782	30	405.87	10	2,129,647.00
2017	3	1,979,196.00	100.553	27.54	372.861	10	3,748,031.00
2017	4	2,005,791.00	102.669	28.07	387.237	10	5,628,438.00
2018	1	2,046,555.00	130.4441	29.79	438.592	9	-
2018	2	2,067,576.00	139.3648	31.63	464.084	9	-
2018	3	2,092,268.00	115.6003	29.11	416.475	9.83	3,817,211.00
2018	4	2,120,998.00	124.5981	29.68	420.422	9.5	5,589,625.00
2019	1	2,146,393.00	164.3625	31.28	456.031	9	-

2019	2	2,192,991.00	172.6933	28.98	464.156	8.67	-
2019	3	2,194,339.00	140.6953	32.06	460.113	9	-
2019	4	2,206,743.00	151.0441	32.63	458.78	9	-
2020	1	2,235,934.00	188.8789	31.79	484.304	7	-
2020	2	2,094,238.00	197.0312	32.46	525.504	7	-
2020	3	2,153,901.00	176.5468	29.19	449.421	7.92	-
2020	4	2,229,078.00	181.3975	30.52	404.066	7	-