EFFECT OF GOVERNMENT INFRASTRUCTURE DEVELOPMENT EXPENDITURE ON PERFORMANCE OF MANUFACTURING IN KENYA

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THIS RESEARCH PROJECT HAS BEEN SUBMITTED TO THE DEPARTMENT OF APPLIED ECONOMICS IN THE SCHOOL OF ECONOMICS IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF ECONOMICS (COOPERATION AND HUMAN DEVELOPMENT) DEGREE OF KENYATTA UNIVERSITY

MAY 2020

DECLARATION

I declare that this research project is my original work and has not been presented for a degree in any other university or any other award.

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DEDICATION

This research project is dedicated to my late parents, Daniel Chirchir and Mary Chirchir.

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ABBREVIATIONS AND ACRONYMS

ADF	Augmented Dickey Fuller
AGOA	African Growth and Opportunities Act
ECS	Export Compensation Scheme
EPC	Export Promotion Council
EPZs	Export Processing Zones
GDP	Gross Domestic Product
ICT	Information Communication and Technology
ISIC	International Standard Industrial Classification
MuB	Manufacturing under Bond
NIP	National Industrial Policy
OLS	Ordinary Least Squares
PPP	Public Private Partnership
SGR	Standard Gauge Railway
USD	United States Dollar
VIF	Variance Inflation Factor

OPERATIONAL DEFINITION OF TERMS

Energy Infrastructure:	Facilities used in the transportation of energy from the producer to the consumer.
ICT Infrastructure:	Facilities used in conveying of information between consumers and producers about firm's products and services.
Infrastructure:	Facilities used in the transmission of energy, information, goods and services from the producer to the consumer.
Manufacturing sector:	Sector that is involved in the production of goods and services for consumption.
Manufacturing Sector Performance:	The measure of output of the manufacturing sector over time.
Transport Infrastructure:	Facilities used in the moving of products from production point to consumption point.

ABSTRACT

The need for infrastructure development in Kenya was initiated in the early years of economic planning. For instance, the Sessional Paper No. 10 of 1965 among other strategic objectives provided a premise for infrastructure development to fuel rapid industrialization and make Kenya a market economy. Emphases have since been made in the subsequent economic development plans in 1970s, National Development Plans in 1980s, the Economic Recovery Strategy for Wealth and Employment creation 2003-2007 and recently, the Kenya Vision 2030 that targets to transform Kenya into an industrialized middle-income economy by the year 2030. As such the government of Kenya has directed large amounts of money to the country's infrastructure development specifically in transport, energy and information communication and technology development with the objective to enhance efficiency in production, trade and investments. However, the performance of the manufacturing sector has stagnated, exhibiting a slower growth rate than that of the economy. The sector's share of Gross Domestic Product increased marginally only in the first three decades of independence then stopped and stagnated below 10 per cent to date. Most studies in Kenya have focused on relationship between government expenditure on infrastructure and economic growth or specifically road infrastructure expenditure and economic growth. No study considering the transport sector in totality - road, air, water and railway as well as energy and fuels and information communication and technology infrastructure has been conducted. It was against this backdrop that this study sought to empirically investigate the effect of infrastructure development expenditure on performance of the manufacturing sector in Kenya. It specifically intended to determine the effect of government expenditure on the development of transport infrastructure, energy infrastructure as well as information communication and technology infrastructure on the share of manufacturing in Gross Domestic Product in Kenya. This study used times series data for the period 1990 to 2017 and used the Ordinary Least Squares method to estimate parameters in its linear equation. The study found that the coefficient of transport was positive (0.128), energy was negative (-0.23974) and information was positive (0.11345) and statistically significant. The study recommends that government should allocate more funds on the development of transport and information, communication and technology infrastructures in order to realize a significant contribution of manufacturing in the share of gross domestic product and economic growth and development in Kenya.

CHAPTER ONE

INTRODUCTION

1.1 Introduction

This chapter provides information on the background of the study particularly on the importance of infrastructure on growth of manufacturing sector and the trends in performance of manufacturing sector in Kenya. The chapter also contains the statement of the problem, research objectives and questions, the significance of the study, the scope of the study as well as the organization of the study.

1.2 Background of the Study

Infrastructure development has continued to attract attention both globally and nationally because of its critical contribution to sustained economic growth and development (Saxena, Chotia & Rao, 2018). Due to the high cost associated with infrastructure investment and development, national governments have remained the main financiers. Recent campaigns on strengthening alternative sustainable sources of financing has seen the private sector actively involved through Public Private Partnerships (PPPs) (Poole, Toohey & Harris, 2014). According to El-Makhloufi (2016), existence of quality and reliable infrastructure is the foundation underpinning a modern economy's sustained economic growth, productivity as well as development. This is achieved through the backward and forward linkages of both economic and financial infrastructures such as roads, energy, telecommunication and capital markets and social infrastructure such as water and waste management, schools, housing and health facilities (Singh, Batra & Gajendra, 2007).

Infrastructure development also augments firms' private capital making it essential in the production of goods and services thus stimulating the growth of firms and industries (Leigh, 2014). Various studies have also shown that there is a positive and significant impact of infrastructure development on the performance of manufacturing sector. For instance, Mesagan and Ezeji (2016) found that teledensity has a positive and significant impact on manufacturing sector performance in Nigeria. Melo *et al*. (2013) and Deepika (2003) suggest that investment in infrastructure - transport and energy - reduces cost of production thus contributing to the growth of firms' output and productivity in the United States, European Union and India. Luger, Bulter and Winch (2013) also found that infrastructure development supports manufacturing activities in United Kingdom. Furthermore, Mitra, Sharma and Marie (2011) conclude that development of core infrastructure - transport and energy and fuel - significantly determine total factor productivity and technical efficiency of manufacturing firms in India. Lastly, Halstead and Deller (1997) suggest that public infrastructure development is key for the growth and performance of small manufacturing firms in upper New England and Wisconsin.

More specifically, as a result of economies of scale from economic infrastructure development, firms benefit due to reduced cost of production resulting to increase in growth and productivity (Zhu & Sun, 2009). It also encourages the establishment of new firms or industries besides attracting additional investments and influencing location decision of foreign owned firms or industries. It offers incentives to both local and foreign owned firms and industries when considering their setup location thus leading to rapid industrialization and increased employment. Furthermore, economic agents benefit from strengthened agglomeration economies - benefits that

come from firms and workers being close to one another either in cities or industrial clusters - induced by transport infrastructure development (Deepika, 2003; Melo, Graham & Brage-Ardao, 2013).

Social infrastructure on the other hand boosts a country's human capital formation as well as human productivity thus improving individual's quality of life. Increased social infrastructure development in education, health and housing for instance, results in increased access to quality education, health care services and affordable housing which improves worker's productivity (Melo, Graham & Brage-Ardao, 2013). Spillover effects of infrastructure development include enhanced trade as well as regional integration and formation of economic blocks (Njoro, 2016). Infrastructure development boosts the aggregate demand through increased economic activities as well as the aggregate supply through increased elasticity and efficiency of factors of production. It therefore, positively influences economic productivity and social welfare (PricewaterhouseCoopers, 2016).

1.2.1 Importance of Infrastructure for Growth of Manufacturing Sector

According to Republic of Kenya (2017) infrastructure development contributes significantly in the Kenyan economy through linkages with other sectors of the economy. Chingoiro and Mbulawa (2016) suggest that there is a bidirectional flow of causality between infrastructure expenditure and economic growth in Kenya. This argument was also echoed by Mburu (2013) and Mugambi (2016) that development expenditure in transport specifically road transport has significant and positive impact in the growth of Kenya's economy.

The need for infrastructure development in Kenya was initiated in the early years of economic planning. For example, the Sessional Paper No. 10 of 1965 among other strategic objectives provided a premise for infrastructure development to fuel rapid industrialization and make Kenya a market economy. This was implemented in the successive economic development plans in 1970s which emphasized on gross capital formation among other goals (United Nations Economic and Social Council, 1970). National Development Plans in the 1980s, aimed at expanding Kenya's economy through infrastructural development in various sectors of the economy (Republic of Kenya, 1990). The Economic Recovery Strategy for Wealth and Employment Creation 2003-2007, championed for need to revitalize infrastructure in order to achieve economic and social development (Njoro, 2016). The most recent, The Kenya Vision 2030 which aims at transforming Kenya into an industrialized middle-income economy by the year 2030 puts emphasis on infrastructural development as one of the enablers and macro foundations in achieving socio-economic transformation (Republic of Kenya, 2008).

The Kenyan Government has recently identified four key strategic areas of focus - dubbed the "Big Four Agenda," a blueprint that seeks to propel Kenya into a middle-level economic country - over the next five years that will accelerate broad based economic growth, and confront the challenges of unemployment, poverty and income inequality so as to better the life of all Kenyans. The manufacturing sector is one of the four with the strategic goal of raising the share of manufacturing sector to 15 per cent of GDP by 2022 through supporting value addition with special emphasis on textile and apparels, leather and leather products and agro - processing. The delivery of the other 'Big Four Agenda' areas of food security, affordable housing, and

universal healthcare are interlinked and involve backward and forward linkages with infrastructure development.

Despite other sources of funding especially through Public-Private Partnerships to boost the country's infrastructure capital formation, the Government of Kenya has remained a key player in financing infrastructure development (Mburu, 2013). Some of the main areas where the government has continued to spend with the aim of supporting industrial and manufacturing growth are transport, energy and information communication and technology infrastructure.

Significant efforts have been made in the development of Kenya's transport, energy and information technology infrastructure with a view to enhancing efficiency in production, trade and investments (Kenya Economic Report, 2017). The expenditures incurred by the government to fund these sub-sectors are shown in Figure 1.1.

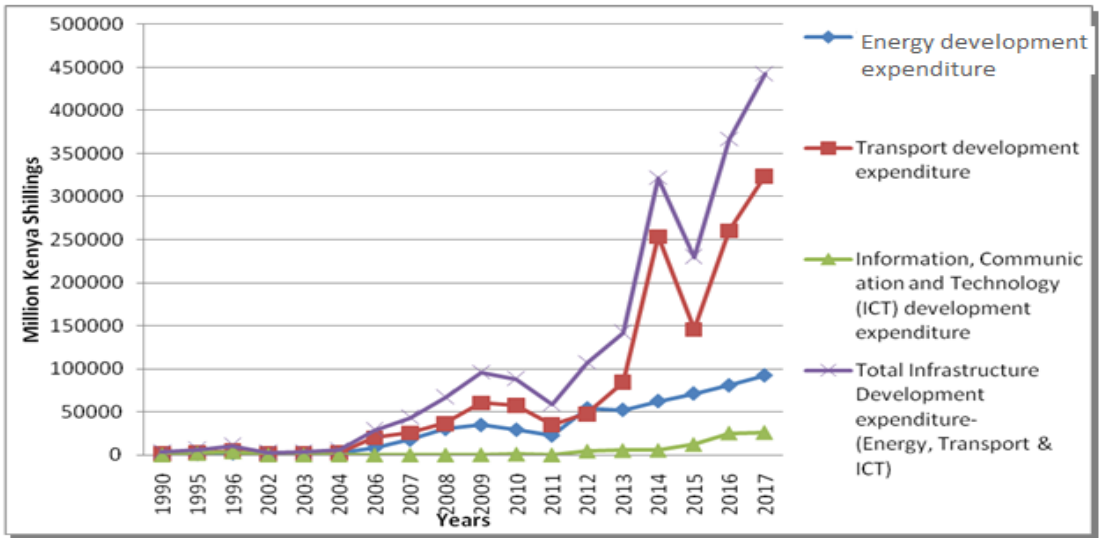

Figure 1.1: Trends in Government spending on development expenditure in the 3 sectors and the total spending on infrastructure development in Kenya from 1990 to 2017.

Source: Kenya National Bureau of Statistics

The Government of Kenya has committed large amounts of its resources toward the development of infrastructure across the country (Kenya Economic Report, 2017). The government has demonstrated its commitment to developing infrastructure in these sub-sectors not only through policies such as the Road Act 2007, the Energy Act 2007 and the Information and Communication Act 1998 - that seek to enhance efficiency and effectiveness of the sub sectors' operations, but also through the amount of money it has channeled as development expenditure in these subsectors.

The development expenditure in transport, energy and Information Communication Technology (ICT) was stagnant in 1990s due to less commitment and emphasis by the government then. However, the development spending in these sub-sectors began to increase rapidly from 2004, as a result of the Government's focus on the Economic Recovery Strategy framework (Republic of Kenya, 2004). The increasing trend in development expenditure has continued to date being propelled by the Government's commitment to achieve the ultimate goal of transforming Kenya into an industrialized, middle-income economy (Republic of Kenya, 2007).

As reported by the Republic of Kenya (2010), the sharp increase of development expenditure witnessed in the transport and energy sub-sector in 2006-2009 was due to construction of the Thika super highway and increased demand for electricity and other sources of energy which saw the government expand the national grid. On the other hand, the decline realized in these sub-sectors' development expenditure in the years 2010 and 2011 was due to the aftershock of global financial crisis and post-election violence (PEV) (Republic of Kenya, 2010).

According to the Republic of Kenya (2016), the increasing trend later picked up in 2012 in all the three sub-sectors as a result of the economic stimulus package which involved huge public spending through the development of key infrastructure facilities and public works. Among them is the financing of Standard Gauge Railway (SGR) and rehabilitation of roads as well as ports, enhancing electricity generation and connection, development of alternative sources of energy such as geothermal power, oil exploration, as well as modernization of security through installation of security cameras (Republic of Kenya, 2016).

As key enablers of the then Economic Recovery Strategy in 2003 and the Vision 2030, infrastructure development was and has remained a top priority of the Kenyan Government. Large amounts of the Government's resources were and are still channeled to development of the three sub-sectors - transport, energy and information, communication and technology infrastructure. For example, the total infrastructure development expenditure channeled to transport, energy and information communication and technology increased from 3,759 million Kenya shillings in 2003 to 67,345 million Kenya shillings by the end of the implementation of the Economic Recovery Strategy in 2007.

In pursuit of the Vision 2030 ultimate goal, infrastructure development expenditure in these three sub - sectors has continued to increase. For instance, development expenditure rose from 88,422 million Kenya shilling in 2010 to 142,325 million Kenya shillings in 2013. In the years 2015, 2016 and 2017 the infrastructure development expenditure in the three sub sectors was recorded as 229,964 million

Kenya shillings, 366,985 million Kenya shillings and 443,096 million Kenya shillings respectively (Republic of Kenya, 2004; 2011; 2015 & 2017).

The outcomes of the burgeoning development expenditure in the three sectors of infrastructure have been increase in road network, connections to national grid and internet connectivity (Moyaki, 2015). It is envisaged that these outcomes stimulate or translate to the growth of manufacturing sector. For instance, increased transport as well as information, communication and technology infrastructure development is envisioned to enhance the importation of affordable product inputs where need be, stimulate exports and local distribution of firms' finished products and enhance firms' innovation capacity to produce new products or improve quality of the existing products. This leads to growth of already existing firms and establishment of new firms hence strengthens firms' competitiveness and productivity as a result of increased competition in the manufacturing sector. On the other hand, energy infrastructure is expected to result to affordable and reliable electricity and other forms of energy thus reducing the cost of production. Therefore increased infrastructure development is associated with boosting domestic demand in the short run and increased potential output in the economy leading to a vibrant and productive manufacturing sector (Luger, Butler & Winch, 2013).

1.2.2 Trend in Performance of Manufacturing Sector in Kenya

The manufacturing sector in Kenya has for many years featured in the government's agenda in pursuit of economic growth and development owing its critical contribution to rapid industrialization and employment creation (Odhiambo, 1991). This has made the government since independence to pursue various polices aimed at improving

productivity as well as general growth and performance of the manufacturing sector. In the 1960s and 1970s the Government pursued import substitution policy which was inherited from the colonial government. The policy's objective was to ensure rapid growth and productivity of the industrial sector, reduce balance of payment pressure and more indigenous participation in the sector among others. This led to impressive performance of the industrial sector during the first two decades of independence. For example, the manufacturing sector grew at an annual average of 8 per cent besides being the second in terms of employment creation after agriculture (Chege, Ngui & Kimuyu, 2016).

Moreover, the sector's output grew faster than both the country's economy and other industrial sectors in Sub-Saharan Africa. The relatively high growth rates recorded in the sector during the early post-independence years were also attributed to the official recognition of the informal sector by the International Labour Office (ILO) in 1972 (Chege, Ngui & Kimuyu, 2016). It is worth noting that the Import Substitution Strategy led to availability of basic products in the domestic market. They were however overpriced resulting to the distortion of industrial evolution by encouraging the excess capacity and generalized inefficiencies. This undermined the ability of Kenyan product to penetrate and compete in the external markets.

The general deteriorating economic performance witnessed in the country in the late 1970s resulted to a new paradigm of policies that were strongly advocated for by the Bretton Woods institutions in 1980s and 1990s. The policies pursued were aimed at redirecting the economy from Import Substitution strategy to export promotion. The implementation of the Structural Adjustment and Liberalization polices in 1980s and

1990s saw the manufacturing sector undergo major restructuring and changes in its institutional frameworks. The policies targeted to completely remove restrictive import licensing as well as tariffs. This led to competition from the imported products which saw most of the local start-up firms and some established firms close down hence making the growth of manufacturing sector to decline (Chege, Ngui & Kimuyu, 2016). This phenomenon was further aggravated as the country was declared as an open economy in 1994 after joining the World Trade Organization (Chege *et al*., 2016).

Moreover, the institutional and market oriented initiatives taken to promote export in the country led to the creation of various export platforms among them the Export Promotion Council (EPC), Export Compensation Scheme (ECS), Manufacturing under Bond (MuB) and Export Processing Zones (EPZs). These platforms were targeted at promoting export oriented manufacturing through a systematic process of tariff reduction (Chege *et al*., 2016).

Although the manufacturing sector enjoyed relatively rapid growth in the early years of post -independence, it has since recorded a sluggish growth without dramatic shift in performance. Kenya has realized fluctuations in annual growth trend in its manufacturing sector over time as shown in Figure 1.2.

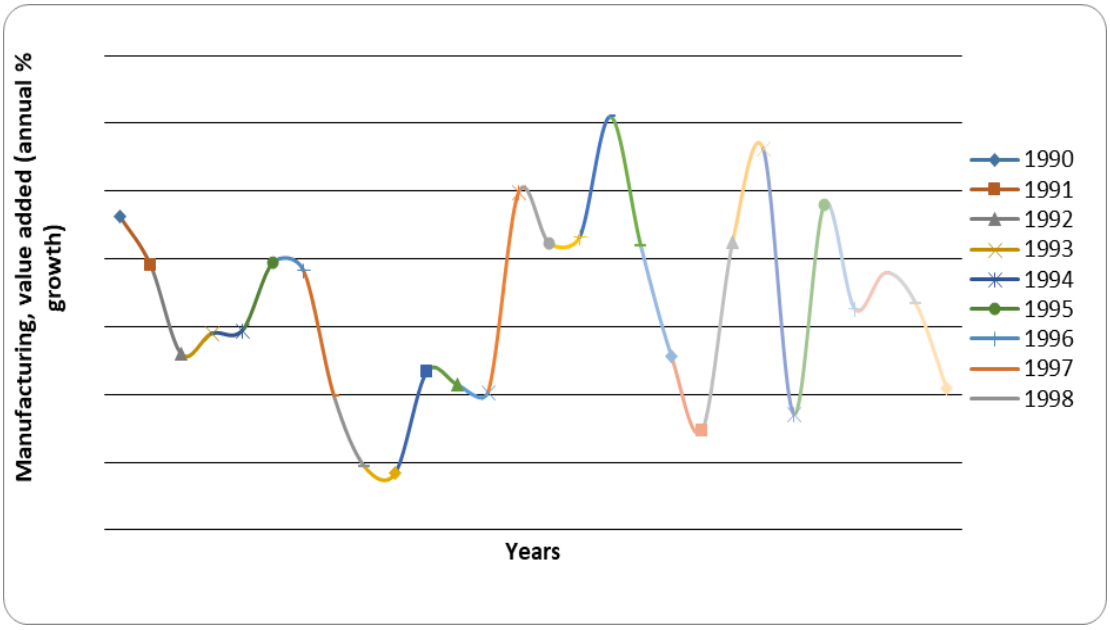

Figure 1.2: Trend in performance of manufacturing sector by growth in value added over the period 1990 to 2017

Source: World Development Indicators, 2017

The annual growth in the manufacturing sector has remained below 10 per cent as shown in Figure 1.2. The average annual growth rate between the period 1990 and 2017 was about 2.6 per cent. Strongly linked with the agricultural sector, the declined growth realized in 1992 was as a result of poor weather conditions that prevailed in the country while the increased growth in the period between 1993 and 1995 was due to improved weather conditions, increased credit from financial institutions to the small and medium enterprises and expansion of Export Processing Zones (Republic of Kenya, 1995; 1996 & 1997).

The declined growth realized in the period between early and mid-1990s was also attributed to the policies pursued by the then Government. These include, the Structural Adjustment Policies, Liberalization polices and joining of the World Trade

Organization in 1994. Aimed at removing restrictive import licensing as well as tariffs and making the Kenyan economy open, these policies led to increased competition between well-established foreign firms and local startup firms in Kenya making the startups close down due to their inability to compete with foreign firms and products (Chege *et al.,* 2016).

According to the Republic of Kenya (2002), the negative growth rates recorded in 1997, 1998 and 1999 was as a result of increased poverty levels in the country that limited the local demand for produced goods as consumers shifted to relatively cheaper imported manufactured goods and unfavourable weather conditions. Additionally, negative growth rates registered in 2009 and 2012 have been attributed to the aftershock of global financial crises and post-election violence in 2008, high cost of fuels, decreased demand for manufactured products due to weak Kenyan shilling, contraction of food processing sub-sectors as a result of drought experienced in the country and reduced credit to small and medium enterprises (Republic of Kenya, 2010 & 2013).

The sharp increase in growth rates recorded in 2003 and 2011 were due to implementation of the Economic Recovery Strategy, favourable weather conditions, reduced cost of production, stable input prices, increased access to credit facilities and expansion of Export Process Zones (Republic of Kenya, 2004 & 2012). In addition, the signing of African Growth and Opportunities Act (AGOA) in 2000 gave EPZs fresh impetus. This gave to a rise in the export of garments and apparel from Kenya since textile and garments were allowed to be exported to USA duty free and without import quota restriction. For instance; the export of garments and apparel from Kenya

increased from 30 million USD to 250 million USD between 2000 and 2006 (Chege e*t al*., 2016). This contributed to the growth witnessed in the sector between 2000 and 2005.

The enactment and implementation of the National Industrial Policy (NIP) in 2007 which advocated for the creation of institutions to coordinate and facilitate industrial development with clear targets and benchmarks also contributed to the impressive growth and performance of the manufacturing sector in 2007. The NIP harmonized and corrected the incoherence lacking in the industrial strategies outlined in the Sessional Paper No 2 of 1997 (Chege *et al*., 2016). In 2015, 2016 and 2017 the sector registered annual growth of 3.6, 2.6 and 0.2 respectively (World Development Indicators, 2019)

Policies have persistently been pursued and implemented by the Government to ensure that the sector lives to its envisioned potential. These policies have continuously had significant implications on industrial performance and development. The manufacturing sector has been identified as a critical acolyte in the Kenya Vision 2030 which envisages transforming Kenya into an industrialized and middle economy. The sector is meant to contribute immensely to the targeted annual GDP growth rate of 10 per cent by increasing industrial activities, creating more jobs and contributing to wealth accumulation (Republic of Kenya, 2007). In the medium term framework 2017 - 2022, the government has identified the sector among its "Big Four Agenda" to accelerate broad based economic growth, and confront the challenges of unemployment, poverty and income inequality so as to better the life of Kenyans. The target is to raise the share of manufacturing in GDP to over 15 per cent by 2022,

through value addition. This stands way above the current share recorded at 7 per cent in 2017 (Republic of Kenya, 2018)

Despite the many policies to stimulate the performance and growth of the manufacturing sector, a sluggish if not a declining growth in the sector's GDP share has been registered over time. As indicated in Figure 1.3, the share of manufacturing in the country's GDP has been declining over the years.

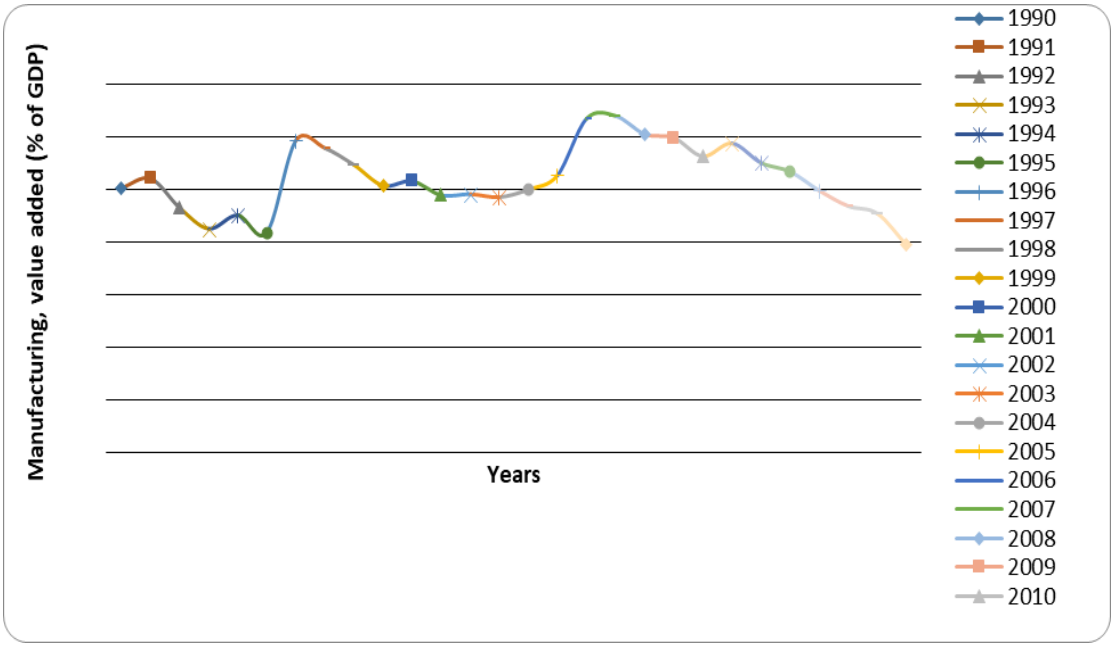

Figure 1.3: Trend of the share of manufacturing in Gross Domestic Product over the period 1990 to 2017

Source: World Development Indicators, 2017

The share of manufacturing in the Gross Domestic Product (GDP) has been reducing over time (Were, 2016; Chege *et al*., 2016). The sector's share of GDP increased marginally only in the first three decades of independence then stopped and stagnated below 10 per cent to date. Kenya's exports have remained predominantly primary commodities with low value addition, thus explaining the sector's declining share in

GDP. This is due to the import liberalization, low productivity, poor implementation of industrial polices and constrained access to financial services by most of the enterprises. Furthermore, the sector's GDP share is viewed to be low compared to other economies in the East African Community despite being the largest economy in the region (World Bank, 2017).

1.2.3 Infrastructure Development and Manufacturing Sector in Kenya

Infrastructure development has significant effect on manufacturing sector performance. This can be seen through the urban agglomeration theory that illustrates the fundamental features of innovation and competitiveness among other benefits derived from firms' proximity or clustering.

A critical trajectory taken by the Government to stimulate and boost the growth and development of the manufacturing sector to its potential since independence has seen increased development expenditure on infrastructure - transport, energy and information, communication and technology infrastructure (Wainaina, 2012). Large amounts of resources have been channeled towards the development of infrastructure with the aim of enhancing efficiency in production, trade and investments (Kenya Economic Report, 2017). Since the implementation of the Economic Recovery Strategy for Wealth and Employment creation in 2003 to the current implementation of medium term development plans under the Kenya Vision 2030, total infrastructure development expenditure by the Government has been burgeoning. For instance the total infrastructure development expenditure channeled to transport, energy and information communication and technology infrastructure increased from 3,759

million Kenya shilling in 2003 to 67,345 million Kenya shillings in 2007 (Republic of Kenya, 2008).

This increased further to 88,422 million Kenya shillings and 142,325 million Kenya shillings in the years 2010 and 2013 respectively. In the years 2015, 2016 and 2017 the total infrastructure development expenditure stood at 229,964 million Kenya shillings, 366,985 million Kenya shillings and 443,096 million Kenya shillings respectively (Republic of Kenya, 2017; 2018). The increasing trend in infrastructure development expenditure is envisaged to increase road connectivity hence boost access to markets, stabilize electricity and energy supply in manufacturing and increase internet connectivity to boost trade and electronic commerce.

Despite the increase in development expenditure on infrastructure in a bid to stimulate the performance and growth of the manufacturing sector, a sluggish if not a declining growth rate has been registered overtime. The sector has exhibited a slower growth rate than that of the economy (Chege *et al*., 2016). For instance, the annual growth of the sector in 2000 was 0.7 percent and 0.08 percent in the year 2002. Although it increased to 4.7 percent and 8.2 percent in the year 2005 and 2006 due to the implementation of the Economic Recovery Strategy, it later reduced to -0.6 percent in 2012 (Republic of Kenya, 2002; 2008 & 2013). In 2015, 2016 and 2017 the sector registered annual growth rates of 3.6, 2.6 and 0.2 percent respectively. The sector's share of GDP increased marginally only in the first three decades of independence then stagnated below 10 percent to date. As of 2018, the sector's GDP share stood at 7 percent (Republic of Kenya, 2018).

With both theoretical and empirical evidence showing positive effects of infrastructure development on manufacturing sector performance, it is worth noting that despite the significant spending by the Government of Kenya on infrastructure development, the growth and performance of the manufacturing sector has remained stagnant if not low. Since the development and implementation of the Economic Recovery Strategy in 2003 that was later succeeded by the Kenya Vision 2030 in 2008, the government has spent large amounts of money on infrastructure development more so in transport, energy and information communication and technology infrastructure with the objective of stimulating growth and performance of the manufacturing sector to achieve sustainable economic growth. Regardless of these efforts, the sector's contribution to the GDP has persistently stagnated below 10 per cent yearly. This forms the motivation of conducting this study.

1.3 Statement of the problem

The government of Kenya has continued to emphasize the importance of manufacturing sector growth in its efforts to realize economic transformation and increased standards of living for its citizens. To realize the annual 10 per cent GDP growth as envisioned in the Kenya Vision 2030, the sector was expected to grow its share in GDP to 10 percent from 2008-2017. This however, has not been realized as the sector's current share is recorded at 7 per cent (Republic of Kenya, 2018). The Government of Kenya has continued to prioritize this sector both in its development plans and policies to stimulate it and benefit from its potential. Recently, the Government of Kenya emphasized on the revival and growth of the manufacturing sector under the set "Big Four Agenda." Under the "Big Four Agenda" the

government targets to grow the share of manufacturing sector in GDP to 15 percent by 2022 (Republic of Kenya, 2018).

Most studies in Kenya have focused on the relationship between government expenditure on infrastructure and economic growth or specifically road infrastructure expenditure and economic growth. Chingoiro and Mbulawa (2016), Mugambi (2016), Njoro (2016) concluded that that transport and energy infrastructure have a positive and significant contribution in driving economic competitiveness of Kenya. However, none of these studies analyzed the effect of government infrastructure development expenditure on performance of manufacturing in Kenya that the current study is anchored on.

1.4 Research Questions

This study was guided by the following questions;

i. What is the effect of government infrastructure development expenditure on transport infrastructure on the share of manufacturing in GDP in Kenya?
ii. What is the effect of government infrastructure development expenditure on energy infrastructure on the share of manufacturing in GDP in Kenya?
iii. What is the effect of government infrastructure development expenditure on information communication and technology infrastructure on share of manufacturing in GDP in Kenya?

1.5 Research Objectives

The general objective of this study was to analyze the effect of government infrastructure development expenditure on performance of manufacturing in Kenya. The specific objectives of the study were;

i. To determine the effect of government infrastructure development expenditure on transport infrastructure on share of manufacturing in GDP in Kenya.
ii. To determine the effect of government infrastructure development expenditure on energy infrastructure on share of manufacturing in GDP in Kenya.
iii. To determine the effect of government infrastructure development expenditure on information communication and technology infrastructure on share of manufacturing in GDP in Kenya.

1.6 Significance of the study

This study sought to analyze the effect of government infrastructure expenditure development on performance of manufacturing in Kenya. The study was significant since it aimed at providing empirical evidence of the effect of infrastructure development on manufacturing sector. The study will therefore be beneficial to the researchers and scholars by providing general information and forming the basis for further research. It will also be useful to the government as it will serve as a tool for formulating policies to stimulate the growth and performance of manufacturing sector as well as ensuring that benefits of infrastructure development are optimally transmitted and realized in the manufacturing sector. The study also serves the private

sector by providing information on what factors or variables that enhance or stimulate the growth of manufacturing sector in Kenya.

1.7 Scope of the study

The study's analysis was limited to the Republic of Kenya while the period of analysis was from 1982-2017 in order to obtain the minimum sample size required for data analysis. Data was retrieved from various sources including, Kenya Economic Survey, World Development Indicators, Annual national budgets and Kenya National Bureau of Statistics.

1.8 Organization of the Study

The study is organized into five chapters. Chapter one provides the background, statement of the problem, research questions and objectives of study, significance of study, scope of the study and organization of the study. Chapter two entails literature review and provides an introduction, theoretical literature, empirical literature and summary of literature. Chapter three is on methodology of study and includes an introduction, research design, theoretical framework, model specification, definition and measurement of variables, data collection procedure and time series analysis. Chapter four contains empirical findings and analysis while chapter five discusses study summary, conclusion and policy implication of the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter discusses literature relevant to infrastructure development and manufacturing sector growth. It starts by presenting the theoretical literature, followed by empirical literature and the last section provides an overview of the literature.

2.2 Theoretical Literature

This study was guided by three theories; the theory of production, the industrial growth theory and the theory of industrial location.

2.2.1 Theory of Production

The production theory describes a firm's process of conversion of inputs to an end product or output. With a given form of production function a firm determines a frontier representing the limit of output that is achievable from each feasible combination of inputs. According to production theory, a firm's output is determined by the quality of various inputs used in its production process. With a given technology, output increases only if inputs increase. In the manufacturing sector, the main inputs are classified mainly as labour, capital and materials. Growth in capital is specifically important in driving output because it expands production capacity. Capital in the production function can take two forms, the public capital that is public infrastructure - transport infrastructure among others as well as the amount of money

available for reinvestment (Barro, 1990). Equation 2.1 shows a production function in the form of Cobb-Douglas production function;

$$Y = AL^{\alpha}K^{\beta} \quad \text{..... 2.1}$$

Where; Y is output, A is technological progress, L is labour, K is capital, α and β are labour and capital elasticities respectively.

In the Cobb-Douglas function in equation 2.1, the public infrastructure - transport infrastructure and information, communication and technology infrastructure - augment private capital in the production function in two ways. Firstly, through 'free input effect', since public infrastructure such as transport infrastructure is not subject to user charges, it is therefore not accounted for as direct input into the production of goods and services. It is expected that good transport infrastructure increases market access, allows efficient delivery of goods and reduces wear and tear on trucks hence lowering the total unit cost of production. This provides benefit that directly affects firm's output and productivity.

Secondly, information, communication and technology infrastructure on the other hand, facilitate the process of innovation and therefore lead to benefits that indirectly affect the firm's output and productivity. For instance, access to information and technology enables firms to innovate making them to venture into the production of new products or improve the quality of their products. Furthermore, e-commerce enables firms to indirectly save their operational costs such as advertising and

marketing as well as personnel and suppliers which can decrease the cost of managing their inventory of goods.

On the other hand, energy infrastructure as a direct input in industrial production ensures availability of reliable and affordable electricity and other forms of energy which in turn reduces the cost of production hence making firms to produce more. The elements of public spending on infrastructure development can therefore be seen as critical inputs in industrial production and hence manufacturing output can be modeled to depend on levels of public infrastructure development spending - transport, energy and information communication and technology infrastructure.

2.2.2 Industrial Growth Theory

This theory was developed by Hollis Chenery in 1960. It states that the growth of industry and industrial output is as a result of increase in per capita income in an economy. Chenery argues that an increase in per capita income leads to a change in the composition of demand. That is, individuals begin to demand more than just the basic commodities and demand other luxury goods, thus the share of food demanded declines as the demand for industrial goods increases. This therefore makes the manufacturing or industry sector grow and become vibrant. According to Chenery, the growth of industrial sector is determined by increase in per capita income as well as the population. Hence the two parameters should be included as explanatory variables in models of growth in manufacturing.

However, the theory has been criticized that growth in industry or manufacturing sector can be realized without increasing per capita income. Due to diversity of

natural resources, countries having a continuing comparative advantage in primary production or production of other goods can realize growth in their manufacturing sector through trade or foreign investments. Thus, the countries can realize an increase in the share of industry without initially having high or rising per capita incomes. The changing composition of domestic demand can therefore be offset through foreign trade or foreign investments and not per capita income.

2.2.3 Theory of Industrial Location

This theory was postulated by Alfred Weber in 1909. The theory attempts to explain the regionally operating variables or factors that influence the setup location of industries. Weber identified the two key operating location factors as transportation costs and labour costs. Being a strict function of space, these factors were analyzed from the point of view of individual, isolated production process. Weber therefore grouped all other factors of location work between industries as the agglomerative factors (Reid, 1966). According to Weber, an industry will move to a location where its transportation costs and labour costs will be low or minimized.

Weber also argues that the forces produced within the framework of these regional factors, create and promote the degree of agglomeration. That is, benefits that come from firms and workers being close to one another which include market size of the industries (Reid, 1966). Assumptions of this theory are; all isolated process of production are first pulled to their optimal points of transportation costs, different costs of labour represent a force that alters the initial network determined by the first location factor - transportation costs, the agglomerating tendency competes with other two location factor - transport and labour costs, all factors affecting transportation

costs are expressed in either weights or distance units and lastly labour costs varies from one location to another. Thus, this theory is relevant to this study, since infrastructure development reduces the cost of production which then encourages the establishment and expansion of firms or industries hence contributing to industrialization.

Weber's theory has been criticized that it is not possible to work through to an optimal solution to the question of location by means of a series of partial solutions. Losch (1944) argues that variability in demand was not taken into account. Therefore, Weber's construction of supply side is invalid (Reid, 1966). Isard (1956) also contended that the space economy is not as continuous as Weber's assumptions suggest. Discontinuities and distortion often arise from varying transport rates, topography and existence of transshipments, thus making transportation not to be physically continuous. Furthermore, Isard (1956) argues that Weber's framework lacks the concept of substitution as found in the production theory. It lacks the substitutability between different transport expenditure on raw materials, between transport expenditure and immobile labour costs on the final product (Reid, 1966). According to Deepika (2003) and Melo *et al.* (2013) infrastructure development reduces cost of production besides offering an incentive to both local and foreign owned firms and industries when considering their setup location. This study seeks to determine the effect of government infrastructure development expenditure on the performance of manufacturing sector in Kenya.

2.3 Empirical Literature

Stephan (1997) conducted a study to examine the impact of road infrastructure on private production in Germany. The study used three different approaches, a Cobb-Douglas production function, a translog production function and a growth accounting approach. The study made use of panel data collected from the manufacturing sector of 11 states from 1970-1993. It found that road infrastructure is significant for the production in manufacturing sector. The study also revealed that variations between states are more important for explaining infrastructure's contribution to the production than across years. Although the study considered infrastructure development as a factor that affects growth in the manufacturing sector, it solely concentrated on road infrastructure and not transport infrastructure- road, air, railway and port in totality. This study borrows from the reviewed literature by treating infrastructure as a public input augmenting the private input that is private capital.

With the objective to determine the effect of infrastructure development on growth and income distribution, Calderon and Serven (2004) used a large panel data set for Latin American and Caribbean countries spanning the period 1960-2000. The study estimated simple equation for GDP growth and conventional inequality measures augmented to include among the regressors infrastructure quantity and quality. With the use of Generalized Method of Moments, the study revealed that stock of quality infrastructure asset positively and significantly affects GDP growth in states found in the Latin America and Caribbean region. In addition, the study found that higher quantity and quality of infrastructure contributes to income inequality in these

countries. This study however failed to consider the performance of manufacturing sector.

Loayza and Odawara (2010) conducted a study to determine the effect of infrastructure on economic growth in selected countries. The study used panel data from 78 countries covering the period between 1961 and 2005. Loayza and Odawara (2010) used panel data growth regression model that employed Generalized Method of Moments to address endogeneity and control for unobserved country specific factors. The study concluded that infrastructure development is positively and significantly linked with economic growth in the countries under study. This study failed to consider the performance of manufacturing sector as it measured economic growth using the growth rate of GDP per capita.

Wainaina (2012) carried out a study to determine the relationship between telecommunication infrastructure and economic growth in Sub-Sahara African countries. The study applied the Generalized Method of Moments to analyze panel data from 44 Sub-Sahara African countries for the period between 1988 and 2010. The main variables considered were economic growth, landline teledensity, mobile teledensity, investment and trade openness. The study's results revealed that there is an existence of a two-way causality for only mobile teledensity and economic growth. Landline teledensity growth was found to influence economic growth and not the other way round. The study also found that population growth, investment and trade openness influence growth in Sub-Sahara African countries. This study only considered one sub-sector of infrastructure - ICT infrastructure. Moreover, it did not

consider what effect ICT infrastructure development has on the performance of manufacturing sector.

Mburu (2013) carried out a study to establish the relationship between government investment in infrastructure and economic growth in Kenya. The study used time series data for the period 2005-2012 and a regression analysis. Key variables considered by the study were government investment in transport, communication, water and energy and fuel infrastructure and GDP. The results from the study showed that the investment made by the government in the considered infrastructure sub-sectors - transport, communication, water and energy and fuel - had significant effect on economic growth in Kenya as well as a positive relationship. Although the study considered infrastructure development in the key sub-sectors of the country's infrastructure, it failed to consider the effect it has on the performance of the manufacturing sector.

Using a Granger causality approach Chingoiro and Mbulawa (2014) sought to determine the causality between infrastructure expenditure and economic growth in Kenya and also to determine whether a shock in one variable explains the future movement in the other variables. The study used time series data for the period between 1980 and 2013. Main variables considered were infrastructure development, human capital development and economic growth. The study's result showed the existence of a bidirectional flow of causality between economic growth and infrastructure. The study also found that infrastructure investment in the previous period explained its own movement in the later years. Furthermore, the study revealed that innovations in economic growth were critical in explaining the behavior of

infrastructure. Although Chingoiro and Mbulawa (2014) considered the government infrastructure expenditure, they failed to consider its relationship with and its effect on the performance of the manufacturing sector in Kenya.

Abu-Bakar and Hadijah (2014) carried out a study to investigate the effect of infrastructure development on economic growth in Malaysia. Using the principal component analysis, the study developed an infrastructure index by combining four key indicators among several indicators. Other key variables considered were labour force and capital investment. With the use of a random fixed model on panel data, the study showed that infrastructure development - measured by the infrastructure index - has a positive and significant impact on economic growth of the four Malaysian states. Labour force and total capital investment were also found to be statistically significant besides having a positive relationship with economic growth. This study failed to consider the effect infrastructure development has on the performance of the manufacturing sector.

Moyaki (2015) conducted a study to determine the nexus between road infrastructure and economic growth in Kenya. With the use of a linear regression model the study analyzed time series data for the period between 1963 and 2014. Key variables considered by the study were economic growth, public infrastructure spending, public expenditure on agricultural sector as well as provision of other major social services. The study revealed that public infrastructure spending had a positive relationship with economic growth besides being statistically significant. Other variables found to have a positive relationship and statistically significant were public expenditure on

education and the agricultural sector. This study failed to consider the effect of public infrastructure spending on the performance of the manufacturing sector.

With the objective to determine the effect of infrastructure development on economic competitiveness in Kenya, Njoro (2016) applied a variant form of Isaack Newton's gravity model using panel data for the period 2000-2013. The study looked at the four sub-sectors of infrastructure and measured economic competitiveness using volumes of exports. Key variables considered in this study were; transport, energy and fuel, information communication and technology (ICT) and water and sanitation infrastructure and volumes of export. Results from the study revealed that transport infrastructures as well as energy infrastructure were statistically significant in explaining the country's competitiveness besides having a positive relationship. ICT infrastructure, water and sanitation infrastructure and exchange rate were found to not only have a negative relationship but also statistically insignificant. Considered control variable such as GDP and labour force were also found to be imperative in determining the country's economic competitiveness. Although Njoro (2016) looked at the four sub-sectors of infrastructure while empirically investigating their impact on Kenya's competitiveness the study never considered the performance or growth of the manufacturing sector.

Mugambi (2016) conducted a study to determine the relationship between road infrastructure investment and economic growth with special reference to the role of public and private sector in Kenya. The study used a regression model to analyze time series data for the period between 1980 and 2014. Key variables considered by the study were GDP growth, public road infrastructure investment, private road

infrastructure investment and work force. The study found that private and public road infrastructure investments were statistically significant in explaining economic growth in Kenya apart from having a positive relationship. Work force was found to be statistically insignificant though positively correlated with economic growth. Mugambi (2016) only considered road infrastructure but failed to consider the other sub-sectors of infrastructure such as energy and fuels as well as ICT. The study also never considered the performance of manufacturing sector.

2.4 Overview of the literature

From the theoretical literature, the illustration given under the Cobb-Douglas production function shows how public capital - public infrastructure - positively contribute to output growth of the manufacturing sector. This study categorizes transport and ICT infrastructure as public capital, while energy infrastructure as a direct input in the production process. Transport infrastructure enters the production function as a 'free input' because it is not subject to user charges. Since it is not accounted for as direct input into the production of goods and services its benefits directly affects firms' output and productivity. Information, communication and technology infrastructure on the other hand, facilitates and enhances the process of innovation making its benefits to indirectly affect firms' output and productivity.

Evidence from Mburu (2013), Abu-Bakar and Hadijah (2014), Moyaki (2015), Njoro (2016) and Mugambi (2016) have shown that public infrastructure development is positively and significantly linked with growth and development of an economy as well as its productivity. Therefore, the discussion shows how public infrastructure development is critical for growth and productivity of manufacturing sector. The

reviewed literature in this study have only considered the effect of public infrastructure development on growth of the economy but none has considered the effect of public infrastructure development on the growth of manufacturing sector. Furthermore, Stephan (1997), Wainaina (2012), Chingoiro and Mbulawa (2014), Moyaki (2015) and Mugambi (2016) have considered only the development of road infrastructure and not the transport infrastructure in totality - road, air, port and railway.

Therefore, the current study sought to fill this gap by analyzing the effect of government infrastructure development expenditure on performance of manufacturing in Kenya. Specifically, it sought to determine the effect of government expenditure on transport infrastructure, energy infrastructure and ICT infrastructure on the performance of manufacturing sector.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter details the methodology employed in this study. It discusses the research design, theoretical framework, the study's empirical model, definition and measurements of variables, data collection and data analysis.

3.2 Research Design

This study sought to determine the effect of infrastructure development expenditure on the performance of manufacturing sector in Kenya. It therefore adopted a non-experimental research design for the purpose of explaining the effect and relationship between infrastructure development and performance of manufacturing sector since independent variables were not manipulated to show statistical relationship with the dependent variable. Time series data covering the period 1982-2018 for the following variables was considered; manufacturing value added as a percentage of GDP, infrastructure development expenditure on transport - road, air, port and railway transport - energy and fuels and information communication and technology, trade, foreign direct investment, net indirect taxes and lending interest rate.

3.3 Theoretical Framework

The theory of production was used to anchor this study, specifically the Cobb-Douglas production function. The argument was that public expenditure on development of infrastructure such as energy infrastructure provides affordable and

reliable electricity and other forms of energy which are utilized directly as inputs in the production process. Public expenditure on the development of energy infrastructure reduces the cost of energy, thus increases firms' output. On the other hand, public infrastructure such as transport and ICT infrastructure is considered as public capital (Shanks & Barnes, 2008). Since transport infrastructure - public capital - is not subject to user charges, it is not accounted for as direct input into the production of goods and services. It is therefore considered as a free input in the production process. This is because it increases market access, enables efficient delivery of goods and reduces wear and tear costs of firms' trucks hence increasing firms' output. Information, communication and technology infrastructure also as a public capital facilitates and enhances the process of innovation leading to increased firms' output and productivity (Shanks & Barnes, 2008).

The Cobb-Douglas production function is expressed in equation 3.1 as shown;

$$Y = AL^{\alpha}K^{\beta} \quad \text{.....3.1}$$

Where; Y is output, A is technological progress, L is labour, K is capital, α and β are labour elasticity and capital elasticity respectively.

This study divides capital into two, the private capital and public capital components. According to Barro (1990), the production function in 3.1, can therefore be rewritten as;

$$Y = AL^{\alpha 1}K_1^{\beta 1}K_2^{\beta 2}I^{\alpha 3} \quad \text{..... 3.2}$$

Where; K_1 is private capital and K_2 is public capital such that $\beta_1 + \beta_2 = \alpha 2$, β_1 and β_2 are private capital elasticity and public capital elasticity respectively and I is energy infrastructure since it is considered as a direct input in the production process.

Public capital includes transport infrastructure and ICT infrastructure. In order to make equation 3.2 a linear function and interpret the coefficients as elasticities we take the natural logarithm on either sides of the equation to get equation 3.3 as shown;

$$\ln Y = \ln A + \alpha_1 \ln L + \beta_1 \ln K_1 + \beta_2 \ln K_2 + \alpha_3 \ln I \ldots\ldots \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.3$$

Where: lnY is natural log of output, lnA is natural log of technological progress, lnL is natural log of labour force, $\ln K_1$ is natural log of private capital, $\ln K_2$ is natural log of public capital, lnI is natural log of energy infrastructure. α_1, $\beta_1 + \beta_2 = \alpha_2$ and α_3 are coefficients.

3.4 Model Specification

The theoretical model can then be specified in a manner to capture the specific public capital as input measures to enable estimation of the relative importance of each of them. Based on the theories reviewed, other factors that influence growth of manufacturing output are from the demand side. They include population, per capita income, and interest rates. Thus, output growth in manufacturing is not only driven by growth in labour and capital but also by growth in demand which is captured by the relevant variables.

The empirical model used to guide this study encompasses variables from both the reviewed theories and empirical studies. It is specified as follows;

Mng = f (Labour, PS_T, $PS_{E,}$ PS_{ICT}, P_C, Population, Interest Rates, Imports, Exports FDI) 3.4

This study will therefore estimate the linear equation below;

Ln Mng = $\ln\alpha_0 + \alpha_1 \ln L + \alpha_2 \ln PO + \alpha_3 \ln LIT + \alpha_4 \ln PS_T + \alpha_5 \ln PS_E + \alpha_6 \ln PS_{ICT} + \alpha_7 \ln M + \alpha_8 \ln X + \alpha_9 \ln FDI + \alpha_{10} \ln P_{CI} + \mu$..……..……..…….3.5

Where: Mng is manufacturing output, L is Labour, LIT is lending interest rate, PO is population, PS_T is public spending on infrastructure development in transport, PS_{ICT} is infrastructure development expenditure on information, communication and technology, PS_E is public spending on infrastructure development in energy, P_{CI} is per capita income, M is imports of manufacturing products, X is exports of manufacturing products, FDI is foreign direct investments, $\alpha_{1...}$ α_{10} are a coefficients and μ is the error term.

3.5 Definition and Measurements of Variables

The definition and measurement of variables is as shown in Table 3.1. The variables are measured using the actual figures recorded for a particular year(s).

Table 3.1: Definition and Measurements of Variables

Variable	Definition	Measurement
Manufacturing output (Mng)	The value of manufacturing output	Share of manufacturing in GDP during a particular period.
Population Growth (PG)	Annual increase in population	Annual total population estimates.
Labour	Proportion of people aged between 18 and 64	Total number of employed persons aged between 18 and 60 years as per the WDI statistics

Lending interest rate (LINT)	Cost of borrowing for consumers.	Commercial banks' lending rate reported for a given year.
Transport infrastructure development expenditure (TI)	Amount of money spent by government to develop the transport system. Transport system includes, air, road, port and railway transport.	Actual development expenditure on transport infrastructure in a particular year.
Information Communication and Technology infrastructure development expenditure (ICTI)	Amount of money spent by the national government to develop information, communication and technology infrastructure.	Actual development expenditure on information communication and technology infrastructure in a particular year.
Energy infrastructure development expenditure (EI)	Amount of money spent by the national government to develop energy and fuels infrastructure.	Actual development expenditure on energy infrastructure in a particular year.
Foreign Direct Investments (FDI)	Net inflows of investment that acquire a lasting management interest in an enterprise.	Net inflows of FDI to Kenya in a particular year.
Imports (M)	Manufacturing products imported into the country	Proportion of manufacturing products imported
Exports (X)	Manufacturing products exported to other countries	Proportion of manufacturing products exported

Source: Researcher, 2020

3.6 Data Collection Procedures

Time series data was collected from the World Development Indicators, Kenya National Bureau of Statistics and Central Bank of Kenya databases, economic surveys and national financial budget reports for the period 1982 to 2018.

3.7 Time Series Properties

3.7.1 Stationarity Test

A unit-root test on both dependent and independent variables was conducted to test for stationarity before the analysis was done. This was to ensure that the series had a constant mean and variance, thus spurious results were not obtained. In case some variables were found not to be stationary, they were differenced in order to attain stationarity. This study adopted the Augmented Dickey Fuller (ADF) test to test for unit root. ADF ensured that the lags in the data on the variables were removed so that spurious results were not obtained.

3.7.2 Co-integration Test

To test for a long-run equilibrium relationship between considered variables, this study carried out a cointegration test using Johansen test. This test is used to test for the existence of a long-haul connection of variables in a non-stationary arrangement. It therefore made it suitable to capture the relationship between non-stationary time series in a stationary model (Adam, 1988). The test ensured that there was no long-run relationship among the independent variables.

3.7.3 Correlation Test

The study employed Variance Inflation Factor (VIF) to test for multicollinearity among the explanatory variables. The test was necessary to ensure that spurious results were not obtained during analysis by eliminating the variables which depicts close multicollinearity.

3.8 Data Processing and Analysis

This study made use of multilinear regression model with Ordinary Least Squares (OLS) method to estimate the parameters in only one linear equation. To achieve objective one, two and three of the study a multivariate regression analysis was done on equation 3.5, and the coefficient of each variables and its statistical significance in the study was explained. Since the study intended to analyze the effect of Government expenditure on infrastructure development on the performance of manufacturing sector, the three components of infrastructure development expenditure - transport, energy and ICT infrastructure - formed the main set of variables under investigation in the regression equation. Thus, regressing this equation generated results that were used to answer the three research questions.

3.9 Diagnostic Tests

To ensure that the coefficient estimates were consistent, this study carried out the necessary diagnostic tests. Breusch-Pagan test was conducted to test for heteroscedastcity while Goldfeld-Quandt was carried out to test for multicollinearity (Gujarati, 2004). Since some variables in the study were lagged, Durbin-Watson test was used to check for serial autocorrelation (Gujarati, 2004). Also, Jarque-Bera test was used to test for the normality of the error term. This test involved computing standard deviation, skewness, kurtosis and probability assisted in identifying presence of outliers.

CHAPTER FOUR

EMPIRICAL FINDINGS

4.1 Introduction

This chapter is presented in four sections; introduction, descriptive statistics, time series analysis, diagnostic tests and empirical findings.

4.2 Descriptive Statistics

The data for all the variables used in the study was collected for the period 1982-2018. Table 4.1 provides an analysis of the descriptive statistics.

Table 4.1: Descriptive Statistics Analysis

	Mng	**PSE**	**X**	**FDI**	**PSICT**	**M**	**INT**	**LABOUR**	**PC**	**POP1**	**PST**
Mean	7.158	13.875	26.037	0.7621	12.945	62.621	18.297	12.873	2.614	31.544	13.827
Median	8.082	13.999	27.500	0.4700	13.927	62.500	16.000	12.338	2.610	30.200	12.029
Maximum	11.50	19.517	37.500	3.4600	17.919	74.900	36.000	14.916	3.039	47.800	19.371
Minimum	1.969	9.7439	9.9000	0.0400	0.0000	50.500	11.000	10.624	2.276	18.800	10.063
Std. Dev.	2.77	3.1852	9.2525	0.8128	3.5804	5.338	6.509	1.590	0.161	8.457	3.198
Skewness	-0.422	0.2549	-0.4274	1.8887	-1.2329	-0.173	1.3407	-0.073	-0.019	0.254	0.660
Kurtosis	2.723	1.4955	1.9319	5.7254	5.6511	3.145	3.749	1.313	4.347	1.989	1.849
Jarque-	1.20	3.890	2.885	33.44	20.20	0.217	12.01	4.416	2.77	1.968	4.746

Bera	7	4	5	9	9	3	2		6		
Probabilit	0.57	0.142	0.236	0.000	0.000	0.897	0.002	0.109	0.25	0.375	0.095
y	7	9	2	0	0	3			8		
Obs	37	37	37	37	37	37	37	37	37	37	37

Source: Author' Computation

Imports had the maximum value of 74.90 while information, communication and technology had the minimum value of 0.0000. The findings also showed that annual share of manufacturing in gross domestic product (Mng), annual exports of manufacturing products, annual government expenditure on information, communication and technology (PS_{ICT}), annual imports of manufacturing products and annual per capita income were negatively skewed while annual government expenditure on energy, annual foreign direct investment (FDI), annual interest rate (INT), annual labour employed in the manufacturing sector, annual government expenditure on transport (PS_T) and annual population growth (PG) were positively skewed. Some variables such as share of manufacturing in gross domestic product, imports of manufacturing products, annual interest rates had kurtosis values close to 3 while foreign direct investment, information, communication and technology and per capita income had a kurtosis values more than 3 hence were found to be leptokurtic and expenditure on energy, export of manufacturing products, labour and expenditure on transport had kurtosis less than 3 hence were platykurtic.

4.3 Time Series Test Results

4.3.1 Unit Root Test

Unit root tests were carried out using Augmented Dickey Fuller (ADF) to ensure that both the independent and dependent variables were stationary before other analyses were done in order to avoid probability of getting spurious results. The test was done at both intercept and at trend and intercept with some variable being stationary at level and some after first difference as shown in Table 4.2.

Table 4.2: Stationarity Test Results

Variables	Form of test	T-statistics	P-Value	Remarks
Energy	Intercept	-7.9670	0.0000	Stationary
(1st Difference)	Trend & Intercept	-7.8274	0.0000	Stationary
Exports	Intercept	-9.4891	0.000	Stationary
(1st Difference)	Trend & Intercept	-9.6657	0.0000	Stationary
FDI (Level)	Intercept	-4.3079	0.0017	Stationary
	Trend & Intercept	-4.7755	0.0025	Stationary
ICT (Level)	Intercept	-3.4480	0.0156	Stationary
	Trend & Intercept	-4.6747	0.0037	Stationary
Imports (Level)	Intercept	-3.6931	0.0054	Stationary
	Trend & Intercept	-3.6670	0.0379	Stationary
Interest Rate	Intercept	-5.9219	0.0000	Stationary
(1st Difference)	Trend & Intercept	-5.5231	0.0006	Stationary
Labour	Intercept	-5.7034	0.0000	Stationary
(1st Difference)	Trend & Intercept	-5.6398	0.0003	Stationary
Manufacturing	Intercept	-6.1108	0.0000	Stationary
(1st Difference)	Trend & Intercept	-6.0439	0.0001	Stationary
PCI (Level)	Intercept	-3.1823	0.0296	Stationary
	Trend & Intercept	-4.9784	0.0016	Stationary

Population	Intercept	-5.3885	0.0001	Stationary
(1st Difference)	Trend & Intercept	-6.2392	0.0000	Stationary
Transport	Intercept	-5.1737	0.0002	Stationary
(1st Difference)	Trend & Intercept	-5.1279	0.0010	Stationary

Source: Author's Computations

The results were obtained at 5 per cent level of significance and according to the rule of the thumb a P-value greater than 0.05 signifies non-stationarity while a P-value of less than 0.05 signifies stationarity. Therefore, the study concluded that all the variables were stationary at different levels. Variables such as foreign direct investment, expenditure on information, communication and technology, imports of manufacturing products and annual per capita income were found to be stationary at level while variables such as expenditure on energy, exports of manufacturing products, lending interest rates, labour employed in manufacturing sector, share of manufacturing in the GDP and expenditure on transport were found to be non-stationary at level hence were differentiated ones in order to be stationary.

4.3.2 Co-integration Test

Co-integration test was carried out to ensure that there was no long-run relationship among the independent variables. The test was carried out using Johansen Co-integration test and the results are shown in Table 4.3.

Table 4.3: Co-integration Test Results

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.999451	785.4370	285.1425	0.0000
At most 1 *	0.982299	522.6791	239.2354	0.0000
At most 2 *	0.949283	381.4837	197.3709	0.0000
At most 3 *	0.875864	277.1317	159.5297	0.0000
At most 4 *	0.824291	204.1084	125.6154	0.0000
At most 5 *	0.741875	143.2461	95.75366	0.0000
At most 6 *	0.720504	95.84520	69.81889	0.0001
At most 7 *	0.475788	51.22833	47.85613	0.0233
At most 8	0.397122	28.62327	29.79707	0.0678
At most 9	0.267237	10.91186	15.49471	0.2170
At most 10	0.000835	0.029225	3.841466	0.8642

Trace test indicates 10 co-integrating equations at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

Source: Author's Computations

Johansen Co-integration test states that if there are n-variables in an equation then co-integrating equations should be n-1. From the analysis, there are ten (10) co-integrating equations obtained from eleven (11) explanatory variables at 5 per cent significance level. Therefore, the study concluded that there was co-integration among the variables.

4.3.3 Correlation Test

Correlation test was carried out to show whether there was correlation among the independent variables. Table 4.4 shows the correlation test results.

Table 4.4: Correlation Test Results

	PS_E	**X**	**FDI**	**PS_{ICT}**	**M**	**INT**	**LABOURPC**	**PG**	**PS_T**
PS_E	1.000								
X	0.751	1.000							
FDI1	0.353	0.358	1.000						
PS_{ICT}	0.556	0.513	0.257	1.000					
M	-0.098	-0.054	-0.117	0.025	1.000				
INT	-0.333	0.176	0.033	-0.056	0.303	1.000			
LABOUR	0.953	0.787	0.329	0.617	-0.057	-0.276	1.000		
PC	-0.122	-0.141	0.077	-0.212	-0.010	0.081	-0.287	1.000	
PG	0.948	0.781	0.384	0.609	-0.008	-0.176	0.954	0.103	1.000
PS_T	0.867	0.594	0.403	0.362	-0.088	-0.201	0.805	0.002	0.875	1.000

Source: Author's computation

From the analysis it was found that all the variables were not highly correlated to one another as the coefficient of correlation matrix was less than or equals to 0.8. Hence, the variables were used in the analysis as there was no signs of singular matrix problem.

4.4 Diagnostic Tests

Diagnostic tests were carried out to test the validity of the model. The tests carried out include serial correlation test, heteroscedasticity test, normality test and multicollinearity test.

4.4.1 Serial Correlation Langrage Multiplier (LM) Test

Breucsch-Godfrey Serial Correlation LM test was carried to check for serial correlation in the error term. The hypothesis was that the error term was serially independent. Table 4.5 shows the LM test results.

Table 4.5: Serial Correlation LM Results

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	2.396207	Prob. F(2,24)	0.1125
Obs*R-squared	6.158544	Prob. Chi-Square(2)	0.0460

Source: Author's Computations

The rule of the thumb states that if the p-value is greater than 0.05 then the error term is not serially independent. The results show that there was no autocorrelation at 5 per cent level of significance as the value of F-statistics was 2.3962 with a probability of 0.11 which is greater than 0.05. Therefore, the study concluded that there was no serial correlation of the error term, meaning that the model was good enough to be used in the analysis of the effect of government infrastructure expenditure on the performance of manufacture firms in Kenya.

4.4.2 Heteroskedasticity Test

The study adopted the Breuscsh-Pagan Godfrey test to check whether the error term in the model had a constant variance or not. The results of the test are shown in Table 4.6.

Table 4.6: Heteroskedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.960297	Prob. F(10,26)	0.4988
Obs*R-squared	9.979785	Prob. Chi-Square(10)	0.4423
Scaled explained SS	3.840184	Prob. Chi-Square(10)	0.9543

Source: Author's Computations

The test was used to ascertain the constancy of the variance of the error term. If the P-value is less than 0.05 then the variance of the error term is not constant and if the P-value is greater than 0.05 then the variance of the error term is constant. The findings show that the F-statistic is 0.9603 with a P-value of 0.4988 which is greater than 0.05 at 5 per cent significance level. The study therefore, concluded that the error term had a constant variance, hence there was no problem of heteroscedasticity in the model.

4.4.3 Normality Test

The test was carried out using histogram-normality test to ensure that the residual values were well distributed in the model. The results are as shown in Figure 4.1

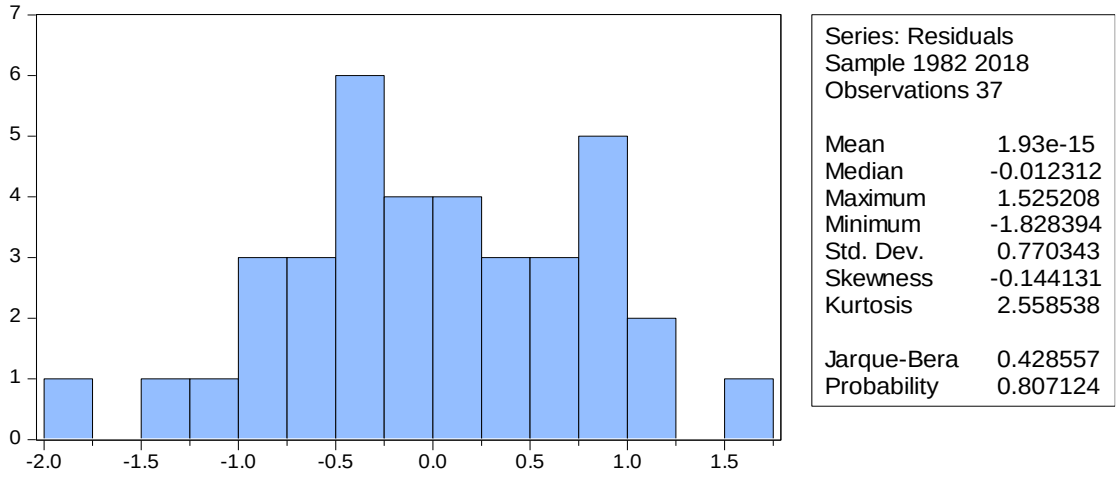

Figure 4.1: Histogram-Normality Test

Source: Author's Computations

From Figure 4.1, the value of the Jarque-Bera statistics (0.43) with a probability of 0.81 is greater than 0.05 at 5 per cent significance level. According to the rule of the thumb if the probability is less than 0.05, then the residual values are normally distributed and if the probability is greater than 0.05 at 5 per cent level of significance then the residual values are normally distributed. From the findings the probability of 0.81 is greater than 0.05 hence the study concluded that the residual values are normally distributed.

4.4.4 Stability Test

Stability test was carried using both Ramsey RESET test and CUSUM test. Stability test was necessary to prove the linear specification of the model. The results are shown in Table 4.7 and Figure 4.2.

Table 4.7: Ramsey RESET Test

	Value		Probability
F-statistic	5.127659	(1, 25)	0.0625
Likelihood ratio	6.903009	1	0.0486

Source: Author's Computations

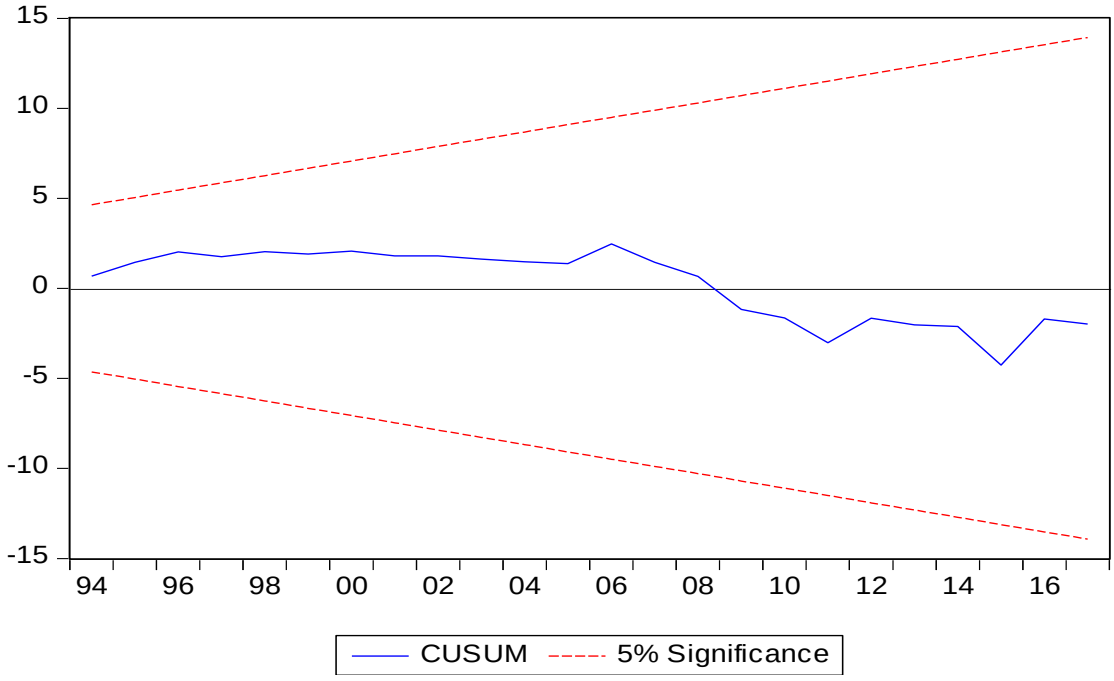

Figure 4.2: CUSUM Test

Source: Author's Computations

The test was carried out to ensure that no variable was excluded from the analysis. The test also signifies whether non-linear values explain any change in the dependent variable and also if the variables have any power in explaining the change in the dependent variable. This is confirmed by the model if the value of the F-statistics is

greater than 0.05 at 5 per cent level of significance. From the findings the value of the F-statistics was 0.0625 which is greater than 0.05. Hence, the study concluded that the model was well specified. A further analysis was done using CUSUM test as shown in the Figure 4.2 and the residuals were found to be within the critical boundaries at 5 per cent level of significance indicating that the model was correctly specified in linear form hence no spurious results could be achieved from the analysis.

4.4.5 Multicollinearity Test

Multicollinearity test was carried out using Variance Inflation Factor (VIF). The results are as presented in Table 4.8.

Table 4.8: Variance Inflation Factor Test

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	60.55174	2726.663	NA
ENERGY1	0.054908	500.3784	24.40737
EXPORTS1	0.001902	65.19033	7.132936
FDI1	0.044839	2.471019	1.298136
ICT1	0.003795	30.76880	2.131140
IMPORTS1	0.001047	186.1284	1.307026
INT_RATE1	0.001960	33.17951	3.630042
LABOUR1	0.361920	2742.155	40.09889
PCI1	1.824946	562.3082	2.125449
POP1	0.010419	499.4290	32.63361
TRANS1	0.018345	165.8205	8.179756

Source: Author's Computation

The test was carried out to show whether there is multicollinearity among the independent variables. According to the rule of the thumb, at 5 per cent level of significant, if the coefficients of Variance Inflation Factor is greater than ten (10), then there is high multicollinearity among the variables and if the coefficients are less or equals to one (1) then the chances of multicollinearity is minimal. From the results in Table 4.7 the coefficients are less than one. The study therefore concluded that there was low chance of multicollinearity among the independent variables.

4.5 Regression Analysis Results

The main objective of this study was to analyze the effect of government infrastructure development expenditure on performance of manufacturing in Kenya. The study had three objectives; the first objective was to determine the effect of government expenditure on transport infrastructure on share of manufacturing in Gross Domestic Product (GDP) in Kenya, the second objective was to determine the effect of government expenditure on energy infrastructure on share on manufacturing in GDP in Kenya, while the third objective was to determine the effect of government expenditure on information, communication and technology infrastructure on share of manufacturing in GDP in Kenya. The regression results are shown in Table 4.9.

Table 4.9: Regression Analysis Results

Dependent Variable: Share of Manufacturing in GDP				
Independent Variables	**Coefficient**	**Std. Error**	**t-Statistics**	**Probability**
Constant Term (C)	-12.00869	7.781500	-1.543236	0.01349
Expenditure on Energy	-0.23974	0.234324	-1.023092	0.03157

Exports of manufacturing products	0.00517	0.043609	0.118548	0.0907
Foreign Direct Investment	-0.32874	0.211752	-1.552487	0.0133
Expenditure on information communication technology	0.11345	0.061602	1.841712	0.0077
Imports of manufacturing products	-2.14432	2.032352	1.369976	0.0182
Lending interest rate	2.06663	1.044273	1.504935	0.01444
Labour force	0.510854	0.601598	0.849162	0.4035
Per capita income	0.509219	1.350905	0.376946	0.7093
Population	0.236753	0.102072	2.319478	0.0285
Expenditure on transport infrastructure	0.128208	0.135442	0.946586	0.03526
R-Squared	0.919671			
Adjusted R-Squared	0.888775	F-Statistics		49.76681
Durbin-Watson Statistics	2.319416	Probability (F-statistics)		0.00000

Source: Author's Computations

The results from regression analysis showed that the value of the adjusted R-squared was 0.8888. This meant that 88.88 per cent of the changes in the share of manufacturing in the GDP in Kenya were explained by the changes in the government expenditure in information, communication and technology, expenditure in energy infrastructure and expenditure in transport infrastructure. It also indicated that only

11.12 per cent of changes in share of manufacturing in GDP were explained by other factors. Further, the value of F-statistics of 49.77 with a probability of 0.0000 was found to be statistically significant at 5 per cent significance level implying that the model is significant and fit for the analysis. The findings support the work of Chingoiro and Mbulawa (2014), Mburu (2013) and Moyaka (2015). The intercept was also found to be statistically significance at 5 per cent level of significance indicating that the value of the share of the manufacturing in the GDP in Kenya is negative (-12.01). The value of Durbin Watson of 2.319416 also indicated that there was non-serial autocorrelation among the variables that the study considered.

4.5.1 Effect of Government Expenditure On Transport Infrastructure On The Share Of Manufacturing in GDP in Kenya

This was the first objective of the study. From Table 4.9, the coefficient of annual government expenditure on transport infrastructure was 0.128 with a P-value of 0.03526. The coefficient was found to be positive and statistically significance at 5 per cent level of significance. The finding was in agreement with that of Mugambi (2016). This implies that a one (1) per cent increase in government expenditure in transport infrastructure results in an increase in the share of manufacturing in gross domestic product in Kenya by 12.8 per cent. The findings that transport sector significantly contributes to the growth of manufacturing and its share in the GDP is also in tandem with the findings by Loayza and Odawara (2010, and Mburu (2013).

The above scenario could be as a result of continuous increase in allocation of more funds to the development of transport infrastructures during annual budgeting by the government. This has enabled the development of more roads, railway lines, sea

transport and upgrading of airports in the country which facilitates the movement of manufacturing products from the production to consumption or value addition points. The development of transport infrastructures has also opened up areas for the established of more manufacturing firms. This is due to easy accessibility and low transportation costs which facilitates faster movement of products or goods and services to the markets and raw materials to the firms. This has tremendously contributed to the growth and particularly share of the manufacturing in the gross domestic product in Kenya (Stephen, 1997).

4.5.2 Effect of Government Expenditure On Energy Infrastructure On The Share Of Manufacturing in GDP in Kenya

This was the second objective of the study. From Table 4.9, the coefficient of the government expenditure on energy infrastructure was negative (-0.23974) and statistically significance at 5 per cent level of significance. The finding contradicts the works of Moyaki (2015). However, the finding confirms the work of Mburu (2013). A possible explanation for this negative relationship is that energy alone cannot steer the growth of the manufacturing sector as other factors such as skilled labour force, means of transportation, information, communication and technology and ready market for the consumption of manufactured products play a great role in the growth of manufacturing and its share in the gross domestic product (Noro, 2016).

The negative sign could also imply that energy availability without the inputs of other factors mentioned above results in no production at all. The Kenyan Government has continuously invested in the production of energy from hydroelectric power to geothermal power and wind power in order to ensure that energy is readily available

and cheap to accelerate the growth of the manufacturing sector which significantly contributes to the growth of Kenya's gross domestic product.

4.5.3 Effect of Government Expenditure On ICT Infrastructure On The Share Of Manufacturing in GDP in Kenya

This was the third objective of this study. From Table 4.9, the coefficient of government expenditure on ICT infrastructure was positive (0.11345) and statistically significant at 5 per cent level of significance. This finding is consistent with that of Wainaina (2012) and Abu-Bakar and Hadijah (2014) who found that ICT significantly contributes to the increase in share of manufacturing in gross domestic product. This implies that a 1 per cent increase in government expenditure in information, communication and technology results to an increase in share of manufacturing in GDP by 0.11 per cent. A possible explanation to this is that ICT promotes new and cheap ways of manufacturing in terms of invention and innovation of new products and services hence increasing the share of manufacturing in the gross domestic product in Kenya (Njoro, 2014).

This increase in the share of manufacturing in GDP in Kenya as a result of increase in the expenditure in ICT could be attributed to the creation of ICT hub and incubation centres. The new ideas are developed through sharing of information in order to boost manufacturing sector which in turn increase its share in gross domestic product. ICT also promotes and facilitates information inflow from experts, thus facilitates the growth of the manufacturing sector.

4.5.4 Effect of Other Variables On The Share Of Manufacturing in GDP in Kenya

The study analyzed the effect of other variables such as foreign direct investments, imports of manufactured products, exports of manufactured products, lending interest rates, labour force employed in the manufacturing sector, per capita income and population growth rate on the share of manufacturing in GDP in Kenya. According to the regression results as presented in Table 4.9, lending interest rate and population growth rate had positive and significant coefficients at 5 per cent level of significance. Implying that increasing lending interest rate by one percentage point, the share of manufacturing in GDP would increase by 2.0666 percentage point while increasing population growth by one percentage point, the share of manufacturing in GDP increases by 0.02368 percentage point.

Foreign direct investment and imports of manufacturing products were found to have negative and significant coefficients at 5 per cent significance level. Increasing imports by one percentage point results to a decrease in manufacturing by 2.14 percentage point, implying that imports of manufacturing products discourages local manufacturing of products as the products are readily available for consumption at a cheaper price. Increasing FDI by one percentage point results to a decrease of the share of manufacturing by 0.3287 percentage point

The coefficients of labour force and per capita income were found to be positive and statistically insignificant at 5 per cent level of significance. This is because labour force without the input of other variables would not boost the share of manufacturing in GDP as most of the activities will be done manually which produces low quality

products as compared to capital intensive production system. Per capita income increase will not necessarily result in increase in the share of manufacturing in GDP because of indirect transmission effect on manufacturing through channels affecting manufacturing in Kenya.

CHAPTER FIVE

SUMMARY, CONCLUSION AND POLICY IMPLICATIONS

5.1 Introduction

This chapter presents the summary of the findings, conclusions of the study as well as policy implications and lastly areas for further study.

5.2 Summary

The share of manufacturing sector to the gross domestic product has been low due to undeveloped transport sector, high cost of energy, low technology, adoption of less capital intensive method of production, high rate of importation of manufacturing products and high lending interest rates. In order to increase the contribution from the current 7 per cent to 10 per cent as envisioned in the vision 2030, the government has put in place measures like the "Big Four Agenda", to help realize this growth. However, Kenya has realized minimal increase in share of manufacturing in gross domestic product. Kenya has made tremendous steps in the manufacturing sector since independence, and the current government has come up with the measures to steer the manufacturing sector to 17 per cent share in the gross domestic product and take Kenya to a middle income economy. In the blue print one of the key pillars is the manufacturing seeks to boost the gross domestic product of Kenya.

The study sought to empirically determine the effect of government infrastructure development expenditure on the performance of the manufacturing sector in Kenya with three objectives. The first objective was to determine the effect of government

expenditure on transport infrastructure on the share of manufacturing in GDP in Kenya, the second objective was to determine the effect of government expenditure on energy infrastructure on the share of manufacturing in GDP in Kenya, while the last was to determine the effect of government expenditure on ICT infrastructure on the share of manufacturing in GDP in Kenya. The study used time series data for the period 1982 - 2018 to achieve the first, second and third objectives. The data was sourced from Kenya economic surveys, Kenya National Bureau of Statistics' statistical abstracts and World Development Indicators. The data was analyzed using a multivariate regression model with Ordinary Least Squares (OLS) method to estimate the parameters in linear equation in order to achieve the three objectives.

The study found that the coefficient of development expenditure on transport infrastructure was positive and statistically significant at 5 per cent level of significance. The study also found that the coefficient of development expenditure on energy infrastructure was negative but statistically significant at 5 per cent level of significance. In addition, the study revealed that the coefficient of development expenditure on information, communication and technology infrastructure was positive and statistically significant at 5 per cent level of significance.

5.3 Conclusions

The three objectives of the study were; to determine the effect of government expenditure on transport infrastructure on share of manufacturing in GDP in Kenya, to determine the effect of government expenditure on energy infrastructure on share of manufacturing in GDP in Kenya and lastly to determine the effect of government expenditure on ICT infrastructure on share of manufacturing in GDP in Kenya. The

study concludes that both government expenditure on transport and ICT infrastructure positively and significantly contribute to the performance of manufacturing in Kenya while government expenditure on energy infrastructure negatively contributes to the performance of manufacturing in Kenya.

5.4 Policy Implications

The Government should concentrate more on the development of transport infrastructure such as roads, railway lines, expansion of airports and sea ports for faster movement of goods and other products in order to boost performance of manufacturing sector hence increasing its share in GDP. In pursuit of the "Big Four Agenda" manufacturing pillar - the government should shift from incurring expenses on power connectivity to expansion of roads, railway construction, expansion of sea and air ports and incurring expenditures on ICT for innovation and inventiveness in order to boost the manufacturing of goods and other products.

For sustainability of growth and performance of the manufacturing sector in Kenya, the ministry of information, communication and technology and the ministry of transport and infrastructural development should come up with policies and frameworks that bring private sector, non-governmental organizations and even the county governments as the units of development to guide the growth and development of the manufacturing sector. The ministry of information, communication and technology should collaborate with the private sector in order to develop and come up with policies that encourage the utilization of technology by Kenyan citizens in order to invent new methods of production.

5.5 Suggested areas for Further Research

Further research needs to be done on specific transport subsectors such as roads and railways construction on the performance of the manufacturing sector in Kenya. Manufacturing products need to be decomposed into consumables and capital products in order to realize the real effect of ICT in the performance of the manufacturing sector. It would also be of interest to identify and know the reason why energy negatively but significantly contributes to the performance of manufacturing sector in Kenya.

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APPENDIX

Appendix 1: Research Data

YEARS	MAN	LAB	INT R	POP	TRANS	ICT	ENGY	IMP	EXP	FDI	PCI
1982	2.7	10.63	11	18.8	10.97	8.56	10.34	52.3	12.1	0.39	2.2
1983	2.7	10.65	12	19.1	10.82	8.29	9.74	50.5	11.6	0.37	2.1
1984	2.9	10.66	13	19.5	10.92	9.06	10.25	53.3	9.9	0.45	2.5
1985	2.6	10.68	14	20.2	10.66	8.47	10.05	54.9	11.4	0.51	2.0
1986	2.7	10.82	14	21.2	10.59	8.78	10.61	69	10.5	0.49	2.5
1987	2.7	10.98	14	21.8	10.67	10.61	10.27	68.6	12.5	0.47	2.3
1988	2.6	11.10	15	22.7	11.29	9.76	10.96	74.9	12.6	0.21	5.7
1989	2.6	11.20	17	23.4	11.47	11.39	11.17	71.2	11.8	0.58	5.8
1990	2.6	11.35	19	24	11.63	11.45	10.97	65.5	29.2	0.75	5.9
1991	2.6	11.52	21	24.8	11.34	11.34	10.62	68	20.5	0.67	6.0
1992	2.6	11.65	30	25.7	11.51	11.47	11.04	54	36.4	0.23	6.4
1993	2.6	11.60	36	26	11.63	11.65	11.16	66.4	28.3	0.08	6.4
1994	2.6	11.70	29	26.8	11.76	11.82	11.20	63.6	28.8	2.53	6.5
1995	2.6	11.81	34	27.5	11.93	12.00	11.27	71.2	27.6	0.18	6.6
1996	2.6	11.91	30	28.3	12.05	12.14	11.18	67.8	26.4	0.47	6.7
1997	2.6	12.01	29	29.5	12.08	12.19	11.17	63.2	25.3	0.93	6.8
1998	3.0	12.10	22	28.8	11.69	12.41	11.43	63.7	23.6	0.47	8.2
1999	3.0	12.21	22	29.5	13.81	14.16	13.88	67.5	22.2	0.19	8.2
2000	2.5	12.34	20	30.2	13.65	14.68	14.06	57.9	20.8	0.46	8.1
2001	2.3	13.85	18	30.8	13.10	14.09	14.00	61.6	23.3	0.87	8.1
2002	2.3	13.93	17	32.2	15.87	14.66	14.09	65	23.9	0.04	8.1
2003	2.3	14.00	13	33.2	15.51	15.05	14.19	61	24.2	0.21	8.1
2004	2.3	14.06	13	34.2	12.98	15.18	15.07	61.3	25.7	0.55	8.1
2005	2.4	14.18	14	35.1	10.09	16.83	15.46	64.3	31.9	0.29	8.1
2006	2.6	14.22	13	36.1	10.63	17.06	15.60	62.6	35.7	0.11	8.1

2007	2.6	14.27	14	35.8	13.21	17.42	16.23	62.2	37.3	0.22	8.2
2008	2.6	14.32	14	36.7	14.10	17.92	16.75	58.1	36.5	2.28	8.2
2009	2.6	14.39	15	37.7	17.39	13.93	19.52	60	36.6	0.27	8.2
2010	2.6	14.45	14	38.5	17.94	0.00	17.41	62.7	34.7	0.31	8.3
2011	2.6	14.49	15	39.5	18.00	14.95	17.56	61.2	33.5	0.45	8.3
2012	2.6	14.53	20	40.7	18.56	15.53	18.24	60.4	36.3	3.46	8.3
2013	2.7	14.77	17	41.8	17.39	13.93	17.20	61.6	36.9	2.74	9.1
2014	2.7	14.77	17	43	19.35	15.50	17.95	62.4	35.7	2.03	11.4
2015	2.7	14.79	16	44.2	18.80	16.33	18.09	61.8	36.4	1.34	11.4
2016	2.7	14.79	17	45.4	19.38	17.06	18.21	62	37.5	0.56	11.5
2017	2.7	14.79	14	46.6	19.23	16.43	18.40	62.5	28.3	0.92	11.5
2018	2.7	14.91	14	47.8	19.13	16.89	18.01	62.8	27.5	1.12	11.5