

**STRATEGIC FACTORS INFLUENCING TRANSPORT AND DISTRIBUTION OF
PETROLEUM PRODUCTS IN KENYA: A CASE STUDY OF KENYA PIPELINE
COMPANY**

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**A Research Project Submitted to The Institute of Post Graduate Studies of Kabarak
University in Partial Fulfilment of The Requirements for The Award of The Post
Graduate Degree of Master of Business Administration (Strategic Management)**

KABARAK UNIVERSITY

NOVEMBER, 2019

DECLARATION

This research Project is my original work and to the best of my knowledge has not been presented for academic award in any other University or College

Signature:

Date.....

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GMB/NE/0190/01/2018

RECOMMENDATIONS

To the institute of Postgraduate Studies:

The research Project entitled “*Strategic Factors Influencing Transport and Distribution of Petroleum Products in Kenya: A Case Study of Kenya Pipeline Company*” and written by **Keter Samson Kipkirui** is presented to the Institute of Postgraduate Studies of Kabarak University. We have reviewed the research Project and recommended it to be accepted in partial fulfilment of the requirement for award of the degree of Master of Business Administration (**Strategic Management Option**).

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DEDICATION

This study is dedicated to my family and friends who supported and encouraged me in the completion of this Project.

ABSTRACT

The transport and distribution of the petroleum products by Kenya Pipeline Company is key in the social economic development of the country. Efficiency in the transport and distribution of the petroleum products ensures that the right volumes of the products are delivered, at the right price, and in a sustainable manner. This study sought to examine the strategic factors (infrastructure, information and communication technology, security, and pipeline capacity) on transport and distribution of the petroleum products. The study used the resource-based theory and dynamic capabilities theory. The study adopted a descriptive research design. The target population was sourced from safety, security, maintenance, operations, Information Technology Support, senior management staff at Head Office, and Corporate Social Responsibility Staff. The study therefore used a target population of 234 staff members for the study. The sample size of the study was 148 respondents. The statistical analysis that was undertaken included the frequency distributions, chi square, correlation analysis and multiple linear regression analysis. The study results concluded that the various variables of the strategic factors that is ICT, Infrastructure, pipeline capacity, and security as well as the transport and distribution of the petroleum products were positively and significantly correlated amongst themselves. This indicated that change in each of the variable was observed to be associated with changes in any other variable in a pair wise manner that was observable in the sample and would be observable in the population. In respect to the relationship between the strategic factors and transport and distribution of petroleum products. The study concluded that strategic factors had a huge influence on transport and distribution of the petroleum products due to a high correlation coefficient and coefficient of determination. In respect to the influence of infrastructure on the transport and distribution of the petroleum products, the study concluded that there was a positive influence of infrastructure on the transport and distribution that would also prevail in the population. The regression coefficient for infrastructure stood at 0.217. Similarly, in respect to the influence of ICT on the transport and distribution of the petroleum products at KPC, the study concluded that there was a positive influence of ICT on transport and distribution of petroleum products at KPC. The regression coefficient of ICT stood at 0.261. The study had also sought to examine on whether there was statistically significant influence of security on transport and distribution of petroleum products at Kenya Pipeline. The study results revealed that security had a positive influence on the transport and distribution of petroleum products at Kenya Pipeline Company. A regression coefficient of 0.250 was achieved. These results were statistically significant. The study further sought to examine the influence of pipeline capacity on the transport and distribution of the petroleum products at Kenya Pipeline Company. A conclusion was reached that pipeline capacity had a positive and significant influence on the transport and distribution of the petroleum products at Kenya Pipeline Company. This was due to a regression model of 0.193. The study recommended that all the strategic factors that is infrastructure, ICT, security, and pipeline capacity should be emphasized at Kenya Pipeline Company in order to improve on the performance of transport and distribution of the petroleum products. Based on the regression coefficients, the study recommend that the strategic factors should be emphasized in terms of ICT, Security, infrastructure, and pipeline capacity aspects due to their relative strengths on the transport and distribution of the petroleum products. The study further recommends that other factors influencing the transport and distribution of the petroleum products should be examined by other scholars.

Key Terms: ICT, Infrastructure, Petroleum Products, Pipeline Capacity, Security, Strategic Factors

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ABBREVIATIONS AND ACRONYMS

AES	:	Applied Energy Service
GPS	:	Global Positioning Technology
ICT	:	Information and Communication Technology
KPC	:	Kenya Pipeline Corporation
MW	:	Mega Watts
LPGs	:	Liquefied Petroleum Gas
NACOSTI	:	National Commission of Science, Technology and Innovation
NNPC	:	Nigerian National Petroleum Corporation
ONGC	:	Oil and Natural Gas Corporation
PPMC	:	Pipelines and Products Marketing Company
RBF-NN	:	Radial Basis Function Neural Network
RBV	:	Resource Based View
ROW	:	Right of Way
WKPE	:	Western Kenya Pipeline Extension
SPSS	:	Statistical Package for Social Science

OPERATIONAL DEFINITION OF TERMS

ICT	Technologies that provide access to information through telecommunications (Kanna, Deepthi, Das, Joseph, & George, 2017). The ICT in the context of this study meant the technologies used in the provision of the KPC operations through the telecommunications facilities.
Petroleum Products	Materials derived from crude oil also referred to as petroleum (Girgin & Krausmann, 2016). The study adopted this definition.
Pipeline Capacity	The amount of the petroleum products that flows through the pipeline (Oladebo, 2014). The study adopted this definition.
Security	Measures taken to protect pipeline infrastructure from various threats that could compromise its functionalities (Salifu, 2015). The study adopted this definition.
Strategy	Action undertaken to address emergent concerns on the operational aspects of an organization (Oladebo, 2014). The study adopted this definition.
Transport and Distribution	Movement of petroleum products to diverse destinations (Salifu, 2015). The study adopted this definition

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

The world depends on petroleum products for energy provision for various domestic and industrial applications in diverse sectors. According to Girgin and Krausmann (2016), petroleum products refers to the materials derived from crude oil also referred to as petroleum. There are diverse petroleum products that can be derived from the petroleum based on the needs of a given country. These products include Liquefied Petroleum Gas (LPGs), petroleum fuels such as diesel, oil lubricants, kerosene, and tar amongst others. The petroleum products are used for various purposes including fuels for transport vessels such as motor vehicles, motorbikes and airplanes, and fuels for cooking through LPGs (Kanna, Deepthi, Das, Joseph, & George, 2017). Other functions include fuel for industrial machinery; electricity generation and used as raw materials in diverse items such as chemicals, plastics and diverse synthetic materials (Oladepo, 2014). The petroleum products are therefore key in the social economic development of countries.

Due to the vast application uses of petroleum products, there is often a need to transport and distribute them from various processing units to consumer points across the country (Salifu, 2015). Transport has been defined as the movement of items from a given point to another point. On the other hand, distribution may cover a wider scope of activities compared to transport. The distribution involves the movement of the items to the consumers and may involve diverse aspects such as storage, order processing, packaging, and delivery to clients amongst other aspects. Within the context of the petroleum products, various means are used for the purposes of transport and distribution. These means of transport and distribution include rail cars, trucks, tanker vessels and pipelines (Godin, 2014). The choice of the means of transport and distribution is based on the distance the petroleum products need to be

transported, the specific petroleum products being transported, and the amounts of products being transported amongst other factors (Chidiebere, 2014).

The transport and distribution of the petroleum products to various destinations are often challenged in diverse ways. According to Agbonifo (2016), amongst the major challenges of the transport of petroleum products through the pipelines is the oil spills and pipeline leakage due to old infrastructure, sabotage and thefts, and equipment failure amongst other challenges. The transportation in oil trucks also face the risk of accidents, oil siphoning, and oil theft amongst other aspects (Balogun S & Kareem B, 2013). To mitigate the transport and distribution challenges, oil firms often deploy diverse strategic factors. These strategic factors include Information and Communication Technology (ICT), security, pipeline capacity, and infrastructure development (Anyadiegwu, 2015; Cooper, Macisaac, Pohec, & Petersen, 2015; Salifu, 2015).

1.1.1 Global Perspective of Strategic Factors Influencing Transport and Distribution of Petroleum Products

The transport and distribution of petroleum products face diverse challenges across the world. In India, Rao *et al.*, (2014) noted that in 2013 the Oil and Natural Gas Corporation (ONGC) had its main pipeline burst resulting into an oil spill. The total oil lost to the leak was estimated to be about 5,000 litres of crude oil being transported from Mumbai high fields (Rao *et al.*, 2014). In Yemen, challenges on the transport of petroleum products exist. In this context, Mills & Alhashemi (2018) noted that the Hadramawt region saw protests and attacks on the pipelines by the locals demanding employment opportunities from the oil firms.

The pipeline capacity to transport petroleum products has been a challenge in the United States in respect to transport of gas for domestic use (Boersma, Mitrova, & Losz, 2018). In this context, Boersma *et al.*, (2018) noted that insufficient pipeline capacity was noted in the Permian resulting to gas flaring within 2018. Boersma *et al.*, (2018) further noted that the export of petroleum products from the United States to Mexico is currently hampered by the bottlenecks in the pipeline in Mexican side. Natural disasters often pose challenges to the physical infrastructure involved in petroleum products . In this context, Alrodini (2015) noted that hurricane Katrina in the United States led to the damage of over 100 pipelines in the United States and resulted oil spills of over 8 million gallons of oil. The United States has had some of the worst oil spills in the developed world. Amongst these pipeline leaks include Keystone Pipeline in 2017, Dakota Access Pipeline (2017), Belle Fourche Pipeline (2016), Colonial Pipeline (2016), and North Dakota Pipeline (2016) amongst others (Hoang, Pham, & Nguyen, 2018).

In Canada, Kilian & Zhou, (2018) noted that the shutdown of the Keystone pipeline from Canada to the United States following a pipeline rupture in South Dakota in November 2017. In the Russian , Chernyaev and Kreydenko, (2018) noted the need for Russia to use technology in the transport of petroleum products in order to systemize control and monitoring as well as efficiency in petroleum products transportation. Pallavi, Dubey, Saha, Megha, and Ezhilarasan (2018) noted that in India there is need to use technology to counter pilferage and adulteration challenges in the country. On the other hand, Salam, Selintung, and Maricar (2014) notes a need to detect the location of leak within a pipeline and its magnitude. In China, Isnart (2017) notes that construction of China-Myanmar gas pipeline as attempts to increase pipeline capacity for petroleum products transport and distribution. The developed world continue to face diverse challenges in petroleum products transport through the

pipelines and tankers (Brekke, Brekke, & Solberg, 2017). Amongst the confirmed oil spills in the developed world include Sanchi oil tanker collision with CF Crystal in 2018 on East China sea, Ennore oil spill of 2017 in India, and ConocoPhillips Canada pipeline spill of 2016 in Canada amongst others (Nezhad, Groppi, Laneve, Marzialetti, & Piras, 2018).

1.1.2 Regional Perspective of Strategic Factors Influencing Transport and Distribution of Petroleum Products

The security of the petroleum product transport and distribution platform is a major concern to oil companies globally. In Nigeria, Nsikan, Ekeins-Wilson, Anyandike, and Ortencia (2019) noted that in 2016 the Niger Delta Avengers militants blew up the Nembe 1, 2 and 3 trunkline in Bayelsa and Rivers states which is owned by the Aiteo group. These attacks had the effect of disrupting the transport and distribution of the petroleum products (Nsikan *et al.*, 2019). Still in Nigeria, Olaniyan (2015) notes that transport and distribution of the petroleum products remain a major challenge in the Niger delta region. In the region, the pipeline vandalism, the resultant oil spills and oil theft are a major challenge to the petroleum products transport. In this context, Olaniyan (2015) noted that by the year 2010, the Nigerian National Petroleum Corporation (NNPC) reported about 5000 cases of vandalisation in the Niger Delta. In Egypt, the worst oil spill occurred at Jebel al-Zayt in 2010 resulting into the pollution of 100 miles (160 km) of coastline (William & Dutta, 2014). Due to the challenges in Nigeria in respect to vandalism of the oil pipelines, Anyio (2015) indicated that the foreign investors had started shifting their investments to Ghana and Angola.

1.1.3 Local Perspective of Strategic Factors Influencing Transport and Distribution of Petroleum Products

In Kenya, Gicharu (2017) noted that petroleum products included products such as automotive diesel, kerosene, super and regular petrol amongst others. The transport and distribution of the petroleum products in Kenya and from Kenya is a critical activity given

that the wider eastern and central Africa are dependent on petroleum products refined in Kenya (Mikwa, 2014). These countries include Uganda, Rwanda, Northern Tanzania, Southern Sudan, and Eastern Democratic Republic of Congo amongst other countries (Lambaino, Guyo, Odhiambo, & Getuno, 2018). Efficiency in the transport and distribution of the petroleum products is therefore key in ensuring that the right volumes of the products are delivered, at the right price, and in a sustainable manner (Muthini, Namusonge, Guyo, & Shale, 2016).

1.1.4 Kenya Pipeline Company

The Kenya Pipeline Company was established in 1978 and is fully owned by the Government of Kenya (Kenya Pipeline Company., 2019a). The objective of the company is the provision of efficient petroleum products transportation from Mombasa to the hinterland (Kenya Pipeline Company., 2019a). The transportation must be undertaken in a reliable, safe, and cost efficient manner (Kenya Pipeline Company., 2019a). Other functions include the building and maintaining of an oil pipeline for conveyance of petroleum products. The company also processes and distributes petroleum products. The company operates two major pipelines that is Mombasa-Nairobi pipeline and Western Kenya Pipeline Extension (WKPE) (Kenya Pipeline Company., 2019a). The Mombasa-Nairobi pipeline has capacity flow of 830,000 liters per hour while the Nairobi-Eldoret pipeline which is part of WKPE has a flow rate of 220,000 liters per hour (Kenya Pipeline Company., 2019c). The company's total storage capacity stands at 612,271,000 litres distributed across depots located in Mombasa, Nakuru, Eldoret, Kisumu and Konza (Kenya Pipeline Company., 2019d). In cognizance of the need for security to ensure the safety of its infrastructure, the company has adopted various security measures to mitigate challenges of pipeline vandalism, terrorist attacks and common thefts and pilferages (Kenya Pipeline Company., 2019b). The security measures put in place include installations and ROW (Right of Way) patrols, physical guarding, aerial

patrols, mobile patrols, intelligence collection and security surveillance (Kenya Pipeline Company., 2019b).

1.2 Statement of the Problem

The transport and distribution of the petroleum products by Kenya Pipeline Company is key in the social economic development of the country (Musau, 2015). The petroleum products are used in the country for various purposes including lighting, transportation, industrial use, and cooking amongst other functions (Mikwa, 2014). The transport and distribution of petroleum products is also key to the social economic development of the regional countries dependent on Kenya for their products. These countries include Uganda, Rwanda, Northern Tanzania, Southern Sudan, and Eastern Democratic Republic of Congo amongst other countries (Lambaino, Guyo, Odhiambo, & Getuno, 2018). Efficiency in the transport and distribution of the petroleum products is therefore key in ensuring that the right volumes of the products are delivered, at the right price, and in a sustainable manner (Muthini, Namusonge, Guyo, & Shale, 2016). Kenya Pipeline Company documents various challenges with the transport and distribution of the petroleum products. The capacity of the pipeline has been limited in addressing the increasing petroleum products demand in the country and other landlocked countries dependent on Kenya for their products.

The demand for the oil products have kept on increasing across the east African countries. For example, according to Kenya Pipeline Company., (2019c) the demand for the Uganda has increased from 1,817,771 to 2,229,410 between 2016/17 and 2017/18 financial years. In Rwanda, the petroleum products demands increased from 17,497 to 34,647 litres between 2016/17 and 2017/18 financial years (Kenya Pipeline Company., 2019c). The increasing demand has led to the infrastructural development at KPC. This has necessitated the need to build a 20 inch line from Mombasa to Nairobi with a higher flow rate of 1.9 million liters per hour by the year 2023 (Kenya Pipeline Company., 2019c). The KPC had constructed a 14-

inch diameter parallel pipeline from Nairobi to Eldoret that enhanced the flow rate to Western Kenya by 311,000 liters per hour (Kenya Pipeline Company., 2019c). However, the two pipelines are yet to achieve their maximum flow rate of 750,000 liters per hour due to lack of additional pumps along the way (Kenya Pipeline Company., 2019c). Due to growing demand for petroleum products in western Kenya and the Eastern Africa region, KPC has commissioned a new 121 km 10-inch diameter parallel pipeline from Sinendet to Kisumu with a flow rate of 350,000 litres per hour (Kenya Pipeline Company., 2019c).

The company has also had challenges with its infrastructure that hampers the transport and distributions of the petroleum products. In this context, (Kenya Pipeline Company., 2019d) indicated that on 30th of March, 2019 there was an oil spillage at Kiboko, Makueni County, on its newly commission Mombasa-Nairobi line 5 that had only been operational for a year. In its 2017 annual report, KPC noted a need for its to strengthen its pipeline network and storage facilities in order for it to meet increasing local and regional demands for petroleum products (Kenya Pipeline Company., 2018). This study seeks to examine the strategic factors (infrastructure, information and communication technology, security, and pipeline capacity) influence on transport and distribution of the petroleum products. While Gicharu, (2017) examined factors influencing supply of petroleum products in Kenya by Kenya Pipeline Company, the study presented a conceptual gap that this study filled. The study had focused on regulations, and quality control on the supply of petroleum products. This study focused on different strategic factors influence on both transport and distribution of petroleum products.

1.3 Purpose of the Study

The purpose of the study is the examination of the strategic factors influencing transport and distribution of petroleum products at Kenya Pipeline Company in 2018/2019 financial year.

1.4 Objectives of the Study

The study was based on the following specific objectives;

- i. To establish the extent to which pipeline infrastructure influence transport and distribution of petroleum products at Kenya Pipeline Company
- ii. To assess how information communication and technology influence transport and distribution of petroleum products at Kenya Pipeline Company
- iii. To determine to what extent security influence transport and distribution of petroleum products at Kenya Pipeline Company
- iv. To examine how the pipeline capacity influence transport and distribution of petroleum products at Kenya Pipeline Company

1.5 Research Hypotheses

The study was based on the following research hypotheses

- i. **H₀₁**: There is no statistically significant influence of pipeline infrastructure on transport and distribution of petroleum products in Kenya pipeline.
- ii. **H₀₂**: There is no statistically significant influence of information communication and technology on transport and distribution of petroleum products in Kenya pipeline.
- iii. **H₀₃**: There is no statistically significant influence of security on transport and distribution of petroleum products in Kenya pipeline
- iv. **H₀₄**: There is no statistically significant influence of pipeline capacity on transport and distribution of petroleum products in Kenya pipeline

1.6 Justification for the Study

The study was undertaken due to the importance of the petroleum products to the social economic development of the country. The KPC as the state monopoly in the transport and distribution of the petroleum products thus influences the use of petroleum products both locally and regionally. The transport and distribution of the petroleum products are key for the purpose of achievement of the big four agenda and the country's vision 2030. This is due

to the centrality of petroleum products for the energy provision and the transport sector within the country. The transport and distribution of the petroleum products is thus critical for the transport of goods across the country and therefore for the industrialization of the country.

1.7 Significance of the Study

This study was of significance to diverse stakeholders in the energy sector in the country. The transport and distribution of the petroleum products is an important foreign earner for the country. The Government of Kenya thus be interested in understanding the various strategic factors influencing the transport and distribution of the petroleum products. This would be key in policy formulation to remove any noted bottlenecks in this transport and distribution aspects. The technical managers at KPC and the top management of the company also benefit from this study. These managers gain insights on the factors influencing the transport and distribution of the petroleum products. This would enable them to put up policies and action plans to address any noted challenges as well as adoption of best practices. The study also was be of benefit to the academicians in general and researchers in enabling them understand the strategic factors driving distribution and transport of the petroleum products in the country. The researchers also have a source for their empirical review.

1.8 Scope of the Study

The geographical scope of the study was Nairobi country. This is due to the headquarters of the company in the region and therefore the ability to get the required information from a centralized location. The study was undertaken for academic purposes and therefore the timelines for the study is six calendar months. The study was undertaken and completed within the second half of 2019 year. The study is expected to be completed by November of 2019.

1.9 Limitations and Delimitations of the Study

The essentials of the petroleum products in Kenya cannot be understated in the day-to-day life, yet the prices of these products can disrupt budgets and economic policies for countries

because of perceived political sensitivity. Against this backdrop, the research encountered challenges when collecting information from the fuel depot, as it is state-owned. Due to the busy nature of the employees at KPC, the researcher employed drop pick method as the said respondents were not be able to fill the questionnaires immediately the researcher applies them.

To this end, the researcher provided the respondents with one week to read and fill the questionnaires as an approach to ensuring consistency and accuracy of information provided.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter examines on the literature review of the study. Amongst the aspects that was examined in this chapter include theoretical review, empirical review, conceptual framework, critique of literature review, summary of reviewed literature, and research gaps.

2.2 Review of Literature

The empirical review of the study examined the influence of the independent variable on the dependent variable. The section examined the interrelationship between the various independent variable on the dependent variable.

2.2.1 Infrastructure and Transport and Distribution of Petroleum Products

The transport and distribution of various petroleum products are dependent on the existent infrastructure for such purposes. In a study based in Akwa Ibom State of Nigeria, Akpan (2014) undertook a meta-analysis study looked on the influence of infrastructure on transport and distribution of petroleum products amongst other aspects. The study revealed that outdated and poorly maintained oil pipeline grinds often led to oil spills during transportation of the commodity. Akpan (2014) further revealed that the rusty oil pipelines has led to Nigeria to have amongst the highest number of oil spills across the globe. The study recommended that the Nigerian government should consider the oil refineries within the delta region which is the source of oil. This mitigated the need to transport oil to great distance for refinery purposes.

In a study focusing on the Kaduna Refinery and Petro-Chemical Company, Obasanjo (2013) examined the influence of the various modes of transport and their influence on the transport and distribution of petroleum products. Amongst the infrastructure examined were aspects of roads, rail and pipelines. The study used a mixed methodology in which both the qualitative

and quantitative methods were utilized for the study. The study further used a sample size of 182 respondents. Obasanjo (2013) noted the poor state of the roads impacted on the transport and distribution of the petroleum products. The problem of the poor road state has led to the delays, high levels of accidents, cost of vehicle maintenance and lower speeds all which have an influence on the distribution of the petroleum products. Obasanjo (2013) further noted infrastructure constraints in terms of insufficient pipeline networks. In the context of the rail transport, insufficient liquid tanks, insufficient rail network, and poor infrastructural development were noted as key challenges (Obasanjo, 2013). The study further revealed several infrastructure requirements for the pipeline in order for it to work optimally. This included storage infrastructure in the form of depots and associated array of equipment such as pumps, valves, loading arms and meters as well as generators.

The state of the pipeline infrastructure has been noted to have an influence on the distribution of the petroleum products. In a study in Nigeria, Cooper, Macisaac, Pochee, and Petersen (2015) noted that pipeline malfunction was one of the greatest challenge in transport and distribution of the petroleum products. In this context, the study revealed that lack of repair and repeated cases of vandalism of the oil pipeline contributed to the slowdown in transport and distribution of petroleum products. The study in similar results to Obasanjo (2013) noted that the poor state of roads led to frequent accidents of the oil tankers. Similar to Obasanjo (2013) and Cooper *et al* (2015), Abioye, Shubber, and Koenigsberger (2019) also found that challenges in the road transport infrastructure led to cost inefficiency in petroleum products transport leading to higher prices at the pump.

The challenges of the infrastructure on the transport and distribution of the petroleum products is also present in the developed countries. In a study on oil industry in Canada,

Kilian & Zhou, (2018) noted various infrastructure challenges with the oil and gas pipeline in the country. The study identified the disruptions in the oil transport infrastructure by human or natural elements undermined the distribution of the petroleum products. In this context, the study cites the case of the shutdown of the Keystone pipeline from Canada to the United States following a pipeline rupture in South Dakota in November 2017.

2.2.2 ICT and Transport and Distribution of Petroleum Products

The use of Information and Technology is a critical component in the efficiency of transport and distribution of the petroleum products. In the Russian context, Chernyaev and Kreydenko, (2018) undertook a study that amongst other aspects noted the role of technology in transport and distribution of the petroleum products. The study was meta-analysis study that was dependent on secondary data sources. The study noted the need for Russia to use technology in the transport of petroleum products in order to systemize control and monitoring as well as efficiency in petroleum products transportation.

Noting pilferage and adulteration as risk in petroleum products transportation, Pallavi, Dubey, Saha, Megha, and Ezhilarasan (2018) undertook a study in India to examine the use of technology in mitigation of these risks. The study used an experimental design to conceptualize technology that mitigate the pilferage and adulteration risks. The study faulted the existed technologies that only detected the changes in the pressure on the oil tankers. The study designed and experimentally tested a technology design that measured the changes in pressure in the oil tankers, detection of changes in fuel level in the oil tanker through a fuel sensor, and monitoring of the actual location of the tanker through Global Positioning Technology (GPS). The study noted that the tested technology would be ideal as anti-pilferage and anti-adulteration technology.

Leaking of the oil pipes as well as the clogging of the pipes is a challenge to transport and distribution of petroleum products. In this context, Sharma, Qavi, and Kumari (2014) undertook a study in India to illustrate the manner in which technology that can be used for leakage detection and cleaning of the pipes. The study similar to Pallavi *et al* (2018) used an experimental research design. The study proposed a crawling robot that could be used in detection of leakages and the cleaning of the pipes.

A study by Salam, Selintung, and Maricar (2014) undertaken in Indonesia sought to examine the role of technology in detecting leakages within a pipeline set up. The study noted that leakages within pipelines delayed that transport and distribution of the pipeline contents. Salam *et al.*, (2014) used an experimental research design to test a proposed system for leakage detection. The study noted that the proposed technological intervention, Radial Basis Function Neural Network (RBF-NN), was proficient in detecting the location of leak within a pipeline and its magnitude through pressure analysis. The study thus recommended need for pipeline companies to be able to detect the leaks within the pipelines in order to mitigate these challenges that may impact on the distribution aspects.

In Nigeria, Cooper, Macisaac, Pochee, and Petersen (2015) undertook a study that sought to examine the influence of technology on the distribution of the petroleum products in the country. The study noted that RFID technology had been adopted in the country in order monitor the movement of tankers during petroleum products distributions. This is prevent diversion of the petroleum products and siphoning of these products while on transit. Cooper *et al.*, (2015) further noted that technology was used for the purpose of verification and reconciliation of the deliveries of the loaded trucks.

In a study on oil transportation by oil marketers in Kenya, Thuo (2015) examined the influence of use of technology in risk mitigation. The study adopted a descriptive research design and used a sample size of 75 respondents composed of risk managers, depot managers, financial officers and operations officers. In concurrence to the results by Chernyaev and Kreydenko, (2018) in Russia, Thuo (2015) had also found that in Kenya technology was used in monitoring the oil on transit with a view of reducing the oil loss.

2.2.3 Security and Transport and Distribution of Petroleum Products

The security of the petroleum products during the transport and distribution of these products is important to the efficiency of the process. The products need to be protected to avoid theft and spillage amongst other aspects (Borok, Agandu, & Morgan, 2013; Chernyaev & Kreydenko, 2018). In Nigeria, Borok *et al.*, (2013) undertook a study that sought to examine the security challenges and way forward in Nigerian context. The study revealed the need for security for the pipeline infrastructure to avoid vandalization aspects that reduce the capacity for petroleum products distribution. In this context, (Borok *et al.*, 2013) gives the example of vandalization of pipeline transporting gas to Egbin and Applied Energy Service (AES) thermal stations to illustrate the need for adequate security for oil pipeline infrastructure. The vandalization in 2006 led to reduction of power capacity from 1 620 MW to 403 MW for over ten days.

Similar to Borok *et al.*, (2013), Ufot Akpan (2014) in a study based in the Akwa Ibom State, Nigeria noted the security challenges in the transport and distribution of petroleum products. Using meta analysis of secondary data derived from journals, newspapers, and various publications, Akpan (2014) indicated that sabotage and pipeline vandalism being a security challenge in the region. Oil bunkerers posed these security challenges for the purposes of

illicit oil trade activities. The study recommended that youth and traditional rulers should be educated on the need to protect the oil pipelines. In particular, the aspects vandalism, and oil theft as an economic crime should be emphasized as well as the legal consequences for the same (Akpan, 2014).

The security challenges of the petroleum products doesn't happen only along the pipelines. In contrast to Borok *et al.*, (2013), and Ufot Akpan (2014), (Anyadiegwu, 2015) examined the need for security intervention at the petroleum depots during the filling of the transportation tankers. In Nigeria, Anyadiegwu (2015) noted that there was often need for the security officers to escort the tankers for a distance from the depots to avoid reselling of the products to unlicensed dealers. Using secondary data, Anyadiegwu (2015) noted that there are security checks along the designated routes to ensure that there is no petroleum products diversion.

The concept of safety and its influence in the transport of petroleum products was also examined by Obasanjo (2013) in a study focusing on Kaduna Refinery and Petro-Chemical Company. The study noted that there were concerns of safety in transportation of petroleum products especially through the road systems due to the high rates of road accidents. These concerns were shared by Cooper *et al.* (2015) in their study based on the transportation of the petroleum products noted security challenges in the pipeline distribution. The study noted that the vandalization of the Atlas Cove-Mosimi line in 2011 disturbed the distribution of petroleum products to the south-west region of Nigeria. This was due to the pipeline supplying five depots with petroleum products.

In Kenya, Thuo (2015) undertook a study that sought to examine inland petroleum transport risk management for oil marketing companies in Kenya. Amongst the risks explored are the

security risks of the oil in transit. The study revealed that oil transported faced security risks to the employees during oil transportation. Thuo (2015) had used structured questionnaires for the purposes of data collection. Similar to Thuo (2015), Mikwa (2014) had also examined the influence of security in the transport of the petroleum products. The study had focused on the transport of the white petroleum by oil marketing companies in Kenya. To achieve its objective the study administered structured questionnaire to 33 respondents derived from the oil marketers. The study noted that there were several security challenges influencing the transport of the petroleum products in Kenya. Amongst these challenges included the security risks of product adulteration, oil tankers accidents and product siphoning.

2.2.4 Pipeline Capacity and Transport and Distribution of Petroleum Products

The petroleum products are transported through the pipelines especially to great distances from refineries to various deports. The capacity of the pipelines is therefore of critical importance to the transport and distribution of the petroleum products. In China, Isnart (2017) undertook a meta-analysis study based on secondary data that examined the China-Myanmar gas pipeline. The study noted that the huge energy demand for China required it diversify its sources of petroleum products and hence the need for the construction of the 793 kilometer pipeline in 2013 with expected supply capacity of 12bcm natural gas per year by the end of 2019 (Isnarti, 2017).

In a study in Nigeria, Oladepo (2014) in a meta analysis study examined aspects of pipeline capacity to transport of petroleum products. The study revealed that in some refineries in Nigeria low production capacity has made it a challenge for the petroleum products to be transported through the pipelines and has led to the use of trucks for such transport.

Contextually similar to Oladepo (2014) study, Anyadiegwu (2015) also examined the aspects of petroleum products transport within Nigeria. Amongst the aspects examined included the pipeline capacity. The study had adopted qualitative research methodology and collected its data from secondary sources. Anyadiegwu (2015) revealed that the pipelines were used for the petroleum products transport from processing plants to the loading depots and thereafter transported by tankers to the filling stations. In this context, the study further revealed of presence of a specialized company dealing with the transport and distribution of the petroleum products in Nigeria. Thus Anyadiegwu (2015) indicated that Pipelines and Products Marketing Company (PPMC) is responsible for the wholesale supply, distribution and marketing of petroleum products in Nigeria.

In order to elaborate the pipeline capacity in petroleum products transport, Obasanjo (2013) compared the pipeline mode of transport to other modes in reference to Kaduna Refinery and Petro-Chemical Company. The study revealed that the pipeline had higher capacity for petroleum products transport due to various factors including higher volume capacity relative to tanker or rail alternatives, and operation in a 24 hours cycle levels. There is continuous conveyance of the petroleum products and thus enabling the achievement of economies of scale in petroleum products movements.

2.3 Theoretical Framework

This study used the resource based view and the dynamic capabilities theory as the theoretical foundation of the study.

2.3.1 Resource Based View (RBV) Theory

The resource based view theory traces its origins to the works of various scholars that elaborated on each other's views over a period. Amongst the various scholars contributing to the theory included Wernerfelt in 1984 and Jay Barney in 1991 amongst other scholars (Tuyon, Bujang, & Jidwin, 2012). The resource based view theory examines the role of the resources in offering a competitive advantage to a firm. The theory defined resources as those tangible and intangible assets that are tied semi permanently to the firm. The resources have also been examined as all those input factors, both tangible and intangible, human and nonhuman, that are owned and controlled by the firm and that enter into the production of goods and services to satisfy human wants (Enrique *et al.*, 2016). The tangible resources refer to those resources that have a physical manifestation such as land, equipment, building and other facilities. The intangible assets on the other hand relates to the items that can't be touched but are valuable to the firm (Manzini, 2016). This may include the brand names, human resources, competences and technical knowhow amongst other aspects. The theory thus indicates that the resources can be utilized by the firm in order to gain higher output levels (Chinchang, 2015).

This theory is applicable to this study as the study seeks to examine on how various resources such as infrastructure, ICT, security and pipeline capacity can be used for the purposes of gaining superior results in the core functions of the firm. The infrastructure, ICT, security and pipeline capacity can be thought as resources at the disposal of KPC in undertaking of its core mandates of transport and distribution of the petroleum products. The study examined the

manner in which the possession of these resources influences the transport and distribution of the petroleum products.

2.3.2 Dynamic Capabilities Theory

David Teece, Gary Pisano and Amy Shuen originated this theory. This was through their 1997 paper *Dynamic Capabilities and Strategic Management*, as "the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments (Bathallath & Kjellin, 2016). The theory is an extension of the resource based theory and examines the dynamic capabilities because of existence of the resources. The theory indicates that the configuration and reconfiguration of the existent resources may lead to emerge of new competences of the firm (Zhu, 2014). The theory indicates that it is therefore not only the existence of the resources that is of important but also the manner in which they are utilized.

This theory is applicable to this study as the study seeks to examine on how various resources such as infrastructure, ICT, security and pipeline capacity can be used for the purposes of gaining superior results in the core functions of the firm. The infrastructure, ICT, security and pipeline capacity can be thought as resources at the disposal of KPC in undertaking of its core mandates of transport and distribution of the petroleum products. The study examined the manner in which the possession of these resources influences the transport and distribution of the petroleum products.

2.4 Conceptual Framework

The conceptual framework presents the diagrammatic interrelationship between variables that is the independent variables on dependent variable. The independent variables of the study include infrastructure, ICT, security and pipeline capacity while the dependent variable is transport and distribution of petroleum products.

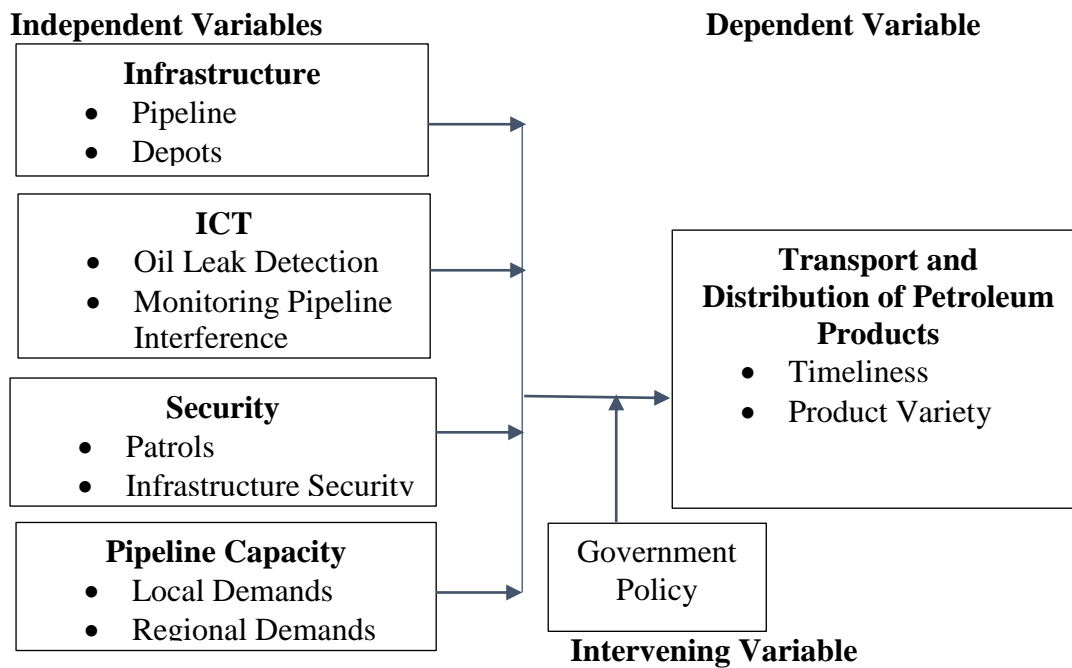


Figure 2.1: Conceptual Framework

Source: Own Conceptualization (2019)

2.5 Critique of Literature Review

In a study on oil industry in Canada, Kilian and Zhou, (2018) noted various infrastructure challenges with the oil and gas pipeline in the country. The study identified the disruptions in the oil transport infrastructure by human or natural elements undermined the distribution of the petroleum products. The study however does not indicate the human or natural elements that undermined the oil transport infrastructure. In a study in Russia, Chernyaev and Kreydenko, (2018) noted the need for Russia to use technology in the transport of petroleum products in order to systemize control and monitoring as well as efficiency in petroleum products transportation. The study does not reveal the inadequacies of the existent technology (if any) and the technology that may be used for monitoring and control aspects. Pallavi,

Dubey, Saha, Megha, and Ezhilarasan (2018) in India proposes a technology that used for anti-pilferage and anti-adulteration purposes. The study however does not elaborate on the validity of such technology beyond the theoretical discussion of the same. Despite stating the use of an experimental research design, Sharma, Qavi, & Kumari (2014) doesn't test the technology that they propose for the purpose of detection of leakages and the cleaning of the pipes. The studies by Borok *et al.*, (2013) and Akpan (2014) lists the various security challenges of oil transportation in Nigeria. However, these studies don't illustrate the manner in which such security challenges are dealt with in the country.

2.6 Summary of Reviewed Literature

The transport and distribution of various petroleum products are dependent on the existent infrastructure for such purposes. In a study based in Akwa Ibom State of Nigeria, Akpan (2014) revealed that outdated and poorly maintained oil pipeline grinds often led to oil spills during transportation of the commodity. Akpan (2014) further revealed that the rusty oil pipelines has led to Nigeria to have amongst the highest number of oil spills across the globe. In a study focusing on the Kaduna Refinery and Petro-Chemical Company, Obasanjo (2013) noted the poor state of the roads impacted on the transport and distribution of the petroleum products. The problem of the poor road state has led to the delays, high levels of accidents, cost of vehicle maintenance and lower speeds all which have an influence on the distribution of the petroleum products. Obasanjo (2013) further noted infrastructure constraints in terms of insufficient pipeline networks. In the context of the rail transport, insufficient liquid tanks, insufficient rail network, and poor infrastructural development were noted as key challenges (Obasanjo, 2013). Cooper, Macisaac, Pochee, and Petersen (2015) noted that pipeline malfunction was one of the greatest challenge in transport and distribution of the petroleum products. The study revealed that lack of repair and repeated cases of vandalism of the oil pipeline contributed to the slowdown in transport and distribution of petroleum products.

The use of Information and Technology is a critical component in the efficiency of transport and distribution of the petroleum products. In the Russian context, Chernyaev and Kreydenko, (2018) noted the need to use technology in the transport of petroleum products in order to systemize control and monitoring as well as efficiency in petroleum products transportation. In India, Pallavi, Dubey, Saha, Megha, and Ezhilarasan (2018) that technology can be to measure pressure in the oil tankers, detection of changes in fuel level in the oil tanker through a fuel sensor, and monitoring of the actual location of the tanker through Global Positioning Technology (GPS). This would be for anti-pilferage and anti-adulteration measures. Sharma, Qavi, and Kumari (2014) further indicated that technology can help in leakage detection and cleaning of the pipelines. The study by Salam, Selintung, and Maricar (2014) revealed that technology can be used in detecting leakages within a pipeline set up through pressure analysis.

The security of the petroleum products during the transport and distribution of these products is important to the efficiency of the process. The products needed protection to avoid theft and spillage amongst other aspects (Borok, Agandu, & Morgan, 2013; Chernyaev & Kreydenko, 2018). In Nigeria, Borok *et al.*, (2013) revealed the need for security for the pipeline infrastructure to avoid vandalization aspects that reduce the capacity for petroleum products distribution. In Nigeria, Akpan (2014) indicated that sabotage and pipeline vandalism being a security challenge in the region. Oil bunkerers posed these security challenges for the purposes of illicit oil trade activities. Still in Nigeria, Anyadiegwu (2015) noted that there was often need for the security officers to escort the tankers for a distance from the depots to avoid reselling of the products to unlicensed dealers. In Kenya, Thuo (2015) study revealed that oil transported faced security risks to the employees during oil transportation. Similar to Thuo (2015), Mikwa (2014) had also examined the influence of

security in the transport of the petroleum products. The study noted that amongst the security challenges faced included the security risks of product adulteration, oil tankers accidents and product siphoning.

The capacity of the pipelines is therefore of critical importance to the transport and distribution of the petroleum products. In China, Isnart (2017) noted that the huge energy demand for China required it diversify its sources of petroleum products and hence the need for the construction of the 793 kilometer pipeline in 2013 with expected supply capacity of 12bcm natural gas per year by the end of 2019 (Isnarti, 2017). In a study in Nigeria, Anyadiiegwu (2015) study revealed presence of a specialized company dealing with the transport and distribution of the petroleum products in Nigeria. Thus, Anyadiiegwu (2015) indicated that Pipelines and Products Marketing Company (PPMC) is responsible for the wholesale supply, distribution and marketing of petroleum products in Nigeria.

2.7 Research Gaps

In a study based in Akwa Ibom State of Nigeria, Akpan (2014) undertook a meta-analysis study looked on the influence of infrastructure on transport and distribution of petroleum products amongst other aspects. The study by Akpan (2014) used a meta-analysis research methodology and thus dependent on secondary data. This presents a methodological gap as this study utilized primary data collected through use of structured questionnaires. Other studies that have used a meta-analysis research methodology and therefore present methodological research gap to the current study include Chernyaev and Kreydenko, (2018) in Russian context, Isnart (2017) in Chinese context and Oladepo (2014) in Nigeria. While the current study used the descriptive research design, several studies have used experimental research design in the reviewed literature. These studies include Pallavi *et al* (2018) in a study undertaken in India, Sharma *et al* (2014), and Salam *et al* (2014) in Indonesia. The current study sought to examine the research variables in an ex post facto manner and hope to

derive empirically better results. These studies thus presented methodological gaps that this study filled. The reviewed literature studies also presented contextual gaps as diverse studies have been undertaken in other countries notably in Nigeria and India. These scholars include Rao *et al.*, (2014), Sharma, *et al* (2014), and Pallavi, *et al* (2018). The current study was undertaken in Kenya.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter discusses the research methodology of the study. The research methodology is critical in enabling the study to achieve its objectives. This study sought to examine the strategic factors influencing transport and distribution of the petroleum products in Kenya with a focus on the Kenya Pipeline Company. The chapter therefore discussed aspects such as research design, location of the study, target population, sampling procedure and sampling size. Other components to be discussed include instrumentation, pilot study, validity and reliability, data collection procedures, data analysis, and ethical consideration aspects.

3.2 Research Design

The research design details the plans and procedures for research that involve decisions of data collection and analysis methods (Sekaran & Bougie, 2011). This study adopted a descriptive research design. The descriptive research design describes the phenomenon as it exists on the ground without any manipulation of the variables (Orodho, 2003). The design was used for the purpose of the describing both the independent and the dependent variables of the study. The design was used for the purposes of describing infrastructure, ICT, security, pipeline capacity, transport and distribution of petroleum products at Kenya Pipeline Company (KPC).

3.3 Location of the Study

The Kenya Pipeline Company has various depots across the country located in Mombasa, Nakuru, Eldoret, Kisumu and Konza (Kenya Pipeline Company., 2019d). Due to the geographical spread of the depots, logistical challenges that such spread poses in data collection, the study was based at the Nairobi Headquarters. The KPC head office is located at Kenpipe Plaza, Sekondi Road, Off Nanyuki Road, Industrial Area, Nairobi.

3.4 Population of the Study

The target population related to the members of a specified group with common observable traits that are of relevance to the study (Saunders, Lewis, & Thornhill, 2009). The target population must be able to have information on both the independent and dependent variables of the study. The unit of analysis will be KPC as an organization. The unit of observation is a set of people within KPC with adequate and credible knowledge on the strategic factors influencing the transport and distribution of the petroleum products by the company. The target population was sourced from safety, security, maintenance, operations, Information Technology Support, senior management staff at Head Office, and Corporate Social Responsibility Staff. These are the staff with adequate knowledge of the research variable being pursued. The study therefore used a target population of 234 staff members for the study.

Table 3.1: Target Population

Staff Category	No. of Staff
Safety	17
Security	24
Maintenance	89
Operations	47
IT Support	15
Senior Management Staff	17
CSR Staff	25
Total	234

Source: KPC

3.5 Sampling Procedure and Sampling Size

3.5.1 Sampling Size

The sampling size relates to the actual number of the members that was derived from the population (Jankowicz, 2005). The sample size was characterized by being representative to the target population from where it is drawn from (Berg, 2011). The sample size of the study was calculated using the Taro Yamane formula as illustrated below. The formula was chosen due to ease of using the same.

$n = \frac{N}{1+N(e^2)}$ where N is the target population that is 234 members, and e is the margin of error at 0.05 margin of error.

The sample size of the study was as follows;

$$n = \frac{N}{1+N(e^2)} = \frac{234}{1+234(0.05^2)} = \frac{234}{1+234(0.05^2)} = \frac{234}{1.585} = 148 \text{ respondents}$$

The study used a sample size of 148 respondents.

3.5.2 Sampling Procedure

The sampling procedures detail the means of collecting the specific members of the target population to form the sample membership (Wanjohi, 2014). Therefore, this method was used to choose the 148 sample members from the 234 population. The study used the stratified random sampling. In this method, the sample size of each group of employees was drawn in proportion to the size in the population. Thereafter, within each sect of the employees, the simple random sampling method was used to pick the specific members. The stratified sampling method was utilized due to its advantage of ensuring that each sub group of the population is represented in the sample. The use of simple random sampling on the individual sub groups also ensures that there is no bias in the selection of the sample members (Miller & Whicker, 2017).

Table 3.2: Sampling Procedure

Staff Category	Proportional Calculations	Sample Size
Safety	$(17/234)*148$	11
Security	$(24/234)*148$	15
Maintenance	$(89/234)*148$	56
Operations	$(47/234)*148$	30
IT Support	$(15/234)*148$	9
Senior Management Staff	$(17/234)*148$	11
CSR Staff	$(25/234)*148$	16
Total		148

3.6 Instrumentation

There are diverse methods of instrumentation that can be used in a research and the choice of such instrumentation dependent on the study's attributes. Since this study uses correlational research design in order to examine the influence of strategic factors on the transport and distribution of the petroleum products by KPC, primary data was collected using structured questionnaires. The structured questions are composed of close-ended questions in which the respondents have been given various response options that they must limit their choices to. The use of structured questionnaire was ideal in this study for various reasons. The structured questionnaire enables the provision of standard and uniform questions to all the respondents and therefore enabling a comparison of the study. The structured questionnaire was associated with ease of data collection, higher response rates, and ease of using software's for data analysis. The structured questionnaire also yielded quantitative data that enabled undertaking of inferential statistics for the purposes of quantitatively concluding on the role of strategic factors influence on transport and distribution of petroleum products.

The structured questionnaire utilized different types of questions to achieve diverse objectives. The first part of the questionnaire sought to determine the demographic characteristics of the respondents. In this context, the categorical questions were used since the section was interested on the factual information about the respondents. The study further

has five sections that have four sections covering the independent variables and a section covering the dependent variable. These five sections utilized the likert based measurement scales. This is with the view that the likert based measurement scale is used for the purposes of measuring the opinions of the respondents in respect to the variables of interest. The study utilized a five point liket based scale with 1.No Extent, 2. Small Extent, 3.Moderate Extent, 4.Large Extent, and 5. Very Large Extent.

3.6.1 Pilot Study

This study undertook a pilot study before the commencement of the final study. The pilot study has been described as rehearsal of the main study and in such a context, it mimics various aspects of the final study (Miller & Whicker, 2017). There are several functions of the pilot study and these functions guided the use of the pilot study in this study. The pilot study assist in finding out whether the questions set are relevant and understandable to the target population (Fitzgerald & Linda, 2015). In this context, the pilot study was used to determine the logistics required for the data collection phase. The period was used for the testing the validity and reliability of the structured questionnaire. A sample size of 10% of the study sample membership is often used for the purposes of pilot study. This is as recommended by (Miller & Whicker, 2017). In this context, then 15 respondents was used for the pilot study. Since the pilot study must mimic the final study for it to be useful in preparation, this pilot study was undertaken at KPC head office in Nairobi. However, the respondents used in the pilot study were not used in the final study to avoid contamination of the final study. The feedback of the pilot study was incorporated in the final study.

3.6.2 Validity of the Instrument

The validity of the research instrument is the degree to which the instrumentation of the study measures what it is designed to measure that is the variables of the study. The validity of the research instrument has also been described as the accuracy of the data collection instruments

(Sekaran & Bougie, 2011). This study used the content validity for the purposes of measuring on whether the structured questionnaire is valid for the study. In this content validity, the content of the questionnaires was examined to determine on whether they are representative of the variables that the study seeks to measure. The content validity was examined using the supervisors and the pilot study respondents who are deemed to be experts of the subject phenomenon. Their feedback was incorporated in the final study.

3.6.3 Reliability of the Instrument

The reliability of the study was conducted to determine on whether the data collection instrument, the questionnaire yielded same results on repeated trials. This study used Cronbach's alpha (α) to measure the internal reliability of the structured questionnaire. While the Cronbach alpha coefficient values range from 0 to 1 with a 0 implying no reliability and 1 implying perfect reliability (Sekaran & Bougie, 2011). The study used a cut off of 0.7 as means of checking the internal reliability of the study. In this context, the study used Cronbach alpha statistical coefficients of 0.7 and above. The study found that infrastructure, ICT, Security, pipeline capacity and transport of petroleum products at Kenya Pipeline Company had Cronbach alpha coefficient of 0.765, 0.876, 0.845, 0.798, and 0.854 respectively.

3.7 Data Collection Procedure

The data collection procedures entailed the process in which the data was collected for the study. The study commenced the data collection through obtaining a set of four authorizations for various stages of data collections. These letters include a letter from institute of postgraduate studies of Kabarak University, a letter from National Commission of Science, Technology and Innovation (NACOSTI), a letter from KPC authorizing data collection amongst its respondents, and consent statement from individual respondents consenting to provide the required information. These authorization letters were collected in a sequential manner. The questionnaire was self-administered due to the high literacy rates of

the target population. The study was administered through the Drop Off Pick Up later method. In this method, the questionnaire is dropped to the respondents and then picked up later at a pre-agreed time. This is to ensure a high response rate for the study.

3.8 Data Analysis

The data analysis refers to the consolidation of the collected data in order to make meaningful research observations in respect to the research variables. The collected data in this study is quantitative in nature and was analysed using the SPSS statistical software. The data was first coded into the software ready for analysis. The statistical analysis that was undertaken include the frequency distributions, means, standard deviation and the multiple linear regression analysis. The regression model that was used for the study is as follows;

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \varepsilon$$

Where;

Y = Transport and Distribution of Petroleum Products

$\beta_0, \beta_1, \beta_2, \beta_3, \beta_4$ = Model coefficients

X1 = Infrastructure

X2= Information Communication Technology

X3 = Security

X4= Pipeline Capacity

ε = Estimate of Error

3.9 Ethical Consideration

The ethical consideration of this study, which refers to the acceptable behaviors in research, was ensured through obtaining various authorization letters from the university, KPC and NACOSTI. The consent letter to the respondents advised them that their responses was kept anonymous and the study results were only used for academic purposes only. The respondents were advised on their rights in respect participation in the study.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND DISCUSSION

4.1 Introduction

This study sought to examine the influence of strategic factors in influencing transport and distribution of petroleum products in Kenya with a focus on the case study of Kenya Pipeline Company. The study thus sought to examine the influence of infrastructure, ICT, security and pipeline capacity on the transport and distribution of the petroleum products at Kenya Pipeline Company. This chapter thus examines the analysis, presentation and conclusion the study. The data was analyzed using frequency distributions, chi squares, correlational analysis, and linear regression analysis aspects.

4.2 Response Rate

The sample size of the study that was utilized for the study was 148 respondents that were drawn from Safety, Security, Maintenance, Operations, IT Support, Senior Management Staff and CSR Staff of Kenya Pipeline Company. The data was being collected using structured questionnaire and thus 148 questionnaires were deployed to the target population. The achieved response rate was displayed as per table 4.1

Table 4.1: Response Rate

Issued Questionnaires	Returned Questionnaires	Response Rate
148	127	85.8%

The response rate of the study was 85.8% which is considered adequate as it exceeds the 80% of the response rate that is recommended for the survey results.

4.3 Gender Distribution

The gender distribution of the respondents of the study was examined and the results presented in Table 4.2 below.

Table 4.2: Gender Distribution

Gender	Frequency Distribution	Percentages
Male	80	62.9%
Female	47	37.1%
Total	127	100%

The study revealed that a majority of the respondents were male with 62.9% of the responses compared 37.1% of the respondents that were female. This was attributed to the Kenya Pipeline Company being technologically oriented leading to a higher number of male respondents compared to female respondents.

4.4 Job Group Distribution

The job group distribution of the respondents were examined and the results presented in Table 4.3 below.

Table 4.3: Job Group Distribution

Staff Category	Frequencies	Sample Size
Safety	8	6.2%
Security	14	11.0%
Maintenance	50	39.3%
Operations	24	18.8%
IT Support	7	5.5%
Senior Management Staff	9	7.0%
CSR Staff	15	12.2%
Total	127	148

The job group distribution of the study revealed that a majority of the respondents at 39.3% of the respondents were from the maintenance department while 18.8% were from the operations department. The study further found that 12.2% of the respondents were from CSR staff while 11.0% of the respondents were from security department. The IT support and senior management staff had the lowest number of respondents at 5.5% and 7.0% respectively.

4.5 Infrastructure

The first objective of the study was the examination of the infrastructure and transport influence on the distribution of petroleum products. The first independent variable was examined using five indicators that is KPC pipelines being adequately maintained, pipelines

being adequately protected from natural elements interference, KPC pipelines being adequately protected from unauthorized human activities, KPC depots having capacity to hold pipelines outputs at all times, and KPC depots being able to hold sufficient products for their oil marketer companies. The frequency distribution results and chi square results are presented in Table 4.4 below.

Table 4.4: Frequency Distribution of Infrastructure

	NE Freq %	SE Freq %	ME Freq %	LE Freq %	VLE Freq %	Chi-Square χ^2	P
All KPC pipelines are adequately maintained	2 1.6%	5 3.9%	34 26.8%	73 57.5%	13 10.2%	18.807	0.016
All KPC pipelines are adequately protected from natural elements interference	1 0.8%	11 8.7%	28 22.0%	81 63.8%	6 4.7%	17.304	0.027
All KPC pipelines are adequately protected from unauthorized human activities	0 0.0%	14 11.0%	40 31.5%	59 46.5%	14 11.0%	8.191	0.224
The KPC depots have capacity to hold pipeline outputs all times	4 3.1%	13 10.2%	43 33.9%	56 44.1%	11 8.7%	22.000	0.005
The KPC depots are able to hold sufficient products for their oil marketer companies	3 2.4%	7 5.5%	35 27.6%	70 55.1%	12 9.4%	15.428	0.049

When asked on whether the KPC pipelines are adequately maintained a majority of the respondents at 57.5% of the respondents indicated it influenced to a large extent. A further 10.2% of the respondent indicated that it influenced to a Very Large Extent. This is compared to 1.6%, 3.9%, and 26.8% of the respondents who indicated to no extent, small extent and moderate extent. In respect to whether the indicator had statistically significant association with distribution of petroleum products, the overserved chi square of 18.807 with a probability value of 0.016 were deemed to have a statistically significant association at 5% level of significance. The maintenance of the of the pipeline is important for the distribution of the oil. In a study based in Akwa Ibom State of Nigeria, Akpan (2014) undertook a meta-analysis study looked on the influence of infrastructure on transport and distribution of

petroleum products amongst other aspects. The study revealed that outdated and poorly maintained oil pipeline grinds often led to oil spills during transportation of the commodity. A cumulative percentage of 68.5% of the respondents were in agreement that all KPC pipelines are adequately protected from natural elements interference compared to 9.5% of the respondents who were in disagreement and a further 22.0% of the respondents who moderately agreed. The observed chi square 17.304 and p value of 0.027 indicated that all pipelines being protected from natural elements interference had a statistically significant association with distribution of petroleum products at 5% level of significance. All pipelines being adequately protected from unauthorized human activities was examined. The study found that 46.5% of the respondents agreed with the respondent for a large extent while 11.0%, 31.5% and 11.0% of the respondents agreed to a small extent, moderate extent and very large extent respectively. This study's results on the importance of the protection of the pipeline from unauthorized human activities is consistent with other scholar's findings on the aspect.

The security of the petroleum products during the transport and distribution of these products is important to the efficiency of the process. The products needed protection to avoid theft and spillage amongst other aspects (Borok, Agandu, & Morgan, 2013; Chernyaev & Kreydenko, 2018). In Nigeria, Borok *et al.*, (2013) revealed the need for security for the pipeline infrastructure to avoid vandalization aspects that reduce the capacity for petroleum products distribution. In Nigeria, Akpan (2014) indicated that sabotage and pipeline vandalism being a security challenge in the region. Oil bunkers posed these security challenges for the purposes of illicit oil trade activities.

In respect to KPC depots having capacity to hold pipeline outputs all times had 3.1%, 10.2%, 33.9%, 44.1%, and 8.7% of the respondents were in agreement with the indicator to no extent, small extent, moderate extent, large extent and very large extent respectively. The indicator with a chi square value of 22.000 and p value of 0.005 was found to have a statistically significant association with KPC depots having capacity to pipeline outs at time and distribution of the petroleum products.

Finally, in respect to KPC depots being able to hold sufficient products for their oil marketer companies had 2.4%, 5.5%, 27.6%, 55.1%, and 9.4% of the respondents indicating to a no extent, small extent, moderate extent, large extent and very large extent respectively. The study further revealed that the achieved chi square of 15.428 and a p value of 0.049 for the KPC depots being able to hold sufficient products for their oil marketer companies. This demonstrated that the indicator had a statistically significant association on the distribution of the petroleum products. The importance of the pipeline capacity on the holding of the petroleum products has also been noted by diverse scholars across the world. The pipeline capacity to transport petroleum products has been a challenge in the United States in respect to transport of gas for domestic use (Boersma, Mitrova, & Losz, 2018). In this context, Boersma *et al.*, (2018) noted that insufficient pipeline capacity was noted in the Permian resulting to gas flaring within 2018. Boersma *et al.*, (2018) further noted that the export of petroleum products from the United States to Mexico is currently hampered by the bottlenecks in the pipeline in Mexican side. Natural disasters often pose challenges to the physical infrastructure involved in petroleum products

4.6 Information and Communication Technology

The influence of the ICT and Transport on the distribution of the oil products was examined using five indicators. These indicators included the use of ICT to locate oil leaks in the

pipeline, use of ICT to adequately detect magnitude of oil leaks in the pipeline, use of ICT to adequately monitor pipeline structural integrity at all times, ICT able to monitor illegal human activities on the pipelines at all times, and use of ICT to adequately monitor the petroleum products flow rates at all times. The frequency distributions and chi square results were presented in Table 4.5.

Table 4.5: Frequency Distribution of ICT

	NE Freq %	SE Freq %	ME Freq %	LE Freq %	VLE Freq %	Chi-Square χ^2	P Value
The used ICT at KPC is able to adequately locate oil leaks in the pipeline	2 1.6%	9 7.1%	41 32.3%	62 48.8%	13 10.2%	19.204	0.013
The used ICT at KPC is able to adequately magnitude of oil leaks in the pipeline	3 2.4%	11 8.7%	46 36.2%	50 39.4%	17 13.4%	19.108	0.014
The used ICT at KPC is able to adequately monitor pipeline structural integrity at all times	0 0.0%	7 5.5%	43 33.9%	70 55.1%	7 5.5%	20.350	0.002
The used ICT at KPC is able to adequately monitor illegal human activities on the pipeline at all times	1 0.8%	8 6.3%	51 40.2%	55 43.3%	12 9.4%	19.615	0.013
The used ICT at KPC is able to adequately monitor petroleum products flow rates at all times	4 3.1%	12 9.4%	52 40.9%	49 38.6%	10 7.9%	13.346	0.100

The extent in which use of ICT at KPC is able to adequately locate oil leaks in the pipelines had 1.6%, 7.1%, 32.3%, 48.8%, and 10.2% of the respondents indicating to no extent, small extent, moderate extent, large extent and very large extent respectively. The study further found that the observed chi square results value was 19.204 and p value of 0.013. This indicated that there was a statistically significant association between the used ICT at KPC being able to adequately locate oil leaks in the pipeline and distribution of the oil products at 5% level of significance. The results of this study correlate with those of other studies. Sharma, Qavi, and Kumari (2014) further indicated that technology can help in leakage detection and cleaning of the pipelines. The study by Salam, Selintung, and Maricar (2014)

revealed that technology can be used in detecting leakages within a pipeline set up through pressure analysis.

The extent in which the used ICT at KPC was able to adequately detect the magnitude of oil leaks in the pipeline had 2.4%, 8.7%, 36.2%, 39.4%, and 13.4% of the respondents indicating no extent, small extent, moderate extent, large extent and very large extent respectively. The indicator further observed a chi square value of 19.108 and a p value of 0.014 which indicated that there was a statistically significant association between used ICT at KPC being able to adequately detect the magnitude of oil leaks in the pipeline and distribution of the oil products. Salam, Selintung, and Maricar (2014) notes a need to detect the location of leak within a pipeline and its magnitude. On whether the used ICT at KPC is able to adequately monitor pipeline structural integrity at all times, a cumulative percentage of 60.1% of the respondents were in agreement compared to 5.5% who disagreed and 33.9% of the respondents indicated that it influenced the oil distribution to a moderate extent.

The study further found that in respect to used ICT at KPC being able to adequately monitor pipeline structural integrity at all times and its association with the oil products distributions had chi square value of 20.350 and a p value of 0.002. This indicated that there was a statistically significant association between the indicator and oil distribution at 5% level of significance. The study's results were collaborated by other scholars. In the Russian context, Chernyaev and Kreydenko, (2018) undertook a study that amongst other aspects noted the role of technology in transport and distribution of the petroleum products. The study was meta-analysis study that was dependent on secondary data sources. The study noted the need for Russia to use technology in the transport of petroleum products in order to systemize control and monitoring as well as efficiency in petroleum products transportation. The

respondents were asked on whether the used ICT at KPC was able to adequately monitor illegal human activities on the pipeline at all times. The respondents had 0.8%, 6.3%, 40.2%, 43.3%, and 9.4% of the respondents indicating to no extent, small extent, moderate extent, large extent and very large extent respectively.

The study further found that there was an observed chi square value of 19.615 and a p value of 0.013 in respect to use of ICT at KPC to adequately monitor illegal human activities on the pipelines at all times and distribution of oil products. This indicated that there was a statistically significant association between use of ICT at KPC to adequately monitor illegal human activities on the pipelines at all times and distribution of oil products at 5% level of significance. Finally, when asked on whether the used ICT at KPC was able to adequately monitor petroleum products flow rates at all times a majority of the respondents had 40.9% indicating to a moderate extent. On the other hand, a cumulative percentage of 46.5% of the respondents were in agreement with the indicator while 12.5% of the respondents cumulatively were in disagreement. The observed chi square value of 13.346 and p value of 0.100 indicated that there was no statistically significant association between the used ICT at KPC being able to adequately monitor petroleum products flow rates at all times and oil products distributions.

The petroleum flow rates are important in the distribution of the oil products. The capacity of the pipeline has been limited in addressing the increasing petroleum products demand in the country and other landlocked countries dependent on Kenya for their products. This has necessitated the need to build a 20 inch line from Mombasa to Nairobi with a higher flow rate of 1.9 million liters per hour by the year 2023 (Kenya Pipeline Company., 2019c). The KPC had constructed a 14-inch diameter parallel pipeline from Nairobi to Eldoret that enhanced

the flow rate to Western Kenya by 311,000 liters per hour (Kenya Pipeline Company., 2019c). However, the two pipelines are yet to achieve their maximum flow rate of 750,000 liters per hour due to lack of additional pumps along the way (Kenya Pipeline Company., 2019c). Due to growing demand for petroleum products in western Kenya and the Eastern Africa region, KPC has commissioned a new 121 km 10-inch diameter parallel pipeline from Sinendet to Kisumu with a flow rate of 350,000 litres per hour (Kenya Pipeline Company., 2019c).

4.7 Security

The influence of security on the transport and distribution of petroleum products had five indicators to examine it. These five indicators included sufficiency of petroleum patrols across the pipeline networks of KPC, sufficient security at KPC depots to mitigate any hazard concerns, sufficient security at KPC depots to avoid fraudulent activities with petroleum products, sufficient security to prevent oil siphoning across the pipeline network, and sufficient security to mitigate against criminal acts on KPC installations. The frequency distributions and chi square results of the variable were presented in Table 4.6

Table 4.6: Distribution Frequencies of Security

	NE	SE	ME	LE	VLE	Chi-Square	
	Freq %	Freq %	Freq %	Freq %	Freq %	χ^2	P Value
There are sufficient patrols across the pipeline network of KPC	0 0.0%	6 4.7%	52 40.9%	50 39.4%	19 15.0%	38.721	0.000
There is sufficient security at the KPC depots to mitigate any hazard concerns	2 1.6%	9 7.1%	54 42.5%	51 40.2%	11 8.7%	18.073	0.021
There is sufficient security at KPC depots to avoid fraudulent activities with petroleum products	5 3.9%	12 9.4%	44 34.6%	49 38.6%	17 13.4%	18.648	0.019
There is sufficient security to prevent oil siphoning across the pipeline network	4 3.1%	10 7.9%	39 30.7%	47 37.0%	27 21.3%	19.569	0.013
There is sufficient security to mitigate against criminal acts on KPC installations	2 1.6%	7 5.5%	50 39.4%	48 37.8%	20 15.7%	23.879	0.004

The respondents were asked on whether there was sufficient patrols across the pipeline network of KPC. This indicator had 4.7%, 40.9%, 39.4%, and 15.0% of the respondents agreeing to a small extent, moderate extent, large extent and very large extent respectively. The association between sufficiency of patrols across the pipeline network of KPC and transport and distribution of petroleum products had a chi square results of 38.721 and a p value of 0.000. The study thus indicated that there was statistically significant association between sufficiency of patrols across the pipeline network of KPC and transport and distribution of petroleum products. Kenya Pipeline Company has undertaken various security aspects on its pipeline. The security measures put in place include installations and ROW (Right of Way) patrols, physical guarding, aerial patrols, mobile patrols, intelligence collection and security surveillance (Kenya Pipeline Company., 2019b).

The extent in which there is sufficient security at the KPC depots to mitigate any hazard concerns had 1.6%, 7.1%, 42.5%, 40.2%, and 8.7% of the respondents indicating to no extent, small extent, moderate extent, large extent and very large extent respectively. The results thus indicated that that a majority of the respondents at 42.5% of the respondents indicated their level of agreement at moderate extent. The study further found that in respect to whether there was statistically significant relationship between sufficient security at the KPC depots to mitigate any hazard concerns and distribution of petroleum products the achieved chi square results were 18.073 and a p value of 0.021. This indicated that there was statistically significant association between presence of sufficient security at the KPC depots to mitigate any hazard concerns and transport of the petroleum products at 5% level of significance. The extent in which there is sufficient security at KPC depots to avoid fraudulent activities with petroleum products was examined in the study.

The study found that a majority of the respondents at 38.6% indicated to a large extent with a further 13.4% indicating to a very large extent. It was only 3.9% and 9.4% of the respondents who indicated to a no extent and small extent respectively. The indicator further had a chi square value of 18.648 and a p value of 0.019 indicating a statistically significant association between sufficient security at KPC depots to avoid fraudulent activities with petroleum products and distribution of petroleum products. The security of the petroleum products during the transport and distribution of these products is important to the efficiency of the process. The products needed protection to avoid theft and spillage amongst other aspects (Borok, Agandu, & Morgan, 2013; Chernyaev & Kreydenko, 2018). In Nigeria, Borok *et al.*, (2013) revealed the need for security for the pipeline infrastructure to avoid vandalization aspects that reduce the capacity for petroleum products distribution. In Nigeria, Akpan (2014) indicated that sabotage and pipeline vandalism being a security challenge in the region. Oil bunkerers posed these security challenges for the purposes of illicit oil trade activities. Still in Nigeria, Anyadiegwu (2015) noted that there was often need for the security officers to escort the tankers for a distance from the depots to avoid reselling of the products to unlicensed dealers. In Kenya, Thuo (2015) study revealed that oil transported faced security risks to the employees during oil transportation. Similar to Thuo (2015), Mikwa (2014) had also examined the influence of security in the transport of the petroleum products. The study noted that amongst the security challenges faced included the security risks of product adulteration, oil tankers accidents and product siphoning. In respect on whether there was sufficient security to prevent oil siphoning across the pipeline network, 37.0% of the respondents indicated to large extent while a further 21.3% of the respondents indicated to a very large extent. It was only 3.1% of the respondents who indicated to no extent. The chi square values of 19.569 and a p value of 0.013 indicated that there was a statistically

significant association between presence of sufficient security to prevent oil siphoning across the pipeline network and transport of petroleum products at 5% level of significance.

The respondents were asked on the presence of sufficient security to mitigate against criminal acts on KPC installations. A majority of 39.4% of the respondents indicated to a moderate extent. On the other hand, 1.6%, 5.5%, 37.8%, and 15.7% of the respondents indicated that there was presence of sufficient security to mitigate against criminal acts on KPC installations to no extent, small extent, large extent, and very large extent respectively. In respect to whether there was statistically significant association between presence of sufficient security to mitigate against criminal acts on KPC installations and transport of petroleum products, the observed statistics were a chi square value of 23.879 and a p value of 0.004. This thus indicated the presence of a statistically significant association between sufficient security to mitigate against criminal acts on KPC installations and transport of petroleum products.

4.8 Pipeline Capacity

The study sought to examine the influence of pipeline capacity on transport and distribution of petroleum products. The study utilized five indicators that is presence of sufficient pipeline capacity to meet depots requirements, influence of sufficient pipeline capacity to periodic fluctuations in local demands, influence of sufficient pipeline capacity to periodic fluctuations in regional demands, influence of sufficient pipeline capacity for diverse petroleum products, and influence of sufficient capacity to meet various orders. The results of the frequency distribution and chi square results were presented in table 4.7 below.

Table 4.7: Distribution Frequencies of Pipeline Capacity

	NE Freq %	SE Freq %	ME Freq %	LE Freq %	VLE Freq %	Chi-Square χ^2	P Value
There is sufficient pipeline capacity to meet depots requirements	0 0.0%	8 6.3%	38 29.9%	56 44.1%	25 19.7%	30.978	0.000
There is sufficient pipeline capacity to periodic fluctuations in local demands	4 3.1%	6 4.7%	49 38.6%	50 39.4%	18 14.2%	31.978	0.000
There is sufficient pipeline capacity to periodic fluctuations in regional demands	1 0.8%	13 10.2%	46 36.2%	56 44.1%	11 8.7%	17.987	0.022
There is sufficient pipeline capacity for diverse petroleum products	2 1.6%	11 8.7%	37 29.1%	51 40.2%	26 20.5%	20.675	0.004
There is sufficient pipeline capacity to meet various orders	5 3.9%	12 9.4%	41 32.3%	52 40.9%	17 13.4%	14.781	0.051

When asked on whether there is sufficient pipeline capacity to meet depots requirements, 6.3% of the respondents indicated to small extent, 29.9% for moderate extent, 44.1% for large extent, and 19.7% of the respondents for very large extent. In respect to whether there is statistically significant association between sufficiency of pipeline capacity to meet depot requirements and transport of petroleum products, the observed chi square value was 30.978 while the p value was 0.000. This indicated that there was a statistically significant association between sufficient pipeline capacity to meet depots requirements and transport of petroleum products at 5% level of significance. The examination on whether there is sufficient pipeline capacity to periodic fluctuations in local demands had 3.1%, 4.7%, 38.6%, 39.4%, and 14.2% of the respondents indicating to no extent, small extent, moderate extent, large extent and very large extent respectively. The statistically significant association between sufficient pipeline capacity to periodic fluctuations and transport of petroleum products had a chi square value of 31.978 and a p value of 0.000. This indicated that there was a statistically significant association between sufficient pipeline capacity to periodic fluctuations and transport of petroleum products at 5% level of significance.

The results of this study are also correlated with those of other studies in the subject matter. The capacity of the pipelines is therefore of critical importance to the transport and distribution of the petroleum products. In China, Isnart (2017) noted that the huge energy demand for China required it diversify its sources of petroleum products and hence the need for the construction of the 793 kilometer pipeline in 2013 with expected supply capacity of 12bcm natural gas per year by the end of 2019 (Isnarti, 2017). The role of the sufficient pipeline capacity to periodic fluctuations in regional demands had a majority of 44.1% of the respondents in agreement with the metric to large extent. On the other hand, 0.8%, 10.2%, 36.2%, and 8.7% of the respondents agreed with the metric to no extent, small extent, moderate extent, and very large extent respectively. The chi square results of the metric indicated an achieved chi square value of 17.987 and a p value of 0.022. This indicated that there was statistically significant association between sufficient pipeline capacity to periodic fluctuations in regional demands and transport of petroleum products at 5% level of significance. The role of sufficient pipeline capacity for diverse petroleum products had a cumulative percentage of 60.7% of the respondents indicating that it influenced it to a large extent. It is only a small percentage of 1.6% of the respondents who indicated its influence was to a no extent and 8.7% to a small extent. The consideration as to whether there was statistically significant association between presence of sufficient pipeline capacity for diverse petroleum products and transport of petroleum products had the observed chi square value being 20.675 and a p value of 0.004. This led to the conclusion that there is a statistically significant association between presence of sufficient pipeline capacity for diverse petroleum products and transport of petroleum products at 5% level of significance. The presence of sufficient pipeline capacity to meet various orders had 3.9%, 9.4%, 32.3%, 40.9%, and 13.4% of the respondents indicating to a no extent, small extent, moderate extent, large extent and very large extent respectively. The study thus noted that a majority of 40.9%

of the respondents indicated there was sufficient pipeline capacity to meet various orders to a large extent.

The study further noted that the chi square value of the association between presence of sufficient pipeline capacity to meet various orders and transport of petroleum products was at 14.781 with a p value of 0.051. This indicated that there was no statistically significant relationship between the metric and transportation of the petroleum products. There are diverse petroleum products that can be derived from the petroleum based on the needs of a given country. These products include Liquefied Petroleum Gas (LPGs), petroleum fuels such as diesel, oil lubricants, kerosene, and tar amongst others. The petroleum products are used for various purposes including fuels for transport vessels such as motor vehicles, motorbikes and airplanes, and fuels for cooking through LPGs (Kanna, Deepthi, Das, Joseph, & George, 2017).

4.9 Transport and Distribution of Petroleum Products

The transport and distribution of the petroleum products was examined using five indicators. These indicators included KPC transporting and distributing petroleum products in a timely manner, KPC transporting and distribution various products with cost efficiency, KPC transporting and distributing various petroleum products as per demands, and KPC transporting and distributing various petroleum products with operational efficiency. The results were presented in Table 4.8

Table 4.8: Frequencies of Transport and Distribution of Petroleum Products

	NE Freq %	SE Freq %	ME Freq %	LE Freq %	VLE Freq %
The KPC transports and distributes the petroleum products in a timely manner	8 6.3%	9 7.1%	48 37.8%	51 40.2%	11 8.7%
The KPC transports and distributes various petroleum products as per demands	1 0.8%	6 4.7%	54 42.5%	56 44.1%	10 7.9%
The KPC transports and distributes various petroleum products with cost efficiency	0 0.0%	7 5.5%	53 41.7%	54 42.5%	13 10.2%
The KPC transports and distributes various petroleum products with operational efficiency	2 1.6%	10 7.9%	55 43.3%	48 37.8%	12 9.4%

In respect as to whether KPC transports and distributes the petroleum products in a timely manner, 6.3%, 7.1%, 37.8%, 40.2%, and 8.7% of the respondents indicated to a no extent, small extent, moderate extent, large extent, and very large extent respectively. The question as to whether the KPC transports and distributes various petroleum products as per demands had a majority of 44.1% of the respondents indicating to a large extent. This was followed by 42.5% of the respondents who indicated to a moderate extent while 7.9% of the respondents indicated to a very large extent and 0.8% of the respondents indicated to a no extent. The KPC transporting and distributing various petroleum products with cost efficiency had 5.5%, 41.7%, 42.5%, and 10.2% of the respondents indicating to a small extent, moderate extent, large extent, and very large extent respectively. Finally, in respect to the KPC transporting and distribution various petroleum products with operational efficiency, 1.6%, 7.9%, 43.3%, 37.8%, and 9.4% of the respondents indicated to no extent, small extent, moderate extent, large extent and very large extent respectively.

4.10 Correlational Analysis

The correlational analysis between various variables was undertaken for the study. The correlational analysis was undertaken with a view of determining on whether there was a correlational relationship between the variables. The results were presented in table 4.9 below.

Table 4.9: Correlational Analysis

		Infrastructure	ICT	Security	Pipeline Capacity	Transport and Distribution
Infrastructure	Pearson Correlation	1				
	Sig. (2-tailed)					
	N	127				
ICT	Pearson Correlation	.187*	1			
	Sig. (2-tailed)	.036				
	N	127	127			
Security	Pearson Correlation	.271**	.302**	1		
	Sig. (2-tailed)	.002	.001			
	N	127	127	127		
Pipeline Capacity	Pearson Correlation	.301**	.251**	.211*	1	
	Sig. (2-tailed)	.001	.004	.017		
	N	127	127	127	127	
Transport and Distribution	Pearson Correlation	.635**	.637**	.676**	.675**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	127	127	127	127	127

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

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

The study results revealed that there was Pearson correlation coefficient of 0.187 between ICT and infrastructure; 0.271 between security and infrastructure; 0.301 between pipeline capacity and infrastructure; 0.635 between transport and distribution on infrastructure; 0.302 between security and ICT; 0.251 between pipeline capacity and ICT; 0.637 between transport and ICT; 0.211 between pipeline capacity and security; 0.676 between transport and security; and 0.675 between transport and pipeline capacity. The study thus noted that all correlational coefficient were positive in nature implying that an increase in one variable was associated with an increase in another variable and vice versa. The study further found that all the correlational relationship between the variables were statistically significant in nature. This implied that the observed relationships would also be found in the population of the study.

4.11 Regression Analysis

The regression analysis was undertaken in this study with a view of examining the influence of the strategic factors influencing transport and distribution of petroleum products in Kenya with a focus on the Kenya Pipeline Company. The strategic factors that were examined included ICT, pipeline capacity, security and infrastructure amongst others. The results for the regression analysis were provided through two tabular presentations at Table 4.10, and Table 4.11 below.

The study results indicated that the correlational coefficient (R) value that was achieved was 0.803. This indicated that there was a strong correlational relationship between the strategic factors (ICT, pipeline capacity, security and infrastructure) and transport of petroleum products. The study also examined the coefficient of determination (R Square) that seeks to examine the variance in the dependent variable that is attributable to the independent variables. The study found that the coefficient of determination was 0.645 indicating 64.5% of the variance in the transport and distribution of the petroleum products was attributable to the strategic factors of pipeline capacity, security, ICT and infrastructure aspects. Thus the difference of 35.5% of the variance in the regression analysis was a result of other factors that were not considered in the regression model.

The study also examined the one-way ANOVA and used the f test to examine on whether the regression is good fit for the model and that it can be used to predict the dependent variable in the population. The f test is often undertaken at 5% level of significance with a p value of less than 0.05 leading to the conclusion that the regression model is good fit for data. The achieved p value of the study was 0.000 indicating that the regression model was good fit for data as the p value of the study was 0.000.

Table 4.10: ANOVA^a

	Model	Sum of Squares	df	Mean Square	F	Sig.
	Regression	7.034	4	1.759	54.968	.000 ^b
1	Residual	3.873	122	.032		
	Total	10.907	126			

R=0.803, R Square =0.645

a. Dependent Variable: Transport and Distribution

b. Predictors: (Constant), Pipeline Capacity, Security, ICT, Infrastructure

The finding that the regression model is good fit for data led to the examination of the regression analysis and the results presented in Table 4.12 below.

Table 4.11: Coefficients^a

	Model	Unstandardized Coefficients		Standardized	t	Sig.
		B	Std. Error	Coefficients		
	(Constant)	.322	.224	Beta	1.437	.153
	Infrastructure	.217	.045	.280	4.822	.000
1	ICT	.261	.043	.350	6.052	.000
	Security	.250	.047	.309	5.298	.000
	Pipeline Capacity	.193	.042	.268	4.610	.000

a. Dependent Variable: Transport and Distribution

The study results indicated that in respect to the influence of infrastructure on the transport and distribution of the petroleum products the achieved results were $\beta_1 = 0.217$, $t=4.822$ and p value < 0.05 . The study results indicated that a unit increase in the infrastructure was associated with 0.217 increase in the transport and distribution of the petroleum products with the other variables kept constant. The study was also interested in testing the following research hypothesis;

H₀₁: There is no statistically significant influence of infrastructure on transport and distribution of petroleum products in Kenya pipeline.

The achieved t test statistic of 4.822 and a p value of 0.000 indicated that there was a statistically significant relationship between infrastructure on the transport and distribution of

the petroleum products at Kenya pipeline. This led to the rejection of the null hypothesis (H_{01}) and acceptance of the alternative hypothesis. The results of this study are consistent with those of other scholars. In a study based in Akwa Ibom State of Nigeria, Akpan (2014) undertook a meta-analysis study looked on the influence of infrastructure on transport and distribution of petroleum products amongst other aspects. The study revealed that outdated and poorly maintained oil pipeline grinds often led to oil spills during transportation of the commodity. Akpan (2014) further revealed that the rusty oil pipelines have led to Nigeria to have amongst the highest number of oil spills across the globe. In a study focusing on the Kaduna Refinery and Petro-Chemical Company, Obasanjo (2013) examined the influence of the various modes of transport and their influence on the transport and distribution of petroleum products.

The study noted the poor state of the roads impacted on the transport and distribution of the petroleum products. The problem of the poor road state has led to the delays, high levels of accidents, cost of vehicle maintenance and lower speeds all which have an influence on the distribution of the petroleum products. In a study in Nigeria, Cooper, Macisaac, Pochech, and Petersen (2015) noted that pipeline malfunction was one of the greatest challenge in transport and distribution of the petroleum products. In this context, the study revealed that lack of repair and repeated cases of vandalism of the oil pipeline contributed to the slowdown in transport and distribution of petroleum products.

The study examined the influence information communication and technology on the transport and distribution of petroleum products at Kenya Pipeline. The study results revealed that were $\beta_2 = 0.261$, $t = 6.052$ and $p \text{ value} = 0.000$. The study results thus indicated that a unit increase in the ICT usage led to a 0.261 increase in the transport and distribution of the

petroleum products with the other variables kept constant. The study was also interested in testing the following research hypothesis.

H₀₂: There is no statistically significant influence of information communication and technology on transport and distribution of petroleum products in Kenya pipeline.

The achieved t test statistic of 6.052 and a p value of 0.000 indicated that there was a statistically significant relationship between ICT on transport and distribution of the petroleum products at Kenya Pipeline. This led to the rejection of the null hypothesis (H₀₂) and acceptance of the alternative hypothesis. The results of this study are consistent with those of other studies that have examined ICT components and distribution of petroleum products. In the Russian context, Chernyaev and Kreydenko, (2018) undertook a study that amongst other aspects noted the role of technology in transport and distribution of the petroleum products. The study noted the need for Russia to use technology in the transport of petroleum products in order to systemize control and monitoring as well as efficiency in petroleum products transportation. A study by Salam, Selintung, and Maricar (2014) undertaken in Indonesia sought to examine the role of technology in detecting leakages within a pipeline set up. The study noted that leakages within pipelines delayed that transport and distribution of the pipeline contents. Salam *et al.*, (2014) used an experimental research design to test a proposed system for leakage detection. The study noted that the proposed technological intervention, Radial Basis Function Neural Network (RBF-NN), was proficient in detecting the location of leak within a pipeline and its magnitude through pressure analysis.

The study sought to examine on whether there was statistically significant influence of security on transport and distribution of petroleum products at Kenya Pipeline. The study results revealed that $\beta_3 = 0.250$, $t = 5.298$ and $p \text{ value} = 0.000$. The study thus indicated that a unit increase in security would lead to 0.250 increase in the transport and distribution of the petroleum products at Kenya Pipeline Company with the other variables kept constant. The study was further interested in testing the following research hypothesis.

H₀₃: There is no statistically significant influence of security on transport and distribution of petroleum products in Kenya pipeline

The achieved t test statistic of 5.298 and a p value of 0.000 indicated that there was a statistically significant influence of security on transport and distribution of the petroleum products at Kenya Pipeline. This was due to a p value below 0.05. This led to the rejection of the null hypothesis (H₀₃) and the acceptance of the alternative hypothesis for the study. The study's results are consistent with those of other studies in the subject area. The concept of safety and its influence in the transport of petroleum products was also examined by Obasanjo (2013) in a study focusing on Kaduna Refinery and Petro-Chemical Company. The study noted that there were concerns of safety in transportation of petroleum products especially through the road systems due to the high rates of road accidents. These concerns were shared by Cooper *et al.* (2015) in their study based on the transportation of the petroleum products noted security challenges in the pipeline distribution. The study noted that the vandalization of the Atlas Cove-Mosimi line in 2011 disturbed the distribution of petroleum products to the south-west region of Nigeria. This was due to the pipeline supplying five depots with petroleum products.

The study sought to examine the influence of pipeline capacity on the transport and distribution of the petroleum products at Kenya Pipeline. The study results revealed that $\beta_4 = 0.193$, $t = 4.610$ and $p \text{ value} = 0.000$. The study thus revealed that a unit increase in pipeline capacity would lead to 0.193 increase in the transport and distribution of the petroleum products at Kenya Pipeline Company with the other variables kept constant. The study was further interested in testing the following research hypothesis;

H₀₄: There is no statistically significant influence of pipeline capacity on transport and distribution of petroleum products in Kenya pipeline

The achieved t test statistic of 4.610 and a p value of 0.000 indicated that there was a statistically significant influence of pipeline capacity on transport and distribution of the petroleum products at Kenya Pipeline. This was due to a p value below 0.05. This led to the rejection of the null hypothesis (H₀₄) and the acceptance of the alternative hypothesis for the study. The capacity of the pipelines is critical importance to the transport and distribution of the petroleum products. In China, Isnart (2017) undertook a meta-analysis study based on secondary data that examined the China-Myanmar gas pipeline. The study noted that the huge energy demand for China required it diversify its sources of petroleum products and hence the need for the construction of the 793 kilometer pipeline in 2013 with expected supply capacity of 12bcm natural gas per year by the end of 2019 (Isnarti, 2017). In a study in Nigeria, Oladepo (2014) in a meta-analysis study examined aspects of pipeline capacity to transport of petroleum products. The study revealed that in some refineries in Nigeria low production capacity has made it a challenge for the petroleum products to be transported through the pipelines and has led to the use of trucks for such transport.

The achieved beta coefficients of the strategic factors that is 0.217, 0.261, 0.250, and 0.193 for infrastructure, ICT, Security and pipeline capacity led to the construction of the following regression analysis model:

$$Y = 0.322 + 0.217X_1 + 0.261X_2 + 0.250X_3 + 0.193X_4$$

Where Y = Transport and Distribution of Petroleum Products; β_0 , β_1 , β_2 , β_3 , and β_4 = Model coefficients; and X_1 , X_2 , X_3 , and X_4 is infrastructure, ICT, Security, and pipeline capacity respectively while e is the estimate of error.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This study sought to examine the influence of strategic factors in influencing transport and distribution of petroleum products in Kenya with a focus on the case study of Kenya Pipeline Company. The study thus sought to examine the influence of infrastructure, ICT, security and pipeline capacity on the transport and distribution of the petroleum products at Kenya Pipeline Company. This chapter thus the summary of findings, conclusions of findings and recommendations of the study.

5.2 Summary of the Findings

The summary of the findings are presented dependent on the research objectives of the study.

5.2.1 Infrastructure and Transport and Distribution of Petroleum Products

The first objective of the study was the examination of the infrastructure and transport influence on the distribution of petroleum products. The first independent variable was examined using five indicators that is KPC pipelines being adequately maintained, pipelines being adequately protected from natural elements interference, KPC pipelines being adequately protected from unauthorized human activities, KPC depots having capacity to hold pipelines outputs at all times, and KPC depots being able to hold sufficient products for their oil marketer companies. The study found a statistically association between KPC pipelines are adequately maintained a majority of the respondents and the transport and distribution of the petroleum products. This was attributed to a majority of 57.5% of the respondents indicating that it influenced to a large extent. A cumulative percentage of 68.5% of the respondents were in agreement that all KPC pipelines are adequately protected from natural elements interference.

The study further noted that all pipelines being protected from natural elements interference had a statistically significant association with distribution of petroleum products. The study found that a majority of 46.5% of the respondents agreed that All pipelines being adequately protected from unauthorized human activities and transport of petroleum products had a statistically significant association. The study noted that KPC depots having capacity to hold pipeline outputs all times had a statistically significant association with distribution of the petroleum products. Finally, in respect to KPC depots being able to hold sufficient products for their oil marketer companies a majority of 55.1% indicated to a large extent. The study further revealed that the achieved chi square of 15.428 and a p value of 0.049 for the KPC depots being able to hold sufficient products for their oil marketer companies. This demonstrated that the indicator had a statistically significant association on the distribution of the petroleum products.

5.2.2 ICT and Transport on Distribution of Oil Products

The second objective of the study was examination of the influence of the ICT and Transport on the distribution of the oil products was examined using five indicators. These indicators included the use of ICT to locate oil leaks in the pipeline, use of ICT to adequately detect magnitude of oil leaks in the pipeline, use of ICT to adequately monitor pipeline structural integrity at all times, ICT able to monitor illegal human activities on the pipelines at all times, and use of ICT to adequately monitor the petroleum products flow rates at all times. A majority of the respondents at 48.8% indicated that the use of ICT at KPC leading to ability to adequately locate oil leaks in the pipelines indicated this capacity was present to a large extent. The study further noted that there was a statistically significant association between the use of ICT at KPC being able to adequately locate oil leaks in the pipeline and distribution of the petroleum products. The extent in which the used ICT at KPC was able to adequately detect the magnitude of oil leaks in the pipeline had a majority of the respondents

indicating to a large extent. The study further found that there was a statistically significant association between used ICT at KPC being able to adequately detect the magnitude of oil leaks in the pipeline and distribution of the petroleum products.

On whether the used ICT at KPC is able to adequately monitor pipeline structural integrity at all times, a cumulative percentage of 60.1% of the respondents were in agreement. The study further found that in respect to used ICT at KPC being able to adequately monitor pipeline structural integrity at all times and its association with the oil products distributions. The respondents further noted that a statistically significant relationship between use of ICT at KPC to adequately monitor illegal human activities on the pipelines at all times and distribution of petroleum products. The study noted the presence of statistically significant association between use of ICT at KPC to adequately monitor illegal human activities on the pipelines at all times and distribution of petroleum products. Finally, when asked on whether the used ICT at KPC was able to adequately monitor petroleum products flow rates at all times a majority of the respondents had 40.9% indicating to a moderate extent.

5.2.3 Security on the Transport and Distribution of Petroleum Products

The third variable of the study was the examination of the influence of security on the transport and distribution of petroleum products had five indicators to examine it. These five indicators included sufficiency of petroleum patrols across the pipeline networks of KPC, sufficient security at KPC depots to mitigate any hazard concerns, sufficient security at KPC depots to avoid fraudulent activities with petroleum products, sufficient security to prevent oil siphoning across the pipeline network, and sufficient security to mitigate against criminal acts on KPC installations. The association between sufficiency of patrols across the pipeline network of KPC and transport and distribution of petroleum products was found to be statistically significant. The extent in which there is sufficient security at the KPC depots to

mitigate any hazard concerns had a majority of the respondents at 42.5% of the respondents indicating to a moderate extent. The study further found a statistically significant relationship between sufficient security at the KPC depots to mitigate any hazard concerns and distribution of petroleum products.

The study found that a majority of the respondents at 38.6% indicated to a large extent the extent in which there was sufficient security at KPC depots to avoid fraudulent activities with petroleum products. The study further noted presence of a statistically significant association between sufficient security at KPC depots to avoid fraudulent activities with petroleum products and distribution of petroleum products. In respect on whether there was sufficient security to prevent oil siphoning across the pipeline network, a majority of 37.0% of the respondents indicated to large extent. The study further noted that there was a statistically significant association between presence of sufficient security to prevent oil siphoning across the pipeline network and transport of petroleum products. The respondents were asked on the presence of sufficient security to mitigate against criminal acts on KPC installations. A majority of 39.4% of the respondents indicated to a moderate extent. The study further found presence of a statistically significant association between sufficient security to mitigate against criminal acts on KPC installations and transport of petroleum products.

5.2.4 Pipeline Capacity on Transport and Distribution of Petroleum Products

The fourth variable of the study was the examination of the influence of pipeline capacity on transport and distribution of petroleum products. The study utilized five indicators that is presence of sufficient pipeline capacity to meet depots requirements, influence of sufficient pipeline capacity to periodic fluctuations in local demands, influence of sufficient pipeline capacity to periodic fluctuations in regional demands, influence of sufficient pipeline capacity for diverse petroleum products, and influence of sufficient capacity to meet various orders.

The study found that there was a statistically significant association between sufficiency of pipeline capacity to meet depot requirements and transport of petroleum products. The examination on whether there was sufficient pipeline capacity to periodic fluctuations in local demands had a majority of the respondents indicating to large extent. The role of the sufficient pipeline capacity to periodic fluctuations in regional demands had a majority of 44.1% of the respondents in agreement with the metric to large extent.

The study further noted that there was a statistically significant association between sufficient pipeline capacity to periodic fluctuations in regional demands and transport of petroleum products. The role of sufficient pipeline capacity for diverse petroleum products had a cumulative percentage of 60.7% of the respondents indicating that it influenced it to a large extent. The study further found that there was a statistically significant association between presence of sufficient pipeline capacity for diverse petroleum products and transport of petroleum products. The presence of sufficient pipeline capacity to meet various orders had a majority of 40.9% of the respondents indicated there was sufficient pipeline capacity to meet various orders to a large extent.

5.3 Conclusions

The study results concluded that the various variables of the strategic factors that is ICT, Infrastructure, pipeline capacity, and security as well as the transport and distribution of the petroleum products were positively and significantly correlated amongst themselves. This indicated that change in each of the variable was observed to be associated with changes in any other variable in a pairwise manner which was observable in the sample and would be observable in the population. In respect to the relationship between the strategic factors and transport and distribution of petroleum products the study concluded that strategic factors had a huge influence on transport and distribution of the petroleum products due to a high

correlation coefficient and coefficient of determination. In respect to the influence of infrastructure on the transport and distribution of the petroleum products, the study concluded that there would be a positive influence of infrastructure on the transport and distribution that would also prevail in the population.

Similarly, in respect to the influence of ICT on the transport and distribution of the petroleum products at KPC, the study concluded that there was a positive influence of ICT on transport and distribution of petroleum products at KPC. This result was also be observable in the population. The study had also sought to examine on whether there was statistically significant influence of security on transport and distribution of petroleum products at Kenya Pipeline. The study results revealed that security had a positive influence on the transport and distribution of petroleum products at Kenya pipeline company. The results were found to statistically significant. The study further sought to examine the influence of pipeline capacity on the transport and distribution of the petroleum products at Kenya Pipeline Company. A conclusion was reached that a pipeline capacity had a positive and significant influence on the transport and distribution of the petroleum products at Kenya Pipeline Company.

5.4 Recommendations

The following were the recommendations of the study.

5.4.1 Policy Recommendations

Based on the conclusions of the study, the study recommended that all the strategic factors that is infrastructure, ICT, security, and pipeline capacity should be emphasized by Kenya Pipeline Company in order to improve on the performance of transport and distribution of the petroleum products. Based on the regression coefficients, the study recommends that the strategic factors should be emphasized in terms of ICT, Security, infrastructure, and pipeline

capacity aspects due to their relative strengths on the transport and distribution of the petroleum products.

5.4.2. Suggestions for Further Studies

The study recommends that other factors influencing the transport and distribution of the petroleum products should be examined by other scholars.

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APPENDIX I: CONSENT STATEMENT

Dear Respondent,

My name is Keter Samson Kipkirui, a Master of Business Administration (Strategic Management) student at Kabarak University. I am undertaking a research entitled *Strategic Factors Influencing Transport and Distribution of Petroleum Products in Kenya: A Case Study Of Kenya Pipeline Company*. The study is in partial fulfilment of my MBA studies.

I am requesting that you assist me in filling the annexed questionnaire geared towards achievement of my studies. The collected data will only be used for academic purpose. The identity of the respondent was kept anonymous and the responses was treated with utmost confidentiality.

Regards,

Keter Samson Kipkirui

APPENDIX II: QUESTIONNAIRE

STRATEGIC FACTORS INFLUENCING TRANSPORT AND DISTRIBUTION OF PETROLEUM PRODUCTS IN KENYA: A CASE STUDY OF KENYA PIPELINE COMPANY

QUESTIONNAIRE

Instruction: Kindly endeavour to answer all questions in this questionnaire and be as honest as possible.

You have a right to voluntary participate in the study and to withdraw this participation any time

Section I: Background Information

1. Your gender:

Male []

Female []

2. How old are you?.....

3. Which of the following best describes your job group?

Safety [] Security [] Maintenance [] IT Support [] Operations []

CSR Staff [] Senior Management Staff [] []

Section II: Infrastructure

The statements in this section examine infrastructure aspects at KPC. Please use the five point Likert scale whereby **1=No extent, 2=small extent, 3=moderate extent, 4=large extent, and 5= very large extent** to appropriately answer the questions.

No	<i>To what extent do you agree that;</i>	1	2	3	4	5
4.	All KPC pipelines are adequately maintained					
5.	All KPC pipelines are adequately protected from natural elements interference					
6.	All KPC pipelines are adequately protected from unauthorized human activities					
7.	The KPC depots have capacity to hold pipeline outputs all times					
8.	The KPC depots are able to hold sufficient products for their oil marketer companies					

Section III: Information Communication Technology

The statements in this section are aimed at establishing ICT capacity of KPC. Please use the five point Likert scale whereby **1=No extent, 2=small extent, 3=moderate extent, 4=large extent, and 5= very large extent** to appropriately answer the questions.

No	<i>To what extent do you agree that;</i>	1	2	3	4	5
9.	The used ICT at KPC is able to adequately locate oil leaks in the pipeline					
10.	The used ICT at KPC is able to adequately detect magnitude of oil leaks in the pipeline					
11.	The used ICT at KPC is able to adequately monitor pipeline structural integrity at all times					
12.	The used ICT at KPC is able to adequately monitor illegal human activities on the pipeline at all times					
13.	The used ICT at KPC is able to adequately monitor petroleum products flow rates at all times					

Section IV: Security

The statements in this section examine security aspects at KPC. Please use the five point Likert scale whereby **1=No extent, 2=small extent, 3=moderate extent, 4=large extent, and 5= very large extent** to appropriately answer the questions.

No	<i>To what extent do you agree that;</i>	1	2	3	4	5
14.	There are sufficient patrols across the pipeline network of KPC					
15.	There is sufficient security at the KPC depots to mitigate any hazard concerns					
16.	There is sufficient security at KPC depots to avoid fraudulent activities with petroleum products					
17.	There is sufficient security to prevent oil siphoning across the pipeline network					
18.	There is sufficient security to mitigate against criminal acts on KPC installations					

Section V: Pipeline Capacity

The statements in this section examine of **Pipeline Capacity** . Please use the five point Likert scale whereby **1=No extent, 2=small extent, 3=moderate extent, 4=large extent, and 5= very large extent** to appropriately answer the questions.

No	<i>To what extent do you agree that;</i>	1	2	3	4	5
19.	There is sufficient pipeline capacity to meet depots requirements					
20.	There is sufficient pipeline capacity to periodic fluctuations in local demands					
21.	There is sufficient pipeline capacity to periodic fluctuations in regional demands					
22.	There is sufficient pipeline capacity for diverse petroleum products					
23.	There is sufficient pipeline capacity to meet various orders					

Section IV: Transport and Distribution

The statements in this section examine of transport and distribution. Please use the five point Likert scale whereby **1=No extent, 2=small extent, 3=moderate extent, 4=large extent, and 5= very large extent** to appropriately answer the questions.

No	<i>To what extent do you agree that;</i>	1	2	3	4	5
24.	The KPC transports and distributes the petroleum products in a timely manner					
25.	The KPC transports and distributes various petroleum products as per demands					
26.	The KPC transports and distributes various petroleum products with cost efficiency					
27.	The KPC transports and distributes various petroleum products with operational efficiency					

Thank you

APPENDIX III: AUTHORIZATION LETTER

KABARAK



UNIVERSITY

Private Bag - 20157
KABARAK, KENYA
<http://kabarak.ac.ke/institute-postgraduate-studies>

Tel: 0773 265 999
E-mail: director.postgraduate@kabarak.ac.ke

BOARD OF POSTGRADUATE STUDIES

15th July, 2019

The Director General
National Commission for Science, Technology & Innovation (NACOSTI)
P.O. Box 30623 - 00100
NAIROBI

Dear Sir/Madam,

RE: KETER SAMSON KIPKIRUI- REG. NO. GMB/NE/0190/01/18

The above named is a Master of Business Administration (MBA) student at Kabarak University in the School of Business & Economics. He is carrying out research entitled "*Strategic Factors Influencing Transport and Distribution of Petroleum Products in Kenya: A Case Study of Kenya Pipeline Company*". He has defended his proposal and has been authorized to proceed with field research.

The information obtained in the course of this research will be used for academic purposes only and will be treated with utmost confidentiality.

Please provide him with a research permit to enable him to undertake his research.

Thank you.

Yours faithfully,


Dr. Betty Jeruto Tikoko
DIRECTOR, POSTGRADUATE STUDIES

Kabarak University Moral Code

As members of Kabarak University family, we purpose at all times and in all places, to set apart in one's heart, Jesus as Lord. (1 Peter 3:15)




APPENDIX IV: NACOSTI PERMIT


REPUBLIC OF KENYA
 NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

RefNo: **962728**
Date of Issue: **09/August/2019**


RESEARCH LICENSE




This is to Certify that Mr.. samson keter of Kabarak University, has been licensed to conduct research in Nairobi on the topic: strategic factors influencing Transport and Distribution of Petroleum Products in Kenya for the period ending : 09/August/2020.

License No: **NACOSTI/P/19/239**

962728
 Applicant Identification Number


 Director General
NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

Verification QR Code



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APPENDIX V: KPC REQUEST LETTER

Keter Samson Kipkirui,
P.O BOX 17396-20100,
Nakuru, Kenya
ketersamson72@gmail.com

23rd August, 2019

Human Resource Manager,
Kenya Pipeline Company,
P.O BOX 73442-0200,
Nairobi, Kenya
info@kpc.co.ke

Dear Sir/Madam,

REF: APPLICATION FOR AUTHORITY TO UNDERTAKE RESEARCH IN YOUR PREMISES

My name is Keter Samson Kipkirui, a Master of Business Administration (Strategic Management) student at Kabarak University. I am undertaking a research entitled *Strategic Factors Influencing Transport and Distribution of Petroleum Products in Kenya: A Case Study Of Kenya Pipeline Company*. The study is in partial fulfilment of my MBA studies.

The purpose of this letter is to request for authority to undertake research in your premises. The collected information from your staff members will be used for academic purposes only. The respondents' identities will not be revealed and neither will they be disadvantaged in any way. Care will be taken not to disrupt any of your operational activities.

I look forward to a favourable response from your office. A copy of the questionnaire is attached on this letter.

Yours Faithfully,



Keter Samson Kipkirui