INFLUENCE OF RISK MITIGATION STRATEGIES ON SUPPLY CHAIN RESILIENCE IN THE PETROLEUM INDUSTRY IN KENYA

NELSON KIPNGETICH LAMBAINO

DOCTOR OF PHILOSOPHY

(Supply Chain Management)

JOMO KENYATTA UNIVERSITY OF

AGRICULTURE AND TECHNOLOGY

2019

Influence of Risk Mitigation Strategies on Supply Chain Resilience in the Petroleum Industry in Kenya

Nelson Kipngetich Lambaino

A thesis submitted in partial fulfilment for the degree of Doctor of Philosophy in Supply Chain Management in the Jomo Kenyatta University of Agriculture and Technology

2019

DECLARATION

This thesis is my original work and has not been presented for a degree in any other University

Signature……**….**Date……

Nelson Kipngetich Lambaino

This thesis has been submitted for examination with our approval as University Supervisors.

Sign**ature**……**….**Date……

Dr. Wario Guyo, PhD

JKUAT, Kenya

Sign**ature**……**….**Date……

Prof. Romanus Odhiambo, PhD

JKUAT, Kenya

Sign**ature**……**….**Date……

Dr. Pamela Getuno, PhD

JKUAT, Kenya

DEDICATION

The thesis is dedicated to my wife Milka and my sons Bruce, Jeff and Kigen for their love, prayers, patience, encouragement and sacrifices.

ACKNOWLEDGEMENT

First and foremost, is to thank God Almighty for everything He has done for me. Secondly is to sincerely thank my supervisors; Dr. Wario Guyo, Prof. Romanus Odhiambo and Dr. Pamela Getuno for their unwavering support and guidance throughout the research period until the completion of this thesis. I wish also to thank Jomo Kenyatta University of Agriculture and Technology for the opportunity given to me to pursue my PhD degree and to my colleagues at the university for their continued support and encouragement.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABBREVIATIONS AND ACRONYMS

BSI	British Standards Institute
ERC	Energy Regulatory Commission
GDP	Gross Domestic Product
KAM	Kenya Association of Manufacturers
KNBS	Kenya National Bureau of Statistics
KPC	Kenya Pipeline Company
KPRL	Kenya Petroleum Refineries Limited
KRA	Kenya Revenue Authority
K-S	Kolmogorov-Smirnov
LAPSSET	Lamu Port and South Sudan Ethiopia Transport Corridor
MOEP	Ministry of Energy and Petroleum
OMCs	Oil Marketing Companies
PIEA	Petroleum Institute of East Africa
QQ Plots	Quantile-Quantile Plots
SCOR	Supply Chain Operations Reference
SCRES	Supply Chain Resilience
SPSS	Statistical Packages for Social Sciences
S-W	Shapiro Wilk

DEFINITION OF TERMS

Risk Acceptance: Risk acceptance is a reactive strategy where the risk is simply retained without any action into the risk situation other than budgeting allocation for control and contingency plans to deal with risk events if it occurs (Sodhi & Tang, 2012).

Risk Avoidance: Risk avoidance is a strategy that entails eradicating of possible risks by avoiding or retracting from the risky situation. It is therefore designed to move the source of risk likelihood to zero which is attained through avoidance or eliminating the source of risk (Hajmohammad & Vachon, 2015).

Risk Management: It is an approach that entails risk identification, evaluation, measurement and prioritization of risks followed by resource deployment to reduce or eliminate the risk, then monitor and control possibility of occurrence and or the consequences that the risk may cause and enhance achievement of opportunities (Antunes, Ricardo, Gonzalez & Vicente, 2015; Ndung'u, 2013).

Risk Mitigation: Risk Mitigation is a strategy that involves putting in requisite necessary steps to remove or minimize the undesirable impact of risks which can be done through risk avoidance, risk acceptance, risk transfer and risk reduction (Herrera, 2013).

Risk Reduction: Risk reduction means either relative or total risk reduction and may entail strategies that include Disaster Risk Reduction, collaboration, Safety Integrity Level and diversification (Spacey, 2015).

Risk Transfer: Risk Transfer is changing the burden of risk of an entity responsible of managing risk to another party who may either

be in a better position to manage the risk or proper owner of the risk (Alfred, 2013).

Risk: Risk is the probability of occurrence of harm, injury, loss, hazard, threat, damage or any other adverse event (Faizal & Palaniappan, 2014).

Supply Chain Resilience: Supply Chain Resilience involves ensuring prompt, effective response and regaining from risk event to a desired level or a better operational performance level (Carvalho, Azevedo & Cruz-Machado, 2014).

Supply Chain Risk Management: Supply Chain Risk Management involves strategy execution in the view of managing risk in the supply chain based on the continuous risk assessment to ensure supply chain continuity and reducing vulnerability (Ghadge, Dani, Chester & Kalawsky, 2013; Wieland & Wallenburg, 2012).

ABSTRACT

The study sought to determine the influence of risk mitigation strategies on supply chain resilience in the petroleum industry in Kenya. The specific objectives for the study were: to determine the influence of Risk Avoidance, to establish the influence of Risk Acceptance, to determine the influence of Risk Reduction and to establish the influence of Risk Transfer on Supply Chain Resilience in Petroleum Industry in Kenya. Also, the study examined the moderating effect of management control policies, rules and procedures on risk mitigation strategies and supply chain resilience. The study adopted descriptive and correlation research design with a target population of the 87 active oil-marketing companies licensed by the Energy Regulatory Commission to import and trade with petroleum products in Kenya. The study employed a census survey technique to collect data from those firms. The data was collected using questionnaires respondents who were depot manager and either supply chain or logistics managers from each firm. Prior study was conducted using 10 companies to test the validity and reliability of the research instrument and a Cronbach's alpha equal to 0.787 was obtained from the analysis of the 20 questionnaires. After eliminating the 10 companies that participated in the pilot study, 77 oil marketing firms remained out of which 75 accepted to participate in the survey and the study obtained 150 fully completed questionnaires. The data was analyzed using SPSS version 22 to obtain descriptive and inferential statistics which were presented in tables and figures and was used to accept or reject the study hypotheses which were tested at five percent significant level. The first regressions analysis was carried out to test the relationship between each of the four risk mitigation strategies (risk avoidance, risk acceptance, risk reduction and risk transfer) and supply chain resilience followed by a test on the moderating effect of management control policies, rules and procedures using Baron and Kenney (1986) technique and finally multiple regression analysis for risk mitigation strategies and supply chain resilience. The first regression analysis that tested each of the four risk mitigation strategies and supply chain resilience indicated that risk avoidance and risk acceptance had significant values at 0.515 and 0.915 higher than p value 0.05 and negative coefficient at -0.032 and -0.012 respectively. Therefore, both risk avoidance and risk acceptance had a negative and statistically insignificant influence on supply chain resilience. Risk reduction and risk transfer had a positive and statistically significant influence on supply chain resilience because their significant values were less than p values at 0.037 and 0.008 respectively and also their coefficients were positive. The second regression which tested moderation effect determined that management control policies, rules and procedures have a positive effect on the relationship between risk mitigation strategies and supply chain resilience because it improved the size of R in the multiple regression analysis from 0.293 to 0.340 and R-Square from 0.086 to 0.116. In addition, it improved the prediction power of the multiple regression model as the p-value for ANOVA, which tests model's statistical significance in predicting the relationship between the study variables reduced from 0.011 to 0.001. The study concluded that control policies and procedures moderates positively the influence of risk mitigation strategies and supply chain resilience. Thirdly, the multiple regression analysis obtained positive correlation coefficient (R) coefficient of determination (R-Square) equal to 0.293 and 0.086 respectively which indicated a positive multiple relationship between the risk

mitigation strategies and supply chain resilience. However, coefficients for risk avoidance and acceptance were both negative (-0.349 and -0.144) and their significant values were 0.099 and 0.763 respectively which are larger than alpha value of 0.05 hence they are not statistically significant in predicting the supply chain resilience. On the other hand, coefficients for risk reduction and transfer were positive (0.497 and 0.508) respectively and were significant since their corresponding p-values were 0.031 and 0.008 respectively which are less than 0.05. The study concluded that risk mitigation strategies have a positive influence on supply chain resilience. The study recommended that firms in the petroleum industry should implement risk reduction and transfer strategies much more rather than the risk avoidance and acceptance as the latter which show preference to status quo have a negative influence on supply chain resilience. Future studies may focus on drivers for vulnerability in the point of view of product or process value stream, infrastructure or asset dependencies, firm-specific or inter-organizational networks, and influences from natural and social environments that could influence oil product supply chain frameworks.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Supply chain resilience is defined as the ability and tendency to recover operational capability after an event causing disruptions and ability to resist disruptions hence, supply chain resilience consists of the capacity for resistance and recovery capacity which are critical but complementary systems ((Urciuoli *et al.* 2014; Melnyk, Closs, Griffis, Zobel & Macdonald (2015). In recent years, disruptions in the supply chain have greatly impacted the performance of companies (Ho, Zheng, Yildiz & Talluri, 2015). The major supply chain disruptions reported globally in the recent past include the tsunami and earthquake at Japan in 2011, catastrophic Thailand flooding of October 2011, the hazardous chemical spill in Arizona in United States of America in 2013, Typhoon Rammasun in South East Asia in July 2014 and Sea pirates in Yemen and Somalia in 2012 (Osoro 2015; Chopra & Sodhi 2014). Owing to these and other disruptions, building Supply Chain Resilience has been considered as the best way of facing up to disruptions and gaining competitive advantage (Rwakira, 2015).

Supply chain resilience and supply chain risk management are complementary concepts all aimed at developing a supply chain system which can bounce back from undesirable events or risk occurrence irrespective of their cause (Durach, 2015). Risk Management is an approach that entails risk identification, evaluation, measurement and prioritization of risks followed by resource deployment to reduce or eliminate the risk, then monitor and control possibility of occurrence and or the consequences that the risk may cause and enhance achievement of opportunities. Supply chain Risk management's objective is to ensure that uncertainty occurrence in business does not alter, disrupt or deflect business goals endeavors (Antunes *et al.,* 2015; Ndung'u, 2013). Supply Chain Risk Mitigation thus involves taking steps to eliminate or reduce adverse effects to facilitate supply chain resilience. Risk mitigation strategies have been classified into four groups which are risk acceptance, risk avoidance, risk transfer and risk reduction (Herrera, 2013). In creating mitigation strategies

organizations must consider their business profile to ensure that supply chain resilience strategy relates and matches to possible risks (Herrera, 2013). Melnyk *et, al*. (2015) observed that resilience is the most critical object in today's supply chain management thinking and that effective responsiveness and recovery from costly disruptions depends on how organizations understand the concept and where to invest in resilience.

1.1.1 Global Perspective on Supply Chain Resilience

Supply chains and transport networks are the defining factors of international economy which promotes trade, consumption and therefore enhances economic growth (World Economic Forum, 2013). In the last two decades, various trends have been experienced in the management of the supply chain. The current trends in Supply Chain Management include innovation through long-term collaboration, globalization of businesses, increased outsourcing, computer-aided designs, cloud transition, environmental issues and business process re-engineering (Robinson, 2016; Deloitte, 2012). The main focus for these trends include reducing the cost across the supply chain, promote productivity and ensure that demands are fulfilled (Arani, Mukuru, Waigonjo & Musyoka, 2015). However, these trends have made modern supply chains to become even more vulnerable to different disruptions due to political difference, man-made and natural events such as terrorism and earthquakes (Behdani, 2013). British Standards Institute (2015) recorded that the global supply chain lost $33billion as an extra cost in 2015 from uncertainties such as extreme weather, threats of terrorists, crime and migrant crisis.

Ho *et al.* (2015) argued that a significant amount of research and work in supply chain resilience is crucial in enhancing control and mitigating adverse effects which are caused by risk occurrences. Given the continually evolving and expanding complexity and risks associated with global supply chains, building a resilient supply chain is considered to be an ongoing and unending process. Global news agencies continue to emphasize the importance of risk management in the supply chain due to the increased number of risk factors (Tukamuhabwa, Stevenson, Busby & Zorzini,

2015). Companies operating in global markets consider supply chain resilience as a priority for them to survive and thrive in a competitive business environment.

1.1.2 Regional Perspective on Supply Chain Resilience

The African business environment is experiencing fast development and constant changes Cawood (2014). Africa is becoming attractive for multi-nationals and supply chain businesses seeking to diversify and expand to new markets (Cawood, 2014). African market is thorny, very competitive and unstable hence requires substantial knowledge of the cultural diversity, local context and institutional dynamics (Sebitosi, 2015). The type of risks and challenges Africa faces include; globalization and the impact of technology, e-documentation, cost containment pressures due to increased competition, Project bankability/viability and access to funding (Heckroodt, 2016).

In order to address supply chain risks and ensure supply chain resilience, African countries should develop ways which overcome inherent capacity limitations, policy incoherence, inadequate regulatory frameworks, debilitating shortage of capacity and skills, corruption and political instability (Cawood, 2014). Therefore, establishing calculated plans for supply chain risk mitigation and business continuity are critical and mandatory for companies to operate effectively and efficiently (Talluri, Kull, Yildiz & Yoon, 2013).

The existing infrastructure in East Africa region is a hurdle for supply chain efficiency coupled with capacity of the seaports and prevalence of weighbridges, political instability, labor disputes, high corruption; weak communication infrastructure, high crime rates and lack of security, are factors that inject risk of disruption into the supply chain (Berg *et al.,* 2015). In order to fully tap the potential of the East Africa region, in particular, all parties should collaborate broadly in partnerships and investments, knowledge sharing, long term commitments and embracing performance improvement with governments, suppliers, and buyers working together to make sustainable progress to ensure supply chain resilience (Berg *et al.,* 2015).

1.1.3 Local Perspective on Supply Chain Resilience

A study by Arani *et al.* (2015) revealed that economic growth in Kenya is highly vulnerable to external shocks and risks because of regional stability and security, developments in the global economy and weather-related supply shocks. Authorities in Kenya should therefore develop measures and systems to mitigate macroeconomic risks and shocks (Arani *et al.* 2015). Supply chain resilience as a concept remains unexplored in Kenya unlike developed countries (Benjamin, Mark, Jerry & Marta, 2015). Kenya Association of Manufacturers (KAM), (2013) and Barasa (2015), however, noted that firms and authorities in Kenya are increasing adopting supply chain risk management practices to ensure that business operations compete favorably in the dynamic global market.

The challenges faced by many firms in Kenya include high taxation, poor transport network, price volatility, the high cost of raw materials and the high cost of energy thus hinder firms from competing favorably (KAM, 2013). A study carried out by Kimani (2013) on the challenges of supply chain management in Kenya petroleum industry revealed that undesirable occurrences facing the management of supply chain in Kenya were related to one or more components of the supply chain which include equipment, communication, suppliers, transportation, labor and finance. Barasa (2015) observed that efforts made in the study of supply chain management in firms regarding challenges experienced and associated solutions has led to implementation of important concepts in supply chain risk management required to achieve supply chain resilience through improved cost, quality, dependability and flexibility.

1.1.4 Overview of Petroleum Industry

The petroleum industry is one of the largest industries in the world that touches on peoples' everyday lives through access to services such as electricity, transportation, lubricants, heating and manufacture of chemical and petrochemical products (Amponsah & Opei, 2014). Report by OPEC (2016) and World Factbook (2016) indicated that the world consumes a total of 30 billion barrels ($4.8KM^3$) of oil annually where developed nations are the largest consumers.

The industry is divided into three sectors namely upstream, midstream and downstream (Tsegha, 2013). Upstream is involves exploration and production of oil, midstream entails storage, transportation and marketing of petroleum products while downstream deals with the refining of oil, distributors of petroleum products and retail outlets (Tsegha, 2013). The petroleum industry is under continuous change and some of the current trends and developments in the sector include the discovery of new Oil and Gas reserves; Improvement in oil and gas technology and the use of Cleantech aimed at reducing the harmful effects of hydrocarbons (OPEC, 2016).

Kenya is a net importer of oil and petroleum products and deeply relies on imported petroleum products to meet its energy as petroleum is seen as an important source of energy (Deloitte, 2014). In Kenya, the industry mid and downstream structure entails processing and delivery of imported products to the inland either by railway, road and pipeline. Large volumes are transported by pipeline by KPC to various storage facilities including Mombasa, Nairobi, Nakuru, Eldoret and Kisumu (MoEP, 2016). Companies sourcing for petroleum products and operating in Kenya are facing supply chain disruptions, which include natural disasters, logistics process, equipment, and communication and labor union actions. Also, Piracy in the Indian Ocean and the Gulf of Aden has led to shipping delays, increased insurance costs and at times caused fuel shortages in Kenya (Osoro, 2015). To address supply chain disruptions, implementation of risk mitigation strategies and investment in research is important in order to develop resilient and which then ensures scalable production function (Kangogo *et al.,* 2013).

1.2 Statement of the Problem

Global business is surrounded and characterized by a multiple of undesirable events which include manufacturing failures, economic crises, natural disasters, and social conflicts (Guunipero *et al.,* 2015). The supply chain resilience and supply chain risk management primary aim being to identify potential risk events and sources of risk and provide planning actions to mitigate the risks (Branson, Beasley & Hancock, 2014; Arani, *et al.* 2015). Supply chain resilience is defined as systems quality that enables supply chain to withstand shocks both internaly and externally, thus

maintaining normal functioning during the ensuing crises and enhances recovery from risk situation to an acceptable levels (Tesh & Cole, 2016; Giunipero *et al*., 2015; Arani *et al.,* 2015). Risk mitigation strategies have been classified into four types namely risk avoidance, risk acceptance, risk reduction and risk Transfer (Herrera, 2013). Implementation of risk mitigation strategies should be supported by written management control policies, rules and procedures. Good written policies and procedures should be visible, clearly understood by the entire organization and must be monitored, and be reviewed on a continuous basis (Angappa *et al.,* 2017). Ability to reduce supply chain risks means that managers can make their businesses resilient and enhance company's competitive positions and growth (Pettit, Croxton, & Fiksel, 2013).

In spite of the above, petroleum industry supply chain in Kenya is however faced with a lot of disruptions and risk resulting to huge adverse effects to their performance and the economic growth (Suraw & Kariuki, 2018*;* Bahaidar, 2013). Petroleum fuels constitute the primary energy source for commercial use in Kenya and Petroleum accounts for 30% of Kenya's annual imports (MoEP, 2016; Deloitte, 2014). The Kenya Vision 2030 Blueprint recognizes that petroleum forms a large part of commercial energy in the economy. Kenya being a net importer of petroleum products and deeply relies on imported petroleum products to meet its energy needs, requires that managing risks associated with the supply of the petroleum products is key for the country. Risk facing supply chain management in Kenyan petroleum industry and market occur in one or more of the supply chain components which include suppliers, transportation, customers, equipment, communication, labor, and finance (Kimani, 2013). Therefore, disruptions arising in the supply chain have had tremendous adverse effects to petroleum firms in achieving customer satisfaction, profitability, operational efficiency and maintaining quality (Bahaidar, 2013; Osoro 2015).

The role of supply chain resilience in the Kenyan petroleum firms has not been fully explored (Rwakira, 2015). Benjamin *et al.* (2015) also pointed out that supply chain resilience is a critical issue in developing countries, which requires extensive research and study for the future development of the supply chain. According to

Thuo (2015), oil marketing firms experience poor financial performance due to supply chain disruptions. Despite prevailing supply chain risks in the petroleum industry in Kenya, the studies that have been carried out have not been able to determine lasting solutions to disruptions so as to develop supply chain resilience in the petroleum industry in Kenya (Siba & Omwenga, 2015; Mburu, 2015; Kangongo, Bowen Guyo, & Ragui 2013; Thuo, 2015; Bahaidar, 2013; Arani *et al.,* 2015). To address this gap, this study seeks to determine supply chain risk mitigation strategies that influence supply chains resilience in the petroleum industry in Kenya. This study will, therefore, be significant in bridging this gap and thus provide solutions to the petroleum industry.

1.3 Objectives of the Study

1.3.1 General Objectives

The general objective of the study was to determines the influence of risk mitigation strategies on supply chain resilience in the Petroleum Industry in Kenya.

1.3.2 Specific Objectives

1. To determine the influence of Risk Avoidance on Supply Chain Resilience in the Petroleum Industry in Kenya.
2. To establish the influence of Risk Acceptance on Supply Chain Resilience in the Petroleum Industry in Kenya.
3. To determine the influence of Risk Reduction on Supply Chain Resilience in the Petroleum Industry in Kenya.
4. To establish the influence of Risk Transfer on Supply Chain Resilience in Petroleum Industry in Kenya.
5. To examine the moderating effect of Management Control policies, rules and procedures on the influence of risk migration strategies on supply chain resilience in Petroleum Industry in Kenya.

1.4 Research Hypotheses

Ha_1: Risk Avoidance has a positive influence on Supply Chain Resilience in the Petroleum Industry in Kenya.

Ha_2: Risk Acceptance has a positive influence on Supply Chain Resilience in the Petroleum Industry in Kenya.

Ha_3: Risk Reduction has a positive influence on Supply Chain Resilience in the Petroleum Industry in Kenya.

Ha_4: Risk Transfer has a positive influence on Supply Chain Resilience in the Petroleum Industry in Kenya.

Ha_5: Management control policies, rules, and procedures moderates positively the influence of Risk Mitigation Strategies and Supply Chain Resilience in Petroleum Industry in Kenya.

1.5 Justification of the Study

The results of this study prepare the managers to prioritize their supply chain risk mitigation efforts and investments better. The findings of the research are useful to the petroleum firms in providing insights on relevant risk mitigation strategies and the influence of the same to supply chain resilience in the industry. This study is also important to policymakers as it highlights implications of supply chain risk mitigation strategies to enable put up a sustainable and resilient framework of supply chain risk management and to implement effective mitigation measures for continuous monitoring and review based on the dynamic environment in the petroleum industry in Kenya. In addition, the outcome of the research is useful by future scholars with relevant prerequisite data in the area of risk management and specific risk mitigation strategies that influence Supply chain resilience in the petroleum industry in Kenya. The study adds to the body of knowledge in the empirical literature on risk management in the petroleum industry and in that regard informs scholars and academicians on this area for future research.

1.6 The Scope of the Study

The scope of the study was all the licenced Oil Marketing Companies specifically those dealing with import and trading with petroleum products in Kenya. The study objective was to determine risk mitigation strategies that influence supply chain resilience in the Petroleum Industry in Kenya. The geographical focus of this study is Kenya and specifically firms located in Nairobi because many petroleum firms have their headquarters located in the Nairobi. The unit of analysis of this research was the Oil Marketing Companies involved in importation and distribution of petroleum products in Kenya. Unit of observation in this study was the depot Managers and Supply Chain/Logistics Managers.

This study, which was carried out in 2018, focused on the midstream and downstream sector of the petroleum industry in Kenya. Although this research borrows from research conducted and theories in the areas of management of supply chain, supply chain risk management, organisational studies and other general management disciplines, its primary focus was full scope on the four types of risk mitigation strategies found in literature namely risk acceptance, risk avoidance, risk reduction and risk transfer and their influence on supply chain resilience in Petroleum Industry in Kenya.

1.7 Limitations of the study

Soliciting information from respondent was a challenge because data sought sometimes evokes negative feelings, emotions, attitudes, and perceptions yet it was difficult to verify information adequately. This was mitigated through encouraging respondents to provide data without holding back and by assuring them that the information was to be used for research work only and that the report would not contain their names. Also seeking for information from Oil Marketing Companies was perceived to be difficult due to the nature of institutions in maintaining confidentiality making information sharing difficult. This was mitigated through the provision of an introduction letter that assured them on the purpose of the study and how the information sought would be handled.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The chapter reviews past studies relevant to the study on the influence of risk mitigation strategies on supply chain resilience. The focus area is the theoretical and conceptual framework on supply chain resilience and risk mitigation strategies namely risk avoidance, risk acceptance, risk reduction, and risk transfer. The chapter concludes with a critique of the literature reviewed and research gaps.

2.2 Theoretical Framework

Lynham (2002) defined a theory as a set of propositions, assumptions and accepted facts attempting to provide a rational and plausible explanation of cause-and-effect (causal) relationships in and among a group of the observed phenomenon. In this section, several theories were discussed on dependent and independent variables on how they interact with supply chain resilience. The study reviewed the following theories; Complex Adaptive System (CAS) Theory, Network Theory, Contingency Theory, Theory of Constraint (TOC), Resource Dependency Theory (RDT) and Compliance Theory. The dependent variable is supply chain resilience while independent variables are risk avoidance mitigation strategy, risk acceptance mitigation strategy, risk reduction mitigation strategy and risk transfer mitigation strategy. The moderating variable is management control policies, rules, and regulations.

2.2.1 Complex Adaptive System (CAS) Theory

The term Complex Adaptive System (CAS) was developed from complexity theory and was initially applied to living things (Nilsson, 2003; Burnes, 2004). According to Lansing (2003), the study of complex adaptive systems, which is used as a subset of nonlinear dynamical systems, is highly interdisciplinary, gives and attracts insights from the social and natural sciences to develop system-level insights and models that allow for the phase transition, heterogeneous agents and emergent behavior. Miller *et*

al. (2007) study added that their complexity comes from the fact that they are dynamic interaction networks and are adaptive in that there are mutation and self-organization of individuals and collective behavior to correspond to the change-initiating collection of events and micro-events. Holland (1995) defined CAS as a system that emerges, through self-organization and adaptation, into a coherent form over time. Choi *et al*. (2001) argued that the theory tries to introduce a system of the interconnected network of multiple agents or entities adaptively responding to the environment and systems of entities within it. This means the CAS agents can modify or develop different responses to match the nature of the requirements of the environment or other agents (Arani *et al.,* 2015).

According to Day (2014), resilience of supply chain is therefore a collective outcome derived from interaction of different firms working separately or jointly along the supply chain through the application of strategies and rules for survival/fitness that enable firms and supply chain systems to modify operations and adapt to the threats in the supply chain. Tukamuhabwa *et al.* (2015) posits that the high logical fit between the study of supply chain resilience and CAS theory makes resilience inherent to CAS theory. Hearnshaw and Wilson (2013) consider the supply chain as a CAS to be resilient where it can adapt effectively to threats in the environment without violating the system integrity and so attaining better performance levels. A CAS is built by agents and connection of these agents where their connectivity determines dimensionality and complexity of the CAS. While comparing CAS and supply chain, Hearnshaw and Wilson (2013) argued that as it is with CAS, clustering, and connectivity of supply network facilitated by information flows enhance resilience, facilitative opportunistic behavior and facilitate collaboration. The theory is useful to supply chain managers in developing strategies for supply chain risk mitigation such as collaboration with key stakeholders in order to facilitate supply chain resilience in the petroleum industry. Based on the above discussion, this theory, therefore, is relevant to the dependent variable - supply chain resilience.

2.2.2 Network Theory

Idous and Wilson (2000) defined a network as a graph in which edges and nodes have attributes. Network theory is applied in many disciplines including statistical physics, logistics, sociology, engineering, economics, computers science, biology, operations research and climatology (Habibi, 2014; Deng, Lu & Yuan, 2013). Network theory was originated by Rutherford Aris, in 1965). Network theory is considered to describe the relationships in which company's stakeholders such as suppliers, customers or buyer are engaged (Soramaki, 2015).

Under the background of global economic integration, the supply chain system is characterized by a complex network. According to Yongxia (2014) supply chain networks have a very complicated relationship between the members of the chain. While the members are highly independent, they cooperate through financial, material and information flows (Tang, 2013; Wang, 2013). Supply chain resilience is derived from the presence of hub firms and networks (Hearnshaw & Wilson, 2013). Therefore, efficient and resilient supply chain systems resemble or are based on network theory (Hearnshaw & Wilson, 2013). Network theory postulates that firms rely on the extended network of relationships with the supply chain firms in addition to the relationship with direct partners. Tang (2013) added that firms must effectively and efficiently orchestrate their supply chain networks to achieve competitive advantage.

Chichsand *et al.* (2012) argued that the focus of network theory in the supply chain is to develop trust-based long-term relationship with and between supply chain firms in the supply network. The theory focuses on behavioral and social aspects of the relationship which include individual-firm, individual-individual and firm-firm. Network theory provides analysis of these relationships through financial, technical and social perspectives to make sustainability decisions (Chicksand *et al.,* 2012).

Network theory has crucial practical significance in optimizing and managing supply chain network (Yongxia, 2014). This is because the network theory facilitates improved methods of security in the supply chain network and also provides good reference and guidance in effectively constructing supply chain networks to enhance

resilience. Therefore, since the disruptions in Supply Chain Network in extreme cases may lead to the bankruptcy of the Supply chain firms, it is essential for the firms to manage these risks and minimize the possible losses based on this theory. This theory is useful to supply chain managers in developing risk avoidance strategies such as information technology solution and security systems to ensure supply chain resilience in the petroleum industry.

2.2.3 Contingency Theory

According to Johannes (1975), a contingency theory is an organizational theory that holds that there is no best way or approach on how corporation is organized, companies are led, or decisions are made. The theory postulated that managing and doing things in an organization depends on different situations which call for different approaches to manage, solve and handle issues (Arani *et al.,* 2015). Jeong and Nawi (2012) viewed organization and management as an 'open system' embracing challenges and anomalies now and then and which then requires contingent 'adaptable' upon internal or external 'situational' solution in order to solve or overcome the issue or problem concerned. A contingent leader can, therefore, apply his leadership style effectively to the right situation (Gallardo, 2015). The contingency leadership, requires managers to adapt to different leadership styles in order to be able to adapt to the situation using the different styles as the situation may demand. Therefore, contingency theory can be an effective business adaptation when specific challenges emerge and in particular the risk management functions. The theory can be applied in much decision making depending on emerging environmental situations (Dass, Nanda &Wang, 2013; Arani *et al.,* 2015).

The contingency theory is applied in Enterprise Risk Management (ERM) in identifying potential risks, the type of risk that a specific ERM practice addresses and appropriate mitigation measures based on minimum necessary contingency framework under different situations as adopted by organizations (Anette & Kaplan, 2013). According to Kulchmanov, Hassan and Rashid, (2016) the Banking industry may take an active role in establishing prudential regulations to ensure investment in

technology and customer-centric banking operation, human capital and necessary innovation to tackle risk management challenges.

Given that supplier insolvencies majorly contribute to supply chain disruptions, scholars continuously suggest proactive supply chain risk management (SCRM) as a way of reducing their occurrence from a contingency theory perspective (Grötsch, Blome & Schleper, 2013). According to the authors, contingency theory has been useful in establishing that a rational cognitive style, mechanical management control system and good buyer-supplier relationships impact positively on proactively managing supplier insolvency risks. Contingency theory is essential as well as critical to the Kenyan firms because it requires managers to adopt different managerial skills and styles in order to develop appropriate risk acceptance strategies. The theory is useful in developing holistic risk management approaches required to proactively and reactively mitigate risk to acceptable, tolerable levels to enable resilience supply chain. This theory is viewed as appropriate to organizations in developing risk acceptance strategies.

2.2.4 Theory of Constraint (TOC)

The Theory of Constraints was first brought up as a management philosophy in 1984 by Dr. Eliyahu M. Goldratt in the book titled 'The Goal' (Goldratt, 2004). The management philosophy was designed to help businesses to achieve high-performance levels by providing a mechanism for gaining better control of their initiatives. Theory of constraint has been used as an organized way of identifying constraints hindering the success of systems and processess and to effect necessary changes to remove the constraints (Asseman *et al.,* 2014).

Asseman *et al.,* (2014) argued that the rate of goal achievement by a goal-oriented system is always limited by one or more constraints which may be internal or external. A constraint is defined as anything that prevents or hinders the system from achieving its goal (Mathu, 2014). The theory of Constraints (TOC) is therefore taken to be a systematic management approach where organizations focus on actively managing bottlenecks that affect or hinder the progress of the firm towards the goal of maximizing profits and using its resources effectively (Pandit & Naik, 2014).

The TOC considers or enhances capacity management when products flow through a chain of processes. While every step in the process has a specific capacity to take input and produce the product, the theory considers that there is always one process step that hinders throughput for the entire input and output chain which is referred to as 'constraint.' Mathu (2014) explained that the constraints are either physical or non-physical. Application of the theory protects a program, project or activity from disruptions that might happen when the activities on the critical chain are performed (Asseman *et al.,* 2014). Managing risks through the constraints means that risk is dealt with upstream which enhances the vision of the organization by leaving more mental energy to make goals and vision real instead of getting shocks constantly (Asseman *et al.,* 2014). Successful implementation of TOC and management through the theory calls for a holistic approach in all types of establishments such as logistics, operations, warehousing (Mathu, 2014). The Theory of Constraints in the supply chains risk management looks at the issues of collaboration within the value chain and supply chain connectivity.

The most significant benefit of the theory of constraint is to improve the responsiveness of the firm to the changes in the marketplace thus providing a competitive advantage. Application of TOC offers the following benefits; product cost reduction, quality improvement, design improvement, productivity improvement, higher production system flexibility and administrative ease and simplicity (Rahman, 2002). Theory of Constraint is relevant in risk reduction mitigation strategy because it addresses constraints to reduce disruptions or risks in supply chain and consequently to provide a solution in developing appropriate risk reduction strategies for building supply chain resilience.

2.2.5 Resource Dependency Theory (RDT)

Pfeffer and Salancik (1978) originally developed Resource Dependency theory which has been used to study and to explain the impact of the surroundings to organizational relations (Delke, 2015). According to Drees and Heugens (2013), firms establish formal and semiformal links with other firms with the aim of reducing uncertainty and managing dependence which is made possible by structuring their

exchange relationships. Sharif and Yeoh (2014) explained that RDT serves an important role of explaining actions taken by the firms such as the formation of alliances, mergers, and acquisitions, joint ventures and interlocks as they strive to improve organizational legitimacy and autonomy and overcome dependencies. Within a supply chain, forming closer long-term relationships with partners, such as a key or lead suppliers, can be regarded as an option of reducing uncertainty and creating governance mechanisms (Ponomarov, 2012).

Resource Dependence Theory, therefore, views inter-firm governance as a strategic move in responding to conditions of uncertainty and dependence building (Drees & Heugens 2013). Amy, Michael, and Brian (2009) argued that RDT was brought about based on firms' dependency on the environment for resources where they were forced to enact strategies that would allow them to acquire the resources. The resource dependency theory is applied in various aspects about key decision making processes in supply management such as make or buys decisions, sourcing strategies, supplier selections, long term contract and Strategic Business Partnerships (Malatesta & Smith, 2014).

Resource dependency theory is a useful theoretical foundation to improve supply management decisions (Vos & Schiele, 2014). The Resource Dependency Theory is therefore useful to managers in the petroleum industry supply chain in Kenya for developing relationship strategies that ensure supply chain resilience. The theory can be applied to the risk transfer mitigation strategy because supply chain managers can adopt relationship strategies to facilitate risk transfer.

2.2.6 Compliance Theory

According to Etzioni (1975), compliance theory is an approach of structuring organizations by integrating several ideas from participatory and classical management models. Etzioni developed compliance Theory in 1975 as an innovative approach to the organizational structure. According to Etzioni (1975), compliance theory considers that organizations can always be classified by the type of involvement of the participants and the type of power they use to direct the behavior of their members (Etzioni, 1975). As such, Etzioni (1975) identified three types of

organizational power which are utilitarian, coercive and normative, and which relate to types of involvement. Coercive power involves the use of fear and force to control participants at a lower level. Utilitarian power involves the use of extrinsic rewards and remuneration to control lower-level participants while normative power controls participants at the lower-level through the allocation of intrinsic rewards. While used in an organization, each of the three approaches can be used to obtain the cooperation of subordinates in an organization. Lunenburg and Omstein (2012) however, noted that relative effectiveness of the approaches depends on how participants in the organization are involved. Involvement in this theory refers to a person's orientation to an object which is characterized in the form of intensity and direction. Goldish (2011) added that people can be placed in a continuum of involvement which ranges from highly negative to highly positive.

This theory can be used by petroleum industry managers to identify appropriate organization power and type of organizational involvement to implement management control policies effectively, rules and procedures that positively moderate risk mitigation strategies and supply chain resilience.

2.3 Conceptual Framework

A conceptual framework is a model that represents the researcher's understanding of the connection of particular variables and relationship with each other where such relationship can be shown graphically or diagrammatically thus; it identifies the variables required in a research or study (McGaghie, Bordage & Shea, 2015). The conceptual framework variables and constructs were derived from the reviewed theories and empirical literature on the concepts under inquiry. Risk mitigation refers to taking steps to eliminate or reduce exposure to risk or to manage the adverse effects of the risky event (Herrera, 2013).

The study sought to establish how Risk Avoidance, Risk Acceptance, Risk Reduction, and Risk Transfer Influence Supply Chain Resilience. This study also examined the moderating effect of management control policies, rules, and procedures on the relationship between risk migration strategies and supply chain

resilience. The hypothesized constructs and their respective casual paths are illustrated in the following figure 2.1.

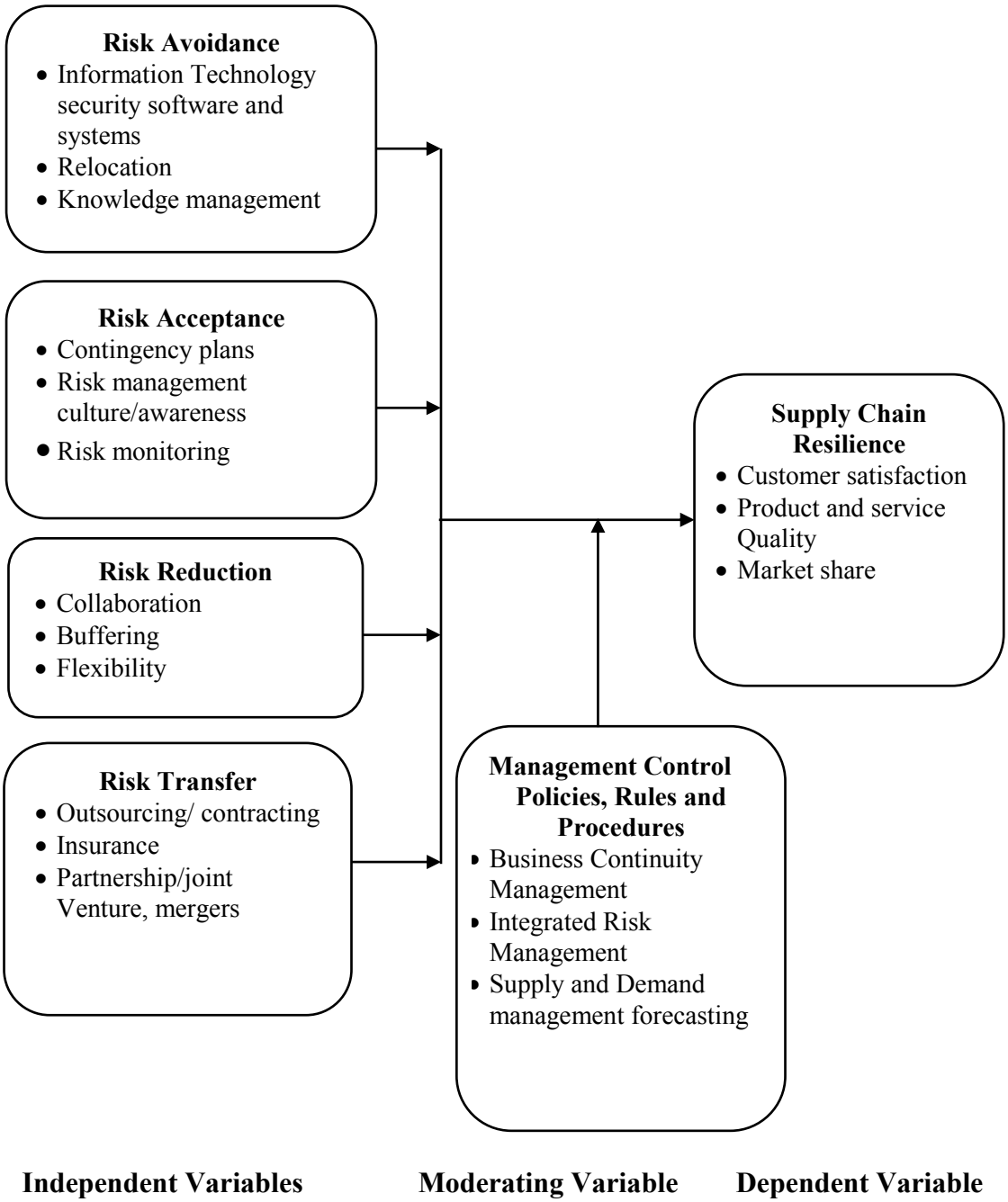


Figure 2.1 Conceptual Framework

2.3.1 Risk Avoidance

Risk avoidance strategy involves eliminating a risk by retracting from a risky event such that the chance of suffering from a loss is reduced to zero through deletion of the risk source (Hajmohammad & Vachon, 2015). Risk avoidance entails altering or shifting an activity so as to eradicate a risk situation and the consequences it may cause hence avoidance can be a prudent strategy if done prudently (Turbide, 2014). According to Behdani (2013) some risk exposure can be so high that even after taking measures to reduce it, some partial exposure remains and the impact can be huge making it appropriate to avoid the risky event completely.

An information technology security system that enhances connectivity for coordinating responses to disruptions is regarded as a preventive tool (Mensah, Merkuryev & Longo, 2015). Supply chain resilience can be enhanced by developing better security and information sharing mechanisms (World Economic Forum, 2013). Information technology security system that aids information and data sharing, pre-programmed responses, scenario modeling and data analytics can significantly improve resilience (World Economic Forum, 2013). Building security involves putting in measures that can help strengthen supply chain resilience by avoiding disruptions like theft, terrorism and counterfeit production infiltrations (Fakoor *et al.,* 2013).

Geographical relocation of business away from risk-prone regions such as earthquakes or insecurity provides the possibility for the business to continue operating in another location (Turbide, 2014). Relocation can also be achieved by avoiding certain products, suppliers, geographical locations and input sources that are seen to be risky (Kwak, 2014). Implementing supplier selection and screening strategy avoid supplier sustainability risk through switching to alternative suppliers who have relatively less risky sustainability score (Hajmohammad & Vachon 2015). Conventionally, organizations evaluate their suppliers on quality, pricing, delivery timeliness, and post-sale services. Due to environmental disasters and associated risks which are on the increase, sustainability has become an essential metric of assessing supply chain resilience (Zohreh *et al.,* 2013).

Knowledge management is important aspect of risk avoidance which entails evaluating the supply chain systems and structures to enable flexibility to any supply chain changes as well as educate other entities to quickly adapt to disruptions and ensure supply chain resilience (Scholten, Sharkey & Fynes, 2014). Knowledge management involves equipping employees through relevant training to ensure that they can communicate both to the downstream and upstream to alert of possible disruptions for action (Machowiak, 2012). Such training programs should ensure workers are thoroughly informed to minimize the probability of occurrence of disruptive abnormities to enhance supply chain resilience (Behdani, 2013). Also, there should be robust response plans which should be checked periodically and modified accordingly (Behdani, 2013). The first objective of this study is to determine the influence of risk avoidance on supply chain resilience in the Petroleum Industry in Kenya.

2.3.2 Risk Acceptance

Risk acceptance is a reactive approach that a risk manager retains the risk without taking no action other than putting contingency plans and budgetary plans to deal with the loss or impacts of such adverse occurrence if it is realized (Sodhi & Tang, 2012). Herrera (2013) indicated that this strategy is employed when the cost of other strategies and measures may outweigh the cost of risk or impact of the risk.

An organization can use risk acceptance strategy by cutting on the budget or avoid spending on other risk mitigation strategies particularly for the risks that are viewed as unlikely to occur (Herrera, 2013). According to Herrera (2013) companies retain some risk exposures if the perceived losses due to the occurrence of the adverse occurrence is way low compared to the returns generated by the project or the business undertakings. Organization employ measures to manage risk exposure by merely monitoring the situation. The main mitigation actions under the risk acceptance mitigation strategy include contingency plans (Sodhi & Tang, 2012), risk awareness and risk monitoring (Herrera, 2013).

Contingency plans have been extensively established in energy companies to enable them to remain resilient in the event of supply chain disruptions (Tech & Cole,

2016). Notably, it is a common practice for successful companies to keep a documented list of the risk exposures commonly known as risk register and possible impacts it could have on the firm and how to deal with the risk situation should it occur. According to Tech and Cole (2016), contingency plans can include documentation of the possible impact to the organization if it lost, for instance, a key supplier. It also entails anticipation of potential events and how such events can impact on the frim and supply chain system (Das & Lashkari, 2015).

Developing excellent risk management culture entails encouraging employees to embrace risk management practices from lowest to the highest level of management and inculcating teamwork (Leat & Revoredo, 2013). Risk management practices include identifying the risks, assessment of the risk exposures, and continuous monitoring of risks in the supply chain frameworks (Behdani, 2013). The continuous risk monitoring makes the process cyclic and helps to avert losses in the pre-disruption phases by identifying emerging new risk areas and how to improve existing risk response plans (Behdani, 2013). The second objective of the study is to establish the influence of Risk Acceptance mitigation strategy on supply chain resilience in the Petroleum Industry in Kenya.

2.3.3 Risk Reduction

Spacey (2015) opine that risk reduction refers to either absolute or relative risk reduction. The risk of disruption can be minimized through reduction of the probability of its occurrence through appropriate actions thus reducing the severity of disruption (Behdani, 2013). Risk Reduction is putting in early steps to minimize the probability of occurrence of an adverse event by preventing its occurrence and is considered as more appropriate rather than trying to repair the impacts of the risky event's occurrence. Risk reduction strategy encompasses both vertical integrations of organizations and redundancy of inventory or capacity (Kwak, 2014). Common risk reduction strategic actions include supply chain collaboration, Buffering, Redundancy and Flexibility (Behdani, 2013).

Supply chain collaboration is one way of attaining risk reduction and it refers to the circumstance when a firm works with many other firms for mutual benefit (Kwak,

2014). Collaboration provides the ability to work effectively with other firms hence increases adaptability in circumstances of turbulence to meet varying requirements within a short time (Pettitt *et al.,* 2013; Arani *et al.* 2015). Collaborating with customers is key for effective demand forecasting which can be achieved by gaining information through an understanding of market perception, trends and risk profiling (Leat & Revoredo, 2013). Strong visibility is achieved through understanding of downstream and upstream inventories, demand and supply forecasting, production conditions and purchase programs (Kwak, 2014). Visibility facilitates trailing and monitoring of supply and demand patterns which ensures relevant actions are undertaken proactively (Deloitte, 2012).

According to Scholten *et al*. (2014) collaboration activities include sharing of information, communication, mutual knowledge platforms and joint efforts help supply chain partners to draw benefits from one another arising from improved speed and flexibility in processes thus enhance supply chain resilience. Common response plans and sharing of resources to modernize the supply chain systems and frameworks is crucial for mutual benefit since no individual player has all the requisite data for resource identification and risk mitigation in the supply chain process (Behdani, 2013).

Buffering or Redundancy is backup abilities or facilities that help to reduce single point failure through bypassing of network blockages (Tech & Cole, 2016). Buffers reduce the possibility of disruptions at downstream activities which ensure maximum revenue and reduced disappointments to customers (Kathryn, Marley, Ward & Hill, 2014). Buffering include provision of extra inventory, backup supplier and overcapacity (Kathryn *et al.,* 2014). Creation of such redundancy strategies is key to ensuring there are spare capacity that can solve shortage problems and can be easily achieved by having spare stocks, extra facilities, and multiple suppliers thus creating supply chain resilience (Saenz & Revilla, 2014; Kristianto *et al.,* 2014). Redundancies strategies can be utilized in the times of demand surges or supply shortages (Wang, Herty & Zhao, 2015). For instance, Elliott *et al.* (2013) indicated that redundancy enhances a firm's flexibility, facilitates higher response rates makes the entity more adaptable in its resource deployment. Buffering therefore help to

reduce or eliminate delays and thus increases supply chain resilience (Elliott *et al.,* 2013).

A critical element of resilience is flexibility which refers to a firm's ability to adapt quickly in response to problems with minimum or without any additional supply chain costs (Delloitte, 2012; Arani *et al.,* 2015). Various literature shows numerous achievements of resilience of the supply chain systems as a result of flexibility (Pettit *et al.,* 2013). The components of flexibility include postponement, having a flexible supply base, various transport means, flexible input arrangements, flexibility from order fulfillment and timeliness from the supplier (Pettit *et al.,* 2013). High flexibility capacity is key for a firm to overcome possible problems of a sudden shift in demand or critical disruption of the supply chain (Wang *et al.,* 2015; Geng, Xiao & Xu, 2014).

Another advantage of flexibility is that it helps a firm to deploy its resources such as labor and transportation appropriately to avert potential losses from supply chain failures (Pettit *et al.,* 2013). The aspect of increasing flexibility relates to a firm's improvement in resilience by being able to adjust to many necessities and demands in a short duration (Azevedo *et al.,* 2013; Arani *et al.,* 2015; Mensah & Merkuryev, 2014). It is important to note that building of a firm's flexibility can be enhanced in similar methods as redundancy (Ambulkar *et al.,* 2015). Flexibility can also be attained through other means like hiring multi-skilled personnel, installation of multipurpose machines and establishment of flexible contractual arrangements (Rwakira, 2015). The third objective of the study is to determine the influence of Risk Reduction mitigation strategy on supply chain resilience in the Petroleum Industry in Kenya.

2.3.4 Risk Transfer

Risk transfer refers to the practice of transferring the risk to another party or transferring the responsibility of the risk management to a third party who is more capable of managing the risk (Alfred, 2013). Risk transfer would imply contractual arrangements or subcontracting of certain activities and the application of this strategy include subscription of insurance against certain risks (Ignacio, 2016). Risk

transfer can take the direction of selling off the responsibility of managing the risk to third parties through outsourcing, hedging and entering into partnerships (Herrera, 2013). For example, some companies outsource some operations like payroll management and customer services management which brings benefits for the company so long as the transferred risky element is not the company's core competence area. It can also be used by a company to enable the firm to focus more on their core competencies (Herrera, 2013). Risk Transfer mitigation strategy includes outsourcing, insurance, and Partnership or joint Venture / mergers (Urciuoli *et al.,* 2014)

A contractual agreement is based on sufficient consideration between two or more competent parties to do or not to do something. A contractual agreement is a legal agreement between a buyer and a seller that defines the terms and conditions of sales. The key objectives are to reduce uncertainty (both in demand and manufacturing cost), help to share risk, incentivize sales efforts and for information sharing (Urciuoli *et al*., 2014). Therefore, it is better to transfer certain risk exposures to third-party firms that are better placed to manage such exposures (Behdani, 2013). Creating appropriate contractual agreements can enable flexibility in supply to minimize shortages and ensure supply chain resilience (Urciuoli *et al.;* 2014).

According to Murigi (2013) insurance firms offer possible platforms of risk transfer to enable firms to be compensated by the insurance firms if a risk event occurs hence evasion of financial losses from risks such as natural disasters. In other words risk transfer gives firms the freedom to engage in core areas of its business to the advantage of the organization since insurance undertake to compensate the firm in case of loss. Reinsurance are used to determine if more data about insured activities or people is required. Reinsurance therefore provide quality assurance to organization that the insurer can underwrite insurance business risks thus ensures supply chain resilience (Courchene & Robert, 2016). According to Dittmann (2014), a hundred percent of supply chain executives surveyed opined that insurance is a useful technique to manage risk. Therefore, organizations ought to work with insurers to mitigate specific exposures through a careful cost-benefit analysis.

Partnerships are another way of transferring risk exposures. Urciuoli *et al.* (2014) argued that good partnerships should have elements of sharing critical information and tasks for mutual benefits. In partnership, individuals combine efforts and resources to create ventures for the benefit of each other. However, even large organizations can combine efforts and resources to undertake some business together for mutual gain through cost reduction in certain product lines for overall profitability (Urciuoli *et al.,* 2014). Oil and gas companies invest in a wide range of partnership, alliances, and joint ventures to facilitate risk sharing to enable resilience (World Economic Forum, 2013). The fourth objective of the study is to determine the influence of Risk Transfer mitigation strategy on supply chain resilience in the Petroleum Industry in Kenya.

2.3.5 Moderating effect of Management Control Policies, Rules and Procedures

Management control is putting in place procedures, rules and policies in place to minimize the risks or to reduce the severity of such losses (Son & Orchard, 2012). Effective organizational controls require supporting infrastructure which is executive led. Strategies to manage Supply Chain Risk should be developed and implemented by organizational policies and procedures and applicable legislative requirements (Angappa *et al.,* 2017). Possible supply chain disruptions can be minimized through higher levels of management control that support the implementation of risk mitigation strategies that influence supply chain resilience which includes business continuity management, integrated risk management and supply and demand management forecasting (Behdani, 2013).

Business Continuity Management (BCM) provides guiding principles and responsibilities for organizations to effectively prepare, manage and achieve supply chain resilience through times of major crisis (Dushie, 2014). Business Continuity Management ensures that the supply chain system maintains appropriate business continuity risk mitigation strategies commensurate with the criticality of its functions. The Business Continuity Management policy, rules, and procedures, therefore, are geared to attaining a robust business continuity program, prevention of disasters and total recovery of business (Dushie, 2014).

The key to attaining resilience in the supply chain has an integrated supply chain management. Rodney and Orr (2015) stated that an integrated risk management system is one that has proactive and systematic steps that are continuously assessed to understand and manage supply chain frameworks for regular communications in the organization. It is about creating a framework that can help the realization of the organization's broad objectives through synergy from all the members. Rodney and Orr (2015) opine that integrated supply chain management is not about just risk mitigation; it includes supporting innovations to realize goals at acceptable risks and costs.

Urciuoli *et al.* (2014) argued that proper demand and supply forecasts are essential for proper planning, pricing and payments and roll-over of products. Responsive supply chain ensures delivery in time, cost reduction, product or service quality and accurate forecasting of data (Rwakira, 2015). It has been viewed that companies that enact policies, procedures and rules that support implementing of setting out different strategies and philosophies, bring continuous improvement, improve supply and demand forecasting, efficiency and supply chain responsiveness (Nyang'au, 2015). Performing companies train their personnel and suppliers as well as customers on better forecasting, responsiveness and continuous improvement for more awareness and enhance supply chain resilience in the entire framework (Nyang'au, 2015). The firth objective of this study is to examine the moderating effect of Management control policies rules and procedures on the relationship between risk mitigation strategies and Supply Chain Resilience in the Petroleum industry in Kenya.

2.3.6 Supply Chain Resilience

Literature agrees that supply chain resilience is concerned with the ability or readiness of a supply chain to respond to and recover from disruptions from supply or demand related issues to attain previous levels or even better ones (Carvalho *et al.,* 2014; Hohenstein *et al.,* 2015). Two factors considered about supply chain resilience is the aspect of agility and robustness. Robustness is the proactive evaluation and anticipation of possible future changes about demand or supply deficits and then

putting measures to maintain a stable situation that is resistant to the forecast changes (Hohenstein *et al.,* 2015). On the other hand, agility aspect refers to the reactive element and deals with building the mechanism to identify the changes as they occur and then reacting with speed and at less cost to get back to the stable situation (Wieland & Wallenburg, 2013; Giunipero *et al.,* 2015).

Companies are currently aware of the need for building resilience to deal with impacts and consequences to companies embedded in the extensive and complex supply chains (Ambulkar *et al.,* 2015). Barasa (2015) noted that a considerable number of empirical papers on supply chain resilience have been undertaken and emphasize on the importance of cost improvement, quality, dependability and flexibility. Many organizations have focused their efforts and resources to achieve those elements in their supply chain (Barasa, 2015). The Petroleum Industry thus must adopt proactive risk approaches to enable a deal with changing risks and vulnerabilities in order to secure supply chain systems resilience (Rajesh, Ravi & Rao, 2014).

The Supply Chain Resilience level is evaluated on the basis of fulfilment of customer requirements to achieve satisfaction, quality of goods and service and market share (Arani *et al.,* 2015). According to Rwakira (2015), building supply chain resilience enables firms to gain competitiveness. Customer satisfaction is the outcome felt by those that have experienced a company's performance that has fulfilled their expectations. The satisfaction of a customer indicates the extent to which the goods or services supplied meets or exceeds their expectation (Inamullah, 2012). However, customer satisfaction is an abstract concept because elements relating to the quality of a food or service, locations, pricing, timeliness, and responsiveness differ across people (Buchanan, 2012). Biljana (2011) noted that most empirical studies link customer satisfaction with profitability because of loyalty, retention and hence assured sales.

Service and product quality refer to the features and characteristics included in a product to make it meet the needed requirements. Onwonga (2013) noted that product and service quality that meets or exceeds the expectation of a consumer

attains customer satisfaction. To sustain and improve competitiveness, organizations should focus on building product quality and quantity. Barasa (2016) stated that studies on the relationship between supply chain quality and firm performance has majorly determined a positive relationship. Therefore, quality of products and services imply availability of comprehensive supply chain quality programs for supply chain efficiency, Investments in infrastructure that supports visibility into the supply chain, the existence of enterprise quality management system or a globally integrated enterprise quality solution to provide quality analytics and reporting (Buchanan, 2012).

Market share refers to a portion of the entire sales potential in a market that an organization controls. It is a crucial indicator of a company's competitiveness in a market (Lopo, Neil & Claes, 2013). It is essential for an organization to aim to enhance its market share. As the market size grows, organizations that can increase their market share are said to be more competitive. Conversely, losers may be looked out of the market (Lopo *et al.,* 2013). Notably, customer satisfaction and market share is a standard measure of firm performance and competitiveness.

2.4 Empirical Review

2.4.1 Risk Avoidance and Supply Chain Resilience

A study by Osoro (2015) on the challenges to supply chain performance in the Petroleum Industries in Kenya found out that both intrinsic and extrinsic variables were predictors of service delivery through supply chain systems. The study noted that while international firms were intensifying competition leading to migration of skilled personnel, the oil companies still relied on personnel for success and sustainability. The study used a survey design, and a census of the registered 73 oil companies was done. The study was obtained through semi-structured questionnaires. The data were analyzed using SPSS to obtain various statistics including descriptive and inferential statistics. The study concluded that current trends such as timeliness forecasting, proactive stock level management, IT, just in time delivery and e-procurement had not been well embraced by the registered oil companies. Further, the study pointed out the need to emphasize the importance of e-

sourcing throughout the supply chain systems to achieve competitiveness in the business markets.

Mensah *et al.* (2015) carried out a study on the role of Information Communication Technology (ICT) in the development of a strategy for supply chain resilience. The authors were concerned about the fact that supply chain has become a global phenomenon making it vulnerable to various risks including terrorism, natural disasters, credit crunches and cyber-attacks. Such disruptions can dampen productivity, profitability, and competitiveness. The study aimed to determine how firms can build supply chain resilience through technological development by incorporating ICT to deal with risk. The study used qualitative methods but also relied on some quantitative secondary data. The study established that strategic tools including lean production, six sigma, flexibility and corporate flexibility were key for supply chain resilience. The findings can help the organizations to deal with their risk exposures for normal operations by getting back to normal operations even after disruptions.

Abolghasemi, Khodakarami, and Tehranifard (2015) conducted a study in which they tried to map supply chain operations risks to Bayesian network to analyze the effects of supply chain risk. The authors used supply chain operations reference (SCOR) to measure supply chain performance amid uncertainty. The authors observed that an increase in uncertainty informs the use of risk mitigation strategies. They analyzed the key factors of supply chain performance as per the SCOR models via diagnostic and predictive capability through Bayesian networks. They determined that Bayesian methods can help in managing supply chain risk to improve the performance of supply chain networks by analyzing the SCOR.

Dehkhoda (2016) carried out a study to develop a framework to help map, prioritize, and engage supply chain networks to manage associated risks. The primary goal of the study was to investigate risk, evaluate risk magnitude and deploy risk management strategies. The objective of the framework was to assist those in charge of making decisions to detect risks, weather, internal or external on time for action. The author developed a generic conceptual risk management framework for risk

verification and control. The author designed a simulation model to detect any uncertainties and to determine the impact of supply chain uncertainties on the performance of firms whereby the company's performance was measured using the lost customers. The author concluded that in order to avoid risk occurrence and to reduce risk impact and likelihood, there was a need to develop a risk management framework.

2.4.2 Risk Acceptance and Supply Chain Resilience

Nyang'au (2016) researched to establish how supply chain risk strategies influence the performance of food and beverage firms in Kenya manufacturing industry. The research found that there is a gap to be filled to enhance continuous improvement of supply chain systems. The research revealed that manufacturing frims focused mainly on implementing different philosophies and strategies in attempts to improve forecasting, improve efficiency, responsiveness, control inventory and eliminate waste. The study found that the efforts made in implementing these philosophies and strategies impacted positively on quality, customer service levels, delivery and operational costs. The study established that it is important for firms to be learning organizations which involves monitoring, controlling and responding to new challenges that have a probability of causing devastating risks on food and beverage manufacturing chains in order to improve supply chain performance. According to Nyang'au (2016), use of control strategies help in increasing knowledge and awareness among employees about risk management plans, testing capacity, reducing time to accomplish a process and incorporating lessons and ways learned from previous tests and actual incidents.

Mburu (2015) undertook research to assess how supply chain performance in Kenyan manufacturing companies is affected by risk identification management strategy. The study was conducted through a cross-section survey adopting a descriptive nature. A total population of 153 respondents was taken through a census approach for the study. Both primary and secondary data were used where primary data were collected through questionnaires administered by the researcher and the assistants. Data collected were analyzed through descriptive statistics and SPSS and presented

through standard deviations, means, percentages, and frequencies. The study found that successful organizations employ risk management strategies for high productivity performance. The research thus requires organizations to identify core competencies and strengths in the market and also manage risk factors across the supply chain. The study further recommended that given the changing nature of markets, enhancing the smooth performance of the supply chain required adequate risk identification, assessment, analysis, awareness, and management.

Kangogo *et al.* (2013) carried out a study on the disruption of the supply chain in the Kenyan floriculture industry where they focused on the Equator Flowers. The study was mainly concerned with the factors that contribute to disruption is supply chain in Eldoret, Kenya. Random sampling and descriptive survey research design were used in the study. The data collection was done using questionnaires. The study established that logistics process design, production function mechanics, labor union actions and natural disasters were the significant factors contributing to the disruption of the supply chain in the floriculture industry. The study recommends that it was necessary to implement comprehensive business continuity plans to eliminate supply chain disruptions. Other strategies recommended include investment is supply chain development research to develop scalable and resilient production function mechanics.

Siba and Omwenga (2015) studied the case of supply chain at Coca Cola Company in Kenya to determine the role of supply chain mitigation strategies on firms in the manufacturing sector. The study aimed at investigating and understanding the supply chain risk mitigation strategies used in Kenyan manufacturing firms. The research used a sample of 83 respondents who include top managers, deputies and staff members in the lower management level. The results were analyzed through descriptive statistical tools such as Micro soft Excel and SPSS that helped researchers to understand and describe the data adequately. The research findings indicated that firms in Kenya experienced supply chain risks in different departments and areas of operations and strategies were therefore required to mitigate the risks. Accordingly, Coca Cola Company focuses on identifying internal and external environment, continual review and monitoring of risks and their treatment,

identification, and assessment of risk and strategizing on supply chain responsiveness as ways of managing supply chain risks.

2.4.3 Risk Reduction and Supply Chain Resilience

Cheng'e (2014) studied the effects of supply chain risk on the performance of Kenya's petroleum industry. The study was done with an intention to investigate the risks factors of supply chain and their effects on the performance of firms in the petroleum industry in the Kenyan context. The study adopted a survey research design. The study targeted 53 licensed petroleum companies as per the Ministry of Energy and Petroleum to import and trade in petroleum products. Stratified random sampling was done, and 47 respondents participated in the survey. Primary data was collected from the target respondents composed of supply chain managers using questionnaires. Inferential and descriptive analysis methods were applied to analyze the study variables. The results indicated that risk mitigation factors applied in the sector include; reviewing petroleum chain infrastructure, extensive consultations, and interaction among industry players, redesign for the customer, construction of more storage facilities and color coding of export petroleum products to curb adulteration.

Urciuoli *et al.* (2014) analyzed the resilience of energy supply chains of oil and gas industry in Europe using multiple case studies. The purpose of the inquiry was to inform on mechanisms employed by the firms in the energy sector to build resilience against possible disruptions by exogenous security threats and then to provide recommendations to the European Union (EU) for further improvement. The study established that energy firms had put in place an assorted number of mitigation strategies including flexible contracting, safety stocks, transport, and capacity plans and portfolio diversification. The main risks feared about by the sampled firms were terrorism, wars and sea piracy. The paper recommended that firms in the energy sector should enhance their strategies by inculcating better communications, coordination, and collaborations with government agencies in relation to foreign politics, minimize dependencies and build robust crisis management.

Murigi (2013) researched on strategies employed to minimize impacts of supply chain interruptions caused by natural disasters. The study used Brookside Dairy

Limited as a case study. The study was informed by the fact that firms face devastating disruptions from catastrophic events making supply chain planning complex. The study identified probable reactive and proactive supply chain strategies to manage the associated risks. The study collected the data through questionnaires which were screened for relevance and accuracy. The study noted that various strategies to manage supply chain risks included maintenance of reasonable buffer stocks, developing robust collaborations with partners, reviewing of supply chain continuity, investment in modern technology for transparency and risk management.

Udbye (2014) carried out a study to evaluate management strategies for various supply chain risks in India. The study focused on operational and sourcing risks it analyzed how frequent, severe, methods of mitigation and expectations and their impact on Indian firms. It sought to determine the frequency, impact, and appropriateness of the strategies employed to manage those risks in mitigating their effects by identifying possible risks before they occur. The scope was the upstream supply chains such as the transport and logistics companies in India. The study employed quantitative methods and empirical study to test the effects and questionnaire was used to collect the data. The study identified inadequacies in logistics and transport facilities, low infrastructure connectivity, labor inadequacies, and bureaucracies were the severer risks than the publicized risks of crime, natural disasters and terrorism.

2.4.4 Risk Transfer and Supply Chain Resilience

Otieno (2013) carried out a study to analyze the strategies applied by oil marketing firms in Kenya to attain a competitive advantage. Out of the 53 oil marketers who were targeted in a census survey 35 responded. The study was carried out through a questionnaire prepared and distributed to the oil marketers. It was established that oil marketers employed broad low-cost strategy, internationalization, vertical integration, outsourcing, and strategic alliances. It was further established that the industry employed alliances as a strategy to enable them to gain operational efficiency as well as access markets that they would otherwise not reach if working alone.

Pereira and Silva (2015) conducted a study on how to enhance the resilience of supply chain from the point of view of buyers and suppliers. The aim was to determine how buyers and suppliers can participate in improving supply chain resilience. A robust literature review was conducted to determine challenges to supply chain resilience. The study used both primary and secondary data. The study established that management supply chain resilience by enhancing three essential areas: the buyer-supplier interface, knowledge acquisitions and decisive risk management practices.

Kwak (2014) carried out a study on risk analysis and mitigation strategies in international container logistics operations. The aim was to investigate risk management strategies employed by such an organization to avert risks and effects of risks for better logistics network. Through focus groups, risk identification, analysis, and clustering were done and data was collected through questionnaires. Critical risk areas including international logistics risk were identified and analyzed. The results found that value streams, logistics activities, information and relationships as well as external environmental constraints were the typical international logistic risks. To mitigate such risks, firms with international engagements should implement strategies like leveraging on logistics information, establishing logistic networks, outsourcing, and collaborations. Logistics networks and collaborations were seen to be most effective in enhancing supply chain resilience.

Kimani (2013) conducted a study to determine the supply chain challenges facing the petroleum industry with National Oil Corporation of Kenya as the case study and the study focused on effectiveness and efficiency of the supply chain networks. The study established that strategic management, outsourcing plans; partnerships and e-procurement were major factors determining the ability to implement effective supply chain resilience in the petroleum sector. Most challenges affecting supply chain resilience in Kenya arose from one or a multiple of the components such as communication, transport, equipment, labor, finance, and buyer and suppliers' failure to perform their part.

2.4.5 Moderating effect of Management Control Policies, Rules and Procedures

Osaro, Zulkipli, and Radzuan (2014) carried out a study that focused on a case of Malaysian pharmaceutical industry to understand and establish a framework to enhance supply chain resilience. The purpose of the study was to investigate the capabilities and vulnerabilities of the supply chain in Malaysian Pharmaceutical manufacturing. This research applied the grounded theory from the managerial perspective. A sample of seven key supply chain personnel from companies with large manufacturing capacities in Malaysia was used as a respondent in the semi-structured interviews. The study found that turbulence, connectivity, external pressures and sensitivity formed supply chain vulnerabilities in the industry. The study also found that adaptability, visibility, reserve capacity, flexibility, and supplier dispersity formed supply chain capabilities. In looking for different risk moderating factors, the study found that adopting the Halal-Toyyiban Assurance had a moderating effect on the vulnerability of the supply chain in Pharmaceutical logistics and also increased supply chain capabilities. The use of Halal was made possible by having Halal-Toyyiban Assurance Pipeline which works as a valued supply chain management system in Malaysian Department of standards enhancing conformance to hygiene standards, nutrition, cleanliness, safety, sanitation, risk exposure, social, environmental and other related aspects as required by Shariah procedures. The study provided a clear understanding of the management of risks in the pharmaceutical supply chain and some critical insight required by decision makers for guiding their principles in policy formulation for pharmaceutical industry global competitiveness.

Ayman, Bader, and Noor (2014) studied how supply chain performance in Jordan is impacted by supply chain management practices. The main purpose of the study was to test how supply chain management practices impact on the performance of the supply chain in terms of supply chain effectiveness and efficiency. Also, the study focused on investigating the moderating factor of competitive intensity on the relationship between supply chain performance and supply chain management practices. A sample of 104 manufacturing companies from Jordan was used for data collection. Hierarchical regression was used for data analysis with the results showing that internal integration, information sharing, and postponement as some of

the supply chain management practices affecting supply chain performance. The study also found that information sharing, internal integration, customer and supplier integration and supply chain efficiency were moderated by competitive intensity.

Brusset and Teller (2017) researched on supply chain capabilities, risks, and resilience. Supply chain resilience in the study is defined as an operational capability that enables broken or disrupted supply chain to redefine, reassess and reconstruct itself to be stronger than before. Dynamic capabilities approach was used to examine resilience grounded on firm's Resource-Based View. The research aimed at providing insight on how to achieve resilience by evaluating and defining the relationship between processes, resources, and practices which a manager has jurisdiction over it. The study used a survey method where the survey was conducted on 171 managers through whom a conceptual model on the relationship between resilience and supply chain capabilities were tested. A test was also conducted to test the relationship supply chain capabilities and the moderating role of supply chain risks. Variance-based structural equation modeling was used which revealed that added resilience was produced through tighter integration between echelons and increased flexibility. Supply chain managers are motivated by the perception of supplier risk to enhance integration capabilities as a moderator thus achieving higher resilience. Overall, the findings support the view that moderating capabilities, routines and resources provide different resilience results depending upon supply chain risk factors.

2.4.6 Supply Chain Resilience

Opata (2015) conducted a study to determine the strategies that can be employed to minimize supply chain risk and enhance supply chain resilience in Pharmaceutical companies in Maryland. The purpose was to determine the strategies employed by supply chain managers to manage such risks in their organizations and borrowed from the contingency theory to develop their conceptual framework. Data were obtained through interviews and select source documents and analyzed through data source triangulation to come up with key themes. The major strategies that were identified included: supply chain design, forecasting, planning, having a multiple

supplier bases, demand management, collaboration with suppliers, monitoring the trends, efficient resource allocation, enterprise resource planning, and supply chain visibility. The implications of those mitigation strategies are reduced costs, increased satisfaction of various stakeholders and better standards of living.

Amponsah and Opei (2014) assessed the major supply chain challenges and the prospects they present to the growth of downstream petroleum industry in Ghana. The concept was premised on the view that growth of the sector is dependent on the effectiveness and efficiency of the consumers in the downstream to receive the value propositions they deserve through the supply chain system. However, that is not the situation. The study used mixed methods to assess the challenges faced by the stakeholders due to supply chain inefficiencies. The data was collected through questionnaires and interviews. The study determined that distribution challenges such as poor infrastructure connectivity slowed product transportation and theft, and those challenges were contributed partly by bureaucracies and delays. The study recommended the improvement of infrastructure and removal of barriers.

Hajmohammad and Vachon (2016) carried out a study on risk avoidance and acceptance mitigation strategies to manage the sustainability of supply chains. It followed theory building approaches to develop a model for supplier risk management. Four risk management strategies were identified: risk avoidance, monitoring, risk acceptance and collaborations to mitigate risk exposures. Collaborative mitigation strategy is also employed for risks perceived to be very high especially when buyer and supplier are highly dependent. Where buyer dominance is high, managers employed monitoring strategy to check for any bottlenecks and take corrective action. In situations when no much dependence between the buyer and supplier, such low-risk situation allows the supplier managers to take no action and accept the risk. Highly risky situations make them to completely avoid risky undertakings.

Rudhumbu (2014) conducted a study to evaluate the levels of understanding of enterprise risk and how it is managed in private institutions of higher learning in Botswana. The primary aim was to determine the understanding and management of

enterprise risk in those institutions. The quantitative research approach was applied and the survey questionnaire was employed data collection tool with convenient sampling being applied to collect the data. The focus was on effectiveness in identifying and managing enterprise risks, more so the implementation of risk management. The study concluded that enterprise risk was poorly managed to leave the institutions exposed to various enterprise risks.

Thuo (2015) conducted a study to determine how the inland transport risks are managed and their effect on the financial performance of Kenya's oil marketing firms. The primary aim was to investigate the role of strategies implemented to manage inland transport risks on the financial performance of the oil marketing firms in Kenya. A descriptive survey design was employed, and a total of 50 oil marketing companies based in Nairobi were targeted. The sample size of 75 respondents was identified through a stratified random sampling method. Primary data was collected through questionnaires. The study determined that there is a positive relationship between risk planning, internal audit, risk identification, the effectiveness of audit plans and portfolio quality on financial performance of oil marketing organizations.

2.5 Critique of the Literature Reviewed

Cheng'e (2014) conducted a study to determine the effect of supply chain risks on the performance of Kenya's petroleum industry. The author recommended the general application of various risk mitigation measures for effectiveness in enhancing supply chain performance. However the author failed to identify specific risk measures for each of the risk factors.

Urciuoli *et al.* (2014) conducted a study to determine the resilience of oil and gas supply chains in Europe. The study established that those firms had put various mechanisms to handle possible disruptions in the supply chain frameworks. Typical external threats feared by the sampled firms included terrorism, wars and sea piracy. They, however, did not have strategies to specially mitigate exogenous security threats to the oil and gas supply chains.

A study by Nyagau (2016) was conducted on control strategies to manage supply chain risks facing financial performance of manufacturing firms in food and beverages in Kenya. The study found out that holding of buffer stock, keeping an extra inventory of strategic items, holding of underutilized capacity, using improved forecasting techniques and regular monitoring of supply chain risks influence supply chain risk strategies on the performance of manufacturing industry. The study did not provide relevant theories to support the variables studied.

Dehkhoda (2016) conducted a study to help in prioritizing, mapping, and engagements for managers to detect both the internal and external risks at early stages. The author pointed out different risk management strategies. However, risk transfer mitigation strategy was not provided in the framework yet it is one of the key mitigation strategy found in the literature.

Otieno (2013) conducted a study to analyze the strategies implemented by Kenya's oil marketing companies in order to gain a competitive advantage. Although the author employed a cross-sectional survey in the research methodology, the author provided neither a conceptual framework nor hypotheses for the study. The conceptual framework is an essential model for depicting the relationships and for informing how the factors relate in a particular study (McGaghie *et al.,* 2015),

Guyo, Kangongo, Bowen and Ragui (2013) conducted a study on risks leading to disruptions in Kenya's floriculture industry. The study established that disruptions in the sector were caused by logistics process design, production mechanism failures, labor union actions, and natural disasters. The study failed to provide suggestions on how the risks causing those disruptions could be addressed to strengthen the industry's supply chain resilience.

2.6 Summary of the Literature Reviewed

The literature from studies indicated that the petroleum industry and other industries comparably face supply chain risks that hinder them from achieving their performance objectives. The literature reviews further revealed various risks that impede supply chain performance namely: natural disasters such as earthquakes,

tsunamis, floods and man-made risks such as procurement risks, transportation risks, inventory risks, terrorism, fire, and cyber risks. The studies provided relevant theories that supply chain managers can use to develop strategies to address petroleum industry supply chain risks. The theories are; Complex Adaptive Systems theory, Network Theory, Contingency Theory, Theory of Constraints, Resource Dependency Theory and Compliance Theory. Supply chain risks can be addressed through the implementation of appropriate risk mitigation strategies. The risk mitigation strategies available in the literature are avoidance, risk acceptance, risk reduction, and risk transfer. Also, the review pointed out various risk mitigation approaches such as supplier evaluation and screening, supply chain collaboration, business continuity plans, supply chain flexibility, buffering, information technology systems and processes, outsourcing, strategies alliance, risk monitoring, training, and awareness. Therefore, to address supply chain risks, application of appropriate risk mitigation strategies is necessary.

2.7 Research Gaps

There is a need for more research on supply chain resilience in the context of developing countries because they constitute a significant size to the global supply chains and have witnessed widespread failures in the past (Transparency International, 2013; British Standards Institute (BSI) 2015; Rwakira, 2015). More crucially, the effects of developing markets supply chain due to a multiple of weaknesses which cause disruptions tend to affect other stakeholders elsewhere in the world (Kim *et al.,* 2015; Levalle & Nof, 2015). That happens because developing countries are either the source of raw material for manufacturing or are the consumers of the outputs from developed markets.

Supply chain resilience in Kenya's petroleum industry, in particular, remains unexplored in the Kenyan context (Rwakira, 2015) and a petroleum master plan for guidance on how petroleum firms should develop strong supply chain resilience is yet to be developed (PwC, 2016). Kenya's Oil industry is somewhat new, in terms of exploration and mining following the discovery of Oil in 2012 by a British firm Tullow Oil. It is imperative that a study on risk management strategies' effectiveness

in the upstream petroleum sector supply chain in Kenya is carried out. The upstream petroleum sector is concerned with the exploration and production of petroleum products.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter provides the methodology approach of the study and it comprises the research philosophy, research design, target population, sample and sampling technique. It also discusses the research instruments adopted in the study, procedures for data collection, pilot study, tests of researcher instrument's validity and reliability as well as data analysis, hypothesis testing and data presentation.

3.2 Research Design

Research design refers to the detailed plan of how a study is to be executed. It includes all the phases of research typical ones being the instrumentation, data collection, analysis and report writing (Creswell, 2014). The current study adopted descriptive and correlation research design. The descriptive design is an approach of carrying research that entails describing the relationships and nature of variables in any context (Creswell, 2014). Through descriptive statistics and methods, the participants were depicted using descriptive statistics which are measures of central tendency. Descriptive designs also help the researcher to describe the relationships between the dependent and independent variables as well as describing the intervening relationships (Choy, 2014). The correlation research design was employed to describe the relationships between two or more sets of factors (Choy, 2014). The descriptive and correlation research design enabled the study to combine both qualitative and quantitative research approaches, which reinforce each other (Zhu, Sarkis & Lai, 2013).

This descriptive and correlation research design was appropriate for this study because the study intended to collect quantitative data for analysis to determine risk mitigation strategies that influence supply chain resilience in the petroleum industry in Kenya. Besides, correlational research was required to determine the nature, extent and direction of relationships between research variables.

3.3 Research Philosophy

Research philosophy is the paradigm upon which a study is situated in relation to the overarching underpinning of how knowledge is acquired and developed (Scotland, 2012). The study adopted the epistemological paradigm research philosophy. Epistemology refers to how best the nature of the world can be investigated (Easterby-Smith *et al.,* 2012). Epistemological assumptions describe the notion of how knowledge can be created, enhanced and transferred (Kotzee, 2013). Epistemological assumptions are crucial in guiding both a scientist and social scientist research and that there are four epistemological positions namely realism, interpretivism, positivism and axiology (Prabash, 2012).

A positivist research paradigm guided this study that preferred the use of empirical tests, which embraces quantitative techniques to develop formal explanations to existing theory (Prabash, 2012). Epistemologists acknowledges at least four general sources or types of knowledge, which include logical, authoritative, intuitive and empirical (Prabash, 2012). This study was based on all four epistemology ways of knowing. The design was linked to epistemological philosophy under the positivist research paradigm where in both cases the data was sourced through authoritative, logical and empirical knowledge. That was appropriate for the current study.

3.4 Target Population

Population refers as a complete number of objects or entities that can be included in a particular study (Zikmund *et al.,* 2012). The target population for this study was the 87 registered Oil Marketing Companies (OMC) licensed by the then Ministry of Energy and Petroleum to import and trade in petroleum products in Kenya. Since the study focused on supply chain petroleum industry, specifically mid and downstream sector in Kenya, the target respondents were the staff across the target population who were mainly involved in supply chain and logistics activities with the necessary knowledge to enable provision of reliable data. Therefore, the target respondents for this study were the Depot Managers and Supply Chain/Logistics Managers.

Unit of analysis refers to the entity under study and in most research studies; the units of analysis are the institutions that comprise the sample (Katri, 2013). The unit of analysis for this study was the registered oil marketing companies (OMC's) licensed to import and trade petroleum products in the petroleum industry in Kenya. Unit of observation refers to the object from which a researcher obtains the data about the unit itself or as representative of the unit of analysis (Sedgwick, 2014). In this study, the unit of observation was key individuals managing supply chain network and with the required knowledge of the industry. The units of observation for this study were the Depot Managers and Supply Chain/Logistics Managers that filled in the questionnaires from various OMC's sampled from the target population.

3.5 Sampling Frame

Sampling frame refers to the collection from which the units of observation can be picked for the study. It includes all the eligible units that can be picked for analysis (Babin & Zikmund, 2012). Therefore, the sampling frame was the list of the entire population that was targeted for the study. In this study, the sampling frame was the 87 Oil Marketing Companies licensed to import and trade in petroleum products in Kenya. Attached as Appendix III is the sampling frame being the list of Oil Marketing Firms.

3.6 Sample Size and Sampling Technique

Sample size refers to the representatives of the population that is picked for inquiry on behalf of the other units in the population. It should contain the attributes of the population and should be a good representation of the population for generalizable results (Arani *et al.,* 2015). This study employed a census survey technique to collect data from the entire population of 87 registered Oil Marketing Companies (OMC) in Kenya. According to Kothari (2004), research should take a significant sample where possible to increase the findings confidence of a researcher. Census Survey Technique was appropriate because it reduces biases in a research since all respondents had an equal chance of participation (Hafizah, 2014).

The target respondents for the study were the Depot Managers and Supply Chain or Logistics Managers. Purposive sampling was adopted to pick the respondents who included the two target respondents (Depot Managers and Supply Chain/Logistics Managers) to provide insights in the study since they are involved in the petroleum supply chain activities and understood the operations of the OMC's. According to Sekaran and Bougie (2010). Purposive sampling entails selection of subjects who can give an advantage to the study being conducted and should be those in possession of requisite information. Therefore the questionnaires were administered to two respondents from each of the 87 Oil Marketing Companies giving a total of 174 target respondents. Table 3.1 provides a total sample size of OMC and total respondents.

Table 3.1: Sample Size for the target population

Number of Oil Marketing Companies	Target respondents from each Oil Marketing Company	Total target respondents (Depot Managers and Supply Chain/Logistics Managers)
87	**2**	**174**

3.7 Data Collection Instruments

Data Collection refers to the specific method that research employs to obtain the data that is needed to answer the research questions for the study (Lawal, 2013). A researcher ought to decide on what data to collect, where to collect it, how to collect it, and whom to assist in collecting the data (Choy, 2014). This study chose to collect the using questionnaires to obtain primary data that can help to answer the study questions. A questionnaire refers to a set of pre-formulated questions about a phenomenon that a respondents fill. It can be closed or open-ended (Saris & Gallhofer, 2014).

The Questionnaire that was used in this study contained both closed and open-ended questions. The closed questions required the respondent to rate the extent to which they agreed with specific statements regarding specific phenomenon by ticking their preferred choice in a Likert-type scale format. Boone and Boone (2012) explain that the Likert scale is a subjective ranking scale in which a respondent is requested to express their liking, agreement or otherwise regarding a specific statement.

Questionnaires were preferred for this study because they provided an opportunity for the researcher to obtain primary information about a phenomenon from diverse respondents within reasonable financial and time efficiency (Boone & Boone, 2012). The questionnaires were administered to target participants involved in supply chain activities and with knowledge on risk mitigation strategies. The target participants were expected to provide adequate data to be able to determine the influence of risk mitigation strategies on supply chain resilience.

3.8 Data Collection Procedures

Data collection procedure refers to the systematic approach of gathering facts about a phenomenon using specific methodologies and precise instruments to meet the goals of the study (Choy, 2014). In this study, questionnaires were used to collect data. A pilot test was first undertaken where questionnaires were administered to a small group of individuals from the target population. After the pilot study, the research instruments were reviewed for validity and reliability before carrying out the study from the entire sampled population. The instrument was accompanied with a letter of introduction from the university. A cover letter was also included to explain to the respondent the purpose for the data collection and to describe to them the research instrument. Anonymity and confidentiality was maintained and the field exercise was conducted with the help of two research assistants with data collection experience. The assistants were trained before the exercise and to ensure efficiency and effectiveness.

Questionnaires were self-administered. The research assistants or/and researcher delivered the instruments to the respondents who were Depot Managers and Supply Chain or Logistics Managers. The respondents were requested to fill the

questionnaires and were then picked after completion. The target participants were Depot Managers and Supply Chain/Logistics managers because they have adequate knowledge about the strategies petroleum firms had employed to create supply chain resilience. The numbers of questionnaires to be sought were 174 given that two respondents from each of the 87 oil marketing firms were targeted.

3.9 Pilot Study

Pilot testing is a survey that is carried out before the actual field work to test the appropriateness of the instrument. It works by trying the instrument out first on a few people before going ahead with a full-blown research study or experiment (Hazzi & Maldaon, 2014). The general practice for pilot studies is to administer the instrument to a small group of representatives who have a similar characteristic with a larger group to be engaged in the actual study (Sidola, Kumar& Kumar, 2012). Pilot testing helps the researcher to fine tune the questionnaire and to ensure the instrument is reliable. It also gives the researcher an opportunity to improve the instrument and to have a feel of what the field work exercise looks like for preparation (Hazzi & Maldaon, 2014).

Mugenda and Mugenda (2003) recommend that the pilot sample be one to ten percent of the sampled population. In this study, the questionnaires were tested on 10 percent of the total target population of 87 which translated to around 10 Oil Marketing Companies. The ten firms that took part in the pilot study were not involved in the actual study.

3.9.1 Reliability of Research Instruments

Reliability analysis of the data collection instruments was tested through Cronbach's alpha. Reliability analysis was done to determine the correlations between the data from various respondents and establish whether each response had a significant relationship with other respondents (Hazzi & Maldaon, 2014). Cronbach alpha is a measure of internal consistency, which is a test of the relationship between items as a group (Eisinga, Grotenhuis & Pelzer, 2013).

Cronbach's alpha is a measure of reliability. It measures the inter-correlations between the items, hence the test is known as the test of internal consistency of a questionnaire (Bryman, 2012). Bryman (2012) opines that Cronbach's alpha indirectly measures the level of correlation between latent constructs which are unidimensional. It is the coefficient that unbiasedly gives the generalizability of the estimates obtained through an instrument (Kinoti, 2013). Cronbach's alpha (α) can be computed using the formula: $\alpha = K / (K - 1) [1- (\Sigma\sigma k2 / \sigma total2)]$, Where K is equal to number of items, $\Sigma\sigma k2$ is the sum of averages scores of the k items, and σ total2 refer variance of scores on the total measurement score's variances (Bryman, 2012). According to DeVellis (2012), a commonly accepted rule to use Cronbach's alpha to describe the internal consistency of an instrument is as follows:

Table 3.2: Cronbach's alpha Internal Consistency Levels

Cronbach's alpha	Internal consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

This study adopted Cronbach's alpha internal consistency level of ≥ 0.7.

3.9.2 Validity of Research Instruments

Validity refers to the level of accuracy of a concept in a quantitative study (Heale & Twycross, 2015). It is the measure of the accuracy in which an instrument measures what it ought to measure. Three types of validity include construct validity, content validity, and criterion validity. Content validity measures the completeness of the instrument by assessing whether it adequately contains all aspects of the variable that should be measured. Construct validity is the test of whether the test scores from the data obtained through the instruments can be used to draw inferences as per the study questions. Criterion validity is about whether the instrument can play in future and

same settings can obtain the same findings. Heale and Twycross (2015) argued that correlations can be employed to test whether the instrument measures the same variables.

This study adopted content validity. Drost (2012) opined that two ways can be employed to test content validity. First, it is to ask the questions to a specific target group and ask similar questions to expert judges. Based on expert views, unclear and confusing statements can be improved while non-important ones are discarded.

3.10 Data Analysis and Presentation

Data analysis is the process of converting raw data into information that can be used to arrive at conclusions. It is the process of applying tools and systems to transform the data to make it have some meaning out of the obtained facts by relating the results to some known judgments and reasoning (Arani *et al.,* 2015).

This study used both qualitative and quantitative data. The data was first cleaned, coded and each concept was categorized accordingly and tabulated in an excel spreadsheet. The data was analyzed through the Statistical Package for Social Sciences (SPSS) version 22 to obtain both inferential and descriptive statistics. SPSS simplifies repetitive tasks and handles large complex data manipulations and analyses hence appropriate for this study. Descriptive statistics were employed to give a descriptive element of analysis of data by obtaining simple summaries such as a measure of central tendency, which include mean, mode and median (Choy, 2014). Data was examined for reliability and validity using Cronbach alpha to establish variables relationship. Inferential statistics including tests of assumptions of regression analysis and correlations were also done. Inferential statistics was carried out to enable determine relationship between independent and dependent variables and for purposes of deriving conclusions whether to reject or fail to reject the study hypotheses.

The data from a Likert scale were analyzed to obtain results for various constructs to describe the ranked data (Boone & Boone, 2012). Likert Scale data analysis provided an understanding of the levels of effectiveness of a particular service and

hence helped to identify areas of improvement more easily. Data presentation was done through tables and figures to visualize the data and make it user friendly in relation to opinions on determinants of risk mitigation strategies that influence supply chain resilience in the petroleum industry in Kenya.

Regression analysis was employed to determine the relationships, the nature, and size of the relationships between the study variables as per the study hypotheses. The linear analysis was carried out in addition to tests of moderating effect of management control policies, rules and procedures on the relationship between risk migration strategies and supply chain resilience in Petroleum Industry in Kenya - X_5. In this study, the regression model to test for the moderation effect is expressed below according to Baron and Kenny (1986). For that purpose, to test the effect of the above variables and the moderation effect, the following regression models were used:

$$Y= \beta_0 + \beta_1 X_1 \times X_5 + \beta_2 X_2 \times X_5 + \beta_3 X_3 \times X_5 + \beta_4 X_4 \times X_5 + \acute{\varepsilon}.$$

Multiple regression analysis was also carried out. Multiple regression analyses the relationship between some predictor variables and a specific dependent variable (Drost, 2012). Multiple regression analysis was done because one single dependent variable that is the Supply Chain Resilience of oil marketing firms in Kenya is presumed to be the function of several independent variables of supply chain risk mitigation strategies namely; Risk Avoidance mitigation strategy X_1; Risk Acceptance mitigation strategy X_2; Risk Reduction mitigation strategy X_3 and Risk Transfer mitigation strategy X_4. The following is the multiple regression model used.

$$Y= \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \acute{\varepsilon}.$$

Where:

Y=Represents the dependent variable; Supply Chain Resilience

B_0 = Constant of Regression (Slope) of the Model; β_1, β_2, β_3, β_4, and β_5 are the regression coefficients

X_1 = Risk Avoidance

X_2 = Risk Acceptance

X_3 =Risk Reduction

X_4= Risk Transfer

$X_{5=}$ Moderating Variables

ε. = Random Error of the Model

3.10.1 Test of Hypotheses

A linear regression model measured all the hypotheses to test the relationship between the dependent and independent variables. Regression models are used to test the hypotheses using the F and t-test statistics. The P value also called significant value is crucial in ascertaining the probability of whether to reject or accept the alternative hypothesis. P values less than alpha value of 0.05 which indicates a 95 percent level of accuracy were used to guide the decision on whether to reject or fail to reject the hypotheses (Hyndman & Athanasopoulos, 2013).

3.10.2 Testing for Linearity

For linear models to be applied, the linearity test is the requirement for the data being analyzed to exhibit linear trends (Matt, Grajales & Kurkiewicz, 2013). Linearity test can be done best by plotting to scatter plots and can also be checked using Q-Q plots and histogram (Paul & Zhang, 2010). However, the correlation coefficient and coefficient of determination can explain the extent to which data fits or is closer to the linear line by explaining variations between the predictor and dependent factor.

3.10.3 Testing for Normality

Normality tests are employed to establish whether the data is normally distributed around a normal curve (Razali & Wah, 2011; Paul & Zhang, 2010). Normality is important for the researcher to determine whether to apply either parametric or non-

parametric statistics to analyze the data (Matt, Grajales & Kurkiewicz, 2013). Normality was tested by analyzing the skewness and kurtosis statistics, QQ Plots and Kolmogorov-Smirnov and Shapiro Wilk test for testing normality in a statistically significant way since the data do not take a large range of different values because it is from Likert Scale type of data (Razali & Wah, 2011; Paul & Zhang, 2010).

3.10.4 Testing for Heteroscedasticity

Heteroscedasticity is the measure of the extent to which the variances of the data set is unequal throughout the data distribution (Matt *et al.,* 2013). When data has unequal variances, it means the data has behaved differently. Regression analysis of such data may have problems because the data behaves differently in its various stages making the model inconsistent (Matt *et al.,* 2013). The methods used to test existence of heteroscedasticity comprise use scatter diagram, Breusch-Pagan and Koenker test statistics, which are the most robust test for heteroscedasticity (Greene, 2012).

This study used both Breusch-Pagan and Koenker test statistics to test the presence of heteroscedasticity. The Breusch-Pagan and Koenker test checks for heteroscedasticity and are considered to be the most robust tests so far in regression analysis. It does this by dividing a data set into two parts or groups and estimates a regression of each subsample and obtain the regression sample variance (Greene, 2012).

3.10.5 Testing for Autocorrelation

Autocorrelation is the measure of the extent to which the data influence its future past counterparts. It is a time series problem whereby data relates with itself making the past data to predict its today's or future equivalents or vice versa. When data relates to itself, models from such data may not be consistent. In such a scenario, the assumptions of the classical Least Squares regression fails and the estimators based on the Least Squares methods are no longer efficient (Hyndman & Athanasopoulos, 2013). This study tested for autocorrelation using the Durbin Watson test.

3.10.6 Testing for Multicollinearity

Multicollinearity refers to a phenomenon in which the independent variables relate to each other (Greene, 2012). In such circumstances, one factor influences the value of the other. The problem becomes more complicated when there are many independent variables like the case for multiple linear regression analysis. High multicollinearity inflates the R and R-Squared making it appear like there is a strong relationship between the independent variables and the dependent variable even though the relationship between the independent variables and the dependent variable is just small (Hyndman & Athanasopoulos, 2013). Greene (2012) indicates that multicollinearity is tested using the Variance Inflation Factor (VIF) and tolerance statistics. In this study multicollinearity was tested using the Variance Inflation Factor (VIF) and tolerance statistics. For data that does not have multicollinearity, tolerance statistics should be less than one, and none of the VIFs should be more than 10 (Greene, 2012).

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSION

4.1 Introduction

The study seeks to determine the influence of risk mitigation strategies on supply chain resilience of the petroleum industry in Kenya. This chapter, therefore, presents the results of the primary data collected by using self-structured questionnaires. Descriptive and inferential statistics were used in the data analysis. The chapter provides the research findings and discussions of the study objectives. First are the results of the response rate, followed by the findings of the pilot study in determining the reliability and validity of the research instruments. The findings of the background information were discussed and the descriptive analysis of the study variables provided. Correlation analysis was carried out to show the strength of the relationship between the independent variables, moderating variable and the dependent variable. Regression analysis was run to determine the kind of relationship between the supply chain resilience and risk mitigation strategies and finally the analysis and discussion on the multiple linear regression models and optimal model.

4.2 Response Rate

The data was collected from 87 registered Oil Marketing Companies (OMC) licensed by the Ministry of Energy and Petroleum to import and trade in petroleum products in Kenya. Given that the target respondents from each of the OMC's were two managers who were depot managers and supply chain/logistics managers, the total target respondents were 174. In this study, the ten firms that were involved during the pilot study were excluded from the final study. According to Bryman (2012); Boone and Boone (2012), the respondents involved during the pilot study should be excluded during the actual study to eliminate biases. That reduced the target firms from 87 to 77 oil marketing companies; thus the target number of respondents also reduced to 154. Of the 77 OMC's, only two declined to participate citing their company's policy as the reason. The response rate for the study is shown in table 4.1.

Table 4.1: Response Rate

Firms/Respondents	Target Population	Completed questionnaire	Response Rate
Oil Marketing Firms	77	75	97.40%
Respondents	154	150	97.40%

From the study results presented in table 4.1, the study obtained 150 questionnaires from 75 oil marketing companies and a response rate of 97.4 percent was obtained. The response rate was suitable for analysis because according to Kothari (2004) a response rate of more than 70% is appropriate. The respondents were depot managers and supply chain/logistics managers who were suitable people with adequate and reliable information for this study.

4.3 Pilot Study Results

The purpose of a pilot study, also referred to as pilot experiment includes the following: to conduct a small scale preliminary study in order to evaluate, feasibility, time, cost and adverse events of the study (Hazzi & Maldaon, 2014). In addition, it helps to test the internal consistency (reliability) of the research instrument and to improve upon the study design before performance of a full-scale research project.

4.3.1 Reliability of the Research Instruments

In testing for the reliability of the questionnaire, Cronbach's alpha was used and the data were analyzed using SPSS version 22. Reliability analysis of the data collection instruments were conducted to determine whether the data gathered on each of the independent variables had a significant relationship in determining supply chain resilience. Cronbach's alpha is a measure of internal consistency; that is, how closely related a set of items are as a group (Eisinga, Grotenhuis & Pelzer, 2013). This study adopted Cronbach's alpha internal consistency level of ≥ 0.7. The pilot study targeted ten companies and two employees in each of the firms who were requested to complete the questionnaire.

The results for the analysis were as shown in table 4.2.

Table 4.2: Cronbach's alpha Internal Consistency Levels for Pilot study

Reliability Statistics				
Cronbach's Alpha		0.787	Number of Items	64
Cases	Valid		20	100.0%
	Excluded[a]		0	.0
	Total		20	100.0%

a. Listwise deletion based on all variables in the procedure.

The results in table 4.2 indicate that 20 research instruments were analyzed to test for reliability (internal consistency) and the obtained Cronbach's Alpha is 0.787. DeVellis (2012), provided the rules of thumb for Cronbach's Alpha values as follows: "> 0.9 is Excellent; > 0.8 is Good; > 0.7 is Acceptable; > 0.6 is Questionable; > 0.5 is Poor; and< 0.5 is Unacceptable". Since the acceptable statistic is 0.7 the responses from the respondents were consistent and hence the results obtained using the instrument is reliable. Since the statistic is above 0.7 that is recommended for achieving reliable results, the instruments were adopted for the actual research undertaking as designed.

According to the findings of the pilot research, there was no cause to worry about feasibility, time, cost and adverse events of the study. From the ten petroleum companies that were sampled and the data collected from 2 respondents from each of the Oil Marketing firms indicated that no significant costs or difficulties could be experienced during the actual data collection. The respondents availed the needed information willingly and all the questionnaires were completed fully. Furthermore, the Cronbach alpha of 0.787 indicated that the variations amongst various despondences were reasonably low as the required threshold is 0.7 as measured using Cronbach alpha (Hazzi & Maldaon, 2014).

4.3.2 The validity of the Research Instrument

The validity of a research instrument refers to the extent to which an instrument measures what it intends to measure accurately. Validity is defined as the extent to which a concept is accurately measured in a quantitative study (Heale & Twycross, 2015). Content, construct, and criterion validities are the three common validities that researchers have to consider. Content validity is the extent to which the items in the instrument adequately represent or measures the content of trait or property that researcher wishes to measure and according to Polit and Beck (2006) involving subject matter, expert opinions is preferred. In this study, expert opinion was sought from the supervisors about the validity of the research instruments. Based on the supervisors' comments, the questionnaires were revised and the ineffective and nonfunctioning questions were discarded.

On the other hand, construct validity refers to the extent to which measurement methods and tools accurately represent what is meant to represent. Construct validity arises because in social science, representative (latent) measures are often used for the case of factors that cannot be observed and measured directly (Heale & Twycross, 2015). Typical methods to assess this type of validity are correlation tests item response theory models and factor analysis. Quite related, criterion validity (both concurrent validity for the case where an instrument is correlated with another one at present and predictive validity where the instrument results are compared with past or future results) can be assessed using correlation tests.

According to McNamara (2006) researchers often use one method that can test the different forms of validity collectively rather than evaluating each type of validity individually. To test the validity of the study instrument and the sample size adequacy, the principal component analysis was conducted on the study results. Principal component analysis is a variable reduction technique to ensure that only the factors that explain much of the variations in construct being measured are used to enhance content and construct validity and it requires that the factors left explains at least 70 percent of the variations (Shirali & Ahmadi, 2017). Table 4.3 shows the

results of principal component analysis after the series of variable reduction iterations to enhance the validity of the measurements.

Table 4.3: Total variance explained

Study Construct	Extraction Sums of Squared Loadings	Determinant
Risk Avoidance	74.363	0.651
Risk Acceptance	73.738	0.672
Risk Reduction	79.410	0.822
Risk Transfer	73.333	0.631
Management Control Policies, Rules and Procedures	78.591	0.707
Supply chain resilience	77.983	0.693

The results in table 4.3 show that extraction sums of squared loadings which represent the total variance explained by the various factors used to measure the constructs for most of the factors were above 70 percent. In addition, the determinant factors for various variables were all above 0.5, which is recommended as the least acceptable determinant statistic for valid representative measurements to accurately measure the latent construct (Bryant & Yarnold, 1995; Shirali & Ahmadi, 2017). According to the results above, reasonably valid measurements of the latent variables was attained from the research instrument that was used.

4.4 Background Information

4.4.1 Job Position versus Work Experience

The target respondents were the depot manager and either the supply chain or logistics manager. Table 4.3 shows a cross-tabulation of the three job title and age of the respondents as well as associated Chi-square test for whether the job position is dependent on the work experience of the respondent. The results in table 4.4 show a Pearson Chi-Square value equal to 30.692 and significant value equal to 0.000 which

is below 0.05 indicating that there is a relationship between experience and positions a person held in the sampled Oil marketing organizations.

Table 4.4: Job Position versus Work Experience

			Years worked in the organization				
Job position of Respondent			**5 years and below**	**6-10 years**	**11-15 years**	**16 years and above**	**Total**
	Logistics manager	Count	6	11	23	3	43
		% within Years worked in the organization	37.5	16.4	44.2	20.0	28.7
	Supply chain manager	Count	6	36	9	1	52
		% within Years worked in the organization	37.5	53.7	17.3	6.7	34.7
	Depot Manager	Count	4	20	20	11	55
		% within Years worked in the organization	25.0	29.9	38.5	73.3	36.7
Total		**Count**	**16**	**67**	**52**	**15**	**150**
		% within Years worked in the organization	100	100	100	100	100
Chi-Square Tests							
			Value	df	Asymp. Sig. (2-sided)		
Pearson Chi-Square			30.692[a]	6	.000		

A quick check of the findings in table 4.4 indicates that the three respondents who were included in the study but slightly more depot managers (36.7 percent) completed the questionnaire while supply chain management and logistics managers were 34.7 and 28.7 percent respectively. Also, 73.3 percent of respondents who had 16 years and above were depot managers. That supports the Chi-square test that job position in the sampled firms depend on experience, which is the number of years they have worked in the company. Therefore, the level of experience is key in this study because the respondents had required understanding of the oil marketing firms to be able to provide reliable data relevant to this study.

4.4.2 Job Position versus Level of Education

The study also sought information about the respondents' level of education. Table 4.5 shows the cross-tabulation of the job position vis-à-vis level of education. In addition, Pearson Chi-square to test whether there is any relationship between job position and level of education. The results in table 4.5 shows that there is no association between level of education and job position in the sampled organizations as indicated by the Pearson Chi-Square of 0.326 which is higher than the alpha value of 0.05.

Table 4.5: Job Position versus Level of Education

			Level of education				
Position of Respondent	Title	% Count	College level	University level	Masters	Other	**Total**
	Logistics manager	Count	1	26	16	0	43
		% within Level of education	100.0	28.6	28.1	0.0	28.7
	Supply chain manager	Count	0	36	16	0	52
		% within Level of education	0.0	39.6	28.1	0.0	34.7
	Depot Manager	Count	0	29	25	1	55
		% within Level of education	0.0	31.9	43.9	100.0	36.7
Total		Count	1	91	57	1	150
		% within Level of education	100	100	100	100	100

Chi-Square Tests			
	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.943[a]	6	.326

The results in table 4.5 suggest that other factors other than education contribute to a person's job position in the sampled firms. Notably, the majority (60.67 percent) of the sampled respondents had a university degree and 38.0 percent had a master's

degree which indicates that 98.67 percent of respondents had at least a university degree and would therefore understand and respond to the issues being discussed. Therefore, based on their experience and level of education, the sampled respondents would be able to respond to the questions asked in the questionnaires.

4.5 Descriptive Analysis of the study Variables

The objective of the descriptive analysis is to provide simple statistical summaries about the observations that have been made on the distribution of results in the study and to provide a meaningful, accurate description of the entire data (Mburu, 2015). Measures of central tendency were used to describe the data scores in terms of average measure, the middle measure and most frequent scores. The statistics that were used include the mean, median, mode, skewness and kurtosis. Mean is the average measure of various data points. The mode is the measure that is most frequently used for certain measurement. Median is the measure that is in the middle when the data is arranged in chronological order. Skewness is a statistic that is used to measure the data's level of symmetry around the mean. Positive skewness shows that the values of symmetry tails extend towards the positive values while the negative skewness shows the skewness towards the negative values. Kurtosis statistic measures whether the measurements are lightly tailed or heavily tailed or just normal. It shows the level of flatness or peakedness of the data set (Kothari, 2004). Kurtosis value that is positive means an elevated peak around the mean and some values on any side tail. Negative kurtosis shows a comparatively plateaued distribution (Kothari, 2004).

This study therefore used mean, median, mode, skewness and kurtosis to present the study findings of the respondents on constructs of the independent variables, moderating variables and dependent variable to determine the extent to which Risk Mitigation Strategies were used to influence supply chain resilience on Oil Marketing Companies in Kenya.

4.5.1 Descriptive Analysis of Risk Avoidance Constructs

According to Zohreh *et al.* (2013); Hajmohammad and Vachon (2015) typical risk avoidance as a supply chain risk mitigation strategy employs information technology solutions, relocation and enhancing knowledge of risk and management of the same. The study sought to determine the extent to which the organization used information technology, office relocation, switching to alternative sources of products and knowledge management strategies to avoid risks strategies. The respondents rated various statements regarding their company's usage of the risk avoidance strategy to manage risk, and the descriptive statistics results were as shown in table 4.6.

The ratings were on a Likert scale of 1-5 where 1 indicated strong disagreement and five strong agreements with the question. A close scan of the mean, median and mode as shown in table 4.6, indicate that majority of the organizations used the information technology, relocation and knowledge management strategies to manage supply chain risk. Since the mean, median and mode for the measurements were above 3 and skewness statistic shows that the measurement was negatively skewed which suggests that the distributions were skewed to the left an indication that they were inclined towards five which was a measurement for strongly agree.

Table 4.6: Descriptive Analysis of Risk Avoidance Constructs

Risk Avoidance Constructs	N Valid	Mean	Median	Mode	Skewness	Kurtosis
Information Technology has enhanced connectivity for quick and coordinating responses to disruptions	150	4.57	5.00	5	-1.788	8.076
Relocating or switching to alternative sources of products, suppliers and/or customers considered risk has increased avoidance of risks from reoccurring in my Company.	150	4.34	4.00	4	-.253	-.650
Knowledge management has increased employee understanding of supply chain structures and ability to easily adopt to disruptions	150	4.50	5.00	5	-.388	-1.063
Knowledge management has increased employee preparedness on plan of action on how to avoid potential risks	150	4.52	5.00	5	-.231	-1.600
Knowledge management had reduced number of supply chain disruption in the organization	150	4.58	5.00	5	-.482	-1.404

4.5.2 Descriptive Analysis of Risk Acceptance constructs

As per the works of Herrera (2013), Das and Lashkari (2015) and Tech and Cole (2016) some organizations merely accept the risk and prepare to deal with the outcomes. According to those typical literature techniques employed when a firm takes risk acceptance includes developing contingency plans, risk management culture/awareness and risk monitoring. Respondents rated their organization's usage of the supply chain risk acceptance mitigation strategies namely; contingency plans,

risk management culture/awareness, and risk monitoring. Table 4.7 shows the descriptive statistics for their ratings.

The results indicate that the mean, median and mode statistics were above 4. In addition, the skewness statistics indicate that the ratings were negatively skewed which indicate that the ratings for the constructs were inclined towards five, which represented strongly agree. To that extent, the results indicate that the organizations used the supply chain risk acceptance mitigation strategies namely; contingency plans, risk management culture/awareness, and risk monitoring.

Table 4.7: Descriptive Analysis of Risk Acceptance constructs

Risk Acceptance constructs	N Valid	Mean	Median	Mode	Skewness	Kurtosis
Contingency Plans has enhanced preparedness in dealing with unanticipated potential risk events.	150	4.58	5.00	5	-.327	-1.919
Contingency plans has reduced risk impacts in the organization	150	4.57	5.00	5	-.300	-1.936
Risk culture, awareness/mainstreaming had embraced supply chain risk management in the organization	150	4.55	5.00	5	-.368	-1.511
Risk awareness had reduced risk impact due to employee understanding of specific risks inherent in specific functions	150	4.53	5.00	5	-.135	-2.009
Risk Monitoring has improved risk response plans in the organization	150	4.52	5.00	5	-.081	-2.021
Risk monitoring has increased level of implementation of risk improvement plans in the organization	150	4.65	5.00	5	-.651	-1.598

4.5.3 Descriptive Analysis of Risk Reduction constructs

Behdani (2013), Kwak (2014) and Tech and Cole (2016) opine that some organizations use supply chain risk reduction strategies that include collaboration, buffering and flexibility. The respondents rated their usage of supply chain risk reduction mitigation strategies such as collaboration, buffering and flexibility and the descriptive statistics are as shown in table 4.8.

The results in table 4.8 indicate that most of the respondents rated agree on which was represented by a rating of 4 as indicated by the mode. Furthermore, the median and mean statistics were 4, and the data were negatively skewed towards 5 which indicate that the ratings for the constructs represented strongly agree. Furthermore, going by the mean, median and mode, the respondents agreed on the usefulness of the risk reduction strategies.

Table 4.8: Descriptive Analysis of Risk Reduction constructs

Risk Reduction constructs	N Valid	Mean	Median	Mode	Skewness	Kurtosis
Supply Chain Collaboration has increased prompt adoptability during turbulence	150	4.26	4.00	4	-.239	.876
Collaboration has increased visibility and velocity through communication across supply chains	150	3.83	4.00	4	.287	-1.190
Collaboration has increased collective response planning and resource sharing	150	3.93	4.00	4	.089	-.794
Buffering has reduced supply shortages failures and increased ability and capacity to cope quickly in response to problems	150	4.07	4.00	4	-.361	.428
Buffering has reduced demand supply surges through strategic and selective use of spare capacity, inventory and adoptable deployment of resources.	150	4.02	4.00	4	-.029	-.991
Flexibility has increased quickly response to problems through flexible arrangements such as flexible transportation, flexible labor arrangements and order fulfilment flexibility	150	4.30	4.00	4	-.543	.021
Flexibility has reduced time and effort in changing certain requirements to adopt and respond to supply chain risks	150	4.35	4.00	4	.651	-1.598

4.5.4 Descriptive Analysis of Risk Transfer Constructs

Herrera (2013), Urciuoli *et al.* (2014) and Ignacio (2016) indicate that organization use risk transfer strategies such as insurance, outsourcing or sub-contracting, partnerships, joint venture, and mergers. The aim is to allow third parties to shoulder the risk or to share in the risk exposure. The respondents were asked to rate their company's usage and effectiveness of supply chain risk transfer mitigation strategies such outsourcing/contracting, insurance and reinsurance and partnership/mergers/ joint ventures and the results were as shown in table 4.9.

Table 4.9: Descriptive Analysis of Risk Transfer Constructs

Risk Transfer Constructs	N Valid	Mean	Median	Mode	Skewness	Kurtosis
Creation of contraction agreements with suppliers has increased supplier service delivery and reliability.	150	4.48	4.00	4	.081	-2.021
Outsourcing/contracting to third parties has reduced many non- core functional responsibilities from the organization.	150	4.45	4.00	4	-.205	-1.153
Outsourcing has increased organizational focus through reallocation of more resources to its core competencies.	150	3.47	3.00	3	.273	-.229
Insurance has increased organization capacity to manage risks of losses.	150	4.82	5.00	5	-1.683	.843
Insurance has enhanced company's disaster management capabilities during disruptions	150	4.82	5.00	5	-1.991	2.903
Partnership/mergers/Joint Ventures has reduced organizational risks because of segregation of various functionalities among parties.	150	4.30	4.00	4	-.181	.983
There is an increased competency in key segregated functions in the organization through Partnership/mergers/Joint Ventures	150	4.42	4.00	4	.039	-1.356

According to the results in the table 4.9, the mean, median and mode for the various ratings, the respondents' ratings were skewed towards 4 and 5 because majority of the ratings as indicated by the mode and median were 4 and 5 apart from the construct asking the extent to which outsourcing had increased organizational focus through reallocation of more resources to its core competencies which received a low rating. Also, the mean for the ratings for various questions was above four which indicate that the respondents agreed with the questions regarding usage of risk transfer strategies and its influence on the supply chain risk management framework in their organization.

4.5.5 Descriptive Analysis of Management Control Policies, Rules, and Regulations

According to Ayman *et al.* (2014), Osaro *et al*. (2014); Brusset and Teller (2017) management control policies, rules and regulations help organizations to achieve business continuity management, integrated risk management framework and to enhance supply and demand forecasting efficiency. The respondents rated the effectiveness of their management control policies, rules and procedures about business continuity, integrated risk management and supply and demand forecasting and the findings were as shown in table 4.10.

According to the results the mean, median and mode, the respondents agreed that the integrated risk management had enhanced continuous, proactive and communicate risk from an organization-wide perspective and the supply and demand management forecasts had reduced wastages and enhanced accurate forecasting of data. In addition, supply and demand management forecasts had reduced delivery times and improved product or service quality. However, the ratings for the constructs regarding business continuity management for this variable was rather low suggesting that the respondent's low trust in the business continuity management strategies by their firm.

Table 4.10: Descriptive Analysis of Management Control Policies, Rules and Regulations

Management Control Policies	N Valid	Mean	Median	Mode	Skewness	Kurtosis
Business Continuity Management help identify potential threats and appropriate mitigation strategies for building supply chain resilience	150	3.37	3.00	3	-.089	-.285
Business Continuity Management enhances timely resumption and delivery of essential business activities in the event of business disruption.	150	3.21	3.00	3	.337	-.222
Integrated risk management does not focus only on mitigation of risks, but also supports activities that foster innovation in the organization	150	3.81	4.00	4	.126	-.451
Integrated risk management enhances continuous, proactive and communicate risk from an organization-wide perspective	150	4.42	4.00	4	-.406	-.714
Supply and Demand management forecasts has reduced waste and provided accurate forecasting of data.	150	4.63	5.00	5	-.559	-1.711
Supply and Demand management forecasts has reduced delivery in time, and improved product or service quality	150	4.63	5.00	5	-.529	-1.744

4.5.6 Descriptive Analysis of Supply Chain Resilience Construct

Amponsah and Opei, (2014), Hajmohammad and Vachon (2016) and Opata (2015) opine that appropriate supply chain risk management strategies ought to realize resilient supply chain that is robust and withstands adverse fluctuations in the market. More importantly, resilient supply chain should enhance the performance of a company in terms of customer service satisfaction, quality of products and services and market share. The respondents rated various constructs about the performance of the firms in terms of customer service satisfaction, quality of products and services and market share and the results were as shown in table 4.11. The findings in table 4.11 indicate that the median and mode for all the ratings were 4 and the mean rating was above 4, which indicates that the respondents agreed with the statements regarding their organization's customer service satisfaction, products and services quality and market share improvement.

Table 4.11: Descriptive Analysis of Supply Chain Resilience Construct

Supply chain Resilience Constructs	N Valid	Mean	Median	Mode	Skewness	Kurtosis
Customer retention rate has increased in the Company	150	4.29	4.00	4	.585	-.761
Customer acquisition rate has improved in the organization	150	4.01	4.00	4	-.010	-1.098
There has been increased number of referral for our company's products	150	4.38	4.00	4	-.481	.610
Number of failures or reject rates have reduced in my company	150	4.37	4.00	4	.223	-1.254
Number of product returned by our clients have reduced	150	4.41	4.00	4	-.536	.660
Number of customer complaints have gone down in our company	150	4.42	4.00	4	-.660	.583
Total sales volume have improved in my organization	150	4.43	4.00	4	.272	-1.952
The demand for our products and services have increased in the company	150	4.44	4.00	4	.244	-1.967
Market share rates have increased in my company	150	4.49	4.00	4	.027	-2.026

In order to empirically confirm whether it is the risk management strategies that had influenced the supply chain resilience as indicated in the results of respondents in tables 4.7,4.8, 4.9 4.10 and 4.11, a regression analysis was carried out in the subsequent sections after the data were tested for adherence to assumptions of regression.

4.6 Diagnostic Tests

Research methodology literature by Choy (2014) and Bryman (2012) indicate that data should be tested for adherence to assumptions of regression analysis before actual such modeling can be applied. Diagnostics tests are used to evaluate the model assumptions and investigate whether or not there are observations with a large and which may have undue influence on the analysis. The four assumptions of regression techniques include linearity, normality, homoscedasticity and absence of both multicollinearity and autocorrelation. If a data fail tests for those assumptions, transformation into other forms like logarithm and inverse form can be done, or the regression analysis could be done using the square of errors for the data.

4.6.1 Test for Linearity

The purpose of testing for linearity is to determine whether the relationship between the independent and dependent variables are linear and to check for outliers since linear regression is sensitive to outlier effects. An outlier refers to as an item with outsized residual meaning that the item value for the point is unique from that expected by the regression model (Matt, Grajales & Kurkiewicz, 2013). Linearity test is the requirement for the data being analyzed to exhibit as a straight line. Test for linearity was assessed using normality Q-Q plots (Paul & Zhang), correlation coefficient and coefficient of determination (R and R-Square).

According to the Q-Q plots shown in Appendices labeled IV to IX the plot for individual data sets show that they are all upward slopping apart from some outliers. That suggests that the data sets follow linear curve. Further, as indicated by the correlation coefficient (R) there is a positive linear relationship between predictor variables: Risk Transfer, Risk Acceptance, Risk Reduction, Risk Avoidance and

supply chain resilience. The causation as shown by the coefficient of determination (R-Square) which suggests that the four predictors account for a .088 variations in the supply chain resilience. Hence, other factors not included in the model are responsible for higher causation in the supply chain resilience. However, the significant coefficients still represent the mean change in the response for one unit of change in the predictor variables regardless of the R-squared size (Cameron & Windmeijer, 1996; Yarkoni & Westfall, 2017). Therefore, even when R-squared is low, low P values still denote an actual relationship between the significant predictors and the response variable (Shokrya, 2014)

The results for the R and R-Square are shown in table 4.12.

Table 4.12: Linearity Test

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.297[a]	.088	.063	.14568

a. Predictors: (Constant), Risk Transfer, Risk Acceptance, Risk Reduction, Risk Avoidance

4.6.2 Normality Test

Normality is essential in understanding the nature of the distribution and assists to foresee dependent variables data (Matt, Grajales & Kurkiewicz, 2013). The variables were tested for normality to determine if the data were generally distributed because if not, then there would be problems in subsequent statistical analysis. Normality tests are applied to establish if scores are correctly modeled by a normal distribution and to figure out how likely it is for a random variable causing the data set to be generally distributed (Razali & Wah 2011; Paul & Zhang, 2010).

Normality tests were carried out using Kolmogorov-Smirnov (K-S) and Shapiro Wilk (S-W) and QQ plot. Kolmogorov-Smirnov (K-S) and Shapiro Wilk (S-W) are the most common normality test procedures (Razali & Wah, 2011). The rule is that if the significant value of the K-S and S-W Test is more than *p value* 0.05, the data is

normal. If it is below 0.05, the data significantly deviate from a normal distribution (Razali & Wah, 2011). Table 4.13 shows the test for normality using K-S and S-W statistics.

Table 4.13: Test for Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Risk Avoidance	.088	150	.007	.973	150	.005
Risk Acceptance	.221	150	.000	.877	150	.000
Risk Reduction	.173	150	.000	.943	150	.000
Risk Transfer	.182	150	.000	.912	150	.000
Management Control, Policies, rules and Procedures	.138	150	.000	.960	150	.000
Supply Chain Resilience	.143	150	.000	.956	150	.000
a. Lilliefors Significance Correction						

The test for normality in table 4.13 shows that the data are not normally distributed because the significant values for both K-S and S-W tests are less than the alpha of 0.05. Therefore, according to K-S and S-W statistical test of normality shows that the data sets are indeed not normally distributed.

Although it is not explicitly required that the data be normally distributed for it to be analyzed (Ghasemi & Zahediasi, 2012) further test using QQ plot was applied. The normal Q-Q plots for each of the study variables shown in appendices VI to IX shows that the data sets almost normally distributed apart from some outliers. The theoretical quantile line of the data is fitted and from the normal QQ plot, it implies that the actual values versus the anticipated normal values are randomly distributed along the line of the best fit hence the dependent variable is normally distributed as shown in Figure 4.1

Normal QQ Plot of Supply Chain Resilience

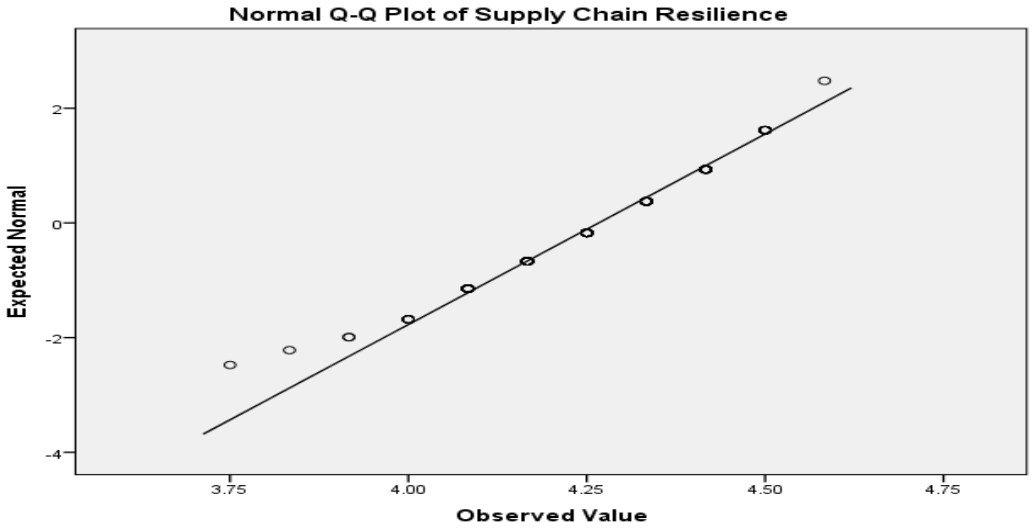


Figure 4.1: Normal QQ plot of supply chain resilience

4.6.3 Test for Heteroscedasticity

In regression analysis, it is a good characteristic for the data to have normal variances, else increasing, or decreasing variances indicates the possibility of the presence of autocorrelation and the results from data which does not have equal variances may lead to wrong conclusions. Heteroscedasticity is a situation in which the variations of a variable is unequal throughout the data distribution (Matt *et al.,* 2013). The test for heteroscedasticity for the data was done using Breusch-Pagan (BP) and Koenker test statistics. The rule is if the significant value of the BP and Koenker Test are greater than 0.05, the data has no heteroscedasticity. The results of the Breusch-Pagan (BP) and Koenker test displayed in table 4.14.

Table 4.14: Breusch-Pagan and Koenker test statistics

Breusch-Pagan and Koenker test statistics and sig-values		
	LM	Sig
BP	6.931	.140
Koenker	7.315	.120

The significant values for both Breusch-Pagan and Koenker test statistics (0.140 and 0.120) are larger than 0.05, which indicate that there is no heteroscedasticity meaning that the data sets have equal variances according to the robust tests for homoscedasticity.

4.6.4 Test for Multicollinearity

In multiple regressions, multicollinearity is a setback when independent variables are highly correlated with one or more of the other independent variables (Hyndman & Athanasopoulos, 2013). Sets of data are said to have multicollinearity when the predictor variables are related and hence influence each other. That is not required because multicollinearity inflates the associated R and R-Square. Presence of multicollinearity was tested using tolerance statistic and Variance Inflation Factor (VIF). The rule is Tolerance Statistics for all the variables must be less than 1 and VIF should not be larger than ten means the absence of multicollinearity in data (Hyndman & Athanasopoulos, 2013). The results were as shown in table 4.15.

Table 4.15: Test for Multicollinearity

Model		Collinearity Statistics	
		Tolerance	**VIF**
1	Risk Avoidance	.900	1.112
	Risk Acceptance	.989	1.011
	Risk Reduction	.911	1.098
	Risk Transfer	.952	1.051

a. Dependent Variable: Supply Chain Resilience

The findings in table 4.15 show that the data has no problem of multicollinearity since the tolerance statistics for all the variables are less than 1 and all the Variance Inflator Factors (VIFs) are small; none of them are more significant than 10 implying no evidence of multicollinearity in the data.

4.6.5 Autocorrelation Test

A data is said to be auto-correlated when the data relates with its past counterpart and hence is caused by its former data, or it influences its future values. Autocorrelation test is a statistical tool that provide an understanding of replicating patterns in time series data and is applied to enable the identification of model trends (Zhiyong, 2017). Durbin-Watson (D-W) statistic is often used to check whether the data has autocorrelation. In other words, D-W test is used to check serial correlation among variables. The D-W test measures whether the data has autocorrelation by testing the sum of squares of variances to determine if they exhibit time autocorrelation tendencies. The rule is D-W test ranges between zero and four and both extremes indicate the presence of autocorrelation. Between 1.5 and 2.5 there are no fears of the possibility of autocorrelation (Zhiyong, 2017). The results for the test are shown in table 4.16.

Table 4.16: Test for Autocorrelation

Model	Durbin-Watson
1	1.685[a]

a. Predictors: (Constant), Risk Transfer, Risk Acceptance, Risk Reduction, Risk Avoidance

b. Dependent Variable: Supply Chain Resilience

The study results in table 4.16 indicate that there is no autocorrelation in the data for the study variables because the D-W is 1.685. Therefore, the test statistic of 1.685 is within the safe area of 1.5 to 2.5; hence no presence of autocorrelation (Azad, 2017).

4.7 Inferential Tests

Inferential statistics attempts to create conclusions that reach beyond data observed and involves data analysis to understand properties that cause probability distribution (Choy, 2014). Inferential statistical analysis covers properties of a population, comprising testing hypotheses and calculating estimates. In this study, correlation and regression tests have been used to test the data.

4.7.1 Correlation Tests

Correlation is a tool of measuring a possible two-way linear relationship between two continuous variables (Mukaka, 2012). Correlation is calculated by a value called the correlation coefficient representing the intensity of linear relationship between the variables and the values range from −1 to +1. A correlation coefficient denoted by zero value means there is no linear relationship between two continuous variables and a perfect linear relationship is given by correlation coefficient of −1 or +1. Intensity of association is between −1 and +1. Correlation coefficient that comes closer to ±1 indicates a stronger the correlation. A positive coefficient shows that the variables are directly related and where a coefficient is a negative number, the variables are inversely related (Mukaka, 2012).

To determine the correlations between the study variables, a two-tailed Pearson correlation test was run and the results were as shown in table 4.17. Pearson correlation coefficient shows the intensity of a linear relationship between variables and the correlation coefficient can be tested for statistical significance using probability measure of 0.05. This procedure also assumes that the correlated variables are normally distributed and that the relationship between the two variables approximates a linear one (Mukaka, 2012).

Correlation analysis for Variables

According to the correlation statistics shown in table 4.17, the variables have medium to low correlations. For instance, the correlation between risk avoidance and risk acceptance practices is merely 0.061 and their relationship is not statistically significant because the P value is greater than 0.05. Also, the correlation between risk avoidance and risk reduction is 0.273 and it is statistically significant at 0.001 level of significance. Similarly, the correlation between risk avoidance and risk transfer is 0.197 and it is statistically significant at 0.016 significant levels while the correlation between risk avoidance and Management Control, Policies, rules and Procedures is 0.181 is statistically significant at 0.027 level of significant.

Additionally, Risk avoidance is statistically insignificant and negative relationship with supply chain resilience. This is indicated by data under consideration which had P=0.526 which is greater than p value 0.05. The weak negative relationship is represented by correlation coefficient of -052 and the number of respondent was 150.

Correlation between risk acceptance and risk reduction practices is positive and statistically insignificant relationship as it is represented by 0.096 and statistically insignificant at 0.244 level of significance. Similarly, Risk acceptance and risk transfer has a positive correlation coefficient of 0.035 with statistically insignificant level of 0.675. Further the relationship between risk acceptance and moderating variable (management control, policies, rules and procedures) is positive at correlation coefficient of 0.155 and statistically insignificant at 0.058 level of significance. In addition, the correlation statistics revealed that Risk acceptance has a weak negative and insignificant relationship with supply chain resilience at P value of 0.912 and correlation coefficient of -0.009. This means that a unit change in risk acceptance result to small negative change on supply chain resilience by negative 0.009. The statistically insignificant relationship is represented by p value of 0.912. The threshold of statistically significant relationship requires data under consideration to have p values <0.05.

The correlation analysis of risk reduction and risk transfer has a positive and statistically insignificant relationship. This is represented by correlation coefficient of 0.147 and insignificant level of 0.072 being >0.05. Risk reduction and management control polices, rules and procedures has positive relationship at a correlation coefficient of 0.143 and statistically insignificant at 0.082 being > 0.05. The study also established that Risk reduction has positive and statistically significant relationship with supply chain resilience at P value of 0.032 and correlation coefficient of 0.175.

Further, Risk Transfer and management control policies, rules and procedures has a positive and statistically insignificant relationship. This is because of the positive correlation coefficient of 0.131 and 0.109 significant level, which is greater than the threshold of > 0.05. In addition, the correlation analysis showed that Risk Transfer

has positive and statistically significant relationship with Supply chain resilience as denoted be a positive correlation coefficient of 0.219 and p value of 0.007. The correlation analysis also disclosed that Management control, policies rules and procedures has positive and significant relationship with Supply chain resilience as per the positive correlation coefficient of 0.192 and p value of 0.019 which is less than 0.05.

Table 4.17: Pearson Correlation Tests

		Risk Avoidance	Risk Acceptance	Risk Reduction	Risk Transfer	Management Control, Policies, rules and Procedures	Supply Chain Res.
Risk Avoidance	Pearson Correlation	1	.061	.273**	.197*	.181*	-.052
	Sig. (2-tailed)		.461	.001	.016	.027	.526
	N	150	150	150	150	150	150
Risk Acceptance	Pearson Correlation	.061	1	.096	.035	.155	-.009
	Sig. (2-tailed)	.461		.244	.675	.058	.912
	N	150	150	150	150	150	150
Risk Reduction	Pearson Correlation	.273**	.096	1	.147	.143	.175*
	Sig. (2-tailed)	.001	.244		.072	.082	.032
	N	150	150	150	150	150	150
Risk Transfer	Pearson Correlation	.197*	.035	.147	1	.131	.219**
	Sig. (2-tailed)	.016	.675	.072		.109	.007
	N	150	150	150	150	150	150
Management Control, Policies, rules and Procedures	Pearson Correlation	.181*	.155	.143	.131	1	.192*
	Sig. (2-tailed)	.027	.058	.082	.109		.019
	N	150	150	150	150	150	150
Supply Chain Resilience	Pearson Correlation	-.052	-.009	.175*	.219**	.192*	1
	Sig. (2-tailed)	.526	.912	.032	.007	.019	
	N	150	150	150	150	150	150

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

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

In general, according to correlation analysis in table 4.17, there is statistically significant relationship between supply chain resilience and Risk Reduction (0.032), Risk Transfer (0.007) and Management Control, Policies, rules and Procedures (0.192) respectively. Therefore, better Risk Reduction, Risk Transfer, and Management Control, Policies, rules and Procedures can positively enhance supply chain resilience of an organization

4.7.3 Regression Tests

Regression test help in producing an equation that describes the statistical relationship between one and more independent variables and the dependent variable (Drost, 2012). R-squared also called the coefficient of determination was used to tell how good the model fitted the data. R-squared is a goodness-of-fit measure for linear regression models. This statistic indicates the percentage of the variance in the dependent variable that the independent variables explain collectively. R-squared measures the strength of the relationship between a model and the dependent variable on a convenient 0 – 100% scale by calculating the scatter of the data points around the fitted regression line (Drost, 2012). P-value was also used to determine the significance of the results and hypothesis tests use a p-value to assess the strength of the data. A small p-value (typically ≤ 0.05) indicates strong evidence against the null hypothesis, hence reject the null hypothesis. A significant p-value (> 0.05) indicates weak evidence against the null hypothesis; hence fail to reject the null hypothesis (Hyndman & Athanasopoulos, 2013).

The data was therefore subjected to regression analysis to determine the statistical relationship between the independent variables namely; risk avoidance mitigation strategy, risk acceptance mitigation strategy, risk reduction mitigation strategy, risk transfer mitigation strategy and management control policies, rules and procedures and the dependent variable. Although the data adhered to the assumptions of homogeneity of variance, multicollinearity, and autocorrelation, normality tests indicated varying results and were not conclusive. In order to be safe with that kind of data, the predictor variables were transformed into their natural logarithm before regression analysis. Three regression analysis was carried out as follows. The first

regression involved each of the four predictor variables: Risk Avoidance, Risk Acceptance, Risk Reduction, and Risk Transfer independently with the dependent variables. Then moderation effect of Management Control, Policies, rules, and Procedures was conducted for all independent variables and dependent followed by multiple linear regression test to determine the relationship between risk mitigation strategies and supply chain resilience.

a) Regression Analysis for Variables Risk Avoidance Constructs versus Supply Chain Resilience

The study sought to determine the influence of risk avoidance on supply chain resilience in petroleum industry in Kenya. A regression analysis was conducted to test whether risk avoidance can influence supply chain resilience and the findings are as shown in table 4.18. According to the study results in table 4.18 the coefficient of determination (R-Square) is 0.003 showing a weak relationship. Furthermore, the model indicates that there is a negative relationship between risk avoidance and supply chain resilience because of the corresponding negative coefficient of -0.032. Further, the relationship is not statistically since the significant value for the analysis of variance (ANOVA) is 0.515 way greater than 0.05. The fitted model is Y=1.494+-0.032*X1. This implies that a unit change in the risk avoidance will result in a decrease in supply chain resilience by the rate of -0.032. Therefore, the study rejected the alternative hypothesis 1 $Ha_{1:}$ that Risk Avoidance has a positive influence on supply chain resilience in petroleum industry in Kenya. The study determined that risk avoidance as a supply chain risk mitigation strategy has a negative and statistically insignificant influence on supply chain resilience in the petroleum industries in Kenya. That could be explained by the fact that avoidance of potentially risky action serves to eliminate the probability of occurrence of the risky event to zero but this does not improve resilience parse. The decision to eliminate risk by withdrawing from the risky situation may perhaps cause the organization to miss on the opportunity to learn and improve its supply chain frameworks hence the negative sign. Again, some situations that may be avoided by a firm in fear of associated risk could bring some benefits to the organization; hence avoidance may not be the optimal choice. Notably, something can be deduced from the negative

coefficient because it suggests that resilience is weakened as organizations avoid risk. The question that becks is what level of exposure should be avoided. Arguably, avoidance of possibility of disruptive events means avoidance of some business opportunity and undertaking others or relocation to other preferable place (Turbide, 2014).

The findings corroborate with the findings of Mensah *et al*. (2015) who discovered that in order to avoid supply chain risks, a supply chain resilient strategy should be developed with appropriate strategies and tools namely, six sigma practices, lean production, flexibility, and a strong corporate culture. In this case, avoidance is not synonymous to resilience. Instead, preparedness to deal with negative consequences or to prevent them from occurring is best instead of complete avoidance of risk. Osoro (2015) pointed out that firms should adopt proactive measures to enhance resilience through proactive stock replenishment, timeliness forecasting, and e-sourcing. Similarly, Dehkhoda (2016) maintain that instead of risk avoidance, firms should develop risk management frameworks. It is the risk management frameworks that could build resilience in terms of robustness to avoid risks by for example having relevant partnerships and developing relationships that build agility which builds capacity to respond spontaneously and quickly to restore the supply chain disruptions when they occur.

Table 4.18: Regression Results for Risk Avoidance Constructs and Supply Chain Resilience

Model Summary						
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate		
1	.054a	0.003	-0.004	0.03571		
a Predictors: (Constant), LnRisk_Avo						
ANOVAa						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	0.001	1	0.001	0.426	.515b
	Residual	0.189	148	0.001		
	Total	0.189	149			
a Dependent Variable: Ln_SupplyChainResil						
b Predictors: (Constant), LnRisk_Avo						
Coefficientsa						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.494	0.068		22.12 2	0.00
	LnRisk_Avo	-0.032	0.049	-0.054	-0.653	0.515
a Dependent Variable: Ln_SupplyChainResil						

b) Regression Analysis for Variables Risk Acceptance Constructs versus Supply Chain Resilience

The study sought to establish the influence of Risk Acceptance on supply chain resilience in petroleum industry in Kenya. This study conducted a regression analysis to determine whether risk acceptance can influence supply chain resilience and Table 4.19 shows the study results. The study results indicate that the R and R-Square are 0.009 and 0.000 respectively. Also, the coefficient was negative (-0.012) and the significant value (0.915) indicates that the relationship is not significant statistically because the significant level is above 0.05. Thus the fitted model based on the results in Table 4.19 is $Y=1.468+-0.012*X_2$. The negative coefficient implies that a unit change in the risk acceptance practices will decrease supply chain resilience by the

rate of -0.012. Therefore, the study rejected the alternative hypothesis 2 Ha_2: that Risk Acceptance has a positive influence on Supply Chain Resilience in Petroleum Industry in Kenya. The study thus determined that Risk acceptance has negative statistically insignificant influence on supply chain resilience in Petroleum Industry in Kenya. In this strategy, managers simply retain the risk by taking no further actions and budgeting for damage control and putting in contingency plans by deciding to deal with the potential risk event should it happen at some point. Though not statistically significant, the negative causation observed in the current study can be explained by the fact that risk acceptance is seen as a naïve way of managing risk. If the magnitude of the impact when the risk occurs is huge, the organization would suffer immensely.

This conclusion corroborates with findings of Sodhi and Tang (2012) that risk acceptance is one of the most naïve supply chain risk management strategy. Herrera (2013) adds that this strategy is employed when the cost of managing the risk through other options like avoidance, reduction, and transfer outweigh the damage from the risk itself. Furthermore, failure to reduce or transfer some risk merely is acceptance of the same meaning the organization does nothing, synonymous to burying their head on the sand and just waiting. Even though organization normally assume some element of risk (Herrera, 2013), it is important to at least have some contingency plans (Sodhi & Tang, 2012), risk awareness and risk monitoring (Herrera, 2013) because assumption of risk is not the best cause of action. The causation noted in the current study could be explained by the fact that the study did not delve on the size of risk to be accepted and hence the impact being assumed was not clearly stated. Nonetheless, effort on the part of the management should be seen rather than just to accept the risk exposures.

The above arguments are also consistent with the arguments of Siba and Omwenga (2015) who concluded that identification of internal and external exposures, continuous monitoring and review of risks and their treatment by ensuring that risk is identified and assessed to build supply chain responsiveness is an important strategy in supply chain risk management. Notably, appropriate contingency plans, risk management culture/awareness and risk monitoring with no action on the risk

exposure do not eliminate the exposure. Similar the findings by Nyangau (2016) concluded that in order to improve supply chain performance, firms must be learning organizations because failure to monitor, control and respond to new challenges can pose devastating risks in supply chains. Also, Mburu (2015) argued that in order to enhance a smooth performance of supply chain in a company given the changing nature of markets, adequate risk identification, assessment, analysis, awareness, and management is inevitable. According to Behdani (2013), building capacity of the supply chain through appropriate response plans is critical for supply chain resilience.

Table 4.19: Regression Results for Risk Acceptance Constructs and Supply Chain Resilience

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.009a	0.000	-0.007	0.03576

a Predictors: (Constant), LnRisk_Acc

ANOVAa

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	0.00	1.00	0.00	0.011	.915b
	Residual	0.189	148	0.001		
	Total	0.189	149			

a Dependent Variable: Ln_SupplyChainResil

b Predictors: (Constant), LnRisk_Acc

Coefficientsa

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.468	0.170		8.614	0.000
	LnRisk_Acc	-0.012	0.116	-0.009	-0.107	0.915

a Dependent Variable: Ln_SupplyChainResil

c) Regression Analysis for Variables Risk Reduction Constructs versus Supply Chain Resilience

This study conducted a regression analysis between risk reduction strategies and supply chain resilience to establish whether there was significant relationship and the findings were as shown in table 4.20. The study results in table 4.20 shows that the R and R-Square are 0.171 and 0.029 respectively suggesting a positive relationship. Also, the coefficient (0.111) and the corresponding significant value (0.037) is less than 0.05 which suggests that the relationship is statistically significant. Furthermore, the analysis of variance (ANOVA) significant value is less than 0.05 indicating that the model is statistically significant. The fitted model based on the results in Table 4.20 is $Y=1.294+ 0.111*X_3$. This implies that a unit change in the risk reduction practices will increase supply chain resilience by the rate of 0.111. Therefore, the current study accepted the alternative hypothesis 3 Ha_3, hence determined that risk reduction has a positive statistical significant influence on supply chain resilience in petroleum industry in Kenya. Therefore, the key finding is that risk reduction is good for supply chain resilience. Thus, collaboration, buffering and flexibility strengthen supply chain robustness and agility. Collaboration is synonymous with building networks, buffering cushions the entity against possible disruptions while flexibility is synonymous with having options to take in times of disruptions (Wang et al., 2015; Tech & Cole, 2016).

According to Spacey (2015), whether a firm undertakes absolute or relative supply chain risk reduction, the action positively impacts the organization as it prevents the occurrence or reduces the negative impact of the occurrence of disruptive events (Behdani, 2013). The study results can be explained by the fact that it is better to reduce the probability of occurrence of risk or/and the impact of the occurrence of the risk instead of trying to repair the damage after the risk has occurred (Kwak, 2014). The finding is consistent with the conclusions of Behdani (2013) who posit that common risk reduction strategic actions including supply chain collaboration, buffering, redundancy and flexibility are the essential ingredients for a resilient.

The study results also concur with the conclusions of Cheng'e (2014) who posit that risk mitigation factors such as reviewing petroleum chain infrastructure, wide consultations and interaction among industry players, redesign for customer, construction of more storage facilities, and color coding of export petroleum products to curb adulteration are essential for supply chain resilience. Also, it agrees with the findings of Urciuoli *et al.* (2014) who concluded that relevant strategies to reduce exposures and build supply chain resilience including portfolio diversification, flexible contracts, transport capacity planning, and safety stocks are important for robust and agile supply chain framework in the context on petroleum dealers. Also, Murigi (2013) opine that petroleum dealers should maintain high buffer stocks/ safe inventory and they should prepare supply chain continuity plans in collaboration with the partners, suppliers, and investment in modern risk information transparency.

Table 4.20: Regression Results for Risk Reduction Constructs and Supply Chain Resilience

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.171a	0.029	0.023	0.03524

a Predictors: (Constant), LnRisk_Red

ANOVAa

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	0.006	1	0.006	4.435	.037 b
	Residual	0.184	148	0.001		
	Total	0.189	149			

a Dependent Variable: Ln_SupplyChainResil
b Predictors: (Constant), LnRisk_Red

Coefficientsa

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.294	0.074		17.423	0.000
	LnRisk_Red	0.111	0.053	0.171	2.106	0.037

a Dependent Variable: Ln_SupplyChainResil

d) Regression Analysis for Variables Risk Transfer Constructs versus Supply Chain Resilience

The study sought to establish influence of risk transfer on supply chain resilience in petroleum industry in Kenya. A regression analysis of risk transfer strategies against resilience was done and the results were as shown in table 4.21. The findings show that the R and R-Square is 0.216 and 0.047 suggesting a positive relationship. Also, the coefficient (0.119) is positive. Also, the relationship is statistically significant because the corresponding significant value (0.008) is less than 0.05. The fitted model based on the results in Table 4.20 is $Y=1.279+ 0.119*X_4$. This implies that a unit change in the risk transfer will increase supply chain resilience by the rate of 0.119. The current study found out that there is a positive influence of risk transfer strategies on supply chain resilience. Therefore, study accepted the alternative hypothesis 4; Ha_4: that Risk Transfer has a positive statistical significant influence on Supply Chain Resilience in Petroleum Industry in Kenya. Therefore, risk transfer is seen as an important predictor of supply chain resilience by the respondents. The positive influence of risk transfer in the current study can be explained by the fact that the respondents who work in the petroleum industry would prefer to have the risks of supply chain disruptions to be handled by other third parties. With third parties being responsible to manage the risk, the organization can focus on what it knows best in order to meet their core objectives. Also, the third party partnerships can be an important source of strategic information.

According to Alfred (2013), risk transfer refers to shifting of the responsibility of managing and resolving the risk to another party who may either be in a better position to manage the risk or proper owner of the risk. Therefore, risk transfer includes outsourcing/ contracting, insurance and through partnerships or joint ventures to manage risk exposures (Ignacio, 2016). According to Herrera (2013), risk transfer includes hedging, outsourcing, and entering into partnerships to ensure that risk is shared or completely transferred to a third party which gives the party who could have incurred the risk to rest, assured that they are not susceptible to exposures. By transferring the risk, the organization is at peace that its sales are assured since the risks of disruptions are born by third parties (Courchene & Robert,

2016). According to Dittmann (2014) transferring risk to third parties like insurance are more effective in risk mitigation.

Those findings are also consistent with the conclusions of Otieno (2013) who determined that oil marketers in Kenya employed strategic alliances as a strategy to enable them to gain operational efficiency as well as access markets that they would otherwise not reach if working alone. Also, it agrees with the views of Kwak (2014) who concluded that oil companies could enhance their supply chain resilience through building a stable logistics networks, taking advantage of logistic information, employing outsourcing contracts and developing logistical collaborations. Further, Pereira and Silva (2015) argued that partnership between buyers and suppliers enhance supply chain resilience by essentially managing and controlling three organization issues which are buyer and supplier interface, risk Management and knowledge management. Also, Kimani (2013) established that outsourcing, strategic management, e-procurement, and partnerships have a positive effect on supply chain resilience.

Table 4.21: Regression Results for Risk Transfer Constructs and Supply Chain Resilience

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.216a	0.047	0.04	0.03491

a Predictors: (Constant), LnRisk_Tra

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	0.009	1	0.009	7.259	.008 b
	Residual	0.18	148	0.001		
	Total	0.189	149			

a Dependent Variable: Ln_SupplyChainResil
b Predictors: (Constant), LnRisk_Tra

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.279	0.064		20.111	0.000
	LnRisk_Tra	0.119	0.044	0.216	2.694	0.008

a Dependent Variable: Ln_SupplyChainResil

4.8 Moderating Effect Test

The study also sought to determine the moderation effect of management control, policies, rules and procedures on the relationship between the risk mitigation strategies and supply chain resilience. The study employed the technique developed by Baron and Kenny (1986) and highly practiced in testing moderation. Accordingly, measures of each of the independent variables were multiplied by the measure of the moderating variable and the resultant variables used as predictor variables to determine the possible change in correlation coefficient and the coefficient of determination as well as the model coefficients and their corresponding significant values. Table 4.22 shows the model summary statistics and the coefficients while table 4.23 shows ANOVA to test the statistical significance of the model.

Table 4.22: Moderation Model Summary Statistics and Coefficients

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.340[a]	0.116	0.091	0.14348

a. Predictors: (Constant), LnRisk_Tra_TIMEX5, LnRisk_Avo_TIMEX5, LnRisk_Red_TIMEX5, LnRisk_Acc_TIMEX5

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.853	.173		22.268	.000
	LnRisk_Avo_TIMEX5	-.104	.051	-.319	-2.057	.041
	LnRisk_Acc_TIMEX5	-.057	.068	-.153	-.840	.402
	LnRisk_Red_TIMEX5	.115	.055	.346	2.105	.037
	LnRisk_Tra_TIMEX5	.117	.045	.370	2.611	.010

a. Dependent Variable: Supply Chain Resilience

According to the study results in table 4.22, inclusion of the moderator caused a change in correlation coefficient and coefficient of determination as well as the coefficients and probability values. R improved from 0.293 (table 4.24) to 0.340

while R^2 improved from 0.086 (table 4.24) to 0.116 when moderator was included in table 4.22. The regression analysis results for Risk Avoidance (Table 4.18) was not statistically significant at 0.515 but turned out to be statistically significant at (0.041) as per Table 4.22 when moderation effect was included. Additionally, risk acceptance significant level reduced from 0.915 in the previous model (4.19) to 0.402 with the inclusion of moderating variable (Table 4.22). However, risk acceptance remained statistically insignificant whether the moderator included or not as shown in table 4.22. Also, the coefficients for risk reduction variable was significant with and without inclusion of the moderating variable although there was improvement on the corresponding coefficients. Notably, the coefficients for the predictors that were negative (risk avoidance and risk acceptance) remained negative while the ones that were positive (risk reduction and transfer) remained significant. The rise in R and R-Square coupled with the decrease in significant values indicated that the moderating variable improved the prediction power of the model.

Therefore, the multiple regression Model with a Moderation Effect of Management Control, Policies, rules and Procedures was $Y = 3.853 + -0.104X_1 + -0.057X_2 + 0.115X_3 + 0.117X_4$.

Where;

X1= Risk Avoidance strategy and the moderating variable (LnRisk_Avo_TIMEX5); X2 = Risk Acceptance strategy and the moderating variable (LnRisk_Acc_TIMEX5); X3=Risk Reduction Strategy and the moderating variable (LnRisk_Red_TIMEX5); X4 = Risk Transfer Strategy and the moderating Variable (LnRisk_Tra_TIMEX5) and Y= Supply Chain Resilience in Petroleum Industry in Kenya. Hence; Supply Chain Resilience in Petroleum Industry in Kenya = 3.853 + -0.104 Avoidance strategy times moderating variable + -0.057 Risk Acceptance strategy times the moderating variable + 0.115 Risk Reduction Strategy times the moderating variable + 0.117 Risk Transfer Strategy times the moderating Variable. The Beta Coefficients in the regression model show that two of the tested variables had negative relationship with Supply Chain Resilience in Petroleum Industry in

Kenya while other two had positive relationship with Supply Chain Resilience in Petroleum Industry in Kenya.

The findings implies that a unit change of X1 (Avoidance strategy and moderating variable) = - 0.104, will results in to negative 0.104 change in Supply Chain Resilience in Petroleum Industry in Kenya; X2 (Risk Acceptance strategy and the moderating variable) = -0.057, will results in to negative 0.057 change in Supply Chain Resilience in Petroleum Industry in Kenya; X3 (Risk Reduction Strategy and the moderating variable)= 0.115; will results in to 0.115 change in the Supply Chain Resilience in Petroleum Industry in Kenya and finally X4 (Risk Transfer Strategy and the moderating Variable) = 0.117, will results in to 0.117 change in the Supply Chain Resilience in Petroleum Industry in Kenya. The Y- Intercept (β0 = 3.853 implies that supply chain resilience in the petroleum industry in Kenya would be 3.853 if all other variables at zero (0). This could be as a result of other factors not explained by the model. Table 4.23 shows the ANOVA to test the statistical significance of the model.

Table 4.23: Analysis of Variance Test for Moderation effect

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	0.39	4	0.097	4.736	.001[b]
	Residual	2.985	145	0.021		
	Total	3.375	149			

a. Dependent Variable: Supply Chain Resilience

b. Predictors: (Constant), LnRisk_Tra_TIMEX5, LnRisk_Avo_TIMEX5, LnRisk_Red_TIMEX5, LnRisk_Acc_TIMEX5

According to the results in table 4.23, the significant value is less than 0.05. Notably, the F statistic increased from 3.397 (Table 4.25) to 4.736 as per table 4.23 above while the significant value for ANOVA reduced from 0.011 (table 4.25) to 0.001

which indicates that inclusion of the moderator which refer to management controls, policies, rules and procedures improved the models prediction power. Therefore, the study rejected the null hypothesis and accepted the alternative hypothesis 5 and determined that Ha_5: Management control policies, rules and procedures moderates positively the influence of Risk Mitigation Strategies and Supply Chain Resilience in Petroleum Industry in Kenya. The study therefore established that management control, policies, rules and procedures have a positive influence on supply chain risk mitigation strategies because its inclusion in the regression model improved the correlation coefficient and the coefficient of determination and increased model prediction power as shown by the change in all the significant values. Therefore, organizations which have relevant management control policies, rules and procedures for employee training, customers and supplier forecasting, integrated risk management, business continuity management, responsiveness and continuous improvement is crucial for strengthening supply chain resilience in organizations. The policies spell out how things should be done in an organization and acts as a manual that guides implementation of various tasks in the organization.

The study concurs with the views of Nyang'au (2015) that companies that have policies, procedures, and rules that support the implementation of different strategies and philosophies bring continuous improvements and can improve supply and demand forecasting, efficiency and supply chain responsiveness. Urciuoli *et al.* (2014) point out that demand or supply forecasting, planning, pricing, delivery timelines, cost reduction, product/service quality and data forecasting are essential for a good function supply chain and according to Rwakira (2015) these become possible if there are supply chain control policies, rules and procedures in an organization.

This study agrees with the findings of Osaro *et al.* (2014) who noted that flexibility, visibility, adaptability, collaboration, reserve capacity, and supplier diversity depend on organization's management control policies, rules and procedures. The study further revealed that decision making through policy formulation and guiding principles enhances long term global competitiveness. Similarly, Brusset and Teller

(2017) concluded that resources, routines, and moderating capabilities provide an improvement in organizations in terms of supply chain resilience.

Furthermore, Ayman *et al.* (2014) argue that supply chain management practices, internal integration, information sharing and reactiveness policies have a significant and positive influence on supply chain efficiency and performance. Similar sentiments were echoed by Kangogo *et al.* (2013) that in order to address supply chain disruptions, firms should implement comprehensive business continuity plans to mitigate against the supply chain effects of natural disasters, develop logistical process redundancies, formulate creative policies and investment in research to develop resiliently. Therefore, appropriate management control policies, rules, and procedures can help an organization to attain resilience by shaping the choice and implementation of risk mitigation strategies.

4.9 Multiple Regression analysis for risk mitigation strategies and supply chain resilience

The study sought to establish the overall influence of risk mitigation strategies and supply chain resilience in Kenya's petroleum industry. Supply chain resilience was regressed against the four risk mitigation strategies and the results provided in the model summary and coefficients as shown in table 4.24 while the analysis of variance (ANOVA) is presented in table 4.25.

Table 4.24: Model Summary Statistics and Coefficients

Model Summary					
Model		R	R Square	Adjusted R Square	Std. Error of the Estimate
1		.293[a]	.086	.060	.14588

a. Predictors: (Constant), LnRisk_Tra, LnRisk_Acc, LnRisk_Red, LnRisk_Avo

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.529	0.779		4.532	0
	LnRisk_Avoidance	-0.349	0.21	-0.139	-1.661	0.099
	LnRisk_Acceptance	-0.144	0.475	-0.024	-0.303	0.763
	LnRisk_Reduction	0.497	0.228	0.181	2.182	0.031
	LnRisk_Transfer	0.508	0.189	0.218	2.685	0.008

a. Dependent Variable: Supply Chain Resilience

According to the results in table 4.24, the four risk mitigation strategies together have a positive influence on supply chain resilience because the correlation coefficient is positive 0.293. In addition, the relationship between the four predictor variables and supply chain resilience is positive with coefficient of determination (R-Square) of 0.086.

The model coefficients indicate that both risk avoidance and acceptance strategies have a negative influence on supply chain resilience because their coefficients -0.349 and -0.144 are negative. Also, the significant values: 0.099 and 0.763 respectively are more than 0.05 which indicate that risk avoidance and risk acceptance are not statistically significant predictors of supply chain resilience in petroleum firms at 5 percent level of significance. That suggests that although they decrease supply chain resilience, their influence is not significant.

On the other hand, risk reduction and transfer strategies have a positive influence on supply chain resilience because their coefficients: 0.497 and 0.508 respectively are positive and statistically significant at 5 percent level of significance since their

significant values are 0.031 and 0.008 respectively which are less than 0.05, the required alpha value. The findings mean that risk reduction and transfer enhances supply chain resilience in a statistically significant manner.

The multiple regression Model for Risk Mitigation Strategies and Supply Chain Resilience derived was $Y = 3.529 + -0.349\ X_1 + -0.144X_2 + 0.497X_3 + 0.508X_4$.

Where;

X1= Risk Avoidance Strategy (LnRisk_Avoidance), X2 = Risk Acceptance Strategy (LnRisk_Acceptance), X3=Risk Reduction Strategy (LnRisk_Reduction), X4 = Risk Transfer Strategy (LnRisk_Transfer), and Y= Supply Chain Resilience in Petroleum Industry in Kenya.

Hence; Supply Chain Resilience in Petroleum Industry in Kenya = 3.529 + -0.349 Avoidance strategy + -0.144 Risk Acceptance strategy + 0.1497 Risk Reduction Strategy + 0.508 Risk Transfer Strategy.

The findings implies that a unit change of X1 (Avoidance strategy) = - 0.349, will results in to negative 0.349 change in Supply Chain Resilience in Petroleum Industry in Kenya; X2 (Risk Acceptance strategy) = -0.144, will results in to negative 0.144 change in Supply Chain Resilience in Petroleum Industry in Kenya; X3 (Risk Reduction Strategy)= 0.497; will results in to positive 0.497 change in the Supply Chain Resilience in Petroleum Industry in Kenya and finally X4 (Risk Transfer Strategy) = 0.508, will results in to positive 0.508 change in the Supply Chain Resilience in Petroleum Industry in Kenya. The Y- Intercept ($\beta 0 = 3.529$), predict that the Supply Chain Resilience in Petroleum Industry in Kenya when all other variables are zero, implying that without the independent variables, the Supply Chain Resilience in Petroleum Industry in Kenya will be 3.529. Table 4.25 shows the analysis of variance to test the efficacy of the modelled relationship in describing the association of the concerned study variables.

Table 4.25: Analysis of Variance for the Multiple Regression Model

ANOVA[a]						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	0.289	4	0.072	3.397	.011[b]
	Residual	3.086	145	0.021		
	Total	3.375	149			

a. Dependent Variable: Supply Chain Resilience

b. Predictors: (Constant), LnRisk_Tra, LnRisk_Acc, LnRisk_Red, LnRisk_Avo

According to the findings in table 4.25 the model is statistically significant because the significant value (0.011) is less than 0.05 which confirms that the regression model is statistically significant. Therefore, it explains that the relationship that exist between the risk mitigation strategies and supply chain performance can be relied upon.

4.10 Optimal Model

Based on the tests carried out and concluded in this study, the overall regression results established that from the four independent variables and the moderating variable used in the study, three independent variables (Risk Reduction and Risk Transfer strategies) and Moderating variable (management control, policies, rules, and procedures) had statistical significance with dependent variable (supply chain resilience). The summary of the hypotheses test is provided in table 4.26.

Table 4.26: Summary of the Hypotheses Tested

Hypothesis	Rule	Results	Decision
Ha_1: Risk Avoidance has a positive influence on Supply Chain Resilience in Petroleum Industry in Kenya.	Reject Ha_1 if P value >0.05	R is 0.054; R^2 is 0.003 P value 0.515 > 0.005	Failed to reject the Null Hypothesis and the Alternative Hypothesis **Ha_1** was rejected.
Ha_2: Risk Acceptance has a positive influence on Supply Chain Resilience in Petroleum Industry in Kenya.	Reject Ha_2 if P value >0.05	R is 0.009; R^2 is 0.00 P value 0.915 > 0.005	Failed to reject the Null Hypothesis and the Alternative Hypothesis **Ha_2** was rejected.
Ha_3: Risk Reduction has a positive influence on Supply Chain Resilience in Petroleum Industry in Kenya.	Reject Ha_3 if P value >0.05	R is 0.171; R^2 is 0.029 P value 0.037 < 0.005	Rejected the Null Hypothesis and the Alternative Hypothesis **Ha_3** was accepted
Ha_4: Risk Transfer has a positive influence on Supply Chain Resilience in Petroleum Industry in Kenya.	Reject Ha_4 if P value >0.05	R is 0.216; R^2 is 0.047 P value 0.008 < 0.005	Rejected the Null Hypothesis and the Alternative Hypothesis **Ha_4.** was accepted
Ha_5: Management control policies, rules and procedures moderates positively the influence of Risk Mitigation Strategies and Supply Chain Resilience in Petroleum Industry in Kenya.	Reject Ha_5 if P value >0.05	R improved from 0.293 to 0.340 while R2 improved from 0.086 to 0.116. Significant test for ANOVA test improved from 0.011 to 0.001	Rejected the Null Hypothesis and the Alternative Hypothesis **Ha_5** accepted

The proposed study model was therefore revised as the optimal model as shown in figure 4.2.

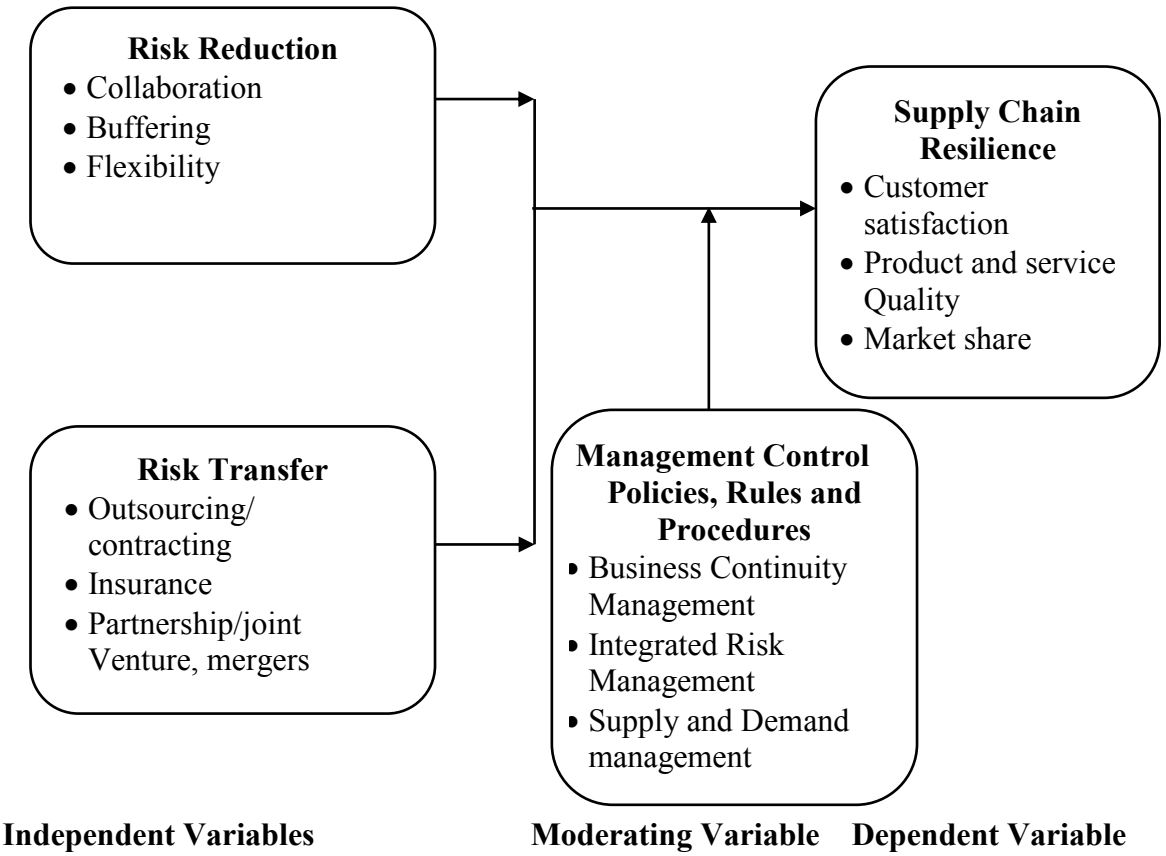


Figure 4.2: Optimal Model

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary, conclusion and recommendation of the study. It contains the summary of the study, provides the conclusion of the study arising from the results of the study conducted as per the study objectives and then presents the recommendations based on the conclusion of the study and finally avails areas for further study.

5.2 Summary of the Findings

This study sought to determine the influence of risk mitigation strategies on supply chain resilience in the petroleum industry in Kenya. The study was informed by the fact that Kenya being a net importer of petroleum products and heavily depends on imported petroleum products to meet its energy needs, hence managing risks associated with the supply of the petroleum is key for the country. At the point the study was carried out, companies sourcing for petroleum products and operating in the country were facing supply chain disruptions thus affecting the petroleum firms' performance, which would slow economic growth. Supply chain resilience could enable petroleum firms to withstand disruptions, recover and continually operate efficiently to meet customers' satisfaction, achieve quality expectation and profitability. Achieving resilience along the supply chain require efforts from internal business as well as from the wider network.

The overall objective of the study was to determine the influence of supply chain risk mitigation strategies on supply chain resilience in the petroleum industry in Kenya. The specific objectives for the study included: to determine the influence of Risk Avoidance on Supply Chain Resilience in Petroleum Industry in Kenya, to establish the influence of Risk Acceptance on Supply Chain Resilience in Petroleum Industry in Kenya, to determine the influence of Risk Reduction on Supply Chain Resilience in Petroleum Industry in Kenya and to establish the influence of Risk Transfer on

Supply Chain Resilience in Petroleum Industry in Kenya. Also, the study examined the moderating effect of management control policies, rules, and procedures on risk mitigation strategies and supply chain resilience.

The study followed descriptive and correlation research design and the target population were the 87 active Oil Marketing companies licensed by the Ministry of Energy and Petroleum to import and trade with petroleum product in Kenya. The study employed a census survey technique to collect data from those firms. This method was deemed appropriate because it reduces biases in research since all respondents have an equal chance of participation. The data collection was carried out using questionnaires containing relevant questions on the supply chain risk mitigation strategy and supply chain resilience. Therefore, primary data was used and was collected from the target respondents who are comprising two respondents from each firm who included: depot manager and either supply chain/logistics managers.

Before the actual survey, a pilot study was conducted using ten companies to test the validity and reliability of the research instrument and a Cronbach's alpha equal to 0.787 was obtained from the analysis of the 20 questionnaires obtained from two respondents each from the ten oil marketers targeted for pilot study. Since the pilot study test indicated that the instrument was internally consistent based on the obtained Cronbach's alpha, the instruments were therefore used to conduct the actual study. After eliminating the 10 companies that participated in the pilot study, 77 oil marketing firms remained out of which 75 accepted to participate in the survey and the study obtained 150 fully completed questionnaires. The data were analyzed using SPSS version 22 to obtain descriptive and inferential statistics which were presented in tables and figures and it was used to accept or reject the study hypothesis which was tested at five percent significant level. The outcomes of the findings can be summarized based on the following research objectives.

5.2.1 Influence of Risk Avoidance on Supply Chain Resilience in the Petroleum Industry in Kenya

The study sought to determine the influence of risk avoidance on supply chain resilience in the petroleum industry in Kenya. The study determined that risk

avoidance as a supply chain risk mitigation strategy has a negative statistically insignificant influence on supply chain resilience in the petroleum industries in Kenya. Arguably, this is because avoidance of the possibility of disruptive events means avoidance of some business opportunity and undertaking others or relocation to another preferable place (Turbide, 2014). The findings corroborate with the findings of Mensah *et al*. (2015) who discovered that in order to avoid supply chain risks, a supply chain resilient strategy should be developed with appropriate strategies and tools namely, six sigma practices, lean production, flexibility and a strong corporate culture.

5.2.2 Influence of Risk Acceptance on Supply Chain Resilience in the Petroleum Industry in Kenya

The study established that risk acceptance has negative statistically insignificant influence on supply chain resilience in the Petroleum Industry in Kenya. In this strategy, managers simply retain the risk by taking no further actions and budgeting for damage control and putting in contingency plans by deciding to deal with the potential risk event should it happen at some point. The statistically insignificant value observed in the current study can be explained by the fact that if the magnitude of the impact of the risk is huge when it occurs, the organization will suffer immensely. This conclusion corroborates with the findings of Sodhi and Tang (2012) that risk acceptance is one of the most naïve supply chain risk management strategy.

5.2.3 Influence of Risk Reduction on Supply Chain Resilience in the Petroleum Industry in Kenya

The study results showed that risk reduction has a positive statistically significant influence on supply chain resilience in the petroleum industry in Kenya. Also, the coefficients for risk reduction variable were significant with and without the inclusion of the moderating variable. However, the inclusion of the moderator caused its significant value to slightly adjust downwards suggesting that tightening management controls, policies, rules, and procedures on risk reduction improved the model prediction power. The findings collaborate with a study by Spacey (2015) who posits that whether a firm undertakes absolute or relative supply chain risk reduction,

the action positively impacts the organization as it prevents the occurrence or reduces the negative impact of the occurrence of disruptive events (Behdani, 2013). The finding is also consistent with the conclusions of Behdani (2013) who found that that average risk reduction strategic actions including supply chain collaboration, buffering, redundancy and flexibility are the essential ingredients for resilience.

5.2.4 Influence of Risk Transfer on Supply Chain Resilience in the Petroleum Industry in Kenya

The findings indicated that risk transfer strategy has a positive statistically significant influence on supply chain resilience in the petroleum industry in Kenya. Also, the coefficient was significant with or without the moderation effect, although the significant values reduced indicating that the moderating variable strengthens the influence of the predictor variable on the dependent variable. The positive influence of risk transfer in the current study can be explained by the fact that the respondents who work in the petroleum industry would prefer to have the risks of supply chain disruptions to be handled by other third parties. Those findings are consistent with the conclusions of Otieno (2013) who determined that oil marketers in Kenya employed strategic alliances as a strategy to enable them to gain operational efficiency as well as access markets that they would otherwise not reach if working alone. Also, it agrees with the views of Kwak (2014) who concluded that oil companies could enhance their supply chain resilience through building a stable logistics networks, taking advantage of logistic information, employing outsourcing contracts and developing logistical collaborations.

5.2.5 The moderating effect of Management Control policies, rules and Procedures

The study also sought to determine the moderation effect of management control, policies, rules, and procedures on the relationship between the risk mitigation strategies and supply chain resilience. Regression analysis was tested on the moderation effect determined that management control policies, rules, and procedures have a positive effect on the relationship between risk mitigation strategies and supply chain resilience because it improved coefficients of both R and

R-Square. Also, the significant value for the analysis of variance (ANOVA) which tests the model's statistical significance in predicting the relationship between the study variables reduced which indicate that inclusion of management controls policies, rules, and procedures as moderator improved the prediction power for the model.

5.2.6 Multiple Linear Regression analysis for risk mitigation strategies and supply chain resilience

Multiple regression analysis was tested to determine the relationship between the four risk mitigation strategies and supply chain resilience. The regression results obtained in overall, that risk mitigation strategies have a positive influence on supply chain resilience because of a significant value for the analysis of variance (ANOVA) was less than 0.05. In addition, the coefficient of determination (R-Square) was positive indicating that there existed a linear relationship between the four predictor variables and supply chain resilience.

5.3 Study Conclusions

The general conclusion from the study is that risk mitigation strategies employed by oil marketing firms had a positive influence on their supply chain resilience. Another general conclusion is that management control policies, rules and procedures have a positive influence on the relationship between risk mitigation strategies and supply chain resilience. In that regard, organizations should aim to implement relevant risk mitigation strategies backed up by appropriate management control policies, rules, and procedures in order to realize resilient supply chain frameworks. However, ensuring are the conclusions as per the specific study objectives and hypotheses.

The study results of the first hypothesis determined that risk avoidance has a statistically insignificant influence on supply chain resilience in the petroleum industries in Kenya. The study results of the second hypothesis determined that risk acceptance has statistically insignificant influence on supply chain resilience. The study results of the third hypothesis established that risk reduction has a positive statistically significant influence on supply chain resilience in the petroleum industry

in Kenya. This implies that risk reduction enhances the resilience of a supply chain. Therefore, organizations should undertake decisions that reduce supply chain risk. For instance, collaborations, buffering and flexibility can help oil marketers to minimize the possibility of occurrence of disruptive shortages which could bring loss to the company. The study results of the fourth hypothesis indicated that risk transfer has a positive, statistically significant influence on supply chain resilience. The positive coefficient indicates that firms that transfer most risk to third parties have more robust and agile supply chains. It makes sense because risk gives the organization the chance to concentrate on its core business and allow other entities to deal with risk. The results from the fifth hypothesis established that inclusion of management control policies, rules, and procedures as a moderator caused both R and R-Square to increase. Furthermore, the p-values for various variables decreased meaning that it improved their significance in the model.

5.4 Recommendations

The following recommendations were made based on the findings and conclusions of the study

5.1.1 Regarding risk avoidance, the current study has concluded that avoidance of risk is counterproductive for the firms in the petroleum industry. That could be because some benefits associated with the occurrences that they seek to avoid for fear of risk may be more than the negative consequences of risk they could be avoiding. Therefore, rather than avoid risk, the study recommends that the organization should use other mitigation measures rather than avoiding the risk situation. To the regulator, the study recommends that there is need to support the industry to manage risk because it is a vital source of energy that has an impact on the economy and Kenyan society.

5.1.2 Concerning risk acceptance, the current study concluded that firms should be careful about the risks that they shoulder. Rather than merely accept the risk, the organization should so do something about the risk exposures. Therefore, the study recommends to managers that they should not to just accept risk but

to do something about it however low the perceived consequences of the risk may be. To the regulator, there is need to support the industry players with insights and support in order to come up with better contingency plans, risk monitoring, management culture practices and other risk mitigation plans.

5.1.3 The study recommends that both risk transfer and reduction strategies should be employed much more than the avoidance and acceptance since the study has concluded that the two strategies are best because the study results indicated that both risk reduction and transfer have a positive influence on supply chain resilience. To that end, the study recommends the two risk mitigation strategies to the management of petroleum companies. To the industry regulator, ample support with storage and infrastructure is essential for the firms to have sufficient buffer though firms should also establish appropriate collaboration and be flexible to overcome disruptions from shortages. In addition outsourcing, contracting, insurance and partnerships to ensure the business against disruptions can help the organization to reduce the negative consequences of risk in a substantial manner.

5.1.4 Regarding moderation effect of management control policies, rules and procedures, the study concluded that presence of relevant controls policies, rules and procedures has a positive influence on the relationship between the risk mitigation strategies and supply chain performance. To the management, the study recommends that management of organizations should adopt relevant policies and procedures to guide and control management of supply chain risk exposures. The management should aim to entrench policies that ensure business continuity, integrated risk management, supply and demand forecasting as well as quantification of risk exposures and determining what level of exposures should be transferred and possible instruments to use to mitigate the exposures.

5.5 Areas for Further Study

This study was confined to risk mitigation strategies namely risk avoidance, risk acceptance, risk reduction and risk transfers that influence supply chain resilience in the petroleum industry in Kenya. This limited the study from exploring and

identifying risks drivers affecting the industry. Future studies could, therefore, focus on drivers of petroleum supply chain vulnerability in the context of developing countries like Kenya. Specifically, the study could seek to determine the understanding of the players in the sector regarding vulnerabilities because by addressing the vulnerability of the supply chain, the supply chain risks mitigation can be enhanced. The study could focus on drivers for a vulnerability in the point of view of product or process value stream, infrastructure or asset dependencies, inter-organizational networks, and from the natural and social environment. Knowledge and action on vulnerabilities from such points of view could be used to bolster supply chain resilience. Also, the concept can be studied considering the threats of international terrorism.

REFERENCES

Abolghasemi, M., Khodakarami, V. & Tehranifard, H., (2015). A new approach for supply chain risk management: Mapping SCOR into bayesian network. *Journal of Industrial Engineering and Management JIEM*, *8*(1), 280-302.

Alfred F., (2013). *Risk Management*., Massachusetts: Software SIG. MITRE Corporation Publications.

Ambulkar, S., Blackhurst, J., & Grawe, S., (2015). Firm's resilience to supply chain disruptions: Scale development and empirical examination. *Journal of Operations Management, 33*(34), 111–122.

Amponsah, R., & Opei, F.K., (2014). Ghana's downstream petroleum sector. An assessment of key supply chain challenges and prospects for growth. *International Journal of Management and Business Studies.* 7(3), 441-448.

Amy, J. H., Michael, C. W. & Brian, J. C., (2009). Resource dependence theory review. *Journal of Management, 35*(6), 1404 –1427.

Anette, M., & Kaplan, R. S., (2013). *Towards a contingency theory of enterprise risk management.*, Boston: Harvard Business School Publications.

Angappa, G, Nachiappan S. & Rahman, L. (2017). Improving supply chain performance through management capabilities, *Journal of Production Planning and Control, 6* (8), 473-477.

Antunes, R.G. & Vicente, C. (2015). A production model for construction buildings. A theoretical framework. *Journal Statistics*. *5*(1), 209–228.

Arani, N., Mukuru, W., Waiganjo, E. & Musyoka, J. (2015). Enhancers for building supply chain resilience in manufacturing firms in Kenya. *The Strategic Journal of Business & Change Management, 2*(71), 709-749.

Asseman, A., Ashqar, A., Salim, M., Eman, R., Dawoud, H., Nasser, A., Mecheter, S., Rihan R. & Bouras, A., (2014). Theory of constraints, risk management,

and performance evaluation. *The Journal of Modern Project Management,* 2 (1), 302-348

Azad, A., (2017). How to Detect and Remove Temporal Autocorrelation in Vehicular Crash Data. *Journal of Transportation Technologies,* 7(1), 133-147

Azevedo, S., Govindan, K., Carvalho, H., & Cruz-Machado, V., 2013. Ecosilient index to assess the greenness and resilience of the upstream automotive supply chain. *Journal of Cleaner Production. 56*(1), 131-146.

Babbie, E. R. (2011). *The Practice of social research*. (11th ed.), Belmont C.A: Wadsworth

Babin, B. & Zikmund, W. (2012). *Essentials of marketing Researc*h, Florida: Harcourt Brace College Publishers.

Bahaidar F.A., (2013). Factors affecting supply chain management in petroleum companies in Kenya. *Unpublished Masters (MBA) Thesis-Kenyatta University.2* (1), 30-46

Bandaly, D., (2012). *Integrated operational and financial approaches in supply chain risk management*. Unpublished PhD thesis, Concordia: Concordia University.

Barasa P. W., (2015). *Contributions of green supply chain management practice on performance of steel manufacturing companies in Kenya*. Unpublished PHD thesis, Juja: Jomo Kenya University of Agriculture and Technology.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of personality and social psychology*, *51*(6), 1173.

Behdani, B., (2013). *Handling disruptions in supply chains. An Integrated Framework and an Agent-based Model.* GA, Delft, the Netherlands: Next Generation Infrastructures Foundation.

Berg, A., Berlemann, B., Hedrick, S., Magnus, K., Mathews, B. & Russo, B. (2015). *Sourcing in a volatile world The East Africa opportunity.* New Jersey: McKinsay & Company publications.

Bigliani, R. (2013) *Reducing risk in oil and gas operations.* New York: IDC Energy Insights.

Biljana A., (2011). Measuring customer satisfaction with service quality using American customer satisfaction model (acsi model). *International Journal of Academic Research in Business and Social Sciences, 1*(1), 3.

Boone, H.N & Boone D. A., (2012). Analyzing likert data. *Journal of Extension 1*(50), 2- 8.

Branson B., Beasley M. & Hancock B., (2014*). Risk oversight: An Overview of Enterprise Risk Management Practices* (7th Edition). North Carolina: North Carolina state University.

British Standards Institution (BSI) (2015). *Global Supply Chain Intelligence Report 2015*-Top Supply Chain Risks., London: BSI publications.

Brusset X and Teller C (2017) Supply chain capabilities, risks, and resilience. *International Journal of Production Economics*, *184*(1), 59-68.

Bryant and Yarnold, (1995). *Principal components analysis and exploratory and confirmatory factor analysis*. In Grimm and Yarnold, Reading and understanding multivariate analysis. American: American Psychological Association Books.

Bryman, A., (2012). *Social Research Methods* (4th ed.). New York: Oxford University Press.

Buchanan, L., (2012). *A Customer Service Makeover.* Harvard Business Review. Philadelphia: Pennsylvania Publishing.

Burnes, B. (2004). Complexity theories: Back to the future? *Journal of Change Management, 4*(4), 309–325.

Cameron, A., C. & Windmeijer, F. G., (1996). R-Squared Measures for Count Data Regression Models with Applications to Health-Care Utilization. *Journal of Business & Economic Statistics 14*(2), 209-220.

Carvalho, H., Azevedo, S., & Cruz-Machado, V., (2014). Impact of supply chain management practices on sustainability, *Journal of Cleaner Production, 85*(1), 212–225.

Cawood J., (2014). *PwC report on Africa Trends, challenges and future outlook*, Lagos Nigeria: PwC.

Chen H. H. & Linderman A. M. (2012), Complex network characteristics and invulnerability simulating analysis of supply chain, *Journal of Networks, 7*(3), 591- 597.

Cheng'e, J.M., (2014). *Supply chain risk factors and performance in petroleum industry in Kenya*. Unpublished Master's Thesis, Nairobi: university of Nairobi.

Chicksand, D., Watson, G., Walker, H., Radnor, Z. & Johnston, R., (2012). Theoretical perspectives in purchasing and supply chain management: an analysis of the literature. Supply chain management: *An International Journal, 17*(4), 454–472.

Choi, T., Dooley, K., & Rungtusanatham, M., (2001). Supply networks and complex adaptive systems: control versus emergence. *Journal of Operations Management, 19*(3), 351–366.

Chopra, S., & Sodhi. M. S. (2014). Reducing the risk of supply chain disruptions. *MIT Sloan Management Review, 55*, 73–80.

Choy, L. T., (2014). The strengths and weaknesses of research methodology: comparison and complimentary between qualitative and quantitative approaches. *Journal of Humanities and Social Science*, *19*(4), 99-104.

Cobb A, & Wry T., (2015). *Resource-Dependence Theory.* Oxford: Oxford University Press.

Courchene, J. & Robert V., (2016). *Optimising non-life reinsurance strategy under risk based capital measures,* USA: Milliman Research publications.

Creswell, J. W., (2014). *Research Design Qualitative Quantitative & Mixed methods approaches* (4th Edition). Los Angeles: SAGE Publications Inc.

Das, K., & Lashkari, R., (2015). Risk readiness and resiliency planning for a supply chain. *International Journal of Production Research, 53*(22), 6752-6771.

Dass, N., Nanda, V. & Wang, Q. (2013). Allocation of decision rights and the investment strategy of mutual funds. *Journal of Financial Economics, 110,* 254-277.

Day, M., 2014. Fostering emergent resilience: The complex adaptive supply network of disaster relief. *International Journal of Production Research, 52*(7), 1970-1988.

DeAngelis, S. F., (2013). *Supply chain risk management: The five "Rs" of resilience and response.* Enterra: Enterra solution insights blog publications.

Dehkhoda, K., (2016). *Developing a framework on supply chain risk mapping, prioritization and engagement*. Unpublished Master's thesis, Concordia: Concordia University.

Delke, V., (2015). The Resource Dependence Theory: Assessment and evaluation as a contributing theory for supply management. *The Strategic Journal of Business & Change Management*. *2*(71), 709-749.

Deloitte, (2012). *Supply Chain Resilience. A risk intelligence approach to managing global supply chains*, UK: Deloitte Publications.

Deloitte, (2014). *Supply chain risk strategies for emerging markets - Understanding the importance of risk.* Deloitte UK: Deloitte and MAPI.

Deng. Y. L., Lu Q. & Yuan J. F., (2013). Topology vulnerability analysis and measure of urban metro network: *The case of Nanjing, Journal of Networks*, *8*(6), 1350-1356.

Devellis, R.F., (2012). *Scale development: Theory and applications*. Los Angeles: SAGE Publications Inc.

Dittmann, P., (2014). *Managing Risk in the global supply chain*. A survey report by the supply chain management faculty at the university of Tennessee USA, USA: university of Tennessee.

Donati, M., (2016). Supply chain risk falls in sub-Saharan Africa. *CIPS supply chain management News bulletins*, *8*(1), 105-123.

Drees, J. M. & Heugens P.P., (2013). Synthesizing and extending resource dependence theory: a meta-analysis. *Journal of Management, 39*, 1666-1698.

Drost, E. A., (2012). Validity and reliability in social science research. *Education Research and Perspectives, 38*(1), 105-123.

Durach, C.F., (2015), Antecedents and dimensions of supply chain robustness: A systematic literature review. *International Journal of Physical Distribution & Logistics Management, 45*(2), 118-137.

Dushie, D. Y, (2014). Business Continuity Planning: An empirical study of factors that hinder effective disaster preparedness of businesses. *Journal of Economics and Sustainable Development, 5*(27), 2222-2855.

Easterby-Smith, M., Thorpe, R. & Jackson, P.R., (2012). *Management Research: Theory and Practice Fourth Edition (SAGE series in Management Research).* Los Angeles: SAGE publications.

Eisinga, R.; Grotenhuis, M.; Pelzer, B., (2013). "The reliability of a two-item scale: Pearson, Cronbach or Spearman-Brown*?". International Journal of Public Health. 58* (4), 637–642.

Elliott, D., Johnson, N., & Drake, P., (2013). Exploring the role of social capital in facilitating supply chain resilience. supply chain management: *An International Journal, 18* (3), 324 – 336.

Etzioni, A. (1975). *A comprehensive analysis of complex organizations (rev. ed.)*. New York: Free Press.

Faizal, K. and Palaniappan K., (2014): Risk assessment and management in supply chain. *The Global Journal of Researches in Engineering, 14* (2), 23-36.

Fakoor, A., Olfat, L., Feizi, K., & Amiri, M., 2013. A method for measuring supply chain resilience in the automobile industry. *Journal of Basic and Applied Scientific Research,* 3(2), 537-544.

Flash Global Solutions, (2015). *4 Key Areas for Managing Supply Chain Risk in the Global Supply chain*. Netherlands: Flash Global Publications.

Gallardo, N. A., (2015). *Contingency Leadership Theory in Organizations. An evolutionary perspective.* New York Irwin: McGraw Hill publishers.

Geng, L., Xiao, R., & Xu, X., (2014). Research on MAS-based supply chain resilience and its self-organized criticality. *Journal on Discrete Dynamics in Nature and Society*, *1* (1), 1-14.

Ghadge, A., Dani, S., Chester, M., & Kalawsky, R. (2013). A systems approach for modelling supply chain risks. Supply chain management: *An International Journal, 18*(5), 523-538.

Giunipero, H. L., Nils-Ole H., & Edda F. E., (2015). Research on the phenomenon of supply chain resilience: a systematic review and paths for further investigation. *International Journal of Physical Distribution & Logistics Management, 45*(2), 90-117.

Goldish, M. (2011). *Marine Corps: Civilian to marine*. New York: Bearport Publishing Company

Goldratt, E. M., (2004). *The goal: a process of ongoing improvement.* New York: North River Press.

Gölgeci, I., & Ponomarov, S., (2014). How does firm innovativeness enable supply chain resilience? the moderating role of supply uncertainty and interdependence. *Journal Technology Analysis & Strategic Management*, *27*(3), 267-282.

Greene, W. H. (2012). *Econometric Analysis* (7th ed.). Boston: Pearson Education.

Grötsch, V. M., Blome, C & Schleper, M. C., (2013). Antecedents of proactive supply chain risk management – a contingency theory perspective. *International Journal of Volker M. Production Research, 51*(10), 2842-2867.

Habibi, I., Emamian, E. S., & Abdi, A., (2014). Quantitative analysis of intracellular communication and signaling errors in signaling networks. *Journal of BMC Systems Biology*, *8* (89).

Hafizah, H., (2014). *Research Methods –How to Interview.* New York: Career Business Press

Hajmohammad, S., & Vachon, S., (2016). Mitigation, avoidance, or acceptance? managing supplier sustainability risk*, Journal of Supply Chain Management, 52*(2), 1-39.

Handfield's, R., (2013). The Next Region for Globalization: East Africa? Global Supply Chain, Logistics, Supply Chain Management. Web Designer publications, New York.

Hazzi, O. A., & Maldaon I., (2014). *A Pilot Study: Vital Methodological Issues*. *Business, Theory and Practice.* Legos Nigeria: VGTU Press.

Heale, R., & Twycross (2015). *Validity and reliability in quantitative studies. British Medical (BMJ) Publishers.* London, United Kingdom

Hearnshaw, E., and Wilson, M., 2013. A complex network approach to supply chain network theory. *International Journal of Operations & Production Management, 33*(4), 442-469.

Heckroodt, S., (2016): *Supply Chain Challenges and Opportunities on the African Continent*. African Business Insights Nanyang Techonological University (NTU) Centre for African Studies, Oxford: Oxford University Press.

Herrera, M., (2013). *Four Types of Risk Mitigation and BCM Governance, Risk and Compliance*. Glendale, Arizona: MHA consulting publications

Holland, J., 1995. *Hidden Order: How Adaptation Builds Complexity*.. Redwood City, CA: Addison Wesley Longman Publishing Co., Inc.

Ho, W., Zheng T., Yildiz H. & Talluri S., (2015). Supply chain risk management: A literature review. *International Journal of Production Research*, *53*(16), 5031 – 5069.

Hohenstein, N., Feisel, E., Hartmann, E., & Giunipero, L., (2015). Research on the phenomenon of supply chain resilience. *International Journal of Physical Distribution & Logistics Management, 45*(1-2), 90 – 117.

Hyndman, R.J., & Athanasopoulos, G., (2013). *Forecasting: principles and practice*. Melbourne, Australia: OTexts.

Idous, and Wilson, (2000). *Graphs and Applications. An Introductory Approach*, New York: Springer publications

Ignacio, C. S., (2016). Risk Management theory: the integrated perspective and its application in the public sector. *Publications by integrated value chain risk management*. *21*(1), 89-126.

Inamullah K., (2012). Impact of customers' satisfaction and customers' retention on customer loyalty. *International Journal of Scientific & Technology Research 1*(2), 65-71.

Ionescu, M., (2015). *Strategic Choices & Strategy Models. Strategic Systems*, London: Consulting Publications.

Irina, V. K; Stephen A. S., and Robert W. P., (2013). Resource-based theory in marketing. *Journal of the Academy of Marketing Science, 42*(1), 1–21

Janvier, A. M., (2012). *A New Introduction to Supply Chains and Supply Chain Management: Definitions and Theories Perspective* (5th ed.). Canada: Canadian Center of Science and Education (CCSE) publishers.

Jeong, C. H. I., & Nawi, N F. N., (2012). *Principles of Public Administration: Malaysian Perspectives*, Kuala Lumpur: Pearson Publishers.

Johannes, M. P., (1975). The relevance of the structural-contingency model for organizational effectiveness. *Journal Administrative Science Quarterly Review*, *20*(3), 393-410.

Kago, W., Gichunge, E. & Baimwera, B., (2018). Relationship between competitive strategies and organizational performance of petroleum companies in Kenya. *International Academic Journal of Human Resource and Business Administration, 3*(2), 407-429.

Kangogo, J., Guyo, W., Bowen, M. & Ragui, M.; (2013). Supply chain disruption in the floriculture industry: A case study of Equator Flowers. *European Journal of Business and Management*, *5*(7), 246-253.

Kaplan, R.S., &. Mikes, A.. (2012). Managing risks: A new framework. *Harvard Business Review, 90*(6), 48-60.

Kathryn A., Marley T., Ward A., & Hill, L. (2014). Mitigating supply chain disruptions – a normal accident perspective. Supply chain management: *An International Journal, 19*(2), 142 – 152.

Katri, K., (2013) Extending the use of institutional theory in operations and supply chain management research: Review and research suggestions, *International Journal of Operations & Production Management*, *33*(10), 1318 – 1345.

Keng L.S., W. P W., and Chu L. Ch., (2015). Strategic Choices: A composite model for logistics service providers. *Journal of Southeast Asian Research*. *1,* 1-10.

Kenya Association of Manufacturers (KAM). (2013). *Kenya Association of Manufacturers Annual Report*, Nairobi: Kenya Association of Manufacturers.

Kenya Economic Outlook (2016). *Kenya Economic Outlook,* Nairobi: Deloitte publications.

Kenya National Bureau of Statistics (2016), *Economic Survey Report*. Nairobi: Government Printer

Kenya Vision 2030 Blueprint.

Kim, Y., Chen, Y., & Linderman, K., (2015). Supply network disruption and resilience: a network structural perspective. *Journal of Operations Management 33*(34), 43-59.

Kimani, C. W., (2013). Supply chain management challenges in Kenya petroleum industry: A case of National Oil Corporation of Kenya, *International Journal of Social Sciences and Entrepreneurship***,** *1* (3), 231-246.

Kinoti, J. B., (2013). *Determinants of supply chain management ethical practices implementation in government ministries in Kenya.* Unpublished PHD thesis, Juja: Jomo Kenyatta University of Agriculture and Technology.

Kotzee, B., (2013). Introduction, education, social epistemology and virtue epistemology. *Journal of Philosophy of Education. 47*(2), 879-942.

Kothari C.R. (2004). *Research Methodology Methods and Techniques. (*Second Revised Edition), New delhi: New Age International Publishers.

Kozlenkova, V., Hult, G., Tomas M., Lund, J., Mena, A. & Kekec, P., (2015). The role of marketing channels in supply chain management. *Journal of Retailing*. *91* (4), 586–609.

Kristianto, Y., Gunasekaran, A., Helo, P., & Hao, Y., (2014). A model of resilient supply chain network design: a two-stage programming with fuzzy shortest path. *Journal Expert Systems with Applications, an international journal 41*(1), 39–49.

Kulchmanov A., Hassan K. & Rashid, M., (2016) Contingency theory approach to risk management practices in Islamic banks: a case study on Kazakhstan. *International Journal of Islamic Business (IJIB), 1* (2), 35-67

Kwak W., (2014). *Risk management in international container logistics operations: risk analysis and mitigating strategies*. Unpublished PHD thesis, Cardiff: Cardiff University.

Lansing, J. S., (2003). *Complex Adaptive Systems*. Annual review of anthropology. *annual reviews. 32*(1), 183–204.

Lawal, I. C, (2013). Data collection techniques a guide for researchers' inhumanities and education. *International Research Journal of Computer Science and Information Systems, (IRJCSIS) 2*(3), 40-44.

Leat, P., & Revoredo-Giha, C., (2013). Risk and resilience in agri-food supply chains: the case of the ASDA pork link supply chain in Scotland. supply chain management: *An International Journal, 18*(2), 219 – 231.

Levalle, R., and Nof, S., (2015). Resilience by teaming in supply network formation and reconfiguration. *International Journal of Production Economics, 160*, 80-93.

Lopo, L. R., Neil A. M., & Claes F., (*2013*) Re-examining the market share–customer satisfaction relationship. *Journal of Marketing*: *77*(5), 1-20.

Lunenburg, F. C., & Ornstein, A. O. (2012). *Educational Administration: Concepts and practices.* Belmont, CA: Wadsworth Cengage.

Lynham, S. A., (2002). *The General Method of Theory-Building Research in Applied Disciplines.* New York: Stanford University Press

Machowiak, W. (2012). Risk management - unappreciated instrument of supply chain management strategy. *Logforum scientific journal of logistics, 8*(1), 277-285.

Malatesta, D. & Smith, C. R., (2014). Lessons from resource dependence theory for contemporary public and nonprofit management. *Journal for American Society for Public Administration*, *74*(1), 14-25.

Mathu, K., (2014). Applying the theory of constraints in the South African coal supply chain. *Mediterranean Journal of Social Sciences MCSER Publishing*, Rome-Italy 5 (9), 2039-2117

Matt, N. W., Grajales C. A., & Kurkiewicz, D., (2013). Practical assessment, research & evaluation. Assumptions of multiple regression: correcting two misconceptions. *A peer-reviewed electronic journal. 18*(11), 1531-7714.

Mburu, D. K., (2015): An assessment of effect of Risk Identification Management Strategy on Supply Chain Performance in manufacturing companies in Kenya. *International Journal of Economics, Commerce and Management, 3*(4), 1-17.

McGaghie, W. C.; Bordage, G.; & Shea, J.A. (2015). *Problem Statement, Conceptual Framework, and Research Question.* Oxford: Blackwell Publishing Ltd..

McNamara, T. (2006). Validity in language testing: The challenge of Sam Messick's legacy. *Language Assessment Quarterly: An International Journal*, *3*(1), 31-51.

Melnyk, S. A., Closs D. J., Griffins S. E., Zobel C. W., & Macdonald J. R., (2015). *Understanding Supply Chain Resilience*. *Supply Chain Management Review*. 11(2), 304 – 319.

Mensah, P., & Merkuryev, Y., (2014). Developing a Resilient Supply Chain. *Procedia - Social and Behavioral Sciences Journal, 110*(1), 309 – 319.

Mensah, P., Merkuryev, Y., & Longo, F., (2015). Using ICT in Developing a Resilient Supply Chain Strategy. *Procedia Computer Science Journal*, *43*(1), 101 – 108.

Mert, Tokman, R. Glenn R. & George, D. (2016). Strategic choice theory taxonomy of retailers' strategic orientations. *Journal of Marketing Theory and Practice*. *24*(2), 186-208

Miller, John H., & Scott, E. (2007). *Complex Adaptive Systems: An Introduction to Computational Models of Social Life*. New Jersey: Princeton University Press.

Ministry of Energy and Petroleum (MoEP) (2016). *Strategic Environment & Social Assessment. (SASA) & Kenya Petroleum Technical Assistance Project (KEPTAP) report 2016,* Nairobi: Ministry of Energy and Petroleum.

Mukaka, M., (2012). A guide to appropriate use of Correlation coefficient in medical research. *Malawi Medical Journal 24*(3), 69–71.

Mugenda, O. & Mugenda, A. (2003). *Research Methods, Quantitative & Qualitative Approaches,* Nairobi: Acts Press.

Murigi, J. M. (2013). Strategies of minimizing the effects of supply chain disruptions caused by natural disasters in Kenya – A case study of Brookside Dairy Limited. *Prime Journal of Business Administration and Management,* 3(4), 971-978.

Ndung'u, A. W. (2013). *Effect of financial risk management on financial performance of oil companies in Kenya.* Unpublished Masters MBA Project, Nairobi: University of Nairobi.

Nilsson, F. (2003). *A Complex Adaptive Systems Approach on Logistics – Implications of Adopting a Complexity Perspective*. Sweden: Lund University.

Nyang'au. F. O. (2016): Influence of supply chain risk control strategies on performance of food and beverage manufacturing firms in Kenya. *Journal of Research in Business and Management, 4*(3), 01-09.

Onwonga A, D. (2013). Perceived service quality and customer loyalty in retail banking in kenya. *British Journal of Marketing Studies*, *1*(3), 32-61.

Opata, J., (2015). *Strategies to minimize the impact of supply chain risk on business performance.* Unpublished MBA thesis, Southern New Hampshire: Southern New Hampshire University.

OPEC, (2016). *World Oil Outlook,* Gulf: OPEC

Osaro A., Zulkipli G., & Radzuan R. (2014) A framework to enhance supply chain resilience, a case of Malaysian pharmaceutical industry. *An International Journal on Global Business and Management Research, 6*(3), 219-268.

Osoro, A. (2015). Challenges affecting performance of supply chain systems in the petroleum industries in Kenya. *Journal of Energy Technologies and Policy 5*(3), 2224-3232

Otieno, B., (2013). *Strategies employed by oil marketing companies in Kenya to achieve competitive advantage*. Unpublished MBA project Nairobi: University of Nairobi.

Paul, S. R., & Zhang, X. (2010). Testing for normality in linear regression models. *Journal of Statistical Computation and Simulation, 80*(10), 1101-1113.

Pereira C. R., Silva A. & Lago D. (2015). Enhancing supply chain resilience: A multiple case study of buyers and suppliers. *Supply Chain Management: an international journal. 6*(1), 1-10.

Petroleum Institute of East Africa (2016). Petroleum Insight: *The Magazine of the Petroleum Institute of East Africa* 4th Quarter, October - December 2016, Nairobi.

Pettit, T. J., Croxton, K. L., & Fiksel, J. (2013). Ensuring supply chain resilience: Development and implementation of an assessment tool. *Journal of Business Logistics, 34*(1), 46-76.

Polit, D. F., & Beck, C. T. (2006). The content validity index: are you sure you know what's being reported? Critique and recommendations. *Research in nursing & health*, *29*(5), 489-497.

Ponomarov, S. 2012. Antecedents and Consequences of Supply Chain Resilience: A Dynamic Capabilities Perspective. *The International Journal of Logistics Management, 20*(1), 124-143.

Prabash, E. (2012). *Interpretivism and Positivism (Ontological and Epistemological Perspectives) Research Paradigms and Approaches*. New York: Irvington Publishers.

Preffer, J., & Salancik, G. (1978). The external control of organizations: *A resource dependence perspective*. California: Stanford University Press.

Pricewaterhousecoopers limited (PwC) consortium (2016). *Towards a petroleum Sector Master Plan for Kenya report.* Nairobi: Pricewaterhousecoopers limited (PwC)

Rahman, S. (2002). The theory of constraints' thinking process approach to developing strategies in supply chains, *International Journal of Physical Distribution & Logistics Management*, *32*(10), 809-828.

Rajes, R. h., Ravi, V. and Rao R. V. (2014). Selection of risk mitigation strategy in electronic supply chains using grey theory and digraph-matrix approaches. *International Journal of Supply chain and management. 53*(1), 1- 12.

Razali, N. & Wah, B. (2011). Power comparisons of shapiro wilk, kolmogorov smirnov, lilliefors and anderson darling tests. *Journal of Statistical Modeling and Analytics. 2*(1), 21–33.

Robinson, A. (2016). *Supply Chain Trends, 7 of 12 Trends that Will Drive Supply Chain Management*. Webinar: Webinar Publications-UAE.

Rodney, R. & Orr, M. (2015). An integrated risk management approach. *Journal of Strength & Conditioning Research, 29*(1), 119-128.

Rudhumbu, N. (2015). Enterprise risk management (erm) practices of private higher education institutions in botswana. *Journal of Education and Practice*, *5*(9).

Rutherford. A. (1965). *The rational analysis of systems of chemical reactions, Archive for Rational Mechanics and Analysis, 19*(2), 81-99.

Rwakira, B.T. (2015). Supply chain resilience: a case study analysis of a supply network in a developing country context-case of Uganda. *International Journal of Production Research*, *53*(18), 5592-5623.

Saenz, J. & Revilla, E. (2014). Creating more resilient supply chains. *MIT Sloan Management Review, 42*(1), 22-24.

Saini, R. and Saini, S. (2014). Improvement in the energy supply chain risk management of oil and petroleum industries" – *International Journal of Application or Innovation in Engineering & Management (IJAIEM) 3*(1), 34-35.

Sajad, F., Andrew, O. & Ambika, Z. (2016). Agency theory and supply chain management: *A structured literature review in Supply Chain Management,* 17(5), 556-570.

Saris, W. E. & Gallhofer, I. N. (2014). *Design, evaluation and analysis of questionnaires for survey research.* (2nd ed.). Hoboken: Wiley.

Sekaran, U. & Bougie, R. (2010). *Research Methods for Business: A skill Building Approach.* (5th Edition). New Jersey: John Wiley and Sons.

Schlegel, G. L. (2016). *Supply chain risk mitigation strategies within the sales & operations planning process.* Les Vegas: Institute of Business Forecasting and Planning.

Scholten, K. & Schilder, S. (2015). The role of collaboration in supply chain resilience. supply chain management*: An International Journal, 20*(4), 1-29.

Scholten, K., Sharkey S., & Fynes, B. (2014). Mitigation processes – antecedents for building supply chain resilience. Supply chain management: *An International Journal, 19*(2), 211–228.

Scotland, J. (2012). *Exploring the Philosophical Underpinnings of Research: Relating Ontology and Epistemology to the Methodology and Methods of the*

Scientific, Interpretive and Critical Research Paradigms. Canada: Canadian Center of Science and Education.

Scott, S. (2013). *Determining Sample Size: How to Ensure You Get the Correct Sample Size.*, Ohio: Qualtrics publication.

Sebitosi, K. (2015). Strategy and culture: Hidden secrets and soft skills in supply chain best practices from Africa. *Acta Universitatis Danubius. Communicatio, Journal*, *9*(1), 83-109.

Sedgwick, P. (2014). Unit of observation versus unit of analysis. *British Medical (BMJ) Journals, 1*(1), 351.

Shahrokh, E. M & Dougherty, E. R. (2014). "Effect of separate sampling on classification accuracy". *Bioinformatics Journals*. *30*(2), 242–250.

Shamuvel,V. P. & Naik, G.R. (2014) Application of theory of constraints on scheduling of Drum Buffer-Rope System. *Journal of mechanical and civil engineering. 1*(1), 15-20.

Sharif, S. P. & Yeoh, K. K. (2014). Independent directors' resource provision capability in publicly-listed companies in Malaysia. corporate ownership and control. *Strategic Journal of Business & Change Management 11*(3), 113-121.

Shirali, G., Shirali, M., & Ahmadi, A., (2017). *Assessing Reliability and Validity of an Instrument for Measuring Resilience Safety Culture in Sociotechnical Systems. Safety and Health at Work.* UK: Occupational Safety and Health Research Institute-UK

Shokrya, S., (2014). Model selection via robust version of R-squared. *Journal of mathematics and statistics, 10*(3), 414-420.

Siba, M, K. & Omwenga, J. (2015). Supply chain risks mitigation strategies adopted by manufacturing firms in Kenya: A case of Coca Cola Company (K).

International Academic Journal of Procurement and Supply Chain Management, *1*(4), 45-65.

Sidola, A., Kumar, P., & Kumar, D. (2012). System dynamics investigation of information technology in small and medium enterprise supply chain. *Journal of Advances in Management Research, 9*(2), 199

Sodhi, M. S. & Tang, C. S. (2012). Managing supply chain risk. in f. s. hillier & c. c. price (series ed.), *International Series in Operations Research & Management Science*: 172. New York: Springer.

Son, Y. & Orchard, K. (2013). Effectiveness of policies for mitigating supply disruptions. I*nternational Journal of Physical Distribution & Logistics Management, 43*(8), 684-706.

Soramaki, K. (2015). Network theory in finance. *Journal of Network Theory in Finance, 1*(4), 123-142.

Suraw, N. I., & Kariuki, S, N., (201*8).* Economic factors and financial performance of the petroleum firms in Kenya. *Strategic Journal of Business & Change Management 5*(4)

Spacey, J. (2015) *Risk Avoidance Examples of Risk Avoidance*. London: Business Encyclopedia publishers.

Talluri, S., Kull, T. J, Yildiz W. H. & Yoon, J. (2015). Assessing the efficiency of risk mitigation strategies in supply chains. *Journal of Business Logistics*, *34*, (1), 253-269.

Tang, X. L. (2013). Vulnerability evaluation of multimedia subsystem based on complex network," *Journal of Multimedia, 8*(4), 439-446.

Tesh, J. & Cole J. (2016). Supply-Chain Resilience- *UK Country Report for CRISMART/MSB*

Thuo, G. C. (2015). *Effect of inland petroleum transport risk management strategies on financial performance of oil marketing in Kenya*. Unpublished MBA Thesis, Nairobi: Strathmore University.

Transparency International, (2013). *Corruption Perceptions Index report 2013*.

Tsegha, E. (2013). Assessing the challenges and opportunities in the oil and gas industry. *Academic Journal of Interdisciplinary Studies*, *2*(12), 2281-4612.

Tseng, M. L. and Chiu, A.S.F.F. (2013). Evaluating firm's green supply chain management in linguistic preferences. *Journal of Cleaner Production, 40*(1) 22–31.

Tukamuhabwa, B. R., Stevenson M., Busby J., & Zorzini. M. (2015). Supply chain resilience: definition, review and theoretical foundations for further study. *Journal International Journal of Production Research*, *53*(18), 5592-5623.

Turbide, D. (2014). *Supply Chain Risk Management – Avoidance*. I.B.I.S., Inc., A Sonata Software Company Publications. SBS Group, USA.

Udbye, A. (2014). *Supply chain risk management in india: An empirical study of sourcing and operations disruptions, their frequency, severity, mitigation methods, and expectations.* Unpublished PHD Thesis, Portland: Portland State University –India.

Urciuoli, L., Mohanty, S., Hintsa, F. & Boekesteijn, E. G. (2014), "The resilience of energy supply chains: a multiple case study approach on oil and gas supply chains to Europe", Supply Chain Management: *An International Journal, 19*(1), 46– 63.

Vilko, J., Ritala, P., & Edelmann, J. (2014). On uncertainty in supply chain risk management. *International Journal of Logistics Management, 25*(1), 3–19.

Volker, G., Constantin, B. & Schleper, C. (2013). Antecedents of proactive supply chain risk management – a contingency theory perspective. *International Journal of Production Research, 51*(10), 2842-2867.

Vos, F. G. S., & Schiele, H. (2014). Evaluating theories in purchasing & SCM literature. Paper presented at the 23rd Annual IPSERA Conference, Pretoria, South Africa.

Wallenburg, C.M & Wieland, A. (2012). Dealing with supply chain risks. Liking risk management practices and strategies to performance. *International Journal of Physical Distribution & Logistics Management, 42*(10), 887-905.

Wang, X., Herty, M. and Zhao L. (2015). Contingent rerouting for enhancing supply chain resilience from supplier behavior perspective. *Operations Research & Management Science Journal* 23(4), 775–796.

Wang, S. L. (2013). "Cascading model of infrastructure networks based on complex network," *Journal of Networks, 8*(6), 1448-1454.

Wellenbrock, M. (2013). *Theoretical basis of supply management, the network theory in supply management.* Unpublished Bachelor Thesis. The Netherlands: University of Twente,

Wieland, A., & Wallenburg, C.M. (2013). The influence of relational competencies on supply chain resilience: a relational view. *International Journal of Physical Distribution & Logistics Management*, *43*(4), 300-320.

World Economic Forum (2013). *Building Resilience in Supply Chains,* Insight Report, Geneva: World Economic Forum.

World Factbook (2016). *Central Intelligence Agency Publications (2016).* Los Angeles: Country Comparison - Oil Consumption.

Yarkoni, T., & Westfall J., (2017). *Choosing Prediction over Explanation in Psychology: Lessons from machine learning. Perspectives on Psychological Science 1 –23*. Los Angeles: SAGE Publications.

Yasuyuki, T., Nakajima, K. & Matous, P. (2014). How do supply chain networks affect the resilience of firms to natural disasters? *Journal of Regional Science, 55*(2), 209–229.

Yongxia, L. (2014). Networked analysis approach of supply chain network. *Journal of Networks, 9*(3).

Zohreh, M., Napsiah, I., Zulkiflle, L., & Norzima, Z. (2013). Supplier selection in a sustainable supply chain. *Journal of Advanced Management Science*, *1*(3), 54-69..

Zhu, Q., Sarkis, J. & Lai, K.H., (2013). Institutional based antecedents and performance outcomes of internal and external green supply chain management practices. *Journal of Purchasing and Supply Management, 19*(2), 106-117.

Zhiyong, Z., (2017). Testing autocorrelation and partial autocorrelation: Asymptotic methods versus resampling techniques. *British Journal of mathematics & Statistical Psychology, 71*(1), 96-116

Zikmund, W. G., Babin, B. J., Carr, J. C., &Griffin, M. (2012). *Business Research Methods* (9th ed.). New York: The Free Press.

APPENDICES

Appendix I: Introduction Letter

To Whom It May Concern

Dear Sir/Madam,

RE: **COLLECTION OF DATA**

I am a student taking degree of Doctor of Philosophy (PHD) in the School of Entrepreneurship Procurement and Management, Jomo Kenyatta University of Agriculture and Technology. As part of the requirement for the award of the degree, I am expected to undertake a research study on "Influence of Risk Mitigation Strategies on Supply Chain Resilience in Petroleum industry in Kenya''. I'm therefore, seeking your assistance to fill the questionnaires attached. Kindly answer all the questions. The research results will be used for academic purposes only and will be treated with utmost confidentiality. Only summary results will be made public. No one, except the institution will have access to these records.

Should you require the summary, kindly indicate so at the end of the questionnaire. A self-Addressed envelope is provided for your reply. Your co-operation will be appreciated.

Yours faithfully,

NELSON K. LAMBAINO

PHD student

Jomo Kenyatta University of Agriculture and Technology.

Appendix II: Questionnaire

The objective of this research is to identify Risk Mitigation Strategies employed by oil marketers that influence supply chain resilience in petroleum industry in Kenya.

The information collected in this study shall be used purely for academic purposes and will be kept confidential. Your participation in this survey shall be highly appreciated.

Name of your organization: _____

SECTION A: Personal Information

Please tick (√) as applicable

1. Kindly Indicate the number of years you have worked with the organization

   - Less than 5 years
   - 6-10 Years
   - 11-15years
   - 16 years and above

2. Kindly Indicate your highest level of education

   - Secondary level
   - College level
   - University level
   - Masters
   - PHD
   - Professional Qualification

Others Specify……

3. Kindly indicate your position (designation) in the organization ……

SECTION B: Risk Mitigation Strategies and Supply Chain Resilience

Please tick (√) as applicable

4. Risk Avoidance Strategy

Please indicate which of the following supply chain risk avoidance mitigation practices have been incorporated in your organization

i. Information Technology software & systems **( )**
ii. Geographical Relocation **( )**
iii. Knowledge Management **( )**
iv. Others ( )

Please specify…….

5. The following statements deal with Supply Chain Risk Avoidance Mitigation Strategies namely information technology solutions, relocation and knowledge management. Please record your answer by ticking at the space provided one number that best reflects your opinion on the following five-point scale indicator: (1= Strongly Disagree, 2 = Disagree, 3 = Moderate Agree, 4 = Agree, 5 = Strongly Agree)

Action/Activities	**1**	**2**	**3**	**4**	**5**
Information technology has enhanced connectivity for quick and coordinating responses to disruptions					
Information Technology has eliminated infiltration of counterfeits in to the organization					
Information Technology has enhanced security, information sharing, analytics, scenario modelling, data and knowledge exchange in the organization					
Relocation of companies from region prone with risk has increased level of risk avoidance					
Relocating or switching to alternative sources of products, suppliers and/or customers considered risk					

Action/Activities	1	2	3	4	5
has increased avoidance of risks from reoccurring in my Company.					
Knowledge management has increased employee understanding of supply chain structures and ability to easily adopt to disruptions					
Knowledge management has increased employee preparedness on plan of action on how to avoid potential risks					
Knowledge management had reduced number of supply chain disruption in the organization					

6. Kindly rate use of information technology as a supply chain risk avoidance mitigation strategy by ticking from the scale provided where 1=Poor, 2=Fair, 3 =Good, 4= Very Good and 5= Excellent

    1. Poor ( )
    2. Fair ( )
    3. Good ( )
    4. Very Good ( )
    5. Excellent ( )

7. Kindly rate use of relocation as a supply chain risk avoidance mitigation strategy by ticking from the scale provided where 1=Poor, 2=Fair, 3 =Good, 4= Very Good and 5= Excellent

    1. Poor ( )
    2. Fair ( )
    3. Good ( )
    4. Very Good ( )
    5. Excellent ( )

8. Kindly rate use of knowledge management as a supply chain risk avoidance mitigation strategy by ticking from the scale provided where 1=Poor, 2=Fair, 3 =Good, 4= Very Good and 5= Excellent

    1. Poor ( )

2. Fair ( )
3. Good ( )
4. Very Good ( )
5. Excellent ( )

9. Risk Acceptance Mitigation Strategy

Please indicate which of the following supply chain risk acceptance mitigation strategies have been incorporated in your organization.

i. Contingency Plans e.g. Budgets **( )**
ii. Creation of risk management culture and awareness **( )**
iii. Supply chain Risk Monitoring **( )**
iv. Others ( )

Please specify……
….

10. The following statements deal with supply chain risk acceptance mitigation strategies namely; contingency plans, risk management culture/awareness and risk monitoring. Please record your answer by ticking at the space provided one number that best reflects your opinion on the following five-point scale indicator: (1= Strongly Disagree, 2 = Disagree, 3 = Moderate Agree, 4 = Agree, 5 = Strongly Agree).

Action/Activities	**1**	**2**	**3**	**4**	**5**
Contingency Plans has enhanced preparedness in dealing with unanticipated potential risk events.					
Contingency plans has reduced risk impacts in the organization					
Risk culture, awareness/mainstreaming had embraced supply chain risk management in the organization					
Risk awareness had reduced risk impact due to employee					

understanding of specific risks inherent in specific functions					
Risk Monitoring has improved risk response plans in the organization					
Risk monitoring has increased level of implementation of risk improvement plans in the organization					

11. Kindly rate use of contingency plans as a supply chain risk acceptance mitigation strategy by ticking from the scale provided where 1=Poor, 2=Fair, 3 =Good, 4= Very Good and 5= Excellent

    1. Poor ( )
    2. Fair ( )
    3. Good ( )
    4. Very Good ( )
    5. Excellent ( )

12. Kindly rate use of supply chain risk awareness/mainstreaming as a supply chain risk acceptance mitigation strategy by ticking from the scale provided where 1=Poor, 2=Fair, 3 =Good, 4= Very Good and 5= Excellent

    1. Poor ( )
    2. Fair ( )
    3. Good ( )
    4. Very Good ( )
    5. Excellent ( )

13. Kindly rate use of supply chain risk monitoring as a supply chain risk acceptance mitigation strategy by ticking from the scale provided where 1=Poor, 2=Fair, 3 =Good, 4= Very Good and 5= Excellent

    1. Poor ( )

2. Fair ( )
3. Good ( )
4. Very Good ( )
5. Excellent ( )

14. Risk Reduction Mitigation Strategy

Please indicate which of the following supply chain risk reduction mitigation strategies have been incorporated in your organization

i. Supply Chain Collaboration ( )
ii. Supply Chain Buffering ( )
iii. Supply chain Flexibility ( )

iv. Others ( )

Please specify……

15. The following statements deal with supply chain risk reduction mitigation strategies namely; collaboration, buffering and flexibility. Please record your answer by ticking at the space provided one number that best reflects your opinion on the following five-point scale indicator: (1= Strongly Disagree, 2 = Disagree, 3 = Moderate Agree, 4 = Agree, 5 = Strongly Agree)

Action/Activities	**1**	**2**	**3**	**4**	**5**
Supply Chain Collaboration has increased prompt adoptability during turbulence or disruptions through joint relationship efforts.					
Collaboration has increased visibility and velocity through communication across supply chains					

Collaboration has increased collective response planning and resource sharing					
Buffering has reduced supply shortages failures and increased ability and capacity to cope quickly in response to problems					
Buffering has reduced demand supply surges through strategic and selective use of spare capacity, inventory and adoptable deployment of resources.					
Flexibility has increased quick response to problems through flexible arrangements such as flexible transportation, flexible labour arrangements and order fulfilment flexibility					
Flexibility has reduced time and effort in changing certain requirements to adopt and respond to supply chain risks					

16. Kindly rate use of supply chain collaboration as a supply chain risk reduction mitigation strategy by ticking from the scale provided where 1=Poor, 2=Fair, 3 =Good, 4= Very Good and 5= Excellent

    1. Poor ( )
    2. Fair ( )
    3. Good ( )
    4. Very Good ( )
    5. Excellent ( )

17. Kindly rate use of buffering/strategic stocks as a supply chain risk reduction mitigation strategy by ticking from the scale provided where 1=Poor, 2=Fair, 3 =Good, 4= Very Good and 5= Excellent

    1. Poor ( )
    2. Fair ( )
    3. Good ( )
    4. Very Good ( )

5. Excellent ( )

18. Kindly rate use of supply chain flexibility as a supply chain risk reduction mitigation strategy by ticking from the scale provided where 1=Poor, 2=Fair, 3 =Good, 4= Very Good and 5= Excellent

    1. Poor ( )
    2. Fair ( )
    3. Good ( )
    4. Very Good ( )
    5. Excellent ( )

19. Risk Transfer/Share Mitigation Strategy

Please indicate which of the following supply chain risk transfer mitigation strategies have been incorporated in your organization.

i. Outsourcing activities to third parties ( )
ii. Insurance & Reinsurance ( )
iii. Partnership/mergers/Joint Ventures ( )
iv. Others ( )

Please specify…….

20. The following statements deal with supply chain risk transfer mitigation strategies namely; outsourcing/contracting, Insurance & Reinsurance and Partnership/mergers/Joint Ventures. Please record your answer by ticking at the space provided one number that best reflects your opinion on the following five-point scale indicator: (1= Strongly Disagree, 2 = Disagree, 3 = Moderate Agree, 4 = Agree, 5 = Strongly Agree)

21.

Action/Activities	**1**	**2**	**3**	**4**	**5**
Creation of contraction agreements with suppliers has increased supplier service delivery and reliability.					
Outsourcing/contracting to third parties has reduced many non- core functional responsibilities from the organization.					
Outsourcing has increased organizational focus through reallocation of more resources to its core competencies					
Insurance has increased organization capacity to manage risks of losses					
Insurance has enhanced company's disaster management capabilities during disruptions					
Partnership/mergers/Joint Ventures has reduced organizational risks because of segregation of various functionalities among parties.					
There is an increased competencies in key segregated functions in the organization through Partnership/mergers/Joint Ventures.					

22. Kindly rate use of outsourcing/contracting activities to third parties as a supply chain risk transfer mitigation strategy by ticking from the scale provided where 1=Poor, 2=Fair, 3 =Good, 4= Very Good and 5= Excellent

1. Poor ( )
2. Fair ( )
3. Good ( )
4. Very Good ( )
5. Excellent ( )

23. Kindly rate use of insurance as a supply chain risk transfer mitigation strategy by ticking from the scale provided where 1=Poor, 2=Fair, 3 =Good, 4= Very Good and 5= Excellent

    1. Poor ( )
    2. Fair ( )
    3. Good ( )
    4. Very Good ( )
    5. Excellent ( )

24. Kindly rate use of Partnership/mergers/Joint Ventures as a supply chain risk transfer mitigation strategy by ticking from the scale provided where 1=Poor, 2=Fair, 3 =Good, 4= Very Good and 5= Excellent

    1. Poor ( )
    2. Fair ( )
    3. Good ( )
    4. Very Good ( )
    5. Excellent ( )

25. Moderating effect of Management Control Policies, Rules and Procedures

Please indicate which of the following management control polies rules and procedures have moderating effect on the relationship between supply chain risk mitigation strategies and supply chain resilience in your organization.

i. Business Continuity Management ( )
ii. Integrated Risks Management ( )
iii. Supply and Demand Forecasting Management ( )
iv. Others –Specify……. ( )

26. The following statements deal with moderating effect of Management Control policies rules and procedures. Please record your answer by ticking at the space provided one number that best reflects your opinion on the following five-point scale indicator: (1= Strongly Disagree, 2 = Disagree, 3 = Moderate Agree, 4 = Agree, 5 = Strongly Agree)

Action/Activities	**1**	**2**	**3**	**4**	**5**
Business Continuity Management help identify potential threats and appropriate mitigation strategies for building supply chain resilience					
Business Continuity Management enhances timely resumption and delivery of essential business activities in the event of business disruption.					
Integrated risk management does not focus only on mitigation of risks, but also supports activities that foster innovation in the organization					
Integrated risk management enhances continuous, proactive and communicate risk from an organization-wide perspective					
Supply and Demand management forecasts has reduced waste and provided accurate forecasting of data.					
Supply and Demand management forecasts has reduced delivery in time, and improved product or service quality					

27. Kindly rate use of Management Control policies, rules and procedures to moderate the influence of risk mitigation strategies and supply chain resilience by ticking from the scale provided where 1=Poor, 2=Fair, 3 =Good, 4= Very Good and 5= Excellent

    1. Poor ( )
    2. Fair ( )
    3. Good ( )

4. Very Good ( )
5. Excellent ( )

28. Supply Chain Resilience

The following statements deal with the influence of supply chain resilience in performance in your company in terms of customer service satisfaction, quality of products and services and market share. Please record your answer by ticking at the space provided one number that best reflects your opinion on the following five-point scale indicator: (1= Strongly Disagree, 2 = Disagree, 3 = Moderate Agree, 4 = Agree, 5 = Strongly Agree)

Action/Activities	**1**	**2**	**3**	**4**	**5**
Customer retention rate has increased due to risk resilience in the Company.					
Supply chain resilience in an organization resulted to improved customer acquisition rate.					
There has been increased number of referral for our company's products arising from resilient supply chain system.					
Number of failures or reject rates have reduced in the company because of risk resilience in the organization.					
Number of product returned by our clients have reduced due to increased supply chain resilience in the organization					
Number of customer complaints have gone down in our company because of improved risk resilience.					
Total sales volume have improved in my organization with improved risk resilience					
The demand for our products and services have increased in the company due to increased risk supply chain resilience					
Market share rates have increased in my company because of enhanced supply chain resilience measures.					

29. Kindly rate influence of supply chain resilience to Company's performance in terms of customer satisfaction by ticking from the scale provided where 1=Poor, 2=Fair, 3 =Good, 4= Very Good and 5= Excellent

    1. Poor ( )
    2. Fair ( )
    3. Good ( )
    4. Very Good ( )
    5. Excellent ( )

30. Kindly rate effect of supply chain resilience to Company's performance in terms of quality of products and services systems by ticking from the scale provided where 1=Poor, 2=Fair, 3 =Good, 4= Very Good and 5= Excellent

    1. Poor ( )
    2. Fair ( )
    3. Good ( )
    4. Very Good ( )
    5. Excellent ( )

31. Kindly rate influence of supply chain resilience to Company's performance in terms of market share by ticking from the scale provided where 1=Poor, 2=Fair, 3 =Good, 4= Very Good and 5= Excellent

    1. Poor ( )
    2. Fair ( )
    3. Good ( )
    4. Very Good ( )
    5. Excellent ( )

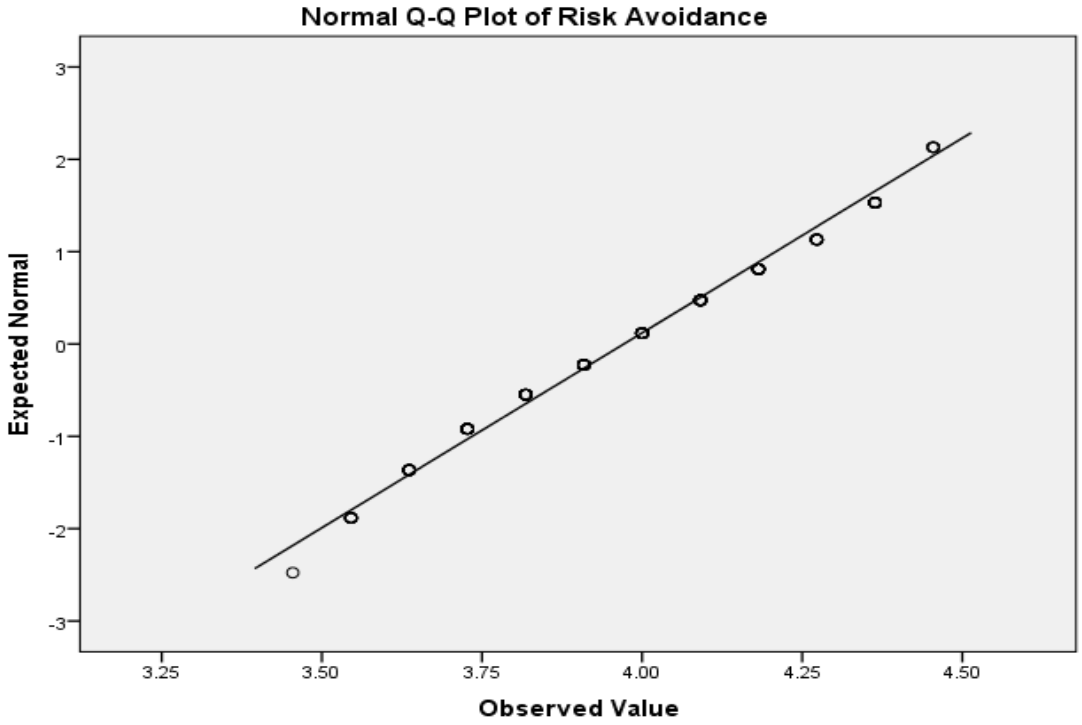
Appendix III: List of Licensed Oil Marketing Companies (OMC's)

ITEM NO	NAMES OF OMC'S
1	ACER PETROLEUM
2	AFRIOIL
3	AFRO PETROLEUM
4	AINUSHAMSI
5	AMANA
6	AMEKEN
7	ARECH
8	ASELS
9	ASPAM ENERGY
10	AXON
11	BACHULAL POPATLA
12	BAKRI
13	BANODA
14	BAZAM PETROLEUM
15	BILAL
16	BLUE SKY
17	BRAIN FIELD
18	BUSHRA ENERGY
19	CENTRE STAR
20	CITY LINKS
21	CITY OIL
22	DALBIT
23	E.A GASOIL
24	ECO OIL
25	ELIORA ENERGY
26	EMKAY
27	ENGEN
28	EPPIC
29	ESSE LIMITED
30	FAST ENERGY
31	FINEJET
32	FOSSIL FUELS
33	FUTURES
34	GALANA
35	GAPCO
36	GLOBAL

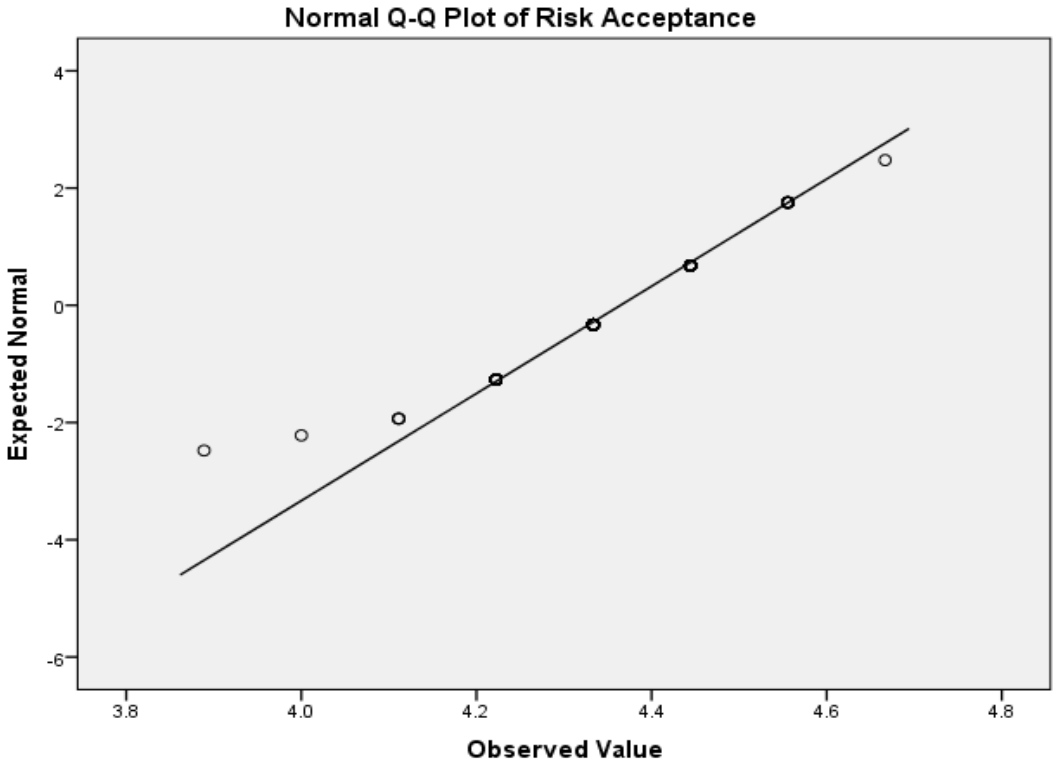
ITEM NO	NAMES OF OMC'S
37	GULF ENERGY
38	HARED PETROLEUM
39	HASHI ENERGY
40	HASS
41	ILADE OIL
42	KENCOR
43	KENOLKOBIL
44	KOSMOIL
45	LINK OIL
46	LUQMAN PETROLEUM
47	MOGAS
48	MOIL
49	MS OIL
50	NET GAS & ENERGY
51	NOCK
52	NOMAD
53	OCEAN ENERGY
54	OIL POINT
55	OILCITY
56	OILCOM
57	OILIBYA
58	OLYMPIC
59	ONE PETROLEUM
60	ORYX ENERGY
61	PACIFIC
62	PERFORMANCE PARTS
63	PETRO OIL
64	PETROCAM
65	PETROSUN
66	PICCALILLY
67	PRIME REGIONAL
68	RAMJI
69	RANWAY
70	REGNOIL
71	RIVA PET
72	ROYAL ENERGY
73	SAFARI PETROLEUM LIMITED
74	SAVANNA ENERGY

ITEM NO	NAMES OF OMC'S
75	SHILOH PETROLEUM
76	SICAR
77	SOCIETE
78	STABEX ENERGY
79	TEXAS ENERGY
80	TIBA OIL
81	TOSHA
82	TOTAL
83	TOWBA
84	TRISTAR
85	TROJAN
86	ULTRA PETROLEUM
87	VIVO ENERGY

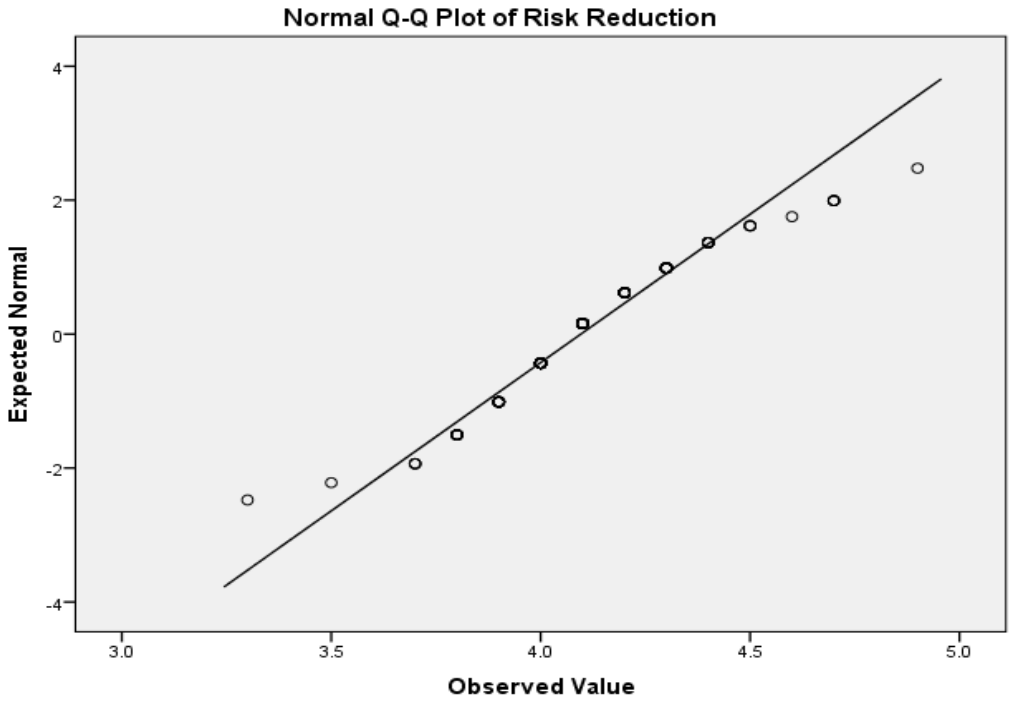
Appendix IV: Normal Q-Q Plot for Risk Avoidance



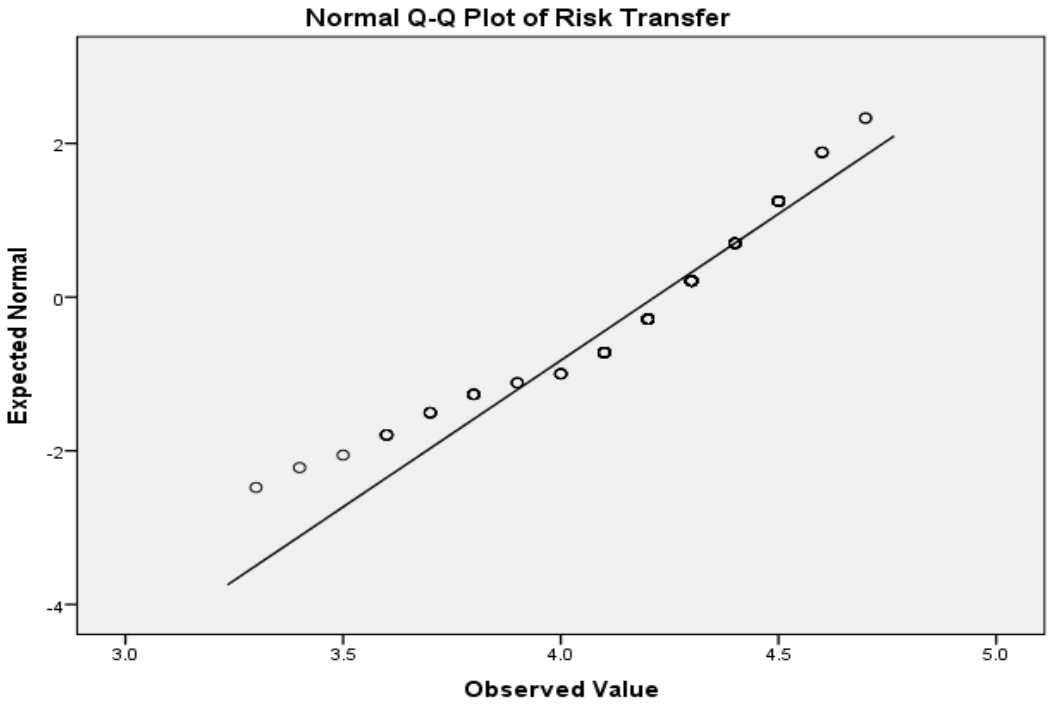
Appendix V: Normal Q-Q Plot for Risk Acceptance



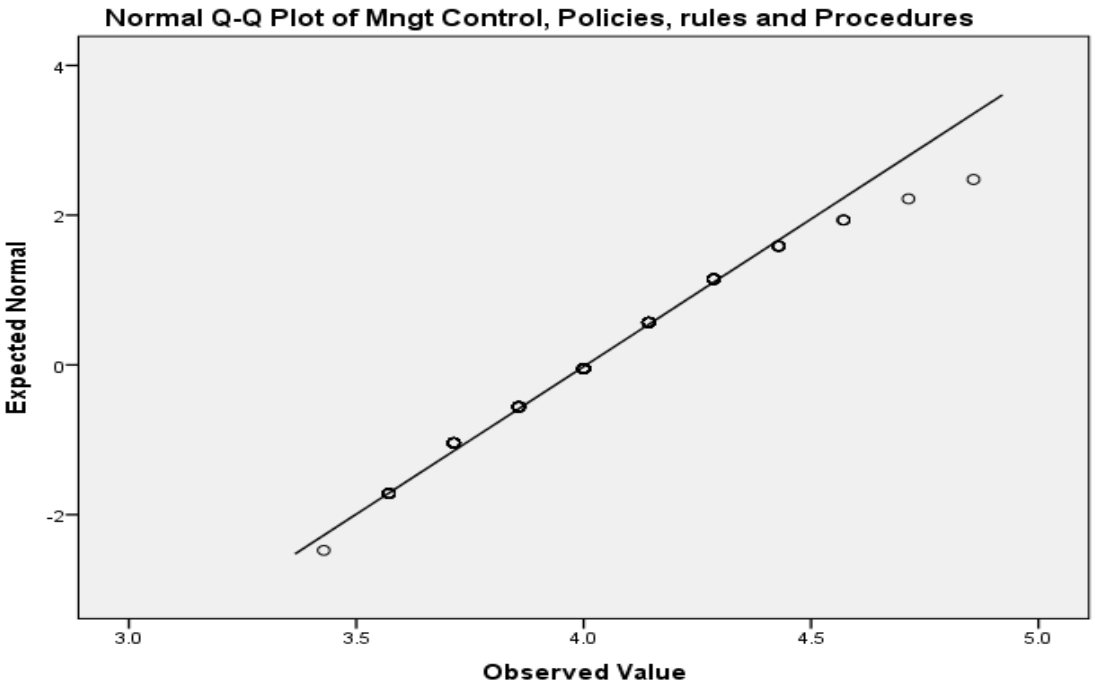
Appendix VI: Normal Q-Q Plot for Risk Reduction



Appendix VII: Normal Q-Q Plot for Risk Transfer



Appendix VIII: Normal Q-Q Plot of Management Control Policies rules and Procedures



Appendix IX: Normal Q-Q Plot for Supply Chain Resilience