

**SUPPLY CHAIN VULNERABILITY AND CUSTOMER  
SATISFACTION ON PETROLEUM PRODUCTS IN KENYA**



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**Research Project Submitted in Partial fulfillment for the Degree of Master of  
Business Administration School of Business, University of Nairobi,**

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## DECLARATION

### BY THE STUDENT:

I declare that this Research Project is my own work and has not been submitted for a degree in any other university.

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This Research Proposal is submitted with my approval as the university Supervisor



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## **DEDICATIONS**

This research Project is dedicated to my brother: George Ambayo for his determination and commitment to educate me. Indeed, he made me live the Martin Luther King junior dream that faith is taking the first step even if you can't see the whole staircase. My niece Merolyn who looked up to me for inspiration during this process, may you live to achieve your academic ambitions. Finally, to Celine, thank you so much for the sleepless nights you spent supporting, encouraging and keeping me company throughout the period that I spent on this research project.

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## **ABSTRACT**

While a supply chain disruption is the trigger that leads to the occurrence of supply chain risks, it is a major determinant of the dissatisfaction from the customers. It therefore seems consequential that the susceptibility of the supply chain to the harm of this disruption is of significant relevance. This leads to the concept of supply chain vulnerability. The basic premise is that supply chain characteristics are antecedents of supply chain vulnerability and impact on both the probability of occurrence as well as on the severity of supply chain disruptions and hence, customer dissatisfaction. The understanding of supply chain vulnerability concept is very important in creating value to the customers.

The research involved a cross sectional survey of the registered distributors of petroleum products in Kenya. It adopted a descriptive approach in establishing the impact of Supply chain vulnerability and customer satisfaction on petroleum products in Kenya. The research employed a census of 54 firms out of which, 30 responded. Data was collected from the respondents through a drop and pick method. The data was then analyzed using SPSS and the findings presented in tables.

This study revealed that there is a positive relationship between the causes of supply chain vulnerability and customer dissatisfaction. The factors targeted as the causes of supply chain vulnerability like focus on efficiency rather than effectiveness, globalization of supply chains, focused factories and centralized distribution systems, trends to outsourcing, reduction of supplier base, volatility of demand, lack of visibility and control, natural calamities, just in time



production system and regulations have a negative effect on customer satisfaction elements studied like price, speed, quality, delivery time and flexibility.

The study recommends that the distributors of petroleum products in Kenya should mitigate against the causes of supply chain vulnerability to create value to the customers of the petroleum products

## CHAPTER ONE: INTRODUCTION

### 1.1 Background

Supply chain management is the combination of art and science that goes into improving the way your company finds the raw components it needs to make a product or service and deliver it to customers (Wailgum and Worthern, 2008). The underlying principle of Supply Chain Management is to establish control of the end to end process in order to create a seamless flow of a good or service to satisfy the customer.

Kenyan consumers and indeed many consumers across the globe have faced tuff economic times due to arrays of severe crisis and shocks that have direct impact on supply chain. This concern is gaining a considerable attention notably due to the frequency and intensity of catastrophes, disasters and crisis that seem to have increased on a global scale (Coleman, 2006, Helferich and Cook, 2002; Munich Re, 2006). Supply chain vulnerability has a significant negative impact on shareholder value and on operational performance (Hendricks and Singhal, 2003, 2005). Generally, Capital Markets have a tendency to severely penalize supply chain vulnerability and rates highly supply chain robustness. This is due to the fact that logistics flows in many industries strive to be lean, responsive and agile.

A smooth supply chain process results in reliable supply to the customer at cost effective means. This tremendously improves firm performance by enabling it to gain a competitive edge over its competitors. Any factors that disrupt the smoothness of the supply chain results in delays, inefficiencies, and lack of competitiveness. This ultimately impact on customer satisfaction and eventually on a firm's profitability.

A vulnerable supply chain exposes consumers to the supply chain risks. Whether managed or not, a supply chain will always display some degrees of vulnerability. (Peck, 2006). Supply chain risk is compounded by some contemporary supply chain management practices like global sourcing and single sourcing. These factors increase the level of supply chain risks. (Juttner, 2005; Wegner and Bodes, 2006).

### **1.1.1 Supply Chain Vulnerability and Customer Satisfaction**

A supply chain consists of all parties involved, directly or indirectly, in fulfilling a customer request. The supply chain not only includes the manufacturer and suppliers, but also transporters, warehouses, retailers, and customers themselves. Within each Company, such as manufacturing or distribution, the supply chain includes all functions involved in receiving and filling a customer request. These functions include, among others, new product development, marketing, operations, distribution, finance, and customer service.

Supply chain vulnerability has been defined as the susceptibility of the supply chain to the likelihood and consequences of disruptions (Bloss et al, 2009; Svensson 2000, 2002; Christopher and Perk, 2004). It is an exceptional and anomalous situation that is triggered by an underlying disruptive event. The vulnerability is associated with a certain probability of occurrence and characterized by its' severity and in essence direct and indirect effects (Kleindorfer and Saad, 2005).

Peck (2002), in a detailed discussion of supply chain vulnerability identified seven sources of supply chain vulnerability. These sources are: over emphasis on efficiency rather than

effectiveness, globalization of supply chains, adoption of focused factories and centralized distribution, increased tendency to outsource, reduction of the supplier base, volatility of demand and lack of visibility and control procedures. Jittner, (2005), distinguishes between environmental, supply and demand risk sources on the one hand, and processes and control mechanisms as a risk amplifier or absorber on the other hand. Environmental risk sources comprise any external uncertainties arising from the supply chain such as disruption caused by political (e.g. fuel crisis), natural (e.g. foot and mouth outbreak, fire, earthquake) or social (e.g. terrorist attacks) uncertainties.

Compared with external, environmental risk sources, demand and supply sources are internal to the supply chain. Jittner (2005) notes that processes can either amplify or absorb the effect of risks in the supply chain and refer to the design and implementation of processes within and between the entities in the supply chain.

Customer satisfaction refers to the measure of how much products or services supplied by a firm meet or surpass customer expectation (Fomell et al, 1996). Customer satisfaction is an overall customer attitude towards a good or a service provider or an emotional reaction towards the difference between what customers expect and what they receive, regarding the fulfillment of some desire, need or goal (Hansemark, & Albinson, 2004, Kotler, 2000, Hoyer, & MacInnis, 2001).

Customer satisfaction is very important because without satisfied customers, you do not have a business. It influences the customers' repurchase decisions. To achieve customer satisfaction, organizations should build and maintain long lasting relationships with the customers through

satisfying their needs. This resultantly motivates them to continue to do business with the organization on an ongoing basis (La Barbera, & Mazurky, 1983).

The importance of customer satisfaction cannot be dismissed because happy customers are like free advertisement. Customer satisfaction is regarded as a fundamental determinant in maintaining long term customer relationship behaviors (Oliver, 1980; Zeithaml, Berry, & Parasuraman, 1996; Anthanassopoulos, Gounaris, & Sathakopoulos, 2001; Anderson, & Sullivan, 1993; Fornel, 1992; Levesque, & McDougall, 1996).

The linkage between supply chain vulnerability and customer satisfaction is based on the argument that there are four main characters in the supply chain which include suppliers, manufacturers, distributors and customers. Thus, understanding the relationship between the mentioned groups and efforts to optimize this relationship is the major issue in organizations. The most difficult and important issue in supply chain management is to manage relations between the four main characters, because they have the tremendous effect on all aspects of supply chain and its function level. Many firms' supply chain vulnerability is as a result of poor transmission of expectations and behaviors that occur between characters of the chain (Dehmorde, Shahraki, Lakzaie, 2010).

In addition, the effective management of relationships is necessary in supply chain that suppliers and customers work together in a coordinated and integrated way while observing of partnership principles, communication, information and dialogue. Suppliers and customers should have the same goals and trust each other (Rajabzadeh, Khadivar, Kazemi, 2007). Supply chain

vulnerabilities may destabilize the dimensions of supply chain relationships thereby affecting customer satisfaction. The linkage between supply chain vulnerability and customer satisfaction is hinging on the fact that the supply chain vulnerability compromises product quality, increases production costs hence price of a product, causes delay in delivery and makes it impossible for the firm to exercise flexibility. These elements are Key to customer satisfaction. Therefore a vulnerable Supply Chain exposes consumers to the Supply Chain Risks.

### **1.1.2 The Petroleum industry and products in Kenya**

The Kenyan petroleum industry was deregulated in late 1994 with the deregulation of retail prices of petroleum products and of the importation of crude oil and refined products. The industry could not be fully deregulated mainly because of the market's dependence on Kenya Petroleum Refinery Limited for liquefied petroleum gas, and the absence of a viable infrastructure for its importation. The Government therefore required oil companies to import and process crude oil through the refinery to satisfy the requirements for liquid petroleum gas. The Government later introduced an open tender system for the importation of crude oil to the refinery. With this system, a tender for importation of crude oil is awarded to individual petroleum firms, which then import crude oil for the whole industry and supplies to the other petroleum firms, Petroleum Insight (3rd Quarter Jun-Sep 2010),

The players in petroleum industry in Kenya are close to sixty in number. The main players in the industry are: Total Kenya Limited, with 27.5% market share, Kenol Kobil with 19.4%, Kenya Shell with 16.1%, Libya Oil with 11.7%, Gapco with 6.3% National Oil Corporation Kenya with

4.1% and others with a market share of 19% between January and June 2010, Petroleum Insight (3rd Quarter Jun-Sep 2010),

The petroleum industry in Kenya concentrates mainly on the downstream business i.e. wholesale and retailing of oil products. Kenya Petroleum Refineries Limited does not own any petroleum products but refines for the players in the petroleum industry. Kenya Pipeline Company only facilitates transfer of petroleum products to various depots owned by these players in the country, Petroleum Insight (3rd Quarter Jun-Sep 2010),

The operations of Kenya Petroleum Refineries Limited and Kenya Pipeline Company are governed by the Energy Regulatory Commission Acts. The Kenya government created the Energy Regulatory Commission with the mandate of offering stewardship to electricity, petroleum and new and renewable sub-sectors, KIPPRA report, (2010). Currently, Kenya imports all its crude oil from global sources.

Governments have employed various policy interventions and strategies to improve access, ensure security of supply of affordable energy and to achieve efficiency and conservation (KIPPRA report, 2010). Faced with the uncertain global sources of crude oil, the Kenya Government through Energy Regulatory Commission has been regulating fuel prices since December 2010. Some of the measures aimed at protecting customers have ended up disrupting petroleum products' supply chain activities

## 1.2 Statement of Problem

Supply chain vulnerability can result into customer dissatisfaction. For customer satisfaction to be achieved, aspects of the supply chain relationships that include communication, trust, conformity, dependence, commitment and co-operation which connects all the players in the supply chain need to be enhanced. (Rajabzadeh, Khadivar, Kazemi, 2007). Any factor(s) that destabilize these dimensions of supply chain relationships will most likely result into customer dissatisfaction. The Kenyan market for petroleum products has been exposed to some of these issues. This has resulted into shortage of the petroleum products, and rise of the prices. The energy regulatory commission has been in place but still, these issues remain unresolved.

A number of studies have been done in the area of supply chain vulnerability. A study by Peck (2002), on supply chain vulnerability in the United Kingdom found that Supply chain vulnerability is an important business issue, and that little research has been undertaken in supply chain vulnerability. The study also revealed that awareness of the subject is poor; and that there is a need for a methodology for managing supply chain vulnerability. Studies by Maboudi et al, 2011 and Gilaninia et al 2012 found that supply chain relationships have an impact on customer satisfaction.

Locally, Abuko (2011) carried out a study to determine the Impact of Green Supply Chain on the performance of oil marketing firms in Kenya. This study used a survey research design and sampled 6 respondents from each of the 5 major oil marketing firms. A structured questionnaire was used to collect data and a multivariate data analysis technique was used. The study found out



that Green Supply Chain Management practices have a positive impact on the overall firms' performance by improving quality, productivity, efficiency and cost savings.

Although a number of studies have been done on supply chain management practices, Supply chain vulnerability and Green supply chain management practices, there is no study that has given an indication on how supply chain vulnerability in the petroleum industry in Kenya impact on customer satisfaction on the petroleum products. This is the gap that the current study seeks to fill.

### **1.3 Objectives of the Study**

The general objective of the study was to evaluate the impact of supply chain vulnerability on customer satisfaction on petroleum products in Kenya. The specific objectives of the study were:

- i. To determine the factors leading to supply chain vulnerability on the petroleum products in Kenya
- ii. To establish the impact of supply chain vulnerability on customer satisfaction on the petroleum products in Kenya.

## **1.4 Value of the study**

This research project present guideline on managing the petroleum supply chain in the era of turbulence by embracing volatility as an opportunity. By understanding the nature and the impact of the volatility, the distributors, may then react by shifting the risk exposure into building hedges and mitigations into their supply chain design.

The management of the regulators will benefit from this study as it will provide insight about the problems that have arisen due the regulations.

The government agencies will make use of this study, as it will provide useful knowledge in formulation of policies and a regulatory framework for price controls.

Researchers and scholars will use this information to add to their understanding of strategic supply chain vulnerability management policies.

The study will provide foundation and material for further related research.

## **CHAPTER TWO: LITERATURE REVIEW**

### **2.1 Introduction**

The current chapter provides a review of the literature pertinent to the objective of the study, mostly derived from reference books, dissertations, thesis, Journals and any other relevant documents. The focus is mainly on the most recent developments the current state of Literature on supply chain vulnerability, and customer satisfaction

### **2.2 Supply Chain Vulnerability**

Supply chain vulnerability has been defined as the susceptibility of the supply chain to the likelihood and consequences of disruptions (Bloss et al, 2009; Svensson 2000, 2002; Christopher and Perk, 2004). It is an exceptional and anomalous situation that is triggered by an underlying disruptive event. The supply chain vulnerability is associated with a certain probability of occurrence and characterized by its severity and in essence direct and indirect effects (Kleindorfer and Saad, 2005).

Supply chain vulnerability is described as an exposure to serious disturbance; the propensity of risk sources and risk drivers to outweigh risk mitigating strategies, thus causing adverse supply chain consequences (Wagner and Bode, 2006). Supply chain vulnerability is a function of certain supply chain characteristics and that the loss incurred by an organization is due to vulnerability as a function to a given supply chain disruption (Wagner and Bode, 2006). Supply chain vulnerability is related to any property of an industrial system that may weaken or limit its ability to endure threats and survive accidental events that originate both within and outside the system boundaries (Asbjornslett, 2008).

There are two types of vulnerability; internal and external. Internal vulnerability is as a result of a lack of internal supply chain agility (Houlitian, 1987, Forrester, 1962). Supply chain disruptions happen under the effect of specific risks that can be internal to an organization being considered, external to the organization or to the supply chain. Wars, terrorist attacks, political uprisings, natural disasters are considered as risks external to the supply chain. Market risks are considered as risks external to the organization and internal to the supply chain, while risks related to processes and activities are considered internal to the organization (Sheffi, 2005, 2006)..

It is not vulnerability of supply chain that can be observed but the variables that determine the vulnerability. These variables are the drivers of supply chain vulnerability. Driver of supply chain vulnerability are grouped into three namely: Supply side, Demand side, and Supply chain structure vulnerabilities (Stephen M. Wagner, 2009). On the demand side, vulnerability resides in the down-stream supply chain operation. This include, in the customer, for instance; the customer dependence, the financial position of the customer; in the product and the product characteristics, for instance; the product life cycle, the product complexity; in the outbound supply chains, for instance; in the physical distribution of a product to end consumer; in the distribution and transportation operation required for serving the customer (Christopher and Lee, 2004). These drivers can also reside in the uncertainty surrounding the random demands of the customer (Nagurney et al., 2005; Tang, 2006).

Vulnerability on the supply side may reside in the supply base, the supplier portfolio or the supplier network, for instance supplier-supplier relationships, supply base complexity, supply

base structure (Choi and Hong, 2002; Choi and Krause, 2006; Halikas et al., 2004). When a supplier in the supply network is vertically integrated by a direct competitor, forcing the termination of the relationship with the buying firm it can increase vulnerability (Chopra and Sodhi, 2004). The characteristics of the individual suppliers in a firm's supplier portfolio can also influence supply chain vulnerability. This majorly concerns, in particular, the financial instability of suppliers and the consequence of supplier default, insolvency, or bankruptcy (Babich et al., 2007). The inability of supplier to adapt to technological or product design changes may have detrimental effects on the customer's costs and competitiveness (Zsidisin and Ellram, 2003).

The supply chain vulnerability drivers that lie on the buyer-supplier interface include opportunistic behavior from the suppliers, especially in single sourcing procurement. It also creates dependence on certain suppliers that leave only a limited room for maneuvering for the procuring firm. (Giunipero and Eltantawy, 2004; Halikas et al., 2005; Trevelen and Schweikhart, 1998; Wagner and Johnson, 2004). Supply chain vulnerability originating from supply chain structure stems largely from the disintegrating supply chains and the global (off shore) sourcing of value adding activities (Srai and Gregory, 2008). Since globalization requires highly coordinated flow of information and cash within and across national boundaries (Bowersox and Calantone, 1998), disruptions can have severe impacts on these flows across national boundaries and consequently on the supply chain performance (Hendricks and Singhai, 2005; Seshadri and Subrahma-Nyam, 2005; Wagner and Bode, 2008).

The degree of external vulnerability is influenced by the complexity of sourcing and the delivery and by and large; the uncertainty in demand forecasting. When supply chains have to cover a large number of international markets and regions of the world, the more susceptible they are to the natural and man-made disasters (Manuj and Mentzer, 2008; Myers et al, 2006). Further still, supply chains contain less slack with lower inventories, fewer buffers and leaner logistics operation making supply chains more fragile (McGillvray, 2000; Zisidisin et al, 2005). Long and complex global supply chains are usually slow to respond to changes, and hence, they are more vulnerable to business disruptions (Tang and Tomlin, 2008). Peck, (2002) noted that supply chain vulnerability is driven by factors that are both internal and external to the supply chain.

Internal factors that drive supply chain vulnerability are caused by sub-optimal interaction and co-operation between the entities along the chain. Such supply chain risks result from a lack of visibility, lack of 'ownership', self-imposed 'chaos', just-in-time practices and inaccurate forecasts. External risks arise from interactions between the supply chain and its environment.

Such interactions include disruptions caused by strikes, terrorism and natural catastrophes. Any disruption at any stage in a supply chain that can be linked to environmental causes is ascribable to external risks.

### **2.3: Causes of Supply Chain Vulnerability**

The causes of Supply Chain can be summarized as follows;

**Focus on efficiency rather than effectiveness:** To attain greater levels of efficiency in the supply chain, experience has shown that there is significant opportunity in many sectors of industry to take out significant cost by focusing on the inventory reduction. Just-in time (JIT) practices were widely adopted and organizations became increasingly dependent upon suppliers, Peck (2002). It is therefore argued that when suppliers emphasize more on efficiency and cost reduction, then the supply chain becomes increasingly vulnerable. Blos et al (2009) notes that the introduction of new models can result in vulnerability of the supply chain. When models like Just in time inventory system is introduced, they may eliminate rework process which is an important aspect in production

**The globalization of supply chains:** Often, the motivation for off-shore sourcing and manufacturing is cost, Peck (2002). The result of these cost- based decisions is often higher level of risk as a result of extended lead-times, greater buffer stocks and potentially higher levels of obsolescence. Markwdes and Berge, (1988) identified the trends to the manufacturing offshore and criticized it as being both unnecessary and risky. They argued that existing manufacturing capacity could be made more competitive and that the hidden costs of obsolescence, inventory holding and demand unresponsiveness are risks that counter the headline benefits.

**Focused factories and centralized distribution:** As a result of focused factories, production costs may be lower but the product has to travel greater distances, often across many borders. Flexibility may be lost because these focused factories tend to be designed to produce in very large batches to achieve maximum scale of economies. Simultaneously, with this move to fewer production sites is the tendency to centralize distribution. Forecast driven companies with long planning horizons and long lead lead-time responses are increasingly vulnerable to wild swings in demand, Peck (2002)

**The trend to outsourcing:** Firms have out-sourced distribution, manufacturing, accounting and information systems for example. There is a strong logic behind outsourcing based upon the view that organizations are more likely to succeed if they focus on the activities in which they have a differential advantage over competitors. However, outsourcing brings with it a number of risks for example, potential loss of control and failure of one of the links in the chain. Jittner, (2005) notes that outsourcing results in organizational and logistical complexity which results in organizations becoming more and more dependant on each other thereby enhancing supply chain vulnerability.

**Reduction of the supplier base:** Cases exist where major supply chain disruptions have been caused by a failure at a single source. Blecker et al (2005), observes that the concentration on a small number of suppliers result in increased supply chain risk because the breakdown of one of the suppliers result in the disruption of the whole production process. It also decreases the ability to compensate disruptions through buffer. Therefore even though there are many benefits to supplier base reduction, it has to be recognized that it brings with it increased risk. Sometimes a consolidation of the supply base happens through merger and acquisition. Since the rate of merger and acquisition has increased so dramatically over recent years, it follows that supply base reduction will have accelerated if for this reason alone. Peck, (2003)

**Volatility of demand:** Because firms are still largely forecast driven, with long planning horizons and long lead-times of response, they are increasingly vulnerable to wild swings in demand, Peck, (2002). There are many reasons for this increased demand volatility. Some are for example, shorter life cycles, often driven by technology changes, this means that the risk of obsolescence increases; higher levels of competitive activity leads to marketing led disturbances to demand in many consumer markets, increasing variety within product ranges further fragment



demand and makes forecast less reliable. Many supply chains also have in built features which contribute to the 'chaos' effect, Peck (2002).

Demand-side risks can originate from the uncertainty surrounding the random demands of the Customers, Nagurney et al., (2005). Disruptions occur here from a mismatch between a company's projections and actual demand as well as from poor supply chain coordination. Consequence of which are costly shortages, obsolescence, and inefficient capacity utilization.

An important issue in this context, affecting forecast quality and therefore demand-side disruptions, is the bullwhip effect, which is characterized by an amplification of demand volatility in the upstream direction of the supply chain

**Lack of visibility and control procedures:** Lack of confidence in the supply chain leads to actions and intervention by managers throughout the supply chain which collectively can increase the risk. Firms need to understand the elements of supply chain confidence-visibility and control; lack of which, will increase supply chain risk, Peck (2002). 'Visibility' refers to the ability of all members of a chain to see from one end of the pipeline to another; an undistorted view not clouded by immediate inventories or other barriers to vision, Peck (2002). Lack of visibility forces supply chain members to rely on forecast and to build buffers which only worsen the situation. Unfortunately it is often the case that members of the supply chain do not have detailed knowledge of what is happening in the rest of the chain – for example, information on finished goods inventory, material inventory, work-in-process, demand levels, production plans, capacity, yields, and order status.

**Natural Calamities:** In many regions of the world, natural hazards such as tsunamis, droughts, earthquakes, hurricanes, and floods are a constant threat to societies in general and to firms in particular (Helferich and Cook, 2002). The negative consequences on supply chains are obvious

since production facilities and transportation are highly vulnerable to natural disasters. Due to the globalization of markets and a surge in globe-spanning supply chain operations, local catastrophes increasingly have indirect global repercussions.

**Just in time production system.** Just-in-time production (JIT) is a management philosophy that embraces eliminating all waste and continually upgrading and improving production processes, Peck (2002). The basic concept of just-in-time is that materials and supplies are replenished exactly when they are needed rather than too early or too late, thus ensuring an efficient flow of production. Just-in-time (JIT) reduces the cost of having expensive materials sitting idle while waiting for production and eliminates the cost of having expensive equipment sitting idle while waiting for materials, Peck (2002). It also reduces or eliminates related production costs such as scrap materials, defective products, unnecessary inventory, and wasted space, so that a company expends the least amount of resource, Blecker et al (2005),

**Regulation:** A supply chain is vulnerable as influenced by different regulatory factors like Power/Dependence (Cartwright, 1959; Emerson, 1962), Risk/Uncertainty (Knight, 1921, Ganeson, 1994), Reliability/Availability (Sandler, 1963; Francliel, 1988), and Conflict/Control (Lusch, 1978; Rosdenburg and Stern, 1971, Pfeffer and Salancik, 1978).

## 2.4 Customer Satisfaction

The customer is the one whom the organization is willing to affect his behavior by the values that are created. Customer satisfaction is an important issue which is related to competition in

global level. The quality of a product is often associated to customer satisfaction. Therefore, quality can be as an indicator of the effectiveness of customer satisfaction. Customer satisfaction is a personal approach of the comparison between actual productivity and efficiency expected of a company (Dehmorde, Shahraki, Lakzac, 2010).

Customer satisfaction is defined as customer's feelings or attitude towards a product or service after use. Customer satisfaction leads to the increase of income and profits through repeat purchase, the purchase of new goods and the purchase of goods by customers who have been encouraged by satisfied customer. Customers who have high satisfaction of an organization give positive experiences to others. They ad for the organization, as a result, reducing the cost which is spent to attract customers (Kavandi, Shakeri, 2010).

## **2.5: Supply Chain Vulnerability and Customer Satisfaction**

Gilaninia et al (2012) identified four main characters in the supply chain which include suppliers, manufacturers, distributors and customers. Thus, understanding the relationship between the mentioned groups and efforts to optimize this relationship is the major issue in most organizations. The elements of customer satisfaction that are likely to be affected by supply chain vulnerability include: quality, flexibility, delivery speed and price (production cost).

As competition in the globalised world increases, firms are increasingly competing on the basis of product quality. Customers are frequently exposed to a variety of products and are without doubt likely to be loyal to producers of quality products. Any factor(s) therefore that disrupt the

supply chain will likely impact on product quality which has an ultimate effect on customer satisfaction.

Flexibility is another element that affects customer satisfaction and which may be affected by supply chain vulnerability. Customers are constantly looking for products that meet their dynamic tastes and preferences. This means firms have to be prepared at all times to redesign their products to match the changing tastes and preferences of their customers. Any factor disrupting the smooth flow of the supply chain makes it difficult to change its production system within a short notice.

With the increased demand, customers increasingly become impatient with suppliers who take long to process their orders. Delivery time has therefore become a major aspect of competitive advantage that firms cannot afford to overlook. In this light, any disruption of the supply chain process would automatically make it impossible for the firm to process and deliver customer orders within the required timeframe.

A smooth, efficient and effective supply chain process makes it possible for a firm to reduce wastage and cut down on its production cost. Customers on the other hand, in a competitive market environment, prefer to pay the lowest price for their required quality.

## **2.6: Empirical Literature**

A study by Peck (2002) of Cranfield university management school in UK on supply chain vulnerability facing department of transport, local government and other regions in the UK

concluded that there is need for a methodology for managing supply chain vulnerability. The study observed that Supply chain vulnerability is an important business issue, little research has been undertaken into supply chain vulnerabilities and that awareness of the subject is poor.

Maboudi et al (2011) sampled out thirty suppliers of Mazandaran Textile Company in a study to determine the relationship between supply relationship management and customer satisfaction in textile industry in Iran. The measurement tool was a questionnaire and the relation between two variables was evaluated by Pearson relation. It observed that the communication management for the suppliers in textile industry is directly related to the customer satisfaction.

A study was done by Gilaninia (2012) on the impact of supply chain dimension on customer satisfaction in Iran. The study used field research method to examine correlation between two independent and dependent variables. Data collection tool of this study was a questionnaire. The study found that the supply chain dimension has direct relationship with customer satisfaction.

Otila (2011) did a study on the supply chain management practices used in the cosmetic industry in Kenya. He used a descriptive design and studied all the cosmetic firms in Kenya dealing with skin care products which are located in Nairobi industrial area. He used both primary and secondary data. The study found that there is consistent performance measures used across the supply chain in the cosmetic companies and suppliers are involved in production planning. The researcher however also found major challenges affecting adoption of the supply chain e.g. geographical distance, supply chain disruptions, resistance to supply chain management changes.

lack of adequate resources to implement supply chain initiatives and customer's geographical distance.

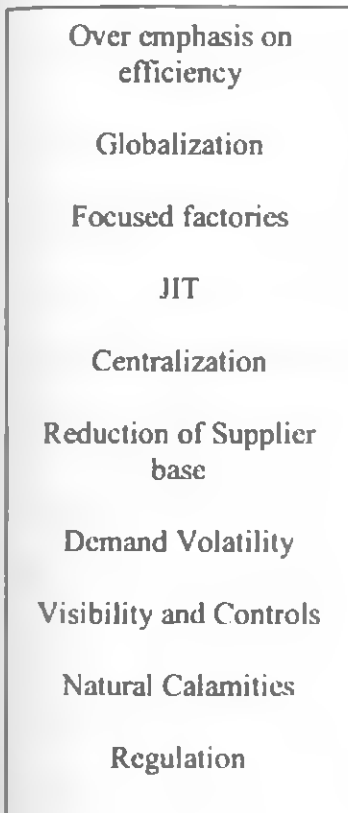
Abuko, (2011), carried out a study to determine the Impact of Green Supply Chain on the performance of oil marketing firms in Kenya. This study used a survey research design and sampled 6 respondents from each of the 5 major oil marketing firms. A structured questionnaire was used to collect data and a multivariate data analysis technique was used. The study found out that Green Supply Chain Management practices had positive impact on the overall firms' performance by improving quality, productivity, efficiency and cost savings.

## 2.7 Conceptual Framework

The relationship between supply chain vulnerability and customer satisfaction can be summarized in the conceptual framework below.

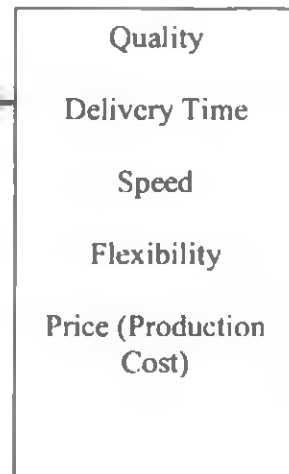
### Supply Chain Vulnerability

(Independent Variables)



### Customer Satisfaction

(Dependent Variables)



The independent variables are the causes of supply chain vulnerabilities that include: over emphasis on the efficiency of the supply chain, globalization of the supply chain, centralization of the production and distribution system, reduction in supplier base, demand volatility, Just in time production system, focused factories and centralized distribution systems, visibility and control procedures in the supply chain, natural calamities and regulation.

The dependent variable is customer satisfaction and include; quality, delivery time, speed, flexibility, and production cost.

## **2.8 Summary of Empirical Literature**

Global empirical evidence shows that the dimensions of supply chain relationships have an effect on customer satisfaction. (Maboudi et al, 2011; Gilaninia et al 2012).

A Study by Peck (2002) of Cranfield university management school found that even though the area of supply chain vulnerability is important in business, no research has been done in the area.

Locally, most research work has concentrated on the supply chain management practices and challenges of green supply chain management practices. Otila (2011) did a study on the supply chain management practices used in the cosmetic industry in Kenya. Abuko (2011) carried out a study to determine the impact of green supply chain on the performance of oil marketing firms in Kenya. In all these studies, no researcher has studied the effect that supply chain vulnerability has on customer satisfaction in the petroleum industry in Kenya. There is therefore no knowledge currently on how supply chain vulnerability impacts on the satisfaction of customers in their consumption of petroleum products in Kenya. This study seeks to fill this knowledge gap.



## **CHAPTER THREE: RESEARCH METHODOLOGY**

### **3.1 Introduction**

This chapter provides a discussion of the outline of the research methodology that was used in this study. It focuses on the research design, population of study, sample and sampling techniques, data collection methods and concludes with the data analysis and data presentation methods that were used in this study.

### **3.2 Research Design**

The research design employed in this study was qualitative and descriptive survey method. According to Cooper and Schindler (2000), descriptive statistics discover and measure cause and effect relationships among variables. The study used a descriptive design because it enables the researcher to collect in-depth information about the population being studied. The qualitative design chosen for this research is theory grounded, or natural inquiry. This design represents theory that unfolds from the emerging data rather than theory based on prior objectives of the study. Grounded theory research unfolds and emerges empirically from the data and is more responsive to contextual values rather than researcher values.

### **3.3 Population of the Study**

The population of study was the companies licensed by energy regulatory commission of Kenya to distribute petroleum products. Even though these companies are not the ultimate customers of petroleum products, the researcher preferred to use them considering the fact that they are more knowledgeable about the supply chain and the challenges faced in the supply chain of the petroleum products. Moreover, they are customers at some point in the supply chain of petroleum products. As at 22nd of August 2012, 50 companies were granted license by energy regulatory commission to distribute petroleum products at various stages of the supply chain.

### **3.4 Data Collection**

Primary data collection method was used. Data was collected via the use of questionnaires as an interview guide. A structured questionnaire was administered. The questionnaire was based on a likert scale whereby respondents were required to state whether they strongly agree, agree, neither agree nor disagree, disagree and strongly disagree.

Cooper and Schindler (2008) observe that a likert scale is reliable and provide a greater volume of data than any other scales. Likert scale was also used by Abuko (2011) in determining the input of Green Supply Chain Management Practices on the performance of oil marketing firms in Kenya.

The drop and pick method was used to collect data. The structured questions were used in an effort to conserve time and money as well as to facilitate an easier analysis as they are in immediate usable form. The unstructured questions were used so as to encourage the respondent to give an in-depth and felt response without feeling held back in revealing of any information.

### **3.5: Data Analysis**

Data was analyzed using descriptive statistics which are a vital part of making sense of the data. Quantitative method of data analysis was used. Data was coded and thereafter analyzed using Statistical Package for Social Sciences (SPSS) program and presented using tables and charts to give a clear picture of the research findings at a glance.

## **CHAPTER FOUR: DATA ANALYSIS, FINDINGS OF THE RESEARCH AND DISCUSSIONS**

### **4.1 Introduction**

This chapter presents the data analysis, findings and interpretation of the study. The data was collected from the firms listed by the Energy Regulatory Commission as the official distributors of petroleum products in Kenya. This was then analyzed and presented in form of tables and figures which are relevant to the objectives of the study.

### **4.2 Response Rate**

The respondents were drawn from a list of registered distributors of petroleum products as outlined by the Energy Regulatory Commission. Out of the 50 registered distributors who were sampled to participate in this study, only 30 responded. This gave a response rate of approximately 60%. This is an above average rate which indicates that the findings can adequately be used for generalization.

### **4.3 Causes of supply chain vulnerability**

There are several causes of supply chain vulnerability. These are the factors that can affect the customer service levels. The researcher asked the respondents to indicate the extent to which these factors expose their supply chains to vulnerable situations on a likert scale (1= most likely, 2 = Likely, 3 = Least Likely, 4 = Unlikely). Their responses were as in the table below.

Table: 4. 1: Causes of supply chain vulnerability

Causes	Mean	Standard Deviation
Globalization	2.4	2.4
Outsourcing	2.3	1.2
Natural calamity	2.3	2.3
Regulation	2.2	2.2
Poor planning	2	2
Demand volatility	2	1.6
Reduction in supplier base/ single sourcing	1.7	1.7
Just in time	1.7	0.8
Lack of control procedure	1.5	1.5
Focused factories and centralize distribution systems	1.5	2

From the findings from table 4.1 above, the likely (mean  $\geq 2.0$ ), all the 10 causes studied like Globalization, Natural calamity, Outsourcing trends, Regulation, Poor Planning, Demand volatility, Just in time production systems, Reduction in supplier base/single sourcing, Focused factories and Centralized distributing systems, and Lack of control procedures are rated by the respondents as the likely causes of supply chain vulnerability. The mean response from the respondents ranges from 1.5 to 2.4; give an average of 2, (likely). This finding is in line with the studies done by. Blecker et al (2005), Jittner, (2005), Nagurney et al, (2005), Peck, (2002), Bloss et al, (2009) and Markwdes and Berge, (1988). All these studies indentified natural calamity, just in time production systems, demand volatilities, outsourcing trends, focus on efficiencies rather than effectiveness, poor planning, globalization, visibilities and lack of control procedures, regulations and reduction in supplier base/single sourcing.

Whereas natural calamities are usually unpredictable and at times come with very severe interruptions, poor planning and regulations can be mitigated, meaning the distributors can avoid engaging in long time planning. Poor planning can also be the main reason behind demand volatility which is rated on a scale of 2 (likely) cause of supply chain vulnerability.

Just in time production systems, Focus on efficiencies rather than effectiveness, poor planning and lack of control procedures and reduction in supplier base/single sourcing are causes of supply chain vulnerabilities that are related to the internal management policies of individual distributors. Restructuring management policies can be employed in order to deal with vulnerabilities created by such policies.

Lastly, globalization and outsourcing, which are rated with the mean of 2.3 and 2.4 respectively, are likely causes of supply chain vulnerabilities that may in most cases originate externally. Appropriate structures and schemes by the distributors can be used to hedge against consequences of supply chain vulnerabilities caused by the external factors.

#### 4.4 Causes of supply chain vulnerability and customer satisfaction

The causes of supply chain vulnerability have different levels of impact on customer satisfaction elements of price, speed, quality, delivery time and flexibility. The researcher asked the respondents to state if they agree that the given factor affects customer satisfaction elements and secondly, if they agree that the stated cause affects customer satisfaction elements, to rank them on a likert scale of 1- Very much, 2- Much, 3- Not much, 4- Not at all. Their responses were as on the table below.

Table: 4. 2: Perception of the respondents on effects of SCV causes on customer satisfaction

	Price		Speed		Quality		Delivery Time		Flexibility	
	Mean	STD	Mean	STD	Mean	STD	Mean	STD	Mean	STD
Natural Calamity	1.2	0.41	1.4	0.49	1.5	0.57	1.2	0.48	1.4	0.61
Just in time	1.3	0.30	0.4	0.3	1.7	0.4	1.5	0.5	1.5	0.3
Demand Volatility	1.4	0.50	1.2	0.1	0.3	0.6	1.2	0.4	1.4	0.5
Outsourcing	1.2	0.48	1.2	0.43	1.3	0.55	1.3	0.45	1.3	0.61
Focus on Efficiency	1.4	0.5	1.0	0.0	1.3	0.48	1.3	0.47	1.6	0.68
Poor planning	1.4	0.5	1.7	0.3	1.4	0.5	1.2	0.4	1.1	0.3
Globalization	1.2	0.40	1.4	0.57	1.4	0.50	1.4	0.61	1.4	0.5
Lack of control procedure	1.4	0.56	1.6	0.67	1.4	0.49	1.3	0.59	1.3	0.66
Regulation	1.3	0.45	1.4	0.55	1.3	0.47	1.5	0.63	1.4	0.68
Reduction in supplier base/ single sourcing	1.3	0.48	1.4	0.57	1.4	0.57	1.5	0.63	1.5	0.57

From the table 4.2 above, the respondents interviewed indicated that even though all the factors listed as causes of supply chain vulnerability actually cause supply chain vulnerability, different factors impact differently on the customer satisfaction elements. All the ten factors are rated as most likely (Mean  $\geq$  1.0) having an impact on the customer satisfaction element of price, quality,

speed, delivery time and flexibility. The mean of the respondents ranges between 1.2 to 1.4, which averages to 1- Most likely, on the scale.

For speed as a customer satisfaction element, factors like Natural calamity, just in time production system, demand volatility, outsourcing, focus on efficiency, globalization, regulations and reduction in supplier base/single sourcing are rated as Most likely having an impact on speed, (mean  $\geq 1$ ), while poor planning and lack of control procedures are rated as likely to impact on speed. (mean  $\geq 2.0$ ).

Demand volatility, outsourcing, focus on efficiency, poor planning, globalization, lack of control procedures, regulations and reduction in supplier base/ single sourcing are rated as Most likely having an impact on Quality, (mean  $\geq 1.0$ ) while natural calamity and just in time production system are rated to have a likely impact on quality, (mean  $\geq 2$ ).

For delivery time, factors like natural calamity, demand volatility, outsourcing, focus on efficiency, poor planning, globalization and lack of control procedures are rated to most likely impact on delivery time, (mean  $\geq 1$ ), while just in time production system, regulation and reduction in supplier base is rated (mean  $\geq 2$ ) - likely impact on delivery time.

Natural calamity, demand volatility, outsourcing, poor planning, globalization, lack of control procedure and regulation are rated to most likely impact on flexibility, (mean  $\geq 1$ ), while just in time production system, focus on efficiency and reduction in supplier base/ single sourcing are rated (mean  $\geq 2$ ), likely impact on flexibility

#### 4.5 Supply chain vulnerability index and Customer Dissatisfaction index

The researcher obtained the total score per the respondent ratings based on the likert scale (1= most likely, 2 = Likely, 3 = Least Likely, 4 = Unlikely) to calculate the supply chain vulnerability index. The researcher also obtained the total score per the respondents on the extent to which they felt that the causes of supply chain vulnerability impact on the customer satisfaction elements of price, quality, speed, delivery time and flexibility; this was used to calculate the consumer satisfaction index. The indices are represented in a table as below.

*Table: 4. 3: Supply Chain Vulnerability and Customer dissatisfaction indices*

SCVI	0.69	0.75	0.64	0.67	0.75	0.89	0.72	0.81	0.67	0.89	0.64	0.81	0.89	0.75	0.69
CDI	0.47	0.54	0.55	0.66	0.74	0.79	0.54	0.56	0.63	0.77	0.54	0.67	0.68	0.61	0.52

SCVI	0.72	0.92	0.81	0.56	0.76	0.45	0.88	0.70	0.80	0.76	0.67	0.45	0.57	0.63	0.87
CDI	0.71	0.53	0.55	0.50	0.78	0.54	0.90	0.65	0.78	0.68	0.80	0.60	0.45	0.75	0.78

The indices obtained were then used to run a regression whose results are relayed on the tables below.



Table 4. 4: Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
.509 <sup>a</sup>	.259	.233	.11053

From the table 4.4 above, R square = 0.259. This means that about 26% of the causes of customer dissatisfaction can be attributed to causes of supply chain vulnerability

Table: 4. 5: Analysis of variance

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	.120	1	.120	9.791	.004 <sup>a</sup>
	Residual	.342	28	.012		
	Total	.462	29			

The F-value is 9.791 while the F-critical is 0.004 meaning the model is accurate and reliable.

This is shown by the table 4.5 above.

Table: 4. 6: Coefficients of Regression analysis

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.245	.124		1.979	.058
	Supply Chain Vulnerability Index	.525	.168	.509	3.129	.004

From the table 4.6 above, results of regression analysis show that there is a positive and significant relationship between customer dissatisfaction and causes of supply chain vulnerability as shown by the predictor coefficient  $\beta_1 = 0.525$ .

The t- value is 3.129 while the t-critical is 0.004 meaning the predictor coefficient is significant.

## **CHAPTER FIVE**

### **SUMMARY, CONCLUSIONS AND RECCOMENDATIONS**

#### **5.1 Summary**

The study sought to evaluate the impact of supply chain vulnerability on customer satisfaction on petroleum products in Kenya. In the study, all the 50 registered petroleum distributing companies in Kenya were targeted, however, only 30 respondents returned the questionnaires sent to them. Questionnaires were administered using drop and pick method. Supply chain vulnerability and customer satisfaction indices were generated from the responses of the respondents. Regression analysis was used to analyses the impact of supply chain vulnerability on customer satisfaction. The study found that all the ten causes of supply chain vulnerability listed, like natural calamity, globalization, just in time production system, demand volatility outsourcing, reduction in supplier base/ single sourcing, poor planning, lack of control procedures and regulation affect all the elements of customer satisfaction i.e. price, speed, delivery time, quality and flexibility.

Results of regression analysis found out that supply chain vulnerability creates customer dissatisfaction.

#### **5.2 Conclusions and Recommendations**

This study concludes that supply chain vulnerability has a significant and positive effect on customer dissatisfaction and that as company experiences supply chain vulnerability in their distribution system, their customers increasingly become dissatisfied.

Following the findings of this study, the researcher recommends that petroleum distributing companies should take steps to mitigate against the causes of supply chain vulnerability.

For example, putting in place buffer stock to cushion the company against the effect of natural calamities, and demand volatility. Companies should also put in place adequate control mechanisms and widen their supplier base in order to deal with the problems associated with lag in supply due to globalization and outsourcing. The companies should also have proper sourcing plans and buffer stock to hedge against demand volatility. In case of companies focused on efficiency and employing just in time production system, adequate planning and proper control procedures on their processes can cushion their customers against the effects of supply chain vulnerability.

### **5.3 Limitations of the research**

In the process of carrying out this study, a number of setbacks were encountered which may limit the findings. One of such limitations include the fact that while the study intended to collect data from all the petroleum distributing companies in Kenya, only 30 companies responded and as such the results are limited to only the 30 companies.

Secondly, due to time and financial constraints, the researcher only considered nine causes of supply chain vulnerability namely, natural calamity, just in time production system, demand volatility, outsourcing, reduction in supplier base, poor planning, globalization, lack of control procedures and regulations. The researcher however acknowledges that there are many other Causes of supply chain vulnerability that if considered would probably change the results of the study.

The researcher also acknowledges that the accuracy of the data is limited to accuracy and honesty of the respondent. In this regard, a different set of respondents even in the same companies may give different views thereby changing the findings of the study.

#### **5.4 Suggestions for further Research**

This study seeks to determine the impact of supply chain vulnerability on customer satisfaction among petroleum distributing companies in Kenya. Generally, the study found that supply chain vulnerability causes customer dissatisfaction. The researcher suggests that further research could be done to determine the effect of supply chain vulnerability on customer satisfaction in the entire energy sector.

Research could also be done to determine the effect that supply chain vulnerability has on the financial performance of petroleum companies in Kenya.



**APPENDIX 1: QUESTIONNAIRE**

**SECTION A: Background Information**

Designation of Respondent.....

Number of years in Operation.....

Current Number of Branches.....

**SECTION B: Causes of Supply Chain Vulnerability**

Please rank the following factors in the order in which they most cause supply chain vulnerability. (1-Most likely; 2-Likely; 3-Least Likely; 4-Unlikely)

CAUSES OF SCV	RANK			
	1	2	3	4
Natural calamities				
Just in Time production systems				
Demand Volatility				
Outsourcing				
Reduction in Supplier Base/Single Sourcing				
Focused factories and centralized distribution systems				
Globalization				
Lack of Control Procedures				
Regulation				
Focus on efficiency				

**SECTION C: Vulnerability and Customer Satisfaction**

**1. a. In your opinion, does the following cause of supply chain vulnerability affect customer satisfaction? YES/NO/INDIFFERENT**

<b>CSCV- NATURAL CALAMITY</b>	<b>Yes</b>	<b>No</b>	<b>Indifferent</b>
<b>CSE - Price</b>			
<b>Speed</b>			
<b>Quality</b>			
<b>Delivery Time</b>			
<b>Flexibility</b>			
<b>Others</b>			

**1. b. If Yes in 1a above, then, On a scale of 1 – 4 (1-Very much; 2-Much; 3-Not much;4-Not at all) Indicate the extent to which natural calamity impacts on these elements of customer satisfaction.**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>CSE - Price</b>				
<b>Speed</b>				
<b>Quality</b>				
<b>Delivery Time</b>				
<b>Flexibility</b>				
<b>Others</b>				

**2. a. In your opinion, does the following cause of supply chain vulnerability affect customer satisfaction? YES/NO/INDIFFERENT**

<b>CSCV – GLOBALIZATION</b>	<b>Yes</b>	<b>No</b>	<b>Indifferent</b>
<b>CSE - Price</b>			
<b>Speed</b>			
<b>Quality</b>			
<b>Delivery Time</b>			
<b>Flexibility</b>			
<b>Others</b>			

2. b. If Yes in 2a above, then, On a scale of 1 – 4 (1-Very much; 2-Much; 3-Not much; 4-Not at all) Indicate the extent to which Globalization impacts on these elements of customer satisfaction.

	1	2	3	4
CSE - Price				
Speed				
Quality				
Delivery Time				
Flexibility				
Others				

3. a. In your opinion, does the following cause of supply chain vulnerability affect customer satisfaction? YES/NO/INDIFFERENT

CSCV- FOCUS ON EFFICIENCY	Yes	No	Indifferent
CSE - Price			
Speed			
Quality			
Delivery Time			
Flexibility			
Others			

3. b. If Yes in 3a above, then, On a scale of 1 – 4 (1-Very much; 2-Much; 3-Not much;4-Not at all) Indicate the extent to which focus on efficiency impacts on these elements of customer satisfaction.

	1	2	3	4
CSE - Price				
Speed				
Quality				
Delivery Time				
Flexibility				
Others				

4. a. In your opinion, does the following cause of supply chain vulnerability affect customer satisfaction? YES/NO/INDIFFERENT

<b>CSCV – OUTSOURCING TRENDS</b>	<b>Yes</b>	<b>No</b>	<b>Indifferent</b>
<b>CSE - Price</b>			
<b>Speed</b>			
<b>Quality</b>			
<b>Delivery Time</b>			
<b>Flexibility</b>			
<b>Others</b>			

4. b. If Yes in 4a above, then, On a scale of 1 – 4 (1-Very much; 2-Much; 3-Not much;4-Not at all) Indicate the extent to which outsourcing trends impacts on these elements of customer satisfaction.

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>CSE - Price</b>				
<b>Speed</b>				
<b>Quality</b>				
<b>Delivery Time</b>				
<b>Flexibility</b>				
<b>Others</b>				

5. a. In your opinion, does the following cause of supply chain vulnerability affect customer satisfaction? YES/NO/INDIFFERENT

<b>CSCV- REDUCTION IN SUPPLIER BASE</b>	<b>Yes</b>	<b>No</b>	<b>Indifferent</b>
<b>CSE - Price</b>			
<b>Speed</b>			
<b>Quality</b>			
<b>Delivery Time</b>			
<b>Flexibility</b>			
<b>Others</b>			



5. b. If Yes in 5a above, then, On a scale of 1 – 4 (1-Very much; 2-Much; 3-Not much;4-Not at all) Indicate the extent to which reduction in supplier base impacts on these elements of customer satisfaction.

	1	2	3	4
CSE - Price				
Speed				
Quality				
Delivery Time				
Flexibility				
Others				

6. a. In your opinion, does the following cause of supply chain vulnerability affect customer satisfaction? YES/NO/INDIFFERENT

CSCV- VISIBILITY AND CONTROL PROCEDURE	Yes	No	Indifferent
CSE - Price			
Speed			
Quality			
Delivery Time			
Flexibility			
Others			

6. b. If Yes in 6a above, then, On a scale of 1 – 4 (1-Very much; 2-Much; 3-Not much;4-Not at all) Indicate the extent to which visibility and control procedure impacts on these elements of customer satisfaction.

	1	2	3	4
CSE - Price				
Speed				
Quality				
Delivery Time				
Flexibility				
Others				

7. a. In your opinion, does the following cause of supply chain vulnerability affect customer satisfaction? YES/NO/INDIFFERENT

CSCV- REGULATION	Yes	No	Indifferent
CSE - Price			
Speed			
Quality			
Delivery Time			
Flexibility			
Others			

7. b. If Yes in 7a above, then, On a scale of 1 – 4 (1-Very much; 2-Much; 3-Not much;4-Not at all) Indicate the extent to which regulation impacts on these elements of customer satisfaction.

	1	2	3	4
CSE - Price				
Speed				
Quality				
Delivery Time				
Flexibility				
Others				

8. a. In your opinion, does the following cause of supply chain vulnerability affect customer satisfaction? YES/NO/INDIFFERENT

CSCV- DEMAND VOLATILITY	Yes	No	Indifferent
CSE - Price			
Speed			
Quality			
Delivery Time			
Flexibility			
Others			

8. b. If Yes in 7a above, then, On a scale of 1 – 4 (1-Very much; 2-Much; 3-Not much;4-Not at all) Indicate the extent to which demand volatility impacts on these elements of customer satisfaction.

	1	2	3	4
<b>CSE - Price</b>				
<b>Speed</b>				
<b>Quality</b>				
<b>Delivery Time</b>				
<b>Flexibility</b>				
<b>Others</b>				

9. a. In your opinion, does the following cause of supply chain vulnerability affect customer satisfaction? YES/NO/INDIFFERENT

<b>CSCV- JUST IN TIME PRODUCTION SYSTEM</b>	Yes	No	Indifferent
<b>CSE - Price</b>			
<b>Speed</b>			
<b>Quality</b>			
<b>Delivery Time</b>			
<b>Flexibility</b>			
<b>Others</b>			

9. b. If Yes in 7a above, then, On a scale of 1 – 4 (1-Very much; 2-Much; 3-Not much;4-Not at all) Indicate the extent to which just in time production system impacts on these elements of customer satisfaction.

	1	2	3	4
<b>CSE - Price</b>				
<b>Speed</b>				
<b>Quality</b>				
<b>Delivery Time</b>				
<b>Flexibility</b>				
<b>Others</b>				

7. a. In your opinion, does the following cause of supply chain vulnerability affect customer satisfaction? YES/NO/INDIFFERENT

SCV- FOCUSED FACTORIES AND CENTRALIZED DISTRIBUTION SYSTEMS	Yes	No	Indifferent
Price			
Speed			
Quality			
Delivery Time			
Flexibility			
Others			

7. b. If Yes in 7a above, then, On a scale of 1 – 4 (1-Very much; 2-Much; 3-Not much; 4-not at all) Indicate the extent to which just in time production system impacts on these elements of customer satisfaction.

	1	2	3	4
Price				
Speed				
Quality				
Delivery Time				
Flexibility				
Others				

**SECTION D:**

Please indicate other factors which in your opinion drive supply chain vulnerability

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## **APPENDIX II: List of Companies distributing Petroleum Products in Kenya**

Atria Multipurpose Enterprise

Black Sea Petroleum Limited

Chirayu Agencies

Cyn Energy Company Limited

Diesel Power Company Limited

Dollarline Services Limited

Dynergy Enterprises

Euro Petroleum Products E.A. Limited

Famus Trading Enterprises

Fast Energy Limited

Flexon Oil Kenya Limited

Frelas Limited

Futures Energy Company Limited

Generation Petroleum Limited

Gulf Energy Limited

Hashi Energy Limited

Heller petroleum Limited

Jilk Petroleum Limited

Jipa Oil Company Limited

Kamkis Trading Company Limited

KenolKobil Limited

Kenya Petroleum Refineries Limited  
Kenya Shell Limited  
Lubeschem Kenya Limited  
Lubesol Kenya Limited  
Majestic Petroleum Enterprises and General Merchandise Limited  
Meifam Petroleum Limited  
Ocean Energy Limited  
Oceanic Oil Limited  
One petroleum Limited  
Orlando Energy Limited  
Osgafre Petroleum Company Limited  
Packfuels Limited  
Partex Petroleum (K) Limited  
Pat Key Energy Limited  
Plan and Trend (EA) Limited  
Premium Petroleum Company Limited  
Prime Regional Supplies Limited  
Prisko Petroleum Network Limited  
SAS Energy Limited  
Sepyana Oil East Africa Limited  
Seydou Resources Limited  
Shreeji Petroleum Investments  
Tech-Energy Company Limited

Towba Petroleum Company Limited

Trans African Energy Limited

Transoceanic Development Project (Kenya) Limited

Tetra Oil Limited

Ultra Petroleum Limited

VTTI Kenya Limited



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