ARCN Journals
Africa Research Corps Network
Publication & Research

Supply Chain Risk Management and Risk Mitigation in the Petroleum Marketing Firms in Rivers State

Dr. S. M Owuso and Godday Raymond Luke
Department of Marketing, Rivers State University, Port Harcourt | Email:
stephen.owuso@gmail.com
Department of Marketing, Niger Delta University, Wilberforce Island, Bayelsa State | Email:
raymondluke99@gmail.com

Abstract: *The purpose of the study was to examine the effect of supply chain risk management and risk mitigation in the petroleum marketing firms in Rivers State. The study adopted the the cross-sectional survey research design. The population of this study consists of the four hundred and fifty (450) independent petroleum marketers in Rivers State. The sample size of this study was drawn from the four hundred and fifty (450) independent petroleum marketers in Rivers State. The sample size of this study was determined using the Yamane (1967) formula. This method was adopted to generate an appropriate sample size for the study from which generalization can be made on the entire population because the population is large. Thus, two hundred and twelve (212) independent marketers or their managers constituted the respondents of the study. The respondents include directors, station managers, station supervisors and depot representatives. The hypotheses were tested using the Pearson Moment Correlation Coefficient with the aid of the Statistical Tool for Social Science (SPSS version 22) The study revealed that there is, positive, and significant relationship between the supply chain risk management and risk mitigation. We therefore, concluded that significant relationship exists between supply chain risk management and risk mitigation in the petroleum marketing firms in the Rivers State. As a result, the study recommends that manages of petroleum marketing Manages in the petroleum marketing firms should consider transferring some of the exposure in their supply chain through multiple sources such as insurance, outsourcing etc. Managers in the petroleum marketing firms are to constantly monitor the supply chain in order to identify appropriate strategies to hedge disruptions*

Keywords: *Supply* *Chain Risk Management, Risk Mitigation Risk identification, Risk Transfer, Risk Acceptance.*

Introduction

The risk that affects the supply chains are multidimensional and have been classified by scholars as operational risk and disruption risk respectively (Sawik, 2011). The operational risks are those risks that affect the day to day disturbances in the supply chain operations e.g. the fluctuations in demand and lead times created by uncertainty in customer demand, uncertainty in supply and uncertainty in cost). While, the disruption risks are the risk that are external to the supply chain they include incidents like natural disaster (corona virus pandemic, tsunami in japan, earthquake typhoons etc.) this has huge impact on the supply chain worldwide the resulting shortage of raw materials in global supply chain, legal dispute or strike. Scholars like (Garvey *et al*., 2015, Dolgui *et al*., 2018, Ivanov *et al*., 2019b, Pavlov *et al*., 2019b, Dolgui *et al*., 2020, Li and

Zobel, 2020) have shown that these risks are characterized by a very strong and immediate impact on the SC network design structure since some factories, suppliers and DCs, and transportation links become temporarily unavailable. Adversely, the resulting material shortages and delivery delays propagate downstream the SC, causing the *ripple effect* and performance degradation in terms of revenue, service level and productivity decreases. This necessitate the need for supply chains risk to be managed so as to mitigate the resultant outcome of an unwanted event occurring to disrupt the smooth functioning of the supply chains.

Problem Statement

Rivers state is nick-named the treasure base of the nation. An indication of the huge deposit of the mineral resources that are found within the state. The petroleum sector has a very huge significance to the wellbeing of the state and the nation in general. The petroleum marketing firms ensure that the petroleum products are distributed to every nook and cranny of the state. Without these firms most organization and indeed the people of the state will have difficulty in carrying out most activities such as fueling their cars, running the generating set to power the office and homes, people will find it difficult to move about as transportation would suffer for lack of fuel to power the various taxis. It is obvious that the petroleum products are very crucial to the survival of the citizenry of the state. The recent outbreak of the corona virus pandemic has once again revealed the fragile state of the supply chain and its attendants effect on the organization. In situations like this, petroleum marketing firms have a series of common questions to ask, for example how long can a supply chain sustain the disruption? How long will it take the supply chains to recover after the pandemic outbreak? Again which supply chain operating policy would best suit the situation? Is it to accept the temporal shortage; or to react situationally by changing the operation policies during the pandemic time. which of these polices is the most efficient to cope with the disruption at the different levels of severity of the pandemic. This seek to examine the nexus between supply chain risk management and risk mitigation within the supply chains of petroleum marketing firms in Rivers State.

Purpose of The Study

The purpose of the study is to examine the nexus between supply chain risk management and risk mitigation in the petroleum marketing firms in rivers state. Other sub objectives include to
1. Ascertain the relationship between risk identification and risk mitigation

2. Risk assessment and risk mitigation

Study Variable and Research Framework.

Study variable are usually pointers as to the direction of the study. This study has two main variables supply chain risk management (predictor variable) and it has risk identification as its indicator, while risk mitigation (criterion variable) has risk transfer and risk acceptance as its measures.
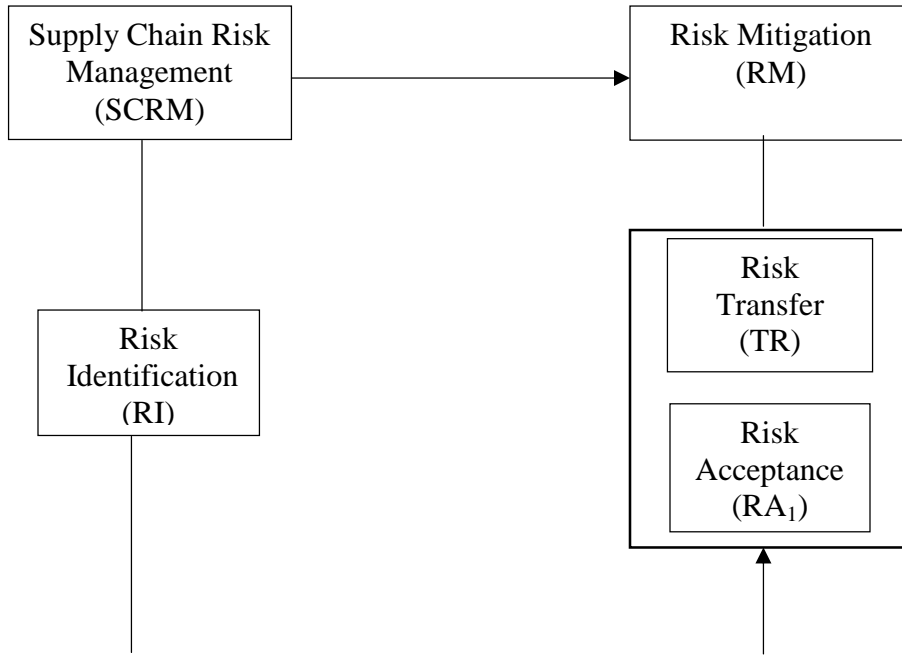
```
┌─────────────────────┐                    ┌─────────────────────┐
│ Supply Chain Risk   │                    │  Risk Mitigation    │
│   Management        │─────────────────▶  │      (RM)           │
│    (SCRM)           │                    │                     │
└─────────────────────┘                    └─────────────────────┘
          │                                 ┌─────────────────────┐
          │                                 │  ┌───────────────┐  │
          │                                 │  │     Risk      │  │
┌─────────────────┐                         │  │   Transfer    │  │
│     Risk        │                         │  │     (TR)      │  │
│ Identification  │                         │  └───────────────┘  │
│     (RI)        │                         │  ┌───────────────┐  │
└─────────────────┘                         │  │     Risk      │  │
          │                                 │  │  Acceptance   │  │
          │                                 │  │    (RA₁)      │  │
          │                                 │  └───────────────┘  │
          │                                 └─────────────────────┘
          └──────────────────────────────────────────▲
```

Fig 1.1 Conceptual framework for Supply chain risk management and mitigation
Source: dimensions adapted from (Stravros *et al*.2016; Ho *et al*. 2015), while measures were
adapted from Curkovic *et al*. (2013)

Research Questions

1. Does risk identification influence risk transfer?

2. Can risk identification influence risk acceptance?

Research Hypotheses

Drawing from the research questions the following hypotheses were developed for the study.

Ho_1: There is no significant relationship between risk identification and risk transfer in the petroleum marketing firms in Rivers State.

Ho_2: There is no significant relationship between risk identification and risk acceptance in the petroleum marketing firms in Rivers State.

Theoretical Foundation

This study is anchored on the New Institutional Economic Theory (NIET)

Zsidisin and Wagner (2010) deployed the new institutional theory to examine why and how organizations create business continuity plans that are geared towards managing supply chain risks. Scholars like Jian (2010) have used theories to reveal important facts about the risk issues in the supply chain. This has also been beneficial to solving continuing arguments, about the

construct supply chain risk management. In the view of Williamson (1998) as cited in Mutuku (2014) the new institutional theory can be used to predict the risk management practices that best suit an individual organization or that is accepted as the best process for the industry or market.

Supply Chain Risk Management (SCRM)
Diehl and Spinler (2013) described supply chain risk management as the organizations deploy to deal with risk that can occur in their supply chains. While, Wieland and Wallenburg (2012) described "supply chain risk management as implementing strategies that hedges risk that occur regularly or are rare within the supply chain which results from a constant assessment to ensure that risk is reduced". The focus of this definition is on how the organization can use strategies to measure and mitigate risk along the supply chain. Thun and Hoenig, (2011) had suggested that" supply chain risk management involves, the identification, analysis and control of risk issues they believe that it includes a cross company orientation that is used to classify and reduce risk such that they can save cost and increase profit". This definition is concerned with how the firm is managing risk with the supply chain. Goh, Lim and Meng (2007) are of the view that "supply chain risk management refers to the classification and managing of risk among supply chain partner both internally and externally to limit the disruption altogether". In this we observe that the management of risk involves identifying and managing the risk by coordinating both the internal and external supply chain partners to hedge disruptions. Scholars like (Neiger Rotaru, Churilov, 2009; Tummala & Schoenherr, 2011; Ho, Zheng, Yildiz & Talluri, 2015) are in consensus that SCRM is aimed at developing strategies for the identification, assessment, treatment, and monitoring of risks in supply chains. Ahmed (2017) argues that scholars have suggested the use of risk identification, risk assessment, risk treatment, and risk monitoring represent the four main stages of the SCRM process. We deployed risk identification and risk assessment as dimensions of supply chain risk management in this study.

Risk identification
David Patrick and Kennedy (2015) described risk identification as "the process by which potential risk sources that may affect the supply chain performance of the organization are identified." This description shed great light as to the rationale of risk identification by organizations on its supply chains; the early detection of the potential risk could mean a huge difference between loss and competitive edge for the firm. Kern, Moser, Hartmann and Moder (2012) stated that risk identification is aimed at discovering all the relevant risk and recognize future uncertainties in order to manage them proactively. The process of identifying risk is any activity by which organizations determines the risks that could potentially thwart the smooth running of their operations, thus preventing the achievement of its stated objectives. The goal of identifying risk is to determine albeit the events that when they happen has the potentials of adversely affect the organization such that it may not be able to accomplished its set objectives The supply chain risk may emanate from outside the supply chain or inside the supply chains" (David *et al.*2015). scholars like (Breuer, Haasis, Wildebrand 2013; Colin, Pfohl, Gallus & Thomas 2011; Samvedi, Jain and Chan. 2013; Wilding *et al*. 2012) are in consensus that risk identification process is one of the critical and initial stages of the supply chain risk management process. Also, the process of risk identification along the supply chain allows the firms to identify the vulnerability that may be found from the inside and from the outside of supply chain. According to Tummala and Schoenherr (2011) risk identification is a tool that us used to "create

a comprehensive list of all possible and thinkable risk associated to the supply chain." The risks identified need to be categorized as this exercise affords the organization the opportunity appreciate the types of risk the supply chain is exposed to.

Meanwhile, Kayis and Karningsih (2012) stated that "in identifying risk it is important to note the existing interrelationship and dependencies between different risk to be able to understand the risk management better." Kern *et al*. (2012) highlighted the possible tools that can be used to identify risk in the supply chain e.g. SC mapping, process mapping, flow chart, checklists or check sheets, event tree analysis, fault tree analysis, failure mode and effect analysis (FMEA), Ishikawa cause and effect analysis (CEA), brainstorming etc." Tummala *et al*. (2011) observed that by using one or several tools hen identifying risk it will be easier to perform the identification in a systematic way."

Risk Mitigation
In the word of Ahmed (2017) risk mitigation can be considered as "the conceptualization of action plans, task and the process of developing options to enhance opportunities." He further stated that risk mitigation allows firms to perform a holistic assessment in order to reduce the likelihood of threat, exposure or damages that can be harmful to the business operation. Essentially every risk mitigation plans can be viewed as strategic in nature. Liu, Li, and Wu (2014) described risk mitigation as "any effort or group of effort that is aimed at reducing the negative impact of an event occurring." There appear to be a consensus among scholars like (Liu, Li, & Wu, 2014; Sodhi, Son, & Tang, 2012; Wagner, &Neshat 2012; Curkovic, Scannell, Wagner, & Vitek, 2013) that risk mitigation has the capacity to reduce the probability of an event occurring, or reduce the effect after the event has occurred, or both on the organization. Hence, they argue that it is essential for managers to choose a strategy that will best mitigate the risk that is affecting the supply chain of the organization. Again, these group of scholars' all agree that firms generally have two types of response to risk mitigation and these include:
(1)   Accepting the risk and
(2)   Reduction or sharing the risk.
(3)   Risk Transfer.

Mitigation strategies have been classified by experts into proactive or reactive. (Scholten, Sharkey Scott, and Fynes 2014; Thun, Druke, and Hoenig. 2011) stated that proactive steps or strategies "are known to decrease the possibility that a risk will occur in the supply chain, while, reactive strategies are known to lessen the impact of the risk after it has occurred. Experts say that proactive strategies refer to improvement in tracking, tracing and the selection competent suppliers with high pedigree. While, reactive strategies refer to the process of double sourcing, various sourcing and maintaining safety stocks". But it is important that before organizations choose a strategy to mitigate risk, they of necessity evaluate each of the risk facing the supply chain against the mitigation strategies available to the firm. Scholars are in consensus that "in order to choose a relevant mitigation strategy for any risk, a cost–benefit analysis needs to be undertaken with risk appetite as a constraint" (Diehl and Spinler 2013; Kumar Sharma and Bhat 2014). Schmitt and Singh (2012) developed the newsvendor model to evaluate the demand risk, also Arcelus, Kumar and Srinivasan (2012) in their study the impact of demand disruption used

the newsvendor model as well. Following in their stead was Tang, Musa and Li (2012) also adopted the newsvendor model to investigate the demand risk in the supply chain. Meanwhile Kang and Kim (2012) used "the mixed integer nonlinear programming model to investigate the impact of demand risk on the supply chains". These studies were centered around 'demand risk mitigation' and 'supply chain' decision making under random demand situations. They were mainly concerned with determining the optimum order placement and what the replenishment order would be to minimize the effect of the demand uncertainties. However, Kim (2013) suggested that "risk should be shared in order to minimize loss that arises over demand uncertainties his work was based on a four-tier supply chain under dynamic market demand and suggested that bilateral contracts should be made flexible in terms of the order quantity". He argued that the fluctuations in demand can be absorbed by the contract design, which allows for a more effective inventory management and customer service. We define risk mitigation as the technique embarked upon by any firm in order to prevent an uncertain event from occurring or limit the impact of an uncontrollable even when it occurs. In this study we shall use risk acceptance and risk transfer as measures of risk mitigation.

Risk Acceptance

According to Ghadge, Dani, Chester and Kalawsky *(*2013) by accepting the risk the firm may adopt either a buffer measure, contingency plan and/or will ensure it source for it source from a secure vendor. Ahmed (2017) stated that accepting risk is actually "the last resort in developing and designing a risk encountering strategy. It implies that when risk is unavoidable and cannot be controlled, indemnified, eradicated transferred or mitigated; then it must be accepted." This he believes ensures that the firm is able to forge ahead as that in itself is significantly better that as the risk associated with going ahead is are less than the risk of not going forward. There appears to be no stated guideline that allows for firm to determine the extent of risk an organization can or should accept. The level of acceptance is based on the context and may include inclination to risk by the management of such organizations. This implies that the willingness of the organization or individual to engage in ventures that are risky and are willing to accept the uncertainty of the outcomes of those ventures while making decisions (Park, Min, & Min, 2016). Meanwhile, Aglan and Lam (2015) cautioned that the willingness to accept a risk does not imply ignoring the altogether, rather they counseled that firm continually monitor and track to ensure that the accepted risk does not increase.

Risk Transfer

Ignacio (2016) defined risk transfer as the subscription to an insurance policy against certain supply chain risk. The emphasis on this description is that the firm takes on an insurance policy due to the uncertain nature of the supply chains activities. While, Herrera (2013) is of the view that supply chain risk transfer often takes the shape of insurance of particular risk, outsourcing or entering into partnership. Here the argument is that aside from purchasing insurance policy the firms in the petroleum marketing firms can outsource or partner with other firms in the industry so as to aid in the execution of task that they don't have the competence to execute. The implication is that the contractual agreement to transfer risk which is a legal agreement allows the firm to be compensated for the insured losses. Diabat, Govindan and Panicker (2012) described risk transfer as the responsibility that is assigned to another party. For example,

business disruption risks can be transferred through business interruption insurance (Zhen *et al*., 2016). Risk transfer however appears more appropriate for disruption risks with a small probability and high impact, e.g. natural disasters and terrorist attacks, than for operational risks with a high probability and low impact (Aqlan and Lam, 2015).

Supply Chain Risk Management and Risk Mitigation
Supply chain risk management has received considerable attention is recent times. When the supply chain functions efficiently and effectively the result is a significant edge over the competition in terms of reduced cost of production and improved quality in products and service delivery. Ho *et al*. (2015) noted that supply chain risk management is crucial for risk management in an organization. They further argue that effective supply chain risk management enhances organizational performance and provide competitive edge. Also, earlier scholars like (Li *et al*. 2015) pointed out that an ineffective supply chain risk management can weaken the accurate assessment of the uncertainties and risk involved in supply chains. Samira, Mohammad, and Majid (2018) observed that several studies have been undertaken to proffer solutions to the myriad of SCRM issues that borders on disruptions. Samira *et al*. (2018) citing (Tang 2006) noted that "many researchers had in the past developed different strategic models to manage supply chain risk and alleviate the problems associated with different types of risk." Interruptions that are capable of obstructing the stable movement of materials, information and finance thereby hindering the organization from achieving its set goal which, may negatively influence the achievement of a firm's goals and also affect the supply chain, with respect to cost, quality and time have been described as supply chain risk by scholars like (Colin *et al*. 2011; Hofmann, Busse, Bode, &Henke. 2014; Spiegler, Naim, & Wikner 2012). Wilding, Colicha and Strozzi (2012) categorized supply chain risks as internal and external risks. Scholars like (Dash Wu, Olson, & Dash Wu 2010; Lin and Zhou 2011) have described Internal risks to include: forecast inaccuracy, worker accidents, distorted information, quality issues and capacity cost while, external risks include price fluctuations, plant fires, labour disputes, customs and regulations and economic downturns. Because of the above-mentioned risks and their negative effects on firm operations and performance, firms need have appropriate mitigating strategies in place to reduce or hedge the effects of disruptions (Johnson, Elliott, & Drake, 2013; Urciuoli, Mohanty, Hintsa, & Gerine, 2014).

Empirical Reviews
Empirical studies have been done on the construct supply chain risk management. This section will undertake a review of some of them. Lambaino, Guyo, Odhiambo and Getuno (2018) conducted a study on risk transfer strategies and supply chain resilience in the petroleum industry in Kenya. The purpose of the study was to investigate the influence of risk transfer strategies on supply chain resilience in the Kenyan petroleum industry. The study revealed that risk transfer strategies have a positive influence on supply chain resilience.

Nooraie and Parast (2015) conducted a study "a multi-objective approach to supply chain risk management: Integrating visibility with supply and demand risk." The objective of the study was to investigate whether a multi-objective approach was sufficient as a mitigation strategy. The study revealed that increased visibility in supply chains offer huge means of saving cost when supply chain disturbances happen. This study is similar with our current in terms of proffering

solution to the issue of supply chain risk management however, the focus of both studies differ Chen, Sohal and Prajogo (2013) conducted a study "supply chain operational risk mitigation: A collaborative approach evaluated the supply chain collaboration (SCC) as a risk mitigation strategy the purpose of the study was to examine the collaborative approach as a mitigation strategy. They collated data from 203 manufacturing enterprises in Australia". The findings reveal that supply chain collaborations do significantly reduce supply chain risks specifically the study addressed the subject of processing risk where they pointed out that risk have a stark and direct impact on supply chain performance, also the fact that hazards have been established to be a major source of the bulk of external hazards, which might be either from the supply or demand side. This study has a elements of the current study in the sense that both studies attempt to proffer solution to supply chain risk issues however, both studies differ in industry.

Wieland and Wallenburg (2012) conducted a "study dealing with supply chain risks linking risk with management practices and strategies to organizational performance in Germany". The empirical analysis was predicated on the survey data from 270 industrial organizations in Germany, the hypotheses were tested using structural equation modelling. The study revealed that supply chain risk management is a prerequisite if firms are to experience agility and strength such that the firm needs to improve organizational performance. The study differs from the current study in the sense that its focus is on management practices

Literature Gap
This study tends to bridge the knowledge gap of other research. Firstly, the study conceptualized supply chain risk management (predictor variable) and risk mitigation (criterion variable) which there has been little study covering both the two variables. Secondly, the dimensions (risk identification and risk assessment) and (risk transfer and risk acceptance) employed has differentiated the work from other research as other research did not use these dimensions and measure in this order. Thirdly, the location and the population of the study may have been used but not with the variables under study. Finally, the sample size is also another distinctive factor from other research study. Therefore, the study serves as a knowledge gap.

Methodology
This study adopted the cross-sectional survey research design. This research design enabled the researcher to collect unprejudiced data from the study targets and describe the relationship between the variables. The population of this study consists of the four hundred and fifty (450) independent petroleum marketers in Rivers State (IPMAN Journal, 2015). The sample size of this study was drawn from the four hundred and fifty (450) independent petroleum marketers in Rivers State. The sample size of this study was determined using the Taro Yamani (1967) formula. This formula was deployed to generate an appropriate sample size for the study from which generalization can be made on the entire population because the population is large. Thus, two hundred and twelve (212) independent marketers or their managers constituted the respondents of the study. This study made use of both descriptive and inferential statistics to analyze the data. Thus, univariate descriptive statistics such as the mean, standard deviation, frequency distribution, percentages, and bar chart were used to analyze the data. Furthermore, bivariate inferential statistics of Pearson Product Moment Correlation (PPMC) was used to test

the hypotheses stated in the study with aid of Statistical Package for Social Sciences (SPSS version 22).

Table 1. Summary of Reliability Analysis

S/N	Variables	Number of items	Cronbach's Alpha Coefficient
1	Risk Identification	4	0.924
3	Risk Acceptance	4	0.951
4	Risk Transfer	4	0.912

Source: SPSS output 2020

Result and Discussion

Ho$_1$: There is no significant relationship between risk identification and risk transfer in the petroleum marketing firms

Table 2: Correlation between Risk Identification and Risk Transfer

		Risk Identification	Risk Transfer
Risk Identification	Pearson Correlation	1	.815**
	Sig.(2-tailed)		.000
	N	200	200
Risk Transfer	Pearson Correlation	.815	1
	Sig.(2-tailed)	.000	
	N	200	200

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

The result above in table 2 is indicative of a strong and positive relationship between risk identification and risk transfer. As shown by the correlation coefficient of 0.815. the probability value is less than the critical value i.e. 0.000< 0.05. thus, we reject the null hypothesis which states that there is no significant relationship between risk identification and risk transfer.

Ho$_2$: There is no significant relationship between risk identification and risk acceptance in the petroleum marketing firms

Table 3: Correlation between Risk Identification and Risk Acceptance

		Risk identification	Risk acceptance
Risk Identification	Pearson Correlation	1	312**
	Sig.(2-tailed)		.000
	N	200	200
Risk Acceptance	Pearson Correlation	-312	1

Sig.(2-tailed)	.000	
N	200	200

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

The result above in table 3 is indicative of a significantly weak and negative and relationship between risk identification and risk acceptance. As shown by the correlation coefficient of .312. the probability value is less than the critical value i.e. $0.000 < 0.05$. thus, we reject the null hypothesis which states that there is no significant relationship between risk identification and risk acceptance.

Discussion
The result from the study shows that risk identification is significant and positively related to risk transfer. This is consistent with the position of Lambaino *et al*. (2018) who found that risk transfer (an antecedent of risk mitigation) have a positive influence on supply chain resilience. The result for $H0_2$ revealed a significantly weak and negative relationship between risk identification and risk acceptance. This position is in line with Park *et al*. (2016) whose stated that the willingness of organizations to accept risk is a function of decision making. Also, Aqlan and lam (2015) argue that the acceptable risk should be continually monitored to ensure it does not escalate to a certain threshold

Conclusion
In conclusion the study confirms that a significant relationship exists between supply chain risk management and risk mitigation in the petroleum marketing firms. The study found that risk identification is positively related to risk transfer and risk acceptance (antecedents of risk mitigation). This is the most rational step to take as it shield the organizations from exposures which, eliminates shortages from adverse fluctuations.

Recommendation
Based on the finding and the conclusion of the study, it is therefore recommended as follows:

❖ Manages in the petroleum marketing firms should consider transferring some of the exposure in their supply chain through multiple sources such as insurance, outsourcing etc.
❖ Managers in the petroleum marketing firms are to constantly monitor the supply chain in order to identify appropriate strategies to hedge disruptions

References
Ahmed, R. (2017). *Risk Mitigation Strategies in Innovative Projects*. London, UK: Intechopen Limited

Aqlan, F., & Lam, S.S. (2015). Supply chain risk modelling and mitigation. *International Journal of Production Research*, 53(18),5640-5656.

Amundson, J., Brown, A., Shuaib, M., Badurdeen, F., Jawahir, I.S., Goldsby, T. (2013). Bayesian methodology for supply chain risk analysis: Concept and case studies. *Industrial and Systems Engineering Research Conference*, 3944–3953.

Berle, Ø., Norstad, I. & Asbjørnslett, B.E., (2013). Optimization, risk assessment and resilience in LNG transportation systems. *Supply Chain Management: An International Journal, 18(3), 253–264*

Breuer, C., S, G., Haasis, H.D., & Wildebrand, H. (2013). Collaborative risk management in sensitive logistics nodes, *Team Sales Management: An International Journal* 19(7/8), 331–351.

Colin, J., Pfohl, H.C., Gallus, P. & Thomas, D. (2011). Interpretive structural modelling of supply chain risks, *International Journal of Physical Distribution & Logistics Management* 41(9), 839–859.

David, K.M., Patrick, K.N., & Kennedy, O. (2015). An assessment of effect of risk identification management strategy on supply chain sales performance in manufacturing companies in Kenya, *International Journal of economic, commerce and management* 3(4), 1-17

Dash Wu, D., Olson, D.L. & Dash Wu, D. (2010). A review of enterprise risk management in supply chain, Kybernetes 39(5), 694–706.

Diabat, A., Govindan, K., & Panicker, V.V. (2012). Supply chain risk management and its mitigation in a food industry. *International Journal of Production Research, 50(11), 3039-3050.*

Dolgui A., Ivanov D., Rozhkov M. (2020). Does the ripple effect influence the bullwhip effect? An integrated analysis of structural and operational dynamics in the supply chain. International. Journal. Production. Research,*58(5),1285–1301.*

Dolgui A., Ivanov D., Sokolov B. (2018). Ripple effect in the supply chain: An analysis and recent literature. International. Journal. Production. Research, 56(1–2),414–430

Ganguly, K. & Guin, K.K., 2013. A Fuzzy AHP approach for inbound supply risk assessment. *Benchmarking: An International Journal, 20(1).*

Garvey M.D., Carnovale S., Yeniyurt S. (2015). An analytical framework for supply network risk propagation: A Bayesian network approach. European Journal of Operations Research, 243(2):618–627

Goh, M.., Lim, J.Y.S., & Meng, F.W. (2007). A stochastic model for risk management in global supply chain networks. *European Journal of Operational Research,* 182(1), 164-173

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

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

Hofmann, H., Busse, C., Bode, C. & Henke, M. (2014). Sustainability-related supply chain risks: Conceptualization and management. *Business Strategy and the Environment* 23(3), 160–172.

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), 89-26.

Ivanov D., & Dolgui A. (2019). Low-Certainty-Need (LCN) supply chains: A new perspective in managing disruption risks and resilience. International. Journal of Production Research, *57(15–16),5119–5136.*

Ivanov D., Dolgui A., Das A., Sokolov B. (2019b) *Digital supply chain twins: Managing the Ripple effect, resilience and disruption risks by data-driven optimization, simulation, and*

visibility. In: Ivanov D., editor. Handbook of Ripple Effects in the Supply Chain. Springer.

Kayis, B. & Karningsih, P.D. (2012). SCRIS: A knowledge-based system tool for assisting manufacturing organizations in identifying supply chain risks. *Journal of Manufacturing Technology Management, 23(7),34–852.*

Kern, D., Moser, R., Hartmann, E. & Moder, M., (2012) Supply risk management: Model development and empirical analysis. *International Journal of Physical Distribution & Logistics Management,.42(1), 60-82.*

Kumar, S., Himes, K. & Kritzer, C. (2014). Risk assessment and operational approaches to managing risk in global supply chains. *Journal of Manufacturing Technology Management 25(6), 873–890.*

Lambaino, N.K., Guyo, W., Odhiambo, R., Getuno, P. (2018). Risk transfer strategies and supply chain resilience in the petroleum industry in Kenya. *International Journal of Economics, Commerce and Management, 6(7),1-7*

Li Y., Zobel C.W., Seref O., & Chatfield D.C. (2019). Network characteristics and supply chain resilience under conditions of risk propagation. International. Journal. Production. Economics.

Lin, Y. & Zhou, L. (2011). The impacts of product design changes on supply chain risk: A case study, *International Journal of Physical Distribution & Logistics Management* 41(2), 162–186.

Lockamy, A., (2014). Assessing disaster risks in supply chains. *Industrial Management & Data Systems 114(5), 755–777*

Neiger, D., Rotaru, K. & Churilov, L., (2009). Supply chain risk identification with value-focused
process engineering. *Journal of Operations Management*, 27(2),154-168.

Park, K., Min, H., & Min, S. (2016). Inter-relationship among risk taking propensity, supply chain
security practices, and supply chain disruption occurrence. *Journal of Purchasing and Supply Management,* 22(2), 120-130.

Pavlov A., Ivanov D., Pavlov D., & Slinko, A. (2019). Optimization of network redundancy and contingency planning in sustainable and resilient supply chain resource management under conditions of structural dynamics. Ann. Operations Research.

Samira S.H., Mohammad K., & Majid S. (2018). A model for supply chain risk management in the automotive industry using fuzzy analytic hierarchy process and fuzzy *TOPSIS, Benchmarking: An International Journal, Vol. 25 Issue: 9, pp.3831-3857*

Samvedi, A., Jain, V., & Chan, F.T.S. (2013). Quantifying risks in a supply chain through integration of fuzzy ahp and fuzzytopsis. *International Journal of Production Research 51, 2433–2442.*

Sawik T. (2011). Selection of supply portfolio under disruption risks. Omega.,39(2),194–208

Simba, S., Niemann, W., Kotzé, T., & Agigi, A. (2017). Supply chain risk management processes
for resilience: A study of South African grocery manufacturers. *Journal of Transport and Supply Chain Management 11(1),325-338.*

Spiegler, V.L.M., Naim, M.M. & Wikner, J. (2012) A control engineering approach to the assessment of supply chain resilience', *International Journal of Production Research* 50(21), 6162–6187.

Tang, C. (2006). Robust strategies for mitigating supply chain disruptions. *International Journal of Logistics, 9(1),33–45*

Thun, J.H. & Hoenig, D., (2011). An empirical analysis of supply chain risk management in the German automotive industry, *International Journal of Production Economics,* 131(1), 242-249.

Tummala, R., & Schoenherr, T. (2011). Assessing and managing risk using the supply chain risk management process (SCRMP). *Supply Chain Management: An International Journal 16(6) 476-483.*

Urciuoli, L., Mohanty, S., Hintsa, J. & Gerine B. E. (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.

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

Wilding, R., Colicchia, C., & Strozzi, F., (2012). Supply chain risk management: A new methodology for a systematic literature review', *Supply Chain Management: An International Journal* 17(4), 403–418.

Yamani, T. (1967). Statistics: An introductory analysis, 2nd edition. New York: Harper and Row.