Role of Government Health and Safety Regulations on Petroleum Supply Chain Management

Jackson Ndolo Muthini[1], Prof. Namusonge G.S[2], Dr. Wario Guyo[3] and Dr. Noor Ismail Shale[4]

[1](PhD Candidate, Supply Chain Management)
[2,3,4](Supervisors, Jomo Kenyatta University of Agriculture and Technology)

Abstract: *The study sought to assess the role of government health and safety regulations on petroleum supply chain management by surveying oil marketing companies in Kenya. The researchers used mixed research design. A field survey was carried out while purposive sampling was used to select 180 respondents from thirsty six (36) oil marketing companies located in Nairobi city involved in importation and marketing of oil products in Kenya. Primary data was collected through a questionnaire. Data was quantitatively analyzed using statistical package for social scientists (SPSS V24) for descriptive statistics and inferential while Analysis of Moment Structure Software (AMOS) was used for structural equation modeling. The study findings indicate that there was a positive relationship (regression weight = 0.41) between government health and safety regulations and Petroleum Supply Chain Management. The researchers therefore recommend the involvement of all stakeholders in the development of policies that will ensure sustainable petroleum supply chain management. It is expected that the study will be of great importance to the management of oil marketing companies, policy makers, suppliers, consumers and the government. These are major stakeholders in the petroleum downstream sector.*
Keywords: safety, regulations, petroleum supply chain management

I. INTRODUCTION

The energy sector worldwide is characterized by monopolistic and oligopolistic market structures which are an impediment to the economic efficiency that is associated with a competitive market. In other words, monopolies have a propensity to use their market power to the detriment of the customer. Mostly natural monopolies are brought about by several factors including; ownership of a scarce resource, prohibitive costs of putting up infrastructure and economies of scale. The role of regulation is therefore to deal with this market failure and administratively promote; efficiency, competition, investment and private sector participation and protect consumer interests in terms of affordability, quality of service and service sustainability (Green, 2006). Supply chain management concept has also been adopted by organizations as a way through which they can serve the customer efficiently and effectively. As an effective business philosophy, supply chain management has gained tremendous amount of attention from both the academics and practitioners in the recent years (Chan & Qi, 2003).

The petroleum supply chain comprises of upstream, middle stream and downstream sectors. The upstream is concerned with exploration and production, the midstream deals with storage, marketing and transportation of commodities like crude oil, natural gas, natural gas liquids (NGLs, mainly ethane, propane and butane) and sulphur. The downstream sector involves oil refineries, petrochemical plants, petroleum products distributors, retail outlets and natural gas distribution companies. Midstream operations are considered as part of the downstream sector, the subject of this study. According to Lewin (2003), the importance of the sector in fulfilling the majority of transportation needs, providing power and serving as a foundation for petrochemical business underpins the survival of other essential industries (Lewin, 2003). This study concentrated on the downstream sector since the upstream petroleum sector is at its development stage in Kenya.

Poor health and well-being in the workplace may affect productivity and reduce effective quality decision making, and is detrimental to one's contribution to the organization (Boyd 1997; Price and Hooijberg 1992; cited in Danna, 2005). This implies that health and safety regulations may affect supply chain management. Although research has generally been documented, few studies have been undertaken in Kenya on the role of government health and safety regulations on petroleum supply chain management in Kenya. Onyango (2013) assessed regulatory and competition– related reforms in Kenya's power and petroleum sectors and found out that the energy sector in

Kenya continues to face huge challenges which includes weaknesses in institutional and legal frameworks, limited and uncoordinated enforcements, inadequate technical capacities and external economic conditions despite reforms in the petroleum sub-sector which allowed greater participation of the private sector, particularly in the importation, distribution and supply services. The researcher recommended strengthening of the regulatory system in the energy sector to ensure sustainability, competitiveness and security of energy supply in Kenya. In Nigeria most of the attention in the research on oil pollution and safety in the petroleum industry and its regulation have been on the upstream sector (Onuoha, 2007; Zabbey, 2009; UNEP, 2011; Ogri, 2001; Emeseh, 2006).

Available literature has hinted that research on Operational Healthy and Safety (OHS) has been carried out in various regions in the world. The ground thus covered tends to focus predominantly on disease prevention, psychosocial factors at the workplace, safety concerns at the workplace, workplace politics, workplace spirituality, epileptic medication at the workplace, safety climate at the workplace, safety management, Exposures to chemicals and perceptions of risks (Cha, et al., 2006; Gandz and Murray 1980; Gillen et al., 2002; Gold and Carbon, 2002; Grandey et al., 2002; Henshaw, et al., 2007; Holness et al., 2004; Millan, et al., 2003; Mygind et al.,2006; Ortiz et al., 2000; WHO 2008). In Africa studies on human perception and experience of environmental safety management are sparse. These studies tend to focus on behavioural qualities of the workers at the workplaces (Burton: 2006) and on issues such as occupational hygiene, global equity challenges, policies, problem solving, welding health hazards, health education, asbestos problems, responsibility assignment, health and safety and equity in the workplace (Asuzu,1998; Spee, 2006; Skinner, 2006;Loewenson, 2004; Jurdak and Shahin, 2001; Meo and Khlaiwi, 2003; Kuye, 2001Rantanen, 1997; Harris and Kahwa 2003; Gyekye and Salminen, 2005).

The Kenyan petroleum industry institutional structure comprises of Ministry of Energy, the Energy Regulatory Commission (ERC), Kenya Pipeline Company (KPC), Kenya Petroleum Refineries Limited (KPRL) and Multinational Independent Oil Marketing Companies that include a State Oil Company, National Oil Corporation of Kenya (NOCK). The Ministry of Energy provides the policy leadership, while ERC provides regulatory stewardship of the sub-sector. KPC is a State Corporation fully owned by government under the MOE. Its overall objective is to provide the economy with the most efficient, reliable, and safe and least cost means of transporting petroleum products from Mombasa to the hinterland. The general regulations on the Kenyan petroleum downstream sector include financial, Environmental, operational, health and safety regulations (The subject of this study). Despite the government interventions in the sector supply inefficiencies in quality, availability and pricing of petroleum products are still visible (All Africa, 2009). The challenge therefore, for many countries is the establishment of effective regulatory infrastructures capable of playing complementary roles in fostering success in supply and safeguarding health and safety regulations on the petroleum supply chain management in Kenya.

The study therefore sought to assess the role of government health and safety regulations in supply chain management since OMCs operations are highly affected by government regulations hence any information on their effects would help them in making the necessary adjustments in their business activities so as to conform and comply accordingly. The study therefore may help them in lobbying for better regulations of the petroleum supply chain management. Government interventions in the oil industry are critical due to its oligopolistic nature hence the study brings into limelight the proactive role the government can undertake in ensuring effective and efficient regulations. The study therefore forms a basis for development of effective regulatory systems in the petroleum supply chain management in Kenya. Hence it is anticipated that the output of this study will find use among policy makers and managers of petroleum companies, suppliers, consumers and government. These are major stakeholders in the petroleum sector. These study output provides them with an understanding of the role played by government regulations on the petroleum supply chain management in Kenya.

II. LITERATURE REVIEW

There is a key role for governments in providing a clear and stable longer term policy framework for industry investment and operations, but it is essential that these policies are harmonized across jurisdictions, are properly integrated with other policies applying to industry, and apply equally to all industry participants. The government recognizes that the regulatory environment has a substantial effect on the behavior and performance of business entities. Private sector participation in the economy and innovation requires a regulatory environment that provides the necessary protections and guidelines, while promoting competition (World bank, 2014). There is a spillover effect, however, to the extent that managing the supply chain provides broader benefits (i.e., positive externalities) to society and not just the firm.

Social Regulation Theories

This study is based on the social regulation theories. Social regulation comprises of policies in the area of the environment, labor conditions (occupational health and safety), consumer protection and labor (equal opportunities and so on). Instruments applied here include regulation dealing with the discharge of environmentally harmful substances, safety regulations in factories and workplaces, the obligation to include information on the packaging of goods or on labels, the prohibition of the supply of certain goods or services unless in the possession of a permit and banning discrimination on race, skin color, religion, sex, or nationality in the recruitment of personnel. The Kenyan petroleum downstream sector experiences health and safety, environmental as well as operational regulations that have an impact on the supply chain hence the relevance of this theory. The increase in consumption of petroleum products has obvious implications for the operations of the petroleum industry in the country (both upstream and downstream), including the risks posed to the natural environment and human safety.

Petroleum Supply Chain Management

Petroleum supply chain management has received a lot of interest owing to the critical role attached to energy in the realization of vision 2030. The increase in consumption of petroleum products has obvious implications for the operations of the petroleum industry in the country (both upstream and downstream), including the risks posed to the natural environment and human safety. The downstream sector activities, potentially pose human health, safety, and environmental risks; and the challenge for any government is balancing these concerns with national economic development and energy security goals (All Africa, 2008). This is done through the establishment of an adequate regulatory framework consisting of laws and regulations setting out rights, obligations, procedures and standards, and regulatory institutions charged with responsibility for monitoring compliance.

Government Health and Safety Regulations

Safety and health in the workplace have become an integral component to the viability of business for employers, labour unions, governments, and environmentalists in general (Anderson and Gough, 2004). According to Zwetsloot (2003) the subject of safety in the workplace has taken a critical position in organizations as a result of globalized economic trends. International conventions have instituted the international organization for standardization to help regulate and bring about improved workplace conditions and services. In Kenya health and safety at work place is governed by two pieces of legislation: the Occupational Safety and Health Act, 2007 (OSHA, 2007) and the Work Injury Benefits Act, 2007 (WIBA, 2007). The purpose of OSHA 2007, is to secure the safety, health and welfare of people at work, and to protect those not at work from risks to their safety and health arising from the activities of people at work. The purpose of WIBA, 2007 is to provide compensation to employees for work-related injuries and diseases contracted in the course of their employment, and for connected purposes. Other legislation that touches on OSH includes the Public Health Act CAP 242, the environmental Management and Coordination Act (EMC 1999), the Radiation Protection Act CAP 243, and the Pest Control Products Act Cap 346. These laws are enforced by different ministries and departments of the Government. EMC 1999 act will be discussed later in this review.

The Government Financial Management (Occupational Safety and Health Fund) Regulations, 2011, establish a levy called the OSH Levy, chargeable to all registered workplaces at a rate of KSh3, 000 annually. The fund's function is to secure the development, coordination and implementation of an effective OSH system for the prevention of occupational accidents and diseases, ill health and damage to property at workplaces hence it is hypothesized;

H_1: *Government Health and Safety Regulations does not significantly influence petroleum Supply chain management in Kenya*

Figure 2.1 represents the hypothesized model of the relationship between Government Health and Safety Regulations (GHSR), the independen variable and petroleum supply chain management (PSCM), the dependent (Mugenda & Mugenda, 2007).
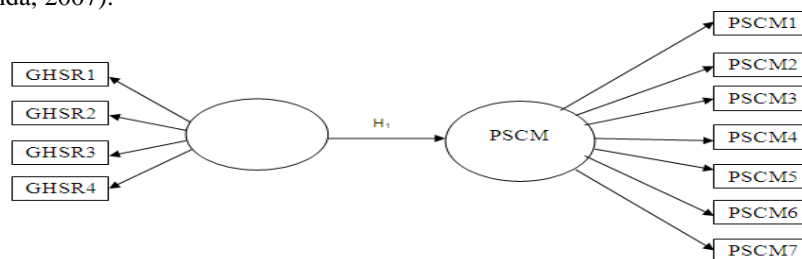
Figure2.1: Conceptual Model

III. RESEARCH METHODOLOGY

Research design is a master plan specifying the methods and procedures for collecting and analyzing the needed information (Kiambati K & Itunga J, 2014). The study adopted a descriptive survey design with both qualitative and quantitative approaches. Recently there is more research in logistics and supply chain management that combines qualitative and quantitative approaches via the use of mixed methods (Spens and Kovacs, 2012). According to Burke Johnson and Larry Christensen (2011), qualitative research relies primarily on the collection of qualitative data such as non-numerical data in the form of words and pictures.

According to Miller (2003) quantitative research involves formal, objective information about the world, with mathematical quantification that can be used to describe, test relationships and examine cause-effect relationships. Kothari (2014) asserts that descriptive research design is suitable for those studies that seek to determine relationships between variables while a survey provides the third component of a research concept, thereby allowing a triangulation of accounts; from a review of documentation, to an analysis of what actually happens, to how this is viewed by those involve or associated with the process (Fielding, 1986). The study targeted all the Oil Marketing Companies (OMCs) in Kenya. The target population is all workers for OMCs especially the ones involved directly in the petroleum supply chain management. According to GoK (2015) there are 36 operational OMCs in Kenya and hence the respondents were drawn from five sections namely; Supplies and Distribution, Human Resources and Production and operations, sales and Marketing and finance departments. Purposive sampling was used to identify 180 respondents from five identified sections out of the 36 registered OMCs involved in importation and retailing of oil products.

Both secondary and primary data were used in the study. Primary data was collected through use of a questionnaire which contained both open and closed ended questions. Secondary data was obtained from the internet, Journals, published thesis and books. The questionnaire was divided into subsections based on the constructs with relevant items used to measure them. Government Health and Safety Regulations (GHSR) was measured by six items; quality of products, operational costs, secure working environment, operational efficiency, work environment risks and supply chain responsiveness labeled as GHSR1, GHSR2, GHSR3 GHSR4 and GHSR5. Lastly Petroleum Supply Chain Management construct was measured by seven constructs; quality of products, steady supply, adequate supply and responsive chain labeled as PSCM1, PSCM2, PSCM3, PSCM4, PSCM5 and PSCM6 respectively. Quantitative data was analyzed using descriptive statistics and inferential analysis. Correlation analysis was done to establish the strength of relationship between the independent and dependent variable. Also standard multiple regression through usage of Analysis of Moment Structures (AMOS) was used to determine the contribution of government regulations on petroleum supply chain management.

A multiple linear regression model was used to test the significance of the influence of GHSR on the PSCM. Multiple regression models basically reveal linear relationship between the predictors and the dependent variable. The multiple linear regression model is as;

$Y = \beta_0 + \beta_1 X_1 + e$, Where: Y = Petroleum Supply chain Management, X_1 = Government Health and Safety Regulation, e = error term which is assumed to be normally distributed with mean zero and constant variance. In the model, β_0 = the constant term while the coefficient $\beta_i = 1$ was used to measure the sensitivity of the dependent variable (Y) to unit change in the predictor variables while the error term (e) captured the unexplained variations in the model. Pearson's correlation analysis was used to establish the relationship between the dependent and the independent variables. T-test was used to test the significance of independent variables X1 at 5% level of significance.

IV. RESEARCH FINDINGS AND DISCUSSIONS

A total of 113 filled questionnaires were returned which represents a 63% response rate. In cognizance of the sensitivity of the required data in the study, for managers of OMCs wouldn't like to be seen to be critical of government policies in a very oligopolistic oil market structure, a 63% response rate was deemed to be adequate and sufficient.

Level of Education of Respondents

Majority (73.7%) of the respondents had bachelors education and above qualifications as indicated in table 4.3 which is an indication that the respondents had the required academic qualification to understand and respond adequately to the questionnaire. Majority (27.3%) of the respondents were supply chain managers which is an indication of their interest in the subject of study hence the study was relevant to their daily operations. Majority (78.7%) of respondents had worked for the current OMCs for a period of 1-10 years.

Awareness of Existence of Government Health and Safety Regulations

The section sought to ascertain respondent's awareness on existence of government health and safety regulations in petroleum supply chain management. Majority (94.7%) of the respondents were aware of the existence of the regulations with only 5.3 percent attesting to not being aware. This is an indication that the sampled respondents had the knowledge and exposure to government health and safety requirements in their activities.

Areas of Application of Government Health and Safety Regulations in Petroleum Supply Chain Management

The researcher sought the respondent's identification of health and safety regulations applications in priority areas. Transportation safety, loading and offloading, fuel receipt, production and station inspections were identified as the areas of application of the regulations in order of decreasing priority. Majority (46%) of the respondents identified transportation as the highest priority area with receiving fuel being the least (9.2%) priority area of the application of government health and safety regulations in OMCs activities.

Measurement of Government Health and Safety Regulations

The researcher sought to identify the role played by GHSR on PSCM. When asked whether GHSR lead to quality petroleum products majority (45%) respondents agreed to a great extent, 26% agreed to a very large extent, 25% agreed moderately with 5% agreeing to small extent. This indicates that majority (71%) agreed to a large extent that GHSR leads to quality petroleum products. Meanwhile majority (52%) of respondents agreed to a large extent that implementation of the GHSR increases their operational costs, 21% agreed to a very large extent, 18% moderately agreed, 7% agreed to a small extent while only 2% thought it never affected them at all.

When asked whether GHSR leads to secure working environment, majority (39%) of the respondents agreed to a large extent, with 38% agreeing to a very extent, 21% to a moderate extent while 2% agreed to a small extent. Majority (42%) of respondents agreed that GHSR had helped them improve their operational efficiency, 32% agreeing to a very large extent, 19% moderately agreeing while only 7% agreed to a small extent. Majority (50%) of the respondents agreed to a large extent that GHSR had helped them reduce work environment risks, 33% agreeing to a very large extent, 15% agreeing to a moderate extent while only 3% of the respondents agreed to a small extent. When asked whether GHSR had helped them improve their supply chain responsiveness, majority (45%) of the respondents agreed to a very large extent, 30% to a large extent, 20% agreed to a moderate extent while only 5% agreed to a small extent with no respondents attesting to no influence by GHSR on their supply chain responsiveness.

Factor Analysis of Government Health and Safety Regulations

Table 4.1 indicates that the overall cronbach's value was 0.845 which is greater than 0.7 and each of the items had a factor loading greater than 0.7 and accounted for 56.59% of the total construct variance. This was an indication of reliable measures hence all the constructs items were accepted and subjected to further analysis.

Table 4.1: Factor Analysis Results for Government Health and Safety Regulations Items

Government Health and Safety Regulations	Overall Cronbach Alpha	Corrected Item-Total Correlation	KMO	Factor Loadings	Total Variance Explained
GHSR and quality of petroleum products	0.845	.650	0.837	.767	56.59%
GHSR and operational costs		.588		.719	
GHSR and working environment		.579		.714	
GHSR and operation efficiency		.687		.802	
GHSR work environment risks		.635		.760	
GHSR supply chain responsiveness		.622		.748	

Influence of Government Health and Safety Regulations on Petroleum Supply Chain Management

The objective of this section was to establish the role of government health and safety regulations on petroleum supply chain management in Kenya. There was a positive relationship (regression weight = 0.41) between GHSR and PSCM as indicated in figure 4.1
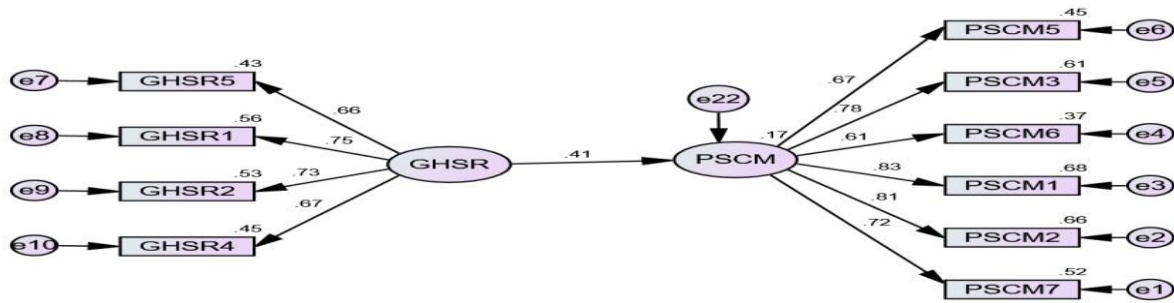
Figure 4.1: CFA 2nd order Results for GHSR and PSCM

The hypothesis to test this objective was;

H01: Government Health and Safety Regulations does not significantly influence petroleum supply chain management in Kenya

The model fit ratios of CFI, GFI and AFGI were 0.960, 0.921 and 0.871 respectively. Although 0.872 is less than 0.90 all the others indicate a good model fit. The RMSEA of 0.069 which is greater than 0.05 hence an indication of a perfect model fit.

Table 4.2: Model Fit Indices

Model	CFI	GFI	AGFI	RMSEA
Default model	.960	.921	.872	.069
Saturated model	1.000	1.000		
Independence model	.000	.410	.279	.301

The path coefficients between GHSR items and PSCM ranged from 0.13 to 0.202 an indication of the positive relationships between the items and factors. T-values ranged from 3.39 to 8.214 which is greater than 1.96 t-static value an indication of the positive significance relationship between GHSR and PSCM. The $R^2 = 0.168$ an indication that 16.8% of the variance in PSCM can be explained by GHSR and the rest percentage variance by other factors.

Table 4.3: Regression Weights

			Unstandardized Estimate	Standardised Estimate	S.E.	T-Value	P
PSCM	<---	GHSR	0.542	0.415	0.16	3.39	***
PSCM2	<---	PSCM	1.028	0.813	0.127	8.094	***
PSCM1	<---	PSCM	1.31	0.826	0.159	8.214	***
PSCM6	<---	PSCM	0.863	0.612	0.141	6.127	***
PSCM3	<---	PSCM	1.011	0.778	0.13	7.766	***
GHSR5	<---	GHSR	1	0.657			
GHSR1	<---	GHSR	1.22	0.746	0.202	6.025	***
GHSR2	<---	GHSR	1.305	0.726	0.22	5.936	***
GHSR4	<---	GHSR	1.184	0.673	0.21	5.647	***
PSCM5	<---	PSCM	0.939	0.674	0.139	6.744	***
PSCM7	<---	PSCM	1	0.72			

Since there exists a positive and significant relationship (R2 = 0.168, t= 3.39, P = 0.05) between GHSR and PSCM therefore the null hypothesis (H01) that Government Health and Safety regulations does not significantly influence petroleum supply chain management in Kenya is rejected.

Regression Analysis Results

The study sought to assess the role of government regulations on petroleum supply chain management through the linear regression model. The multiple linear regression model was used to test the significance of the influence of GHSR on PSCM i.e PSCM = $\beta_0 + \beta_1$ GHSR+ e

A model summary was generated using SPSS to estimate R; R squared and adjusted R squared as shown in Table 4.4

Table 4.4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.828[a]	.685	.660	.66223

From table 4.4, R is the correlation between predicted and observed values of the dependent variable. This implies that there was significant association of 0.828 between petroleum supply chain management and government regulations. Adjusted R^2 is referred as the coefficient of determination which is an indication of the variance in petroleum supply chain management when GHSR varies. The study established that there is a positive relationship between GHSR and PSCM for $R^2 = 0.66$ P = 0.05; however this does not indicate the influence of each independent variable on the dependent variable. This is the interest of the next section of this study.

Analysis of Variance (ANOVA)

The total variance (39.031) as indicated in table 4.46 was the difference in variance that can be explained by the independent variables (Model) and the variance that cannot be explained by the independent variable (error). The study established that there existed good ness of fit between variables as F- test (F= 19.375, P= 0.00 < 0.001) as indicated in table 4.5

Table 4.5: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	33.988	4	8.497	19.375	.000[b]
	Residual	39.031	89	.439		
	Total	73.019	93			

Coefficients Estimate of Variance

The coefficients estimate of variables is shown in table 4.6

Table 4.6: Coefficients of Variations

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.157	.069		2.278	.025
	GHSR	.252	.070	.303	3.606	.001

a. Dependent Variable: PSCM

From the regression analysis shown in table 4.6 it was found that petroleum supply chain management would be at 0.157 (constant) when GSHR is at zero (0). This could be because of other factors that could not be explained by the model. The study also found at there existed a positive and significant relationship between PSCM and GHSR since r = 0.252, t=3.606 and P =0.001 < 0.005. The findings were similar to Ken (2012) findings that government bears the responsibility of establishing and setting up effective regulatory system that minimizes dangers imposed on by the petroleum sector. The findings also Zwetsloot (2003) that government health and safety regulations helps in ensuring quality supply of products. Therefore the linear relationship of the overall model is

PSCM = 0.157 + 0.252 GHSR

This indicates that for every change of one unity by PSCM, a change of 0.252 takes place at GHSR and an error term of 0.157. The large value for the error term (0.157) is an indication that there are other factors affecting PSCM other than government regulations.

V. CONCLUSIONS AND RECOMMENDATIONS

Government health and safety regulations are geared towards provision of a safe and secure petroleum supply chain environment to the workers and customers as well as other key players (GoK, 2006). The study therefore concludes that government health and safety regulations play a critical role in petroleum supply chain management more so in the areas of transportation safety, loading and offloading, fuel receipt, and production and station inspections. This is so since they lead to quality petroleum products, secure working environment and helps in improving the petroleum supply chain responsiveness. Lastly the government bears the responsibility of establishing and setting up effective regulatory system that minimizes dangers imposed by the petroleum sector. The researchers recommend that OMCs need to implement government health and safety regulations in full

regulatory agencies need to continuously research and develop policies that are in line with business environment changes so as to promote fair competition as well as promote sustainable petroleum supply chain management. Moreover stakeholder involvement in the policy development can lead to ownership which eventually improves on implementation and conformance as well as compliance.

Limitations of the study

The study limited itself to only five sections in the thirty six oil marketing companies located in Nairobi due to limited financial capacity.

Directions for future research

There is need to carry out research on the role of the other regulations namely economic, environmental and operational. A study to establish the effect of geopolitics on the petroleum supply chain management in Kenya may also be appropriate.

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