

SUPPLY CHAIN MANAGEMENT CHALLENGES IN KENYA PETROLEUM INDUSTRY: CASE OF NATIONAL OIL CORPORATION OF KENYA

Kimani Charles W.

Director, Jocha Enterprises Ltd.

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ABSTRACT

Kenya's petroleum industry faces supply chain challenges such as lack of strategic stocks, relatively high petroleum prices compared to other East African countries, frequent fuel shortages, sub-standard products and diversion of products destined for export back into the country. The discussions of this paper sought to explore challenges facing implementation of effective supply chain management practices in petroleum industry in Kenya, a case of National Oil Corporation. Specifically the paper sought to explore the influence information technology, supply chain design, people issues and partnership/collaboration issues to the implementation of effective supply chain management. The study found that all four independent variables have high effect on implementation of effective SCM in the petroleum sector.

Keywords: *Petroleum, Supply Chain, Kenya, National Oil, SCM, WPC and Corporation.*

Introduction

Organizations adopt numerous business improvement methodologies to improve the business performance. Manufacturers and researchers have noted a number of problems regarding supply chain activities in their research and practice (Togar et al., 2004). Successful

implementation of SCM is seen as closely dependent upon the need for breaking down barriers not only between internal departments and business processes, but also across companies within the whole supply chain (Vollman et al., 2005). Its success is also associated with the challenging development of a new culture based on empowerment on-going shared learning and continuous improvement.

This research project is centered on a survey of the challenges facing effective implementation of supply chain management in the petroleum industry and it has focused on National oil Corporation of Kenya. The study was taken against the backdrop of the importance of petroleum energy as a key pillar to the achievement of vision 2030. Petroleum fuel accounts for about 28.57% of the total final energy consumption (KIPPRA, 2010). According to Kenya's Vision 2030 blue print launched in 2008, Kenya's energy sector will be a key enabler for the country's vision. Effective supply chain management in the Petroleum sector in Kenya will therefore have a great positive impact in the achievement of Kenya's vision 2030. According to World Petroleum Congress (WPC) news letter (2008), Petroleum is the world's major source of energy and is a key factor in the continued development of world economies.

National Oil is State Corporation under the Ministry of Energy incorporated in April 1981 and charged with participation in all aspects of the petroleum industry. National Oil has a 100% Government shareholding.

Literature Review

The Concept of Supply Chain Management

Supply Chain Management aims to link all the supply chain agents to jointly cooperate within the firm as a way to maximize productivity in the supply chain and deliver the most benefits

to all related parties (Finch, 2006). Adoption of Supply chain management practices in industries has steadily increased since the 1980s.

Over the past decade, the traditional purchasing and logistics activities have emerged and shifted into broader strategic approach to materials and distributions management known as supply chain management. It is currently a major issue as organizations realize the substance of developing an integrated connection with their suppliers and final users. Theoretically, as described by Mentzer et al (2001), a supply chain can be defined as "a set of three or more organizations directly linked by one or more of the upstream and downstream flows of products, services, finances, and information from a source to a customer." The main goal and important aspect of supply chain is leveraging the expertise, experience, skills and capabilities of the supply chain professionals who comprise this competitive network (Mentzer et al, 2001).

The performance of a firm depends not only on how efficiently it cooperates with its direct partners, but also on how well these partners cooperate with their own business partners. Network theory (NT) can be used to provide a basis for the conceptual analysis of reciprocity (Oliver, 1990) in cooperative relationships. Here, the firm's continuous interaction with other players becomes an important factor in the development of new resources (Haakansson and Ford, 2002). Relationships combine the resources of two organizations to achieve more advantages than through individual efforts.

Factors affecting effective supply chain management in petroleum sector in Kenya

The study has analyzed the effect on supply chain management by four factors namely, information technology, supply chain design, people issues and collaboration/partnership issues.

Sweeny (2005) argues that managing the information flows is the most critical of these activities. This is because the flow or movement of materials or money is usually triggered by associated information movement.

Lalwani et al (2006) proposed that current developments in systems thinking and continuous system simulation, when applied within the context of an operations management framework, may offer the good design of supply chain and improve in supply chain performance.

According to Matthew (2008), as global markets grow increasingly efficient, competition no longer takes place between individual businesses, but between entire value chains. Therefore executives are developing supply chain partnerships/collaboration in an attempt to reduce costs, improve service and to gain competitive advantage.

The cooperation arises directly from both relationship trust and commitment (Morgan et al, 1994). According to past research, trust has two dimensions: “honesty” and “benevolence” (Rajendra *et al*, 1995). There are several dimensions of trust in supply chain performance such as confidence in preferred trading partner, always keeping promises, always being honest, good reputation and close personal friendship (Batt, 2003).

Research Methodology

Research Design

Towards ascertaining and describing the characteristics of the variables of interest a descriptive research design was adopted. It involved collection, measurement, classification, analysis and interpretation of data.

Interviews were conducted and questionnaires administered on a sample of individuals. The design was selected for this study because it can provide numeric descriptions of the population and describes events as they are, as they were or as they will be (Kombo & Trump, 2006).

The focus of this study was quantitative. However some qualitative approach was used in order to gain a better understanding and possibly enable a better and more insightful interpretation of the results from the quantitative study. The researcher sought to use this approach because it is more objective and it helps in achieving high levels of reliability and a higher degree of objectivity (Mugenda & Mugenda, 2003).

The study also used qualitative approach, i.e. through open ended questions. The researcher sought to use qualitative approach because the method produces more in-depth, comprehensive information and has been known to use subjective information which may not be otherwise gathered through a quantitative approach, i.e. by use of open ended questions. Use of qualitative design helped in gaining wider, deeper understanding of the entire situation under investigation.

The research assumed a case study because it places more emphasis on a full contextual analysis of few elements and conditions and their interrelations which relies on qualitative data (Kothari, 2004). The use of a case study assisted in getting detailed information about the experiences of the employees of National Corporation of Kenya concerning factors affecting implementation of Supply chain management in the petroleum sector in Kenya.

The target population of the study was composed of all the firms in the Petroleum Sector in Kenya. The respondents were drawn from the employees of National Oil which according to human resource department of the company had 150 employees.

From the target population of one hundred and fifty, proportional allocation was used to calculate the sample size from each strata using stratified random sampling which gives each item in the population an equal probability chance of being selected. According to Kothari (2004) a representative sample is one which is at least 10% of the population thus the choice of 30% equal to 50 staff members is considered as representative.

The study utilized both primary and secondary data. Primary data was gathered through questionnaires, while secondary data was obtained from published documents or materials such as journals, periodicals, magazines and reports obtained from the ministry and government reports. These supplemented the primary data received from questionnaires.

The questionnaire designed in this study comprised of two sections. The first part included the demographic and operational characteristics designed to determine fundamental issues including the demographic characteristics of the respondent. The second part was devoted to the identification of the challenges facing implementation of effective supply chain management practice by government agents in the Petroleum Sector in Kenya where the variables of the study was be put into focus.

Pilot Study

A pilot study was conducted using the questionnaire on 3 respondents working in the supply chain department from different government agencies in the petroleum sector. The purpose of pilot testing will be to establish the accuracy and appropriateness of the research design and instrumentation and therefore enhance face validity. After the pilot study the main survey followed.

Reliability and Validity measurement instruments

Validity is the degree to which results obtained from the analysis of the data actually represent the phenomenon. The content validity of the research instrument was be evaluated through the actual administration of the pilot group.

Reliability of the questionnaire was evaluated through administration of the said instrument to the pilot group. A construct composite reliability co-efficient (Crobanch alpha) of 0.6 or above for all the constructs was considered adequate for this study. The acceptable reliability coefficient is 0.6 and above (Nunnaly, 1978).

Data Analysis

Both quantitative and qualitative techniques were used. The data obtained from the research instruments was analyzed using of descriptive statistics (frequencies and percentages), as well as inferential statistics. To test the relationships that presuppose a relationship between criterion and response variables, data coded was extracted using factor analysis methods (Kothari, 2004). Pearson correlation coefficient and bi-variate correlation coefficient were used in this study to indicate one-on-one association between each of the independent variables to the dependent variable, while holding other factors constant. Statistical Package for the Social Sciences (SPSS) version 17.0 was used for data analysis. The use of this version is because there was need for data reduction through factor analysis, for the purposes of regression and correlation analysis. In addition, test for scale reliability and validity was possible through this version of SPSS, which has advanced features that are also user friendly.

Percentages were used to determine sample distribution across various demographic variables while mean scores of the variables were used to determine the extent to which certain factors are challenges to effective implementation of the SCM. Standard deviation represented the degree of variability in the responses. Frequency distribution tables and pie charts were used to present the data.

Multiple regression analysis was used to determine the relationships between the variables and the effective implementation of SCM. The coefficient of determination (R-Square) resulting from the linear regression was used to determine the goodness of fit. To determine the relative importance of each of the independent variables on the dependent variable beta coefficients (slope) was done and tested for significance at 5% significance level.

Research Findings

Reliability of results

Table 4.2, illustrates the results of the reliability analysis using Cronbach alpha. Cronbach's alpha determines the internal consistency or average correlation of items in a survey instrument to gauge its reliability (Nunnaly, 1987). Reliability of the scale for the constructs describing the variables of the study was found to be sufficient because all the items and composite reliability coefficients were equal to or above 0.6 set as the acceptable minimum (Nunnaly, 1987). Reliability evaluates accuracy of the measures through assessing the internal stability and consistency of items in each variable. Thus, it can be concluded that the measures have an acceptable level of reliability.

Validity of results

Validity determines whether the research truly measures that which it was intended to measure or how truthful the research results are. Factor analysis was performed for testing the validity of measures used in measuring the factors affecting implementation of effective supply chain management in the Petroleum sector in Kenya. The Kaiser-Meyer-Olkin measure of sampling adequacy is 0.8 (above the recommended level of 0.6). Content validity is the technique used to ensure that the measures adequately quantify the concepts that they are supposed to be tested (Kothari, 2004). Therefore, it was concluded that response and common method variance biases did not pose any significant problems to the validity of the results

The independent variables and their effect on supply chain management

The respondents were asked to rate the extent to which they thought that each of the indicators of information technology and information management affected effective implementation of supply chain management within the organization. Standard deviation of

the ratings was also computed. A mean of greater than 3 indicates that the factor has high effect. A mean of 3 indicates average effect while a mean of less than 3 indicates small effect. Standard deviation of less than 1 is generally considered as small and indicates that there was high level of consensus around the mean. Standard deviation greater than 1 shows huge variations in respondent ratings indicating that there was not much congregation of responses around the mean.

Based on the findings of the study, it can be deduced that all the four independent variables pose challenges in the implementation of effective supply chain management.

Relationship between each independent variable and Effective Supply Chain Management

The study used Pearson correlation coefficient to estimate the relationship between each variable and effective implementation of supply chain. Pearson's correlation coefficient (r) is a measure of the strength of the association between the two variables. Pearson's r can range from -1 to 1. An r of -1 indicates a perfect negative linear relationship between variables, an r of 0 indicates no linear relationship between variables, and an r of 1 indicates a perfect positive relationship between variables. An absolute value of 0.1 to 0.3 indicates a weak correlation, 0.3 to 0.5 indicates a moderate correlation while 0.5 to 1.0 indicates a strong correlation between variables.

A strong positive correlation was found to exist for all the variables as shown in the table below.

Determination of challenges of effective implementation of SCM using regression analysis

Linear regression was used to determine the relative importance of the independent variables in explaining the variations in the dependent variable. The model yielded an R-square of

0.7735 as shown on table 4.5, indicating that the model explained only 77% of the variability in the dependent variable. The unexplained variability could be attributed to random factors and other variables not captured in the model.

From the results shown, the model shows a goodness of fit as indicated by the coefficient of determination (R^2) with a value of 0.7735. This implies that the independent variables explain 77 percent of the variations of effective supply chain management. The R Squared value was of average good fit in the model. These findings are supported by the model study done by Stanley et al in (2008) which indicated that there are other barriers to effective implementation of SCM not just the four independent variables under this study.

Beta coefficients of regression variables

According to Dunn (2001), the beta coefficients indicate the slope in the model that relates the independent variables to the dependent variables and the size of the beta coefficient indicates its magnitude in influencing the dependent variable.

From Table 4.6 the variable 'Information Technology has the most statistically significant coefficient as indicated by a t-ratio of 2.562. This implies that a one unit change in information technology will change effective supply chain management by 2.562 units. There is also a positive relationship between partnership/collaboration and supply chain management with a statistically significant coefficient as indicated by a t-ratio of 2.423. A one unit change in partnership/collaboration will change effective supply chain management by 2.423 units. Supply design is also statistically significant as indicated by a T-ratio of 2.207. People issues are also statistically significant as indicated by a T-ratio of 2.061. This implies that the four variables significantly explain the variations in implementation of effective supply chain management in the petroleum energy sector in Kenya.

Summary of Findings, Conclusions and Recommendations

Information Technology and effective implementation of SCM

The study established that the impact of information technology on effective implementation of SCM is high. Findings indicated that information system factor that had the highest effect is accuracy of information followed by flow of information and compatibility of technology. These three components pose as the biggest information technology related challenges in implementation of effective SCM. The study further determined that there is a strong and positive relationship between information technology and effective implementation of SCM in the petroleum sector in Kenya. Damien Power (2005) stated that effective application of information technology to the integration of supply chain activities has the effect of reducing levels of complexity. The “bullwhip effect” is an example of a typical supply chain management outcome resulting from distortion of information flow.

Supply chain design and effective supply chain management

The study found that the effect of supply chain design and effective SCM is also high as indicated by the mean. According to the study, there is a strong positive association between supply chain design and effective supply chain management. These findings are in support of a research carried out by Lalwani et al (2006) that found out that supply chain design has a direct impact on cost and customer service thus a need for companies to be careful in designing their supply chain network.

Partnership/collaboration issues and effective supply chain management

The study found that majority of the respondents indicated that Partnership/collaboration issues promotes effective SCM in the petroleum sector through promptness of delivery of products and sharing expertise between or among different firms. The study established a strong positive association between partnership/collaboration issues and effective SCM in the

petroleum sector in Kenya. These findings are in support of a study done by Mathew (2008) that established that knowledge sharing between partners has more upsides than downsides, provided that the right kind of knowledge goes back and forth.

However a common worry is that divulged information regarding the firms strategies can be copied or shared with competitors. Another worry is that relying on knowledge flows from other organizations can undermine a company's flexibility and leave it vulnerable to changes in its partners' priorities (Mathew, 2008).

People issues and Effective Supply Chain Management

Based on the findings, majority of the respondents were of the view that existing policies and procedures were important. The findings further indicated that chain of command from top to bottom and extent of staff participation in day to day decision making within the organization. Alignment of strategies and objectives as well as employees' acceptance to change were also found to have significant effect on the implementation of effective supply chain management as supported by a significant proportion of the respondents.

Conclusions

According to the analysis of findings, it was concluded that all the four independent variables are very critical to effective SCM in the petroleum sector. Any distortion of information in the supply chain would lead to "bull whip" effects.

From the results of this study, it was concluded that supply chain design also plays a key role in determining effectiveness of the SCM in the sector. It was noted that the supply chain design is to a large extent determined by the government. The government controls a majority stake in every level of the supply chain i.e., it controls the importation process, the petroleum refining process, the pipeline transportation mode and the retail distribution channel.

From the results of the study, it was concluded that partnership and collaboration between firms in the sector is important but has moderate effect on effectiveness of the SCM. This is mainly due to fear of sharing critical information with others who may leak it to competitors. The importance of collaboration/partnership is important due to the fact that it is cost effective especially when applied in transport and distribution.

Based on the findings, the study concluded that people issues had significant effect on implementation of effective supply chain management. Specifically the people issues that were found to be important were existing policies and procedures, chain of command from top to bottom and extent of staff participation in day to day decision making within the organization. The study further concluded that the influence of people issues on the implementation of effective supply management was dependent on the personal traits mainly honesty, trust and commitment.

Recommendations

On the basis of Information technology, the study recommended that there is need for adoption of improved technology so as to ensure efficiency in information flow. For a supply chain to achieve its maximum level of effectiveness and efficiency, material flows, money flows and information flow throughout the entire chain must be managed in an integrated and holistic manner, driven by the overall service and cost objectives. This concurs with Sweeney, (2005) who argued that managing the information flows is the most critical of these activities in SCM.

Based on the findings, the study recommended that there is need for integration of the supply chain design so as to increase efficiency which will lead to improved financial performance. This is in agreement with Damien (2005) who examined different perspectives on integration

and suggested that integration of several functions at different organizational levels achieve above average financial and performance results.

In relation to partnership and collaboration, the study recommended that there is need for the supply chain actors to collaborate especially in the provision of transport and distribution. Executives should develop supply chain partnerships/collaborations in an attempt to reduce costs, improve service and to gain competitive advantage. The best supply chains have buyer-supplier relationships that are based on value and consistent delivery of this value.

The study recommended that important people issues such as honesty, trust and commitment should be upheld by all supply chain actors. This is in the bid to improve on the cooperation amongst them. This concurs with Rajendra *et al*, (1995) who observed that trust has two dimensions: “honesty” and “benevolence”. There are several dimensions of trust in supply chain performance such as confidence in preferred trading partner, always keeping promises, always being honest, good reputation and close personal friendship.

Recommendations for Further Research

The analysis of the empirical study has indicated a number of relevant issues that the research project did not investigate, but which might be important for further research on challenges facing implementation of effective supply chain management.

- i) The findings were gathered from a small sample; a replica study with large sample size should seek validity.
- ii) The study further recommends that an in-depth study be undertaken to ascertain the effects of government regulation on effective supply chain management in the petroleum industry.

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