EFFECT OF VENDOR MANAGED INVENTORY SYSTEMS ON SUPPLY CHAIN PERFORMANCE IN PETROLEUM INDUSTRY IN KENYA: A CASE OF NATIONAL OIL CORPORATION OF KENYA

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ABSTRACT

The general objective of this study was to assess the effect of vendor managed inventory (VMI) systems on supply chain performance in the petroleum industry in Kenya. The specific objectives of this study were focused on finding out the roles of collaborative forecasting; supplier monitoring; information sharing and shared risk on the supply chain performance in the petroleum industry. The study is beneficial to the management of national oil company, the customers and the government. The variables that were studied included collaborative forecasting, supplier monitoring, information sharing and shared risks, and the effects they have on the performance of a supply chain. The study was done within Nairobi County, specifically at the national oil company. The study involved the staff and managers and covered Nairobi branch only and was carried out between the months of March and May 2015). The study utilized descriptive survey research design, with a target population of all the 86 staff working at the national oil corporation. For sampling, Census Survey was used to target all the selected respondents in the target population because the number was small and can be managed through that method. Questionnaires were used for primary data collection. A pilot test was done on the target group before the actual data was collected. Then, the collected was analyzed using SPSS and presented in terms of tables and graphs, charts, and the interpretation was done through frequencies and percentages. The study findings confirmed that the four selected variables including collaboration forecasting, supplier monitoring, information sharing and shared risks systems of Vendor Inventory Management have tremendous effects on supply chain performance. This study recommends that the management of National Oil Corporation and the entire Petroleum Industry should show full commitment in the entire supply chain to increase the supply chain performance. Additionally, the study recommends that the Petroleum Industry and

other organizations should adopt competitive information sharing, risk sharing and supplier monitoring strategies to enhance the effectiveness of supply chain performance.

Keywords: Collaborative Forecasting, Information Sharing, Inventory, Shared Risk, Supplier monitoring, Vendor and Vendor Managed Inventory.

INTRODUCTION

Vendor-managed inventory (VMI) is a family of business models in which the buyer of a product (business) provides certain information to a vendor (supply chain) supplier of that product and the supplier takes full responsibility for maintaining an agreed inventory of the material, usually at the buyer's consumption location (usually a store). A third-party logistics provider can also be involved to make sure that the buyer has the required level of inventory by adjusting the demand and supply gaps. Vendor Managed Inventory (VMI) is a category of supply system models that holds promise for supply chain performance improvement in developing countries such as Kenya. VMI can be defined as a method of inventory control where the supplier (Vendor) monitors and maintains the quantity of commodities at the customers' location. In some cases, this management responsibility is expanded to inventory management support systems, related physical infrastructure, or other related services

The history of Vendor Managed Inventory starts in the 1980s, when mass retailers started to require their suppliers to take control of the inventory management. Later VMI has expanded to many other industries and different kind of products as well (Claassen, Van Weel & van Raaij 2008, 406). The present trend of outsourcing is that more goods are being outsourced with more advanced services included. Vendor Managed Inventory is an example of such value added process being outsourced (Zammori, Braglia & Frosolini 2009). For many companies, inventory management represents a key success factor; as Silver et al (1998) suggests that a company's fate depends on how it manages its inventory. Much of a company's costs can be attributed to the amount it invests in inventory and associated holding, transportation, and management costs.

Vendor managed inventory (VMI), also known as continuous replenishment or supplier-managed inventory, is one of the most widely discussed partnering initiatives for encouraging collaboration and information sharing among trading partners (Angulo et al., 2004). Popularized in the late 1980s by Wal-Mart and Procter & Gamble (Waller et al., 1999), it was subsequently implemented by many other leading companies from different industries, such as GlaxoSmithKline, Electrolux Italia, Nestle and Tesco and Boeing and Alcoa (Micheau, 2005). It is a supply chain initiative where the vendor decides on the appropriate inventory levels of each of the products and the appropriate inventory policies to maintain those levels. The retailer provides the vendor with access to its real-time inventory level. In this partnership program, the retailer may set certain service-level and/or shelf-space requirements, which are then taken into consideration by the vendor. That is, in a VMI system, the retailer's role shifts from managing

inventory to simply renting retail space (Simchi-Levi et al., 2003; Mishra and Raghunathan, 2004).

Profile of National Oil Corporation of Kenya

National Oil was incorporated in April 1981 with a mandate to participate in all aspects of the petroleum industry. The Corporation is wholly owned by the Government of Kenya through a joint ownership by the Ministry of Energy and Petroleum and The National Treasury.

National Oil became operational in 1984 and its initial operations were limited to exploration activities delegated from the then Ministry of Energy. In 1988, National Oil went downstream and actively started participating in the importation and sale of petroleum products including crude oil, white fuels, lubricants and LPG.

The formation of National Oil was precipitated by the oil crises of the 1970's (1973/74 and 1979/80) and the correspondent supply disruptions and price hikes which resulted in the country's cost of hitting the all-time high of over one third of the total import bill and therefore making petroleum the single largest drain of Kenya's foreign exchange earnings.

National Oil was set up to become a special instrument for the Government of Kenya to have greater control of the petroleum sector which is key to the country's economic performance. National Oil has since remained the Government's policy instrument in matters related to oil and gas specifically in the upstream exploration of oil and gas, mid-stream petroleum infrastructure development and the downstream marketing and distribution of petroleum products and services.

The National Oil Corporation of Kenya is a fully integrated State Corporation involved in all aspects of the petroleum supply chain covering the upstream oil and gas exploration, midstream petroleum infrastructure development and downstream marketing of petroleum products. In the upstream, National Oil facilitates and directly participates in oil and gas exploration activities in Kenya. As a facilitator, National Oil is tasked with the marketing of Kenya's exploration acreage, management of gas and exploration data and the running of the National Petroleum Laboratory among other attendant responsibilities.

In the midstream development of petroleum infrastructure, National Oil identified and is working on three key projects including the development of an offshore floating jetty technically known as a Single Buoy Mooring (SBM), the establishment of the Strategic Petroleum Reserves (SPR) and the crafting of a Petroleum Development Master Plan for Kenya. With the ongoing petroleum infrastructure projects, National Oil aims to position the Kenyan coast an important petroleum trading hub in the same league as Fujairah, Amsterdam and Rotterdam as well as prepare for the anticipated oil and gas production from Kenya and the East African region following recent discoveries.

National Oil has an active downstream business segment with a growing retail network of over 109 service stations spread throughout the country. The Corporation also serves a cross-section of resellers, industrial and government businesses from its modern Nairobi National Terminal. In addition to its fuels business, National Oil has developed and deployed a number of innovative products and services including its Supa Gas brand of Liquefied Petroleum Gas (LPG), the Supa range of motor and industrial lubricants, an advanced electronic fuel management system named Supa Card and a vibrant alternative business unit that deals with non-fuel businesses.

Statement of the problem

The modern day firms are evaluated by customers using indicators such as, response time, delivery accuracy, ability to customize, lean and agile manufacturing. Around the globe, there is evidence of increased emphasizes on the need to be effective in managing the supply chain (Fisher, 1997). Vendor-Managed inventory (VMI) is one of the ways of improving supply chain management, this is demonstrated by previous researchers in the United States of America and United Arab Emirates that showed reduced manufacturing costs, lower inventory, increase competitiveness and meet customer satisfaction (Waller, Johnson & Davis, 1999).

In majority of manufacturing industries, stock constitutes a significant part of current assets (Songet al., 2006). Manufacturing companies can attain significant savings from effective materials management of inventory can which can lead to reduction in cost, resulting in significant saving. A potential of a 6% saving on total cost through effective inventory management is achievable (Bell & Sturkhart, 2007). The various types of materials to be managed in any organization include purchased materials, work in progress (WIP), materials and finished goods (Banjoko, 2009). Indeed, for many manufacturing firms inventory costs accounts for over 50% of total production costs (Chen, 2005).

Today, it is commonly accepted that the cost of holding stock to a business is between 4% and 10% on top of the stock's value (PPOA, 2005). manufacturing firms in Kenyan are characterized by elongated or over extended chain retailers (buyers and agents) which in turn mean long chains of transactions between chain members and consumers (Amoro, 2011; World Firm, 2007) showed that leading firms in Kenya are faced with problems of wrong forecasting due to an unavailability of enough inventory management information. In 2012 New KCC was affected by poor inventory management related cases leading to low performance (KAM, 2013). This caused erratic deliveries in these firms, late deliveries and inflexibility hence affecting customer satisfaction within their downstream chain (KAM, 2013) Customers are concerned with the availability of the product and the ability of the firms to meet their needs timely (Aghazadesh, 2003). Unavailability of integrated inventory management has affected supply chain performance at New KCC hence reduced profits in the downstream chain hence leading to loss chain profits (Otieno, 2011).

Locally, studies which have been done, for example, Kariuki (2003) attempted to explain the benefits of inventory cost management among private companies, Gathumbi (1997) examined the Application of Inventory Models in Drug inventory Management. These are few local studies done on establishing the role of effective inventory management in enhancing performance of commercial firms in Kenya. These are studies on the adoption of inventory management system by the public sector in the developed world. Thus, there is a need to validate this in the context of the developing countries, and in specific, the firming sector in the developing Countries since the implementation of inventory management system adversely affects the performance positively in terms of increasing the effectiveness and efficiency of inventory management in the private sector.

In Kenya vendor Managed Inventory has been around since early 1980s. While vendor managed inventory has successfully been implemented in the supermarket chains in Kenya (Irungu, 2011), not much has been studied with the effect of vendor managed inventory on the supply chain performance of petroleum firms in Kenya hence the need to carry out a study in this area.

OBJECTIVE OF THE STUDY

The main purpose of this study was to establish the effect of vendor managed inventory (VMI) systems on supply chain performance in the petroleum industry in Kenya.

LITERATURE REVIEW

Appropriate integration of inventory management systems is fundamental to the management of a supply chain management as a way of ensuring great performance. Frahm (2003) emphasized the importance of collaborative forecasting in the experience of inventory management, similar to the idea proposed by Barratt and Oliveira (2001). Customers bring their earlier experiences and overall perceptions of a service firm to each encounter because customers often have continuous contacts with the same service firm (Frahm, 2003). Therefore, the collaborative forecasting was introduced as yet another important component in the perceived quality inventory management model, so that the dynamic aspect of the service perception process was considered as well. A favorable and well-known forecasting strategy is an asset for any firm because it has an impact on customer perceptions of the communication and operations of the firm in many respects. If a service provider has a strong inventory management in the minds of customers, minor mistakes will be forgiven. If mistakes often occur, however, the image will be damaged. If a provider's image is negative, the impact of any mistake will often be magnified in the consumer's mind. In a word, collaborative forecasting can be viewed as a filter in terms of a consumer's perception of quality (Raghunathan, 1999). Collaborative collaboration has to live up to service promises, especially if the service provider is “claiming” the quality service position in the firming industry.

Narasimhan, Swink & Kim (2006) did a study to evaluate on the effect of information sharing on the quality of supply chains. Narasimhan, Swink & Kim (2006) found that information sharing is

a vital aspect of coordination among the parties in a supply chain, which provides great of the possibilities and opportunities for the improvements in the supply chain efficiency. However, from analytical research perspective, the benefits of sharing information among supply chain members are not always the same. They depend on the supply chain structure (e.g., serial distribution systems), the operational characteristics (e.g., demand patterns and costs involved), and the shared information type (e.g., order information and planning information). Various studies have examined their model based on different structures, operational characteristics, and information types.

Huang et al (2003) summarized types of information being shared into six categories: product, process, inventory, resource, order, and planning. In our proposed model, we are more interested in considering the inventory, capacity, and demand information. Academic researchers have addressed strong interests in the information sharing aspect of supply chains. Some review works about information sharing in the supply chain have been done by. These reviews are very extensive and have broad scopes in terms of supply chain models, methodologies, and types of information being shared. In the literature, the suppliers in the top of supply chain are usually called the upstream members, while the retailers (or buyers) are called the downstream members. Information sharing can occur between both of the upstream and downstream sources. For example, the upstream supplier may provide detailed information about how much of the order is being shipped and when the order will arrive at the downstream. This is called upstream advanced shipping information sharing, which could be particularly important when the upstream supply chain member has processes with yield losses or output uncertainty. An example of sharing downstream information can be found in Vendor Managed Inventory (VMI) platforms where downstream retailers share end customer point of sale (POS) demand data with their upstream suppliers.

Although the need for performance in firms has long been recognized, for a variety of reasons, many organizations fail to measure it adequately (Cagliano et al, 2003) review the history of PP in the literature through the 1980s and early 1990s and conclude that a general weakness of "traditional" measures is that they recognize and reward mainly short-term gains, rather than long-term ones. (Donovan & Williams, 2003) argued that measuring long-term impact is notoriously difficult. In another study, Zineldin (1995) described and empirically analyzed the major factors influencing the relationship between firms and their corporate customers in Sweden. Zineldin's study was based on 179 responses from small, medium, and large firms. Significant findings include the following. First, small and medium-sized firms have more stable relationships and contact with their firms than do larger firms. They also have relationships with fewer firms. Second, small firms are less satisfied with their relationship with their firms due to a lack of confidence and cooperation. In addition, small firms feel their Companies are less knowledgeable of their business. Third, the most important factors in the selection of a lead firm are confidence and trust, competitiveness on loans, and adaptations and speed of decisions.

RESEARCH DESIGN AND METHODOLOGY

In this study, a descriptive research design was selected as the most appropriate. The target population was the employees and management of national oil company. The employees involved are those in procurement, Accounts, sales and management. A total of 86 employees and management were targeted for the study. In this study, a census survey was used to select the study sample. Data was collected by the use of a questionnaire. The information gathered in the questionnaire was sorted, coded and input into the statistical package for social sciences (SPSS) version 20 for production of frequencies descriptive statistics and inferential statistics.

RESEARCH FINDINGS AND DISCUSSION

The findings of the study indicated that the quality of vendor managed inventory systems determined the performance of supply chains within your organization. More specifically, the study found out that customer service quality affects supply chain performance, and mainly, consumer expectation-management and the delivery of service standards also affect supply chain performance to a large extent.

With this objective, the study found out that the suppliers of the organization have always participated in the forecasting process in our organization. In addition, the study found out that that the suppliers inject their input whenever the petroleum industry officers are forecasting on future activities. It was also evident from the study that supplier forecasts are always used in the planning process of the organization; the forecasts made are more accurate when the organization involves the suppliers than when it does not involve them.

Also, the study found out that the organization's way of doing forecasting has reduced the wastage of inventory in their organization, and that collaborative forecasting has reduced the time the organization takes to respond to customer requests. Finally, the study establishes that forecasting has reduced the cost of handling the organization's inventory. The results confirm the finding of Seifert (2003) which prescribes that the retailer and the supplier create a demand forecast and enter it into the collaboration platform. This has the implication that the organization values collaboration forecasting system of Vendor Inventory Management because it has tremendous effects on supply chain performance.

With this objective, the study found out that the organization emphasizes on monitoring as a way of enhancing the effectiveness of supply chains. In addition, the study findings indicated that suppliers monitor the activities of the supply chain of the organization. It was also evident from the findings that the staff keeps track of the entire inventory of the organization that they have supplied, and that suppliers participate in decision making regarding which inventory to replenish and which one to discontinue.

The research findings on supplier monitoring further indicated that supplier participation in inventory controlling has reduced the burden on the organization's store, and that vendor participation in monitoring the stock has reduced wastage in the organization. Another major finding was that supplier monitoring has reduced the time taken to respond to customer requests, and also that supplier monitoring has reduced the cost of handling the organization's inventory. This was an indication that the respondents were in agreement that supplier monitoring as a vendor inventory management system affects supply chain performance at the petroleum industry. These findings concurred with Emiliani & Stec (2004) who supported the use of supplier monitoring by stating that a positive feature of a continuous system is that the inventory level is continuously monitored, so management always knows the inventory status. Emiliani & Stec (2004) added that supplier monitoring is advantageous for critical items such as replacement parts or raw materials and supplies.

With this objective, the study found out that petroleum industry values information sharing as a system that aids in the management of vendor inventories for improves supply chain performance. Specifically, the study established that suppliers are always willing to share information with the organization, and that the organization had access to supplier's information. The was also evidence from the findings that crucial information shared by the suppliers has greatly improved the efficiency of the organization's supply chain, suppliers' sharing of information has reduced the time taken to respond to the customers' orders and that supplier sharing of information has reduced wastage in the organization.

Most importantly, the study found out that supplier sharing of information has reduced the cost of handling the organization's inventories. This has the implication that information sharing at the petroleum industry is valued as a factor that influences the performance of the supply chain performance. This concurs with a finding that information sharing has been shown to be the key to successful downstream chains by Aviv (2003. Also, the finding confirms Lee and Wang's (2000) study which asserts that information sharing provides information regarding inventory levels and position, sales data and forecasts, order status, production and delivery schedules and capacity, and that it is considered as the most reliable real time tool to decrease uncertainty in the chain which leads to the bullwhip effect.

With this objective, the study had several findings. First, the major study finding was that shared risk was important in supply chain performance in the petroleum industry because it helps in reducing supply chain associated risks, promotes trust between the supplier and the customer and also aids in preventing any occurrence of risks in future operations. This concurs with the finding that benefits from mutual understanding of each other's processes lead to a stronger relationships and a possibility to collaborative development from a study carried out by Disney (2003).

In addition, the study findings indicated that the organization's suppliers accept back rejected or returned goods for replacement to a great extent. Another major finding was that suppliers

participate in decision making regarding which inventory to replenish and which one to discontinue. More to that, the findings indicated that supplier participation in inventory controlling has reduced the burden on the organization's stores to a great extent, shared risk with suppliers has reduced wastage in the organization, shared risk with suppliers has reduced the time taken to respond to customer requests, and that shared risk with suppliers has reduced the cost of handling our inventory to a great extent. This implies that the organization values shared risk systems because they affect supply chain performance to a great extent. The finding also confirms the finding of a study by Claassen & Weele (2005) which asserts that shared risk promotes information transparency, giving better information for decision making and minimizing the risk of sub optimizing the inventories.

Regression analysis

Model summary

Adjusted R squared is coefficient of determination which tells us the variation in the dependent variable due to changes in the independent variable. From the findings in the table below, the value of adjusted R squared was 0.786 an indication that there was variation of 78.6 percent on supply chain performance of the National Oil Corporation due to changes in collaborative forecasting, supplier monitoring, and information sharing and shared risk at 95 percent confidence interval. This shows that 78.6 percent changes in supply chain performance of the National Oil Corporation could be accounted collaborative forecasting, supplier monitoring, and information sharing and shared risk, R is the correlation coefficient which shows the relationship between the study variables, from the findings shown in the table below is notable that there extists strong positive relationship between the study variables as shown by 0.919.

Table 4.1: Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.919	.844	0.776	.32561

Conclusions

From the study findings, it was concluded that the quality of vendor managed inventory, specifically, the study found out that customer service, consumer expectation-management and the delivery of service standards affects supply chain performance to a large extent.

Concerning collaborative forecasting as a Vendor Inventory Management, the study concluded that the suppliers of the organization have always participated in the forecasting process in our organization, the suppliers inject their input whenever the petroleum industry officers are forecasting on future activities, supplier forecasts are always used in the planning process of the organization; and that the forecasts made are more accurate when the organization involves the

suppliers than when it does not involve them. Also, the study concluded that the organization's way of doing forecasting has reduced the wastage of inventory in their organization, collaborative forecasting has reduced the time the organization takes to respond to customer requests, and that forecasting has reduced the cost of handling the organization's inventory. The results confirm the conclusion of Seifert (2003) which prescribes that the retailer and the supplier create a demand forecast and enter it into the collaboration platform. In conclusion, the petroleum industry values collaboration forecasting system of Vendor Inventory Management because it has tremendous effects on supply chain performance.

On the objective of supplier monitoring, the study concluded that suppliers monitor the activities, the staff keeps track of the entire inventory of the organization that they have supplied, and that suppliers participate in decision making regarding which inventory to replenish and which one to discontinue. It was also concluded that supplier participation in inventory controlling has reduced the burden on the organization's store, and that vendor participation in monitoring the stock has reduced wastage in the organization, supplier monitoring has reduced the time taken to respond to customer requests, and that supplier monitoring has reduced the cost of handling the organization's inventory. The general conclusion was that supplier monitoring as a vendor inventory management system affects supply chain performance at the petroleum industry. These findings concurred with Emiliani & Stec (2004) who supported the use of supplier monitoring by stating that a positive feature of a continuous system is that the inventory level is continuously monitored, so management always knows the inventory status. Emiliani & Stec (2004) added that supplier monitoring is advantageous for critical items such as replacement parts or raw materials and supplies.

Regarding information sharing, the study concluded that that petroleum industry values information sharing as a system that aids in the management of vendor inventories for improves supply chain performance. Specifically, the study concluded that suppliers are always willing to share information with the organization, the organization had access to supplier's information, crucial information shared by the suppliers has greatly improved the efficiency of the organization's supply chain, suppliers' sharing of information has reduced the time taken to respond to the customers' orders and that supplier sharing of information has reduced wastage in the organization. Most importantly, the study concluded that supplier sharing of information has reduced the cost of handling the organization's inventories. From the findings, it has been conclude that information sharing at the petroleum industry is valued as a factor that influences the performance of the supply chain performance. This concurs with a conclusion that information sharing has been shown to be the key to successful downstream chains by Aviv (2003. Also, the conclusion confirms Lee and Wang's (2000) study which asserts that information sharing provides information regarding inventory levels and position, sales data and forecasts, order status, production and delivery schedules and capacity, and that it is considered as the most reliable real time tool to decrease uncertainty in the chain which leads to the bullwhip effect.

With this objective, the study concluded that the organization's suppliers accept back rejected or returned goods for replacement to a great extent and that suppliers participate in decision making regarding which inventory to replenish and which one to discontinue. More to that, the findings led to a conclusion that supplier participation in inventory controlling has reduced the burden on the organization's stores to a great extent, shared risk with suppliers has reduced wastage in the organization, shared risk with suppliers has reduced the time taken to respond to customer requests, and that shared risk with suppliers has reduced the cost of handling our inventory to a great extent. Wholesomely, the study concluded that the organization values shared risk systems because they affect supply chain performance to a great extent. This concurs with the assertion that benefits from mutual understanding of each other's processes lead to a stronger relationships and a possibility to collaborative development from a study carried out by Disney (2003). The finding also confirms the finding of a study by Claassen & Weele (2005) which asserts that shared risk promotes information transparency, giving better information for decision making and minimizing the risk of sub optimizing the inventories.

RECOMMENDATIONS

This study recommends that the management of National Oil Corporation and the entire Petroleum Industry should show full commitment in the entire supply chain; because this will serve as a motivation to the personnel in the lower levels of management and thus increasing the supply chain performance. Also, all organization need to adopt improved collaborative forecasting strategies as collaborative forecasting as was found to facilitate effective management, by enhancing decision making , lowering production cost as well as ensuring quality production.

Additionally, the management of National Oil Corporation and the entire Petroleum industry should consider establishing relationships that are strategic with suppliers as meeting supplier demand enhanced timeliness in supply operations which led to increased supply chain performance.

Thirdly, this study puts across a recommendation that the petroleum industry, specifically the National Oil Corporation should adopt competitive information sharing strategies so as to enhance supply chain performance. Also, organizations should consider adopting up to date communication strategies as well as improving the ones already in place to enhance supply chain performance.

Finally, the study recommends that the petroleum industry should check out the efficiency of the shared risk systems currently in use so as to improve them for better performance. In connection to this, the organizations should regularly evaluate the effectiveness of the methods used and improve where necessary so as to ensure that supply chain performance follows an elevating trend because the study found that shared risk influences supply chain performance to a great extent.

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