# VENDOR MANAGED INVENTORY AND LOGISTICS PERFORMANCE OF QUOTED OIL AND GAS COMPANIES IN NIGERIA

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#### Abstract

This study investigated the relationship between vendor managed inventory (VMI) and logistics performance of quoted oil and gas companies in Nigeria. The study adopted a survey research design. Primary data was collected from 27 senior managers in operations, logistics, and warehousing from 9 oil and gas firms listed on the Nigerian Exchange Group (NGX). The study employed a structured questionnaire for the collection of data to assess the impact of VMI on 3 indicators of logistics performance: on-time delivery, order fulfilment, and transportation cost. Spearman's rank-order correlation was utilized for data analysis, with the results revealing significant positive relationship between VMI and all 3 logistics performance metrics. Specifically, VMI was found to have a strong correlation with on-time delivery (rho = .961, p = .000), order fulfilment (rho = .955, p = .000), and transportation cost (rho = .949, p = .000). These findings suggest that VMI improve logistics performance by reducing lead times, enhancing order accuracy, and minimizing transportation expenses. The study recommends the full adoption of VMI, supported by advanced technology and continuous supplier collaboration, to optimize logistics performance in the Nigerian oil and gas sector. **Keywords:** Logistics performance, on-time delivery, order fulfilment, transportation cost, vendor managed inventory

#### Introduction

Logistics performance has become a critical determinant of a firm's success in today's dynamic business environment, especially in industries with complex supply chains such as oil and gas. The efficient movement of goods, services and information from points of origin to points of consumption is essential to maintaining competitive advantage (Lambert & Cooper, 2000). One innovative strategy that has gained prominence in the management of supply chains is vendor managed inventory (VMI).

VMI is a collaborative supply chain initiative where suppliers assume responsibility for maintaining customers' inventory levels, ensuring that replenishment decisions are made based on real-time data (Kaipia, 2009). This system shifts the responsibility of inventory management from the buyer to the supplier, aiming to optimize inventory levels, minimize stock-outs, and improve service delivery (Disney & Towill, 2003).

VMI has been widely adopted across industries to streamline logistics operations and reduce costs. Research shows that VMI contributes significantly to enhancing logistics performance by improving on-time delivery, order fulfilment and reducing transportation costs (Ojo & Adebayo, 2019). Companies that implement VMI report better alignment of their inventory management processes with customer demand, thereby enhancing their ability to meet service expectations (Christopher, 1992). In the oil and gas sector, where timely and reliable delivery of products is crucial, VMI offer substantial benefits by allowing suppliers to optimize inventory levels and anticipate changes in demand, resulting in improved operational efficiency (Bowersox & Closs, 1986).

Several studies have demonstrated the positive effects of VMI on logistics performance. For instance, Vidal and Goetschalckx (2019) found that companies utilizing VMI achieved significantly improved logistics efficiency by optimizing transportation routes and reducing fuel consumption. Similarly, Odiwuor and Muyhoni (2023) showed that retail outlets in

Kenya adopting VMI were able to improve their order fulfilment processes and overall performance. This evidence underscores the importance of VMI as a strategic tool in managing inventory and logistics processes, particularly in the as oil and gas industry where there is heavy reliance on timely and accurate delivery.

Despite the proven benefits of VMI, its implementation in Nigeria's oil and gas sector remains relatively underexplored. Nigeria's oil and gas industry is characterized by complex logistics operations that are often challenged by inefficient inventory management, leading to increased costs and delayed deliveries (Vidal & Goetschalckx, 2019). Addressing these issues requires innovative solutions like VMI to streamline the replenishment process, optimize transportation, and improve overall logistics performance.

This study aims to examine the relationship between VMI and logistics performance of quoted oil and gas companies in Nigeria. The research seeks to investigate how VMI influences key logistics performance indicators such as on-time delivery, order fulfilment, and transportation costs. Understanding this relationship is crucial to the oil and gas sector, where operational efficiency directly affects profitability and customer satisfaction (Sari, 2008). By focusing on the Nigerian context, this study aimed to provide valuable insights into how VMI can be leveraged to improve logistics performance in a challenging and dynamic environment.



Fig. 1: Conceptual framework of relationship between vendor managed inventory and logistics performance.

### **Theoretical Foundation: Resource-Based View**

This study took its bearing from the Resource-Based View (RBV) - is a strategic management framework that emphasizes the role of a firm's resources and capabilities in achieving sustainable competitive advantage. According to Barney (1991), firms attain superior performance by leveraging valuable, rare, inimitable, and non-substitutable (VRIN) resources. In logistics management, RBV can be applied to understand how internal resources, such as VMI, contribute to logistics performance and overall business success.

VMI is a collaborative inventory replenishment strategy where the vendor takes responsibility for managing buyers' inventory levels. The system relies on information sharing and strong vendor-buyers relationships, and results in better inventory control and minimizing stock-outs or excess inventory (Sari, 2008). VMI can be viewed through the lens of RBV as a critical capability that firms can develop to enhance logistics efficiency.

By adopting VMI, firms can leverage internal resources, such as advanced data analytics, real-time information systems, and skilled personnel, to improve supply chain responsiveness

and reduce lead times (Zhao et al., 2002). These resources, if valuable and unique, can become sources of competitive advantage. For instance, the ability to predict demand accurately through data-driven decision-making is a resource that can make a firm more competitive in the marketplace.

RBV suggests that firms that invest in superior logistics resources, such as VMI systems, are more likely to outperform competitors in terms of delivery speed, inventory accuracy, and customer satisfaction (Bowersox et al., 2013). Logistics performance improves due to better inventory visibility, reduced stock-outs, and enhanced collaboration between suppliers and customers. These improvements can directly lead to cost reductions, optimized resource utilization, and enhanced customer service, thus providing a competitive edge (Simchi-Levi et al., 2003). The use of VMI as a logistics resource can transform the supply chain into a more agile and responsive system, aligning with the RBV framework's emphasis on leveraging internal capabilities for long-term success

#### **Concept of Vendor Managed Inventory**

VMI is a strategic approach to inventory management where the supplier assumes responsibility for managing the inventory levels of the customer based on real-time data. This collaborative method aims to reduce stock-outs, improve inventory turnover and enhance supplier-customer relationships. Mishra and Shekhar (2020) found that VMI implementation in the manufacturing sector resulted in 20% reduction in inventory holding costs and 15% increase in inventory turnover, highlighting its value in optimizing inventory management processes.

At its core, VMI is a supply chain tool that empowers suppliers to take control of replenishing customer inventory when stock levels drop below a certain threshold (Beheshti et al., 2020). This system grants the supplier transparency into the customer's sales data and inventory levels, allowing for proactive inventory management. This level of visibility helps maintain stable product availability, particularly in retail settings where product shortages can disrupt operations (Sabila et al., 2018). By analyzing customer data, suppliers are better positioned to anticipate inventory needs, ensuring products are available without requiring the customer to place frequent orders.

Sainathan and Groenevelt (2019) opine that the primary advantage of VMI is the transfer of inventory management tasks from the buyer to the supplier. However, this process depends heavily on trust and transparent communication between the two parties (Disney & Towill, 2003). Suppliers need access to accurate, real-time data, such as point-of-sale (POS) information and inventory levels, to make informed decisions about when and how much to replenish. Through this collaboration, VMI reduces the "bullwhip effect," a phenomenon where small fluctuations in demand lead to larger inefficiencies across the supply chain (Holweg & Disney, 2005). As suppliers have direct access to customer data, they can reduce excess inventory and improve inventory turnover by responding more accurately to actual demand (Kaipia, 2009).

Another significant benefit of VMI is inventory optimization. Suppliers can maintain optimal stock levels based on demand patterns, minimizing both stock-outs and overstocking (Waller et al., 1999). This results in lower safety stock requirements for buyers, which translates into improved cash flow, as there is less capital tied up in inventory. Additionally, shorter lead times become possible as suppliers are better equipped to anticipate and adjust to fluctuations in demand (Dong et al., 2007). This increased responsiveness enhances customer service and strengthens the supply chain's overall agility.

VMI also leads to substantial cost reductions for both suppliers and customers. Suppliers can manage inventory more efficiently, which reduces their operational costs. These savings benefit both parties, as they lead to fewer administrative tasks, streamlined procurement processes, and less frequent order negotiations (Kuk, 2004). By simplifying these processes, VMI creates a more cost-effective supply chain, fostering long-term partnerships between suppliers and customers.

## **Concept of Logistics Performance**

Bowersox (1978) describe logistics performance as the integration and coordination of logistics activities to achieve service and cost objectives, enhance overall business performance and contribute to competitiveness. Bowersox and Closs (1986) refined this view, by focusing on the ability of logistics systems to meet service levels at the lowest total cost. Their definition integrated customer satisfaction into the performance equation, recognizing that achieving logistics efficiency is inseparable from customer service.

Logistics performance is integral to a firm's operational success and competitive advantage, particularly in industries such as oil and gas, where timely and reliable logistics are paramount for business continuity. Drucker (1963) first highlighted logistics performance as operational efficiency in moving and storing goods, stressing the importance of minimizing costs while ensuring timely delivery.

Lambert and Stock (1993) characterized logistics performance as the effectiveness and efficiency of logistics processes in meeting customer expectations and organizational goals. They highlighted the importance of continuous process improvement and innovation in enhancing logistics outcomes. Christopher (1992) emphasized that logistics performance is a strategic enabler of competitive advantage.

Kumar and Kumara (2005) adds that logistics performance is increasingly measured by advanced metrics and real-time data analytics, which enhance decision-making and supply chain responsiveness. Similarly, Gunasekaran and Kobu (2007) highlighted the role of technology in logistics, noting that the integration of advanced information systems has shifted traditional performance metrics toward real-time efficiency and adaptability.

Logistics performance has been measured differently in different contexts and by different scholars. Herein, we use on-time delivery, order fulfillment and transportation costs to represent logistics performance.

### **On-time delivery**

On-time delivery refers to the ability of a company to deliver products to customers within agreed-upon timeframe, ensuring that customer demands are met efficiently and reliably. On-time delivery is particularly important in today's competitive market, where customer satisfaction often hinges on timely fulfilment. According to Christopher (1992), on-time delivery is a key component of logistics performance, as it directly influences customer satisfaction and loyalty.

Companies that consistently meet delivery deadlines are more likely to retain customers and gain a competitive edge in their respective markets. On-time delivery is not only a reflection of operational efficiency but also a measure of the effectiveness of a company's supply chain management. Lambert and Cooper (2000) emphasized that ability to meet delivery schedules depends on seamless coordination of various logistics activities, including transportation, inventory management, and order processing.

In supply chain management, on-time delivery is closely linked to reliability and flexibility of the logistics network. Firms must be able to adapt to fluctuating customer demands, unexpected disruptions, and varying market conditions to maintain consistent delivery performance. Gunasekaran and Kobu (2007) argued that on-time delivery serves as an important indicator of a company's agility and responsiveness, which are vital in managing complex and dynamic supply chains.

By continuously monitoring and improving on-time delivery rates, companies can reduce stock-outs, production delays and customer dissatisfaction. On-time delivery is a vital measure of logistics performance, influencing customer satisfaction, operational efficiency, and overall supply chain effectiveness. By focusing on improving on-time delivery, companies can enhance their competitiveness, strengthen customer relationships, and ensure long-term success of their logistics operations.

### **Order fulfilment**

Order fulfilment refers to the complete process of receiving, processing, and delivering customer orders in a timely and accurate manner. It is a critical measure of logistics performance because it directly impacts customer satisfaction and operational efficiency. In today's fast-paced market, companies must excel in order fulfilment to stay competitive. Effective order fulfilment ensures that products are delivered accurately, within the expected timeframe, and in good condition, thus playing a crucial role in the overall success of supply chain management (Bowersox et al., 2013).

Christopher (1998) states that customer expectations have evolved, with demands for shorter lead times, higher accuracy, and better service quality. As such, order fulfilment performance is a key determinant of customer satisfaction. Poor order fulfilment can lead to customer dissatisfaction, lost sales, and damage to a company's reputation (Mentzer et al., 2001). Conversely, efficient and timely order fulfilment enhances customer loyalty and strengthens business relationships.

Order fulfilment involves multiple logistics activities, including order processing, picking, packing, and shipping. The efficiency of these activities reflects a company's logistics capabilities and overall supply chain performance. Gunasekaran et al. (2001) noted that metrics such as order cycle time, order accuracy, and the percentage of orders delivered on time are commonly used to evaluate the performance of order fulfilment processes.

### **Transportation cost**

Transportation cost is a critical component of overall logistics expenses, significantly influencing a firm's profitability and supply chain efficiency. Effective management and reduction of transportation costs are vital for enhancing logistics performance and maintaining competitive advantage. Optimizing transportation routes, improving fuel efficiency, and adopting advanced technologies are key strategies for minimizing transportation costs and enhancing operational efficiency (Vidal & Goetschalckx, 2019).

Transportation cost reduction is crucial in improving margins and ensuring better logistics performance. Vidal and Goetschalckx (2019) found that companies prioritizing transportation cost reduction achieved higher profit margins and greater overall logistics performance (Christopher, 2016). The impact of transportation costs on economic activities and international trade cannot be overstated. Thai et al. (2021) highlight that transportation costs have significant implications for the structure of economic activities, affecting trade patterns and supply chain efficiency on a global scale.

Efficient management of transportation costs is essential for optimizing supply chains and reducing lead times, which in turn enhances customer satisfaction. Finally, Kamungo (2014) emphasizes the importance of coordination between different elements of the logistics system, with transportation acting as the connecting factor between production, distribution, and delivery. Effective coordination among transportation activities ensures that goods are moved efficiently through the supply chain, maximizing benefits and reducing overall costs.

### **Empirical Review**

Empirical studies across multiple industries show that VMI has a significant positive impact on logistics performance. By allowing suppliers to manage inventory levels, VMI helps reduce stock-outs, improve delivery efficiency, and optimize overall supply chain operations. Prior studies offer empirical evidence to support this position.

Disney and Towill (2003) conducted an empirical study in the UK manufacturing sector and found that VMI led to a 30% reduction in lead times and improved logistics performance by reducing excess inventory and enhancing supplier-manufacturer coordination. This empirical evidence aligns with the literature review's assertion that VMI improves logistics efficiency by reducing the bullwhip effect and optimizing inventory levels.

In a study on retail chains in Turkey, Sari (2008) found that VMI improved logistics performance by reducing stock-outs and improving inventory turnover by 25%. The study noted that retailers experienced better product availability and customer satisfaction, corroborating the literature review's findings that VMI enhances logistics performance by improving stock management.

De Vries (2011) empirically examined the impact of VMI in Dutch hospitals and found that logistics performance improved significantly, with a 20% reduction in stock-outs and a 15% improvement in inventory turnover. This empirical evidence supports the literature review's position that VMI enhances healthcare logistics by ensuring the timely availability of critical medical supplies.

Also, Holweg and Pil (2004) conducted a case study in the automotive sector and reported that VMI improved logistics performance by 35%, reducing delays in part deliveries and improving production efficiency. This report is consistent with the view that VMI enhances logistics synchronization between suppliers and manufacturers in the automotive industry. Wang and Gupta (2011) performed an empirical analysis of electronics manufacturers and found that VMI improved logistics performance by reducing inventory holding costs by 20% and improving lead times by 15%.

In an empirical study on textile firms in Bangladesh, Rana et al. (2015) found that VMI improved logistics performance by reducing lead times by 18% and minimizing stock-outs. This empirical evidence strengthens the position in the literature review that VMI plays a crucial role in ensuring timely availability of materials, leading to improved production efficiency in the textile industry.

Ogbo et al. (2014) empirically analyzed the pharmaceutical sector in Nigeria and found that VMI led to a 30% improvement in logistics performance by reducing stock-outs and ensuring the timely replenishment of critical drugs. This empirical evidence supports the literature review's conclusion that VMI improves logistics performance by ensuring the availability of essential medicines, reducing the risk of shortages, and enhancing overall supply chain efficiency.

Evidence in literature demonstrate that VMI has a substantial impact on logistics performance across multiple industries. By allowing suppliers to manage inventory levels and replenishment schedules, VMI reduces stock-outs, improves lead times, and enhances supply chain coordination. These benefits are consistently observed across manufacturing, retail, healthcare, automotive, electronics, textile and pharmaceutical industries.

The foregoing shows that VMI relates to logistics performance. However, in view of our need to conduct statistical tests, we hypothesize as follows:

- **Ho**<sub>1</sub>: These is no significant relationship between VMI and on-time delivery of quoted oil and gas companies in Nigeria.
- **Ho2**: There is no significant relationship between VMI and order fulfillment of quoted oil and gas companies in Nigeria
- **Ho3:** There is no significant relationship between VMI and transportation cost of quoted oil and gas companies in Nigeria.

### Methodology

The study adopted a survey research design. The population for the study comprised 9 oil and gas companies listed on the Nigerian Exchange Group's official website (NGX, 2024). The study adopted the entire population of study as its operational unit of analysis. 3 copies of the research instrument were sent to each of the 9 quoted oil and gas companies involving senior managers of operations, logistics and warehousing, resulting in a total of 27 respondents. Structured questionnaire was administered to senior managers in charge of warehousing, operations, and logistics. This study ensures validity through content validity and construct validity. To assess the reliability of the questionnaire, internal consistency reliability was employed, specifically using Cronbach's Alpha. The Spearman's Rank Order Correlation was used to test the hypotheses and examine relationships between VMI and measures of logistics performance. The statistical package for social sciences (SPSS) was employed to facilitate data analysis and ensure accuracy.

#### Data Analysis and Results Table 1: Correlation between Vendor Managed Inventory and On-Time Delivery

			Vendor Managed	On-Time
			Inventory	Delivery
Spearman's	Vendor Managed	l Correlation Coefficient	1.000	.961**
rho	Inventory	Sig. (2-tailed)		.000
		Ν	20	20
	On-Time Delivery	<b>Correlation Coefficient</b>	.961**	1.000
		Sig. (2-tailed)	.000	
		Ν	20	20

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

Source: Output of data analyses on vendor managed inventory and logistics performance (2024). Table 1 illustrates the Spearman Rank Order Correlation result generated by the statistical package for social science (SPSS) version 25. The attendant p-value of the relationship between VMI and on-time delivery is revealed to be significant (where p = .000) which is less than 0.05 as stated in our decision rule. The result from the Spearman correlation is .961 from this result we see that VMI has a very strong relationship with on-time delivery. Also, we observe the sign to be positive indicating a very strong and positive relationship exist between VMI and on-time delivery. Based on this result we therefore reject the null hypothesis and accept the alternate hypothesis. Indicating that there is a strong, positive and significant relationship between VMI and on-time delivery in quoted oil and gas companies in Nigeria.

				Vendor Managed	Order
				Inventory	Fulfilment
Spearman's	Vendor	Managed	Correlation Coefficient	1.000	.955**
rho	Inventory		Sig. (2-tailed)		.000
			Ν	20	20
	Order Fulf	ilment	Correlation Coefficient	.955**	1.000
			Sig. (2-tailed)	.000	
			Ν	20	20

Table 2: Correlation between Vendor Manage	ed Inventor	v and Order	<b>Fulfilment</b>
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\*\*. Correlation is significant at the 0.01 level (2-tailed).

Source: Output of data analyses on vendor managed inventory and logistics performance (2024).

Table 2 illustrates the Spearman Rank Order Correlation result generated by the statistical package for social science (SPSS) version 25. The attendant p-value of the relationship between VMI and order fulfilment is revealed to be significant (where p= .000) which is less than 0.05 as stated in our decision rule. The result from the Spearman rho correlation is .955 from this result we see that VMI has a very strong relationship with order fulfilment. Also, we observe the sign to be positive indicating a very strong and positive relationship exist between VMI and order fulfilment. Based on this result we therefore reject the null hypothesis and accept the alternate hypothesis. Indicating that there is a strong, positive and significant relationship between VMI and order fulfilment in quoted oil and gas companies in Nigeria.

			Vendor Managed	Transportation
			Inventory	Cost
Spearman's	Vendor Manageo	l Correlation Coefficient	1.000	.949**
rho	Inventory	Sig. (2-tailed)		.000
		N	20	20
	Transportation	Correlation Coefficient	.949**	1.000
	Cost	Sig. (2-tailed)	.000	
		N	20	20

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

Source: Output of data analyses on vendor managed inventory and logistics performance (2024).

Table 3 illustrates the Spearman Rank Order Correlation result generated by the statistical package for social science (SPSS) version 25. The attendant p-value of the relationship between VMI and transportation cost is revealed to be significant (where p= .000) which is less than 0.05 as stated in our decision rule. The result from the Spearman rho correlation is .949 from this result we see that VMI has a very strong relationship with transportation cost Also, we observe the sign to be positive indicating a very strong and positive relationship exist between VMI and transportation cost. Based on this result we therefore reject the null hypothesis and accept the alternate hypothesis. Indicating that there is a strong, positive and significant relationship between VMI and transportation cost in quoted oil and gas companies in Nigeria.

# **Discussion of Findings**

Empirical evidence strongly supports VMI enhances logistics performance across several metrics, including on-time delivery, order fulfilment, and transportation costs. The results from the study demonstrate that the p-value of the relationship between VMI and on-time delivery is 0.00, which is less than the threshold of 0.05. This suggests a statistically

significant relationship between VMI and on-time delivery. Additionally, the study revealed a very strong positive correlation between VMI and on-time delivery, providing sufficient evidence to reject the null hypothesis. This implies that VMI, which aims to ensure that both internal and external customers receive the required service levels in terms of quantity and order rate fulfilment, has a significant positive effect on logistics performance in quoted oil and gas companies in Nigeria.

Moreover, the study results show that the p-value for the relationship between VMI and order fulfilment is also 0.00, indicating a significant relationship. The correlation between VMI and order fulfilment was found to be very strong and positive, leading to the rejection of the null hypothesis. This means that VMI not only gives suppliers the responsibility and authority to manage the entire replenishment process but also improves order fulfilment efficiency. These findings are consistent with the work of Odiwuor and Muyhoni (2023), which found that VMI positively and significantly impacts performance of retail outlets in Kenya. According to their study, retail outlets that adopt VMI are better positioned to fulfill their orders effectively, improving overall operational efficiency.

The evidence further aligns with the study by Wamoto et al. (2020), which establishes the significant influence of VMI on operational performance, particularly in store functions. VMI enhances the replenishment process, ensuring that inventory levels are optimized to meet customer demand without delays.

Additionally, the results from the study show that the p-value for the relationship between VMI and transportation costs is also 0.00, which is statistically significant. A strong positive correlation was found between VMI and transportation costs, suggesting that VMI reduce transportation costs. Consequently, the null hypothesis was rejected, indicating that VMI provides a competitive advantage by reducing lead times, enhancing product availability, and improving service levels while lowering the need for inventory monitoring and ordering in oil and gas companies in Nigeria. This finding is consistent with the study by Maio and Lagana (2020), which reported that VMI leads to reduced transportation costs, particularly for last-mile delivery. Similarly, John et al. (2020) found that VMI improves on-time delivery by reducing operational costs, with transportation costs being a key contributor to those savings.

### **Conclusion and Recommendations**

This study examined the relationship VMI and logistics performance in quoted oil and gas companies in Nigeria. Through statistical analysis using the Spearman Rank Order Correlation, the study found significant positive relationships between VMI and dimensions of logistics performance, including on-time delivery, order fulfillment, and transportation cost. The p-values of all three relationships were below the threshold of 0.05, indicating statistical significance. The results of this study provide compelling evidence that VMI is a key enabler of improved logistics performance in Nigeria's oil and gas sector. By enhancing on-time delivery, order fulfillment, and reducing transportation costs, VMI significantly contribute to operational efficiency and profitability of firms in this industry. These findings highlight the strategic importance of adopting VMI as part of broader inventory and supply chain management practices.

Based on the findings of this study, it is recommended that quoted oil and gas companies in Nigeria should fully adopt and implement VMI systems to enhance their logistics performance. This can be achieved through strategic partnerships with suppliers, enabling them to take a more active role in managing inventory levels, replenishment schedules, and

logistics processes. By leveraging advanced technologies such as real-time tracking systems, RFID, and automated inventory management tools, companies can achieve significant improvements in on-time delivery, order fulfilment, and transportation cost reduction.

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