Global Journal of
Purchasing and Procurement Management
(GJPPM)

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IPRJB
INTERNATIONAL PEER REVIEWED
JOURNAL AND BOOK PUBLISHING

Global Journal of Purchasing and Procurement Management
ISSN 2710-1053 (Online)
Vol.4, Issue 1, No.1, pp 1 - 16, 2025

www.iprjb.org

The Effect of Vendor Managed Inventory on Performance of Level Five Hospitals in Kenya

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Article History

Received 19th September 2025

Received in Revised Form 21st October 2025

Accepted 25th November 2025

How to cite in APA format:

Okore, T., Karani, A., & Chengetich, C. (2025). The Effect of Vendor Managed Inventory on Performance of Level Five Hospitals in Kenya. *Global Journal of Purchasing and Procurement Management*, *4*(1), 1–16. https://doi.org/10.47604/gjppm.3576

Abstract

Purpose: This study aimed to assess the effect of vendor managed inventory on performance of level five hospitals in Kenya.

Methodology: The researcher used correlational research design and both qualitative and quantitative data were combined. The Research Instruments were both structured and semi structured. The target population of this study was 328 respondents comprising procurement, finance, pharmacist and administration directors within level five hospitals in the forty-seven counties. The research used census survey. The researcher applied a purposive random samping technique since the respondents share the same features with high skills, technical knowledge and the experience on the area of study. The data was analyzed by Statistical Package for the Social Sciences version 26 and the same was translated and presented in the form of data tables, graphs, pie charts and histograms.

Findings: The Pearson correlation coefficient of 0.769 indicated that there was strong positive linear relationship between vendor managed inventory and performance of level five hospitals.

Unique Contribution to Theory, Practice and Policy: The study recommended that organizations should design and implement a lean procurement that incorporates lean and agility operation across the value chain.

Keywords: *Health Service Delivery, Hospital Performance, Vendor Managed Inventory*

JEL Codes: *I18, L25, M11*

INTRODUCTION

Vendor Managed Inventory (VMI) has increasingly been recognized as a critical strategy in healthcare supply chains, where timely access to medicines, medical devices, and consumables directly affects patient outcomes. By shifting responsibility for stock monitoring and replenishment to suppliers, VMI enhances responsiveness, reduces stock-outs, and improves resource utilization, these capabilities that are vital for hospitals operating in volatile and resource-constrained environments (Mwiti & Mutuku, 2023). Lessons from other industries reinforce this potential: multinational corporations such as Walmart, Coca-Cola, and Unilever have successfully applied VMI to reduce lead times and eliminate waste (De Maio & Lagana, 2020), while Singapore's transparent procurement systems demonstrate how supplier-driven inventory management ensures timely delivery of goods and services (Bhunia & Shaikh, 2019). Similarly, Toyota's lean practices, later adopted in Europe, illustrate how collaborative supply chain strategies can strengthen efficiency and customer satisfaction (Yaqoobi, 2021). These global experiences highlight the applicability of VMI to hospital inventory systems, where responsiveness and reliability are paramount.

Regionally, African economies have sought to streamline procurement and inventory systems to improve service delivery. Uganda's reforms reduced bureaucracies and emphasized leaner processes (Kiseleva et al., 2016), while Kenyan firms such as Safaricom have leveraged vendor-related strategies to build strong supplier relationships and optimize performance (Kagume et al., 2018). Within East Africa, practices such as VMI, just-in-time, and e-procurement have been identified as mechanisms to minimize waste and enhance responsiveness (Kabuga, 2012). However, successful adoption requires supportive systems such as information technology, automation, and reliable data management (Carrasco, 2020). Despite these regional advances, healthcare supply chains remain vulnerable to inefficiencies, with poor inventory control directly compromising patient care (Mayerson, 2012).

In Kenya, Level Five hospitals continue to face persistent challenges in procurement and inventory management, including delays in equipment utilization, lack of consumables, breakdowns, and poor maintenance (Gathungu, 2018). Reports from the Ministry of Health Annual Health Sector Performance Review (2020) and the Office of the Auditor-General (2021) have highlighted recurrent stock-outs, expired drugs, and weak accountability in procurement processes across public hospitals. Similarly, the KEMSA Internal Audit Report (2020) and the Special Audit Report by the Auditor-General on KEMSA (2021) revealed untimely deliveries, mismanagement of medical supplies, and financial irregularities that undermined service delivery. These institutional findings underscore systemic weaknesses in inventory management and reinforce the need to explore vendor managed inventory as a strategy to improve responsiveness and efficiency in Level Five hospitals. Although legal frameworks such as the Public Procurement and Disposal Act (2005) exist, devolved systems have failed to integrate VMI effectively, resulting in inefficiencies and loss of public confidence (PPAD, 2015; Njanja, 2020). Moreover, there is limited empirical evidence linking VMI directly to hospital performance, and little quantitative data on how VMI could reduce stock-outs or improve supply chain responsiveness in Kenyan hospitals. This study therefore seeks to fill this gap by examining the effect of vendor managed inventory on the performance of Level Five hospitals in Kenya, providing actionable insights into how VMI can strengthen healthcare supply chains and improve patient care (Ayah et al., 2020).

Problem Statement

The 2010 Constitution of Kenya devolved the management of health systems with the expectation that county governments, through Level Five hospitals, would deliver efficient, timely, and quality healthcare services to citizens. Ideally, these hospitals should ensure uninterrupted availability of essential drugs and medical supplies, reduce bureaucratic delays, and optimize inventory management to guarantee value for money and improved patient satisfaction. Vendor Managed Inventory (VMI) offers a promising approach where suppliers take responsibility for monitoring and replenishing stock, thereby reducing inefficiencies and ensuring hospitals maintain optimal inventory levels. By minimizing stock-outs, VMI directly enhances service delivery through timely availability of medicines, improved utilization of medical equipment, and reduced delays in patient treatment.

However, evidence shows that Level Five hospitals continue to face severe challenges in inventory management. Performance approval ratings declined from 60% to 37% in 2022 due to delays in hospital supplies and constant defaults in payments to suppliers (Mwaniki, 2023). Drug deliveries from KEMSA have been marred by untimely supply, leaving hospitals stockless and patients without essential medication (Watuleke, 2017). This has directly affected service quality, forcing patients to seek alternatives in private hospitals, which enjoy higher approval rates of 64% compared to 39% in public Level Five hospitals (Njanja, 2020). The inefficiencies, ranging from expired drugs, redundant stock, and delayed treatment, have led to loss of lives and wastage of public funds. Previous studies highlight persistent procurement and inventory challenges in Kenya's devolved health sector, including red tape, poor contract management, and inadequate adoption of lean approaches (Lwiga, 2017; Hassan, 2019; Achieng et al., 2018; Dubois et al., 2019). While global and regional evidence demonstrates the effectiveness of VMI in improving supply chain performance, little empirical work has been done to assess its impact in Kenya's healthcare context. This study therefore sought to fill this gap by examining how vendor managed inventory can influence the performance of Level Five hospitals in Kenya, with a focus on reducing stock-outs, ensuring timeliness in supply, optimizing utilization of medical equipment, and enhancing patient care.

LITERATURE REVIEW

Theoretical Framework

The Collaborative Supply Chain Framework Theory was advanced in the 1990s as an extension of Just-in-Time (JIT), Quick Response (QR), and Electronic Data Interchange (EDI), and was first articulated by Fawcett et al. (2008). The theory posits that when hospitals and suppliers jointly plan and execute supply chain activities, they achieve superior outcomes compared to operating independently. Collaboration entails shared objectives, resource pooling, transparent communication, synchronized decision-making, and long-term relationship building (Melo & Alcantara, 2016). Proponents such as Cao and Zhang (2011) emphasize that collaborative relationships reduce transaction costs, enhance flexibility, and improve competitive advantage, while Gomes and Kleimann (2015) highlight gains in visibility, service quality, and patient satisfaction. Nyaga et al. (2010) further argue that organizations must adopt collaborative initiatives suited to their operational contexts to realize efficiency benefits. This theory directly informs Vendor Managed Inventory (VMI), which relies on strong partnerships between hospitals and suppliers such as KEMSA to jointly manage inventory. By embedding

collaboration into inventory practices, VMI can reduce stock-outs, optimize resource utilization, and improve the performance of Level Five hospitals in Kenya.

Complementing this perspective, Agency Theory provides an additional lens by addressing issues of decision rights, incentives, and information asymmetry between hospitals and suppliers. In the Kenyan context, hospitals (principals) delegate inventory monitoring and replenishment responsibilities to suppliers like KEMSA (agents). Agency Theory explains how clear allocation of decision rights, aligned incentives, and transparent information sharing reduce opportunism and inefficiencies in procurement. By integrating Agency Theory with the Collaborative Supply Chain Framework, this study underscores that effective VMI requires not only strong partnerships but also mechanisms to balance authority, motivate suppliers, and minimize information gaps. Together, these theories provide a robust conceptual foundation for examining how VMI can strengthen hospital supply chains and enhance patient care.

Conceptual Framework

This section provides a structure that is highly simplified that is intended to provide insight into what the paper wants to explain (Kakwezi & Nyeko, 2010). The independent variable is vendor managed inventory while the dependent variable is performance of level 5 hospitals while the moderating variable is Compliance to Legal Framework, that moderates the relationship between lean procurement practices and performance of level five hospitals in Kenya.

Global Journal of Purchasing and Procurement Management
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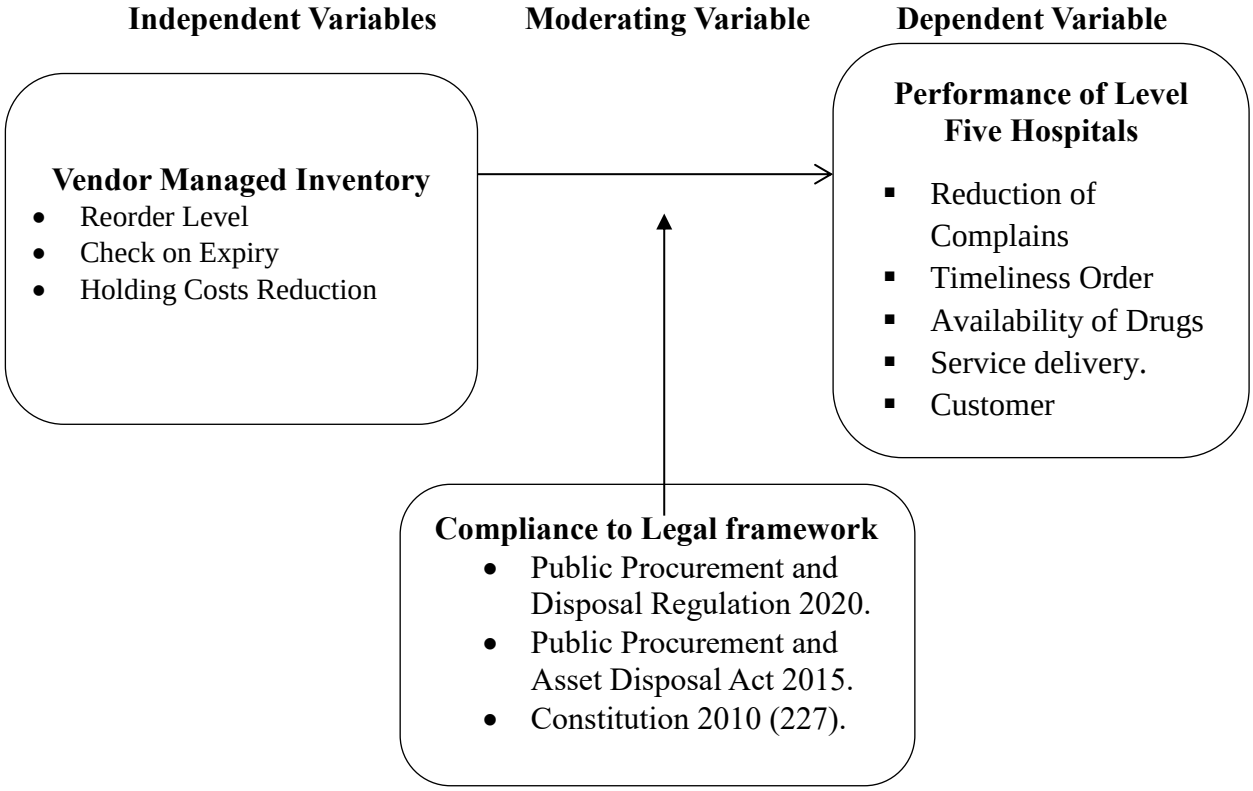

Figure 1: Conceptual Framework

Empirical Review

VMI has been widely adopted by many industries in different parts of the world. The partnership between Wal-Mart and Procter & Gamble is just one of a classical success story for VMI implementation. Interestingly, the two companies were at one time considered great rivals. In the partnership, P&G was the supplier while Wal-Mart was the retailer. The two business partners leveraged on them sharing of data across the supply chain. Since they agreed on a common channel, their SCM has improved significantly because of better coordination. The partner got a better approach of managing their customers demand. Some studies showed the difficulties to implement VMI successfully (Grean & Shaw, 2015). The information and knowledge sharing particularly helped the two companies with category management, process coordination and continuous replenishment. In the long run, they accrued significant mutual benefits from efficient supply chain. However, this study was focused on retail supply chains and did not examine how VMI could be applied to hospital contexts such as drug availability, equipment utilization, and patient care in public health facilities.

Dresner & Yao (2014), presented key characteristics of VMI as short replenishment lead times and frequent and punctual deliveries that optimize production and transport planning. Furthermore, according to them, the middle/long-term collaboration allows suppliers to proportion production capacity and to determine the minimum and maximum customer's inventory level. Yet, their study concentrated on industrial production and transport planning, leaving a gap on how VMI timeliness and delivery frequency could improve the availability of medicines and consumables in hospitals.

Holweg et al. (2005) explained that if a supplier does not integrate information at a tactical planning level, the impact of VMI is negative. For example, the Bullwhip effect, which theoretically considerably decreases or increases. He further concluded that existing collaborations between the two actors would certainly facilitate the adoption of the VMI. Nevertheless, the study did not explore how information asymmetry between suppliers such as KEMSA and hospitals in Kenya affects VMI adoption, nor how ICT integration could mitigate these challenges in healthcare supply chains.

VMI represents more than this pull version of the classical supplier-customer relationship. According to the concept, it may lead to a collaboration situation between the partners. VMI has to introduce information sharing and common decision-making processes. The integration of the VMI in the planning and scheduling process of partners results in a new collaboration protocol. We define three levels in this protocol. The Partnering Agreement specifies the integration of the planning processes of the partners into a VMI replenishment planning process. The Logistical Agreement fixes the parameters, which regulate the management of each article. The Production and Dispatch process monitors pull short-term decisions as production dispatch and transport (Groning & Holma, 2007). However, this study was limited to industrial logistics and did not investigate how formal agreements between hospitals and suppliers in Kenya influence VMI effectiveness, particularly in reducing expired drugs, redundant stock, and delayed treatment.

METHODOLOGY

The anchoring paradigm in this study was positivism. The population of interest in this study consisted of 328 respondents comprising senior procurement officer, senior finance officer, senior pharmacist officer and senior administration officer from all forty-seven counties. A census survey was conducted to all 328 targeted individuals in procurement, administration, pharmacy and finance directorates in County Government in Kenya. Questionnaires as well as interviews were used in data collection with the help of the research Assistants. The suitability of the questionnaire for this study was tested by first administering to 10% (33) respondents different from the 328 main respondents to detect any weaknesses in the design. The data was analyzed with SPSS version 26 and translated into readable in the form of data tables, graphs, charts, and in plain texts. Both descriptive statistics such as means, modes and measures central tendencies and inferential statistics was used to analyze the data to establish normality, collinearity, and multicollinearity between the dependent. The following multiple regression model was used to determine implication of the independent variable on the dependent variable;

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon$$

RESULTS

Response Rate

The researcher circulated questionnaires to 295 respondents after pilot testing 10% (33) respondents for reliability and validity of the research instruments. All from the level five hospitals in Kenya. 210 questionnaires were dully filled and returned for analysis. This represented a response rate of 71.3% and a non-response rate of 28.7%.

Global Journal of Purchasing and Procurement Management
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Descriptive Statistics

Vendor Managed Inventory

The descriptive results for this objective are displayed in Table 1 below.

Table 1: Descriptive statistics for Vendor Managed Inventory

Statement	1	2	2	4	5	Mean	Std. Dev.
Our Inventory is efficiently managed by manufacturers of products	18.2% N (38)	7.5% N(16)	11.5% N (24)	52.4% N (110)	10.4% N (22)	4.20	0.874
VMI Actual Usage is well understood	3.7% N (8)	12.9% N(27)	40.3% N (84)	40.5% N (84)	2.6 % N (5)	4.24	0.892
Records of On-Hand Inventory is accurate, ever ready and accessible at any time	5% N (11)	12.4% N(26)	24.1% N (51)	29% N (61)	30% N (63)	4.01	1.152
The right inventory are delivered in right place and right times	3% N (6)	9.3% N(20)	10.1% N (21)	51.7% N(109)	25.8% N (54)	4.79	1.805
Inventory delivered are clearly labelled and complies with packaging standards	1.8% N (4)	3.7% N (8)	15.2% N (32)	59.1% N (124)	20.2% N (42)	2.84	1.169
Regular meetings are held to identify on areas which require improvement	2.2% N (5)	4.8% N (10)	25.4% N (53)	43.2% N (91)	24.4% N (51)	4.20	0.809
VMI program data is continuously reviewed	2.8% N (6)	5.4% N (11)	9.0% N (19)	51.8% N(109)	30.8% N (65)	4.73	0.746
Contracts management strategies adopted in Vendor managed Inventory	6.3% N (13)	9.2% N(19)	23.9% N (50)	30.9% N (65)	29.6% N (62)	4.24	1.024
Record Keeping will show vendor management inventory	2.4% N (5)	10% N(21)	20% N (42)	42.4% N (89)	25.2% N (53)	2.10	0.896

Key: N = 210 Strongly Disagree =1, Disagree = 2, Neutral = 3, Agree = 4, Strongly Agree = 5

Vendor managed inventory (VMI) practices were generally perceived to positively influence the performance of Level Five hospitals in Kenya. Most respondents agreed that efficiency of inventory managed by manufacturers, understanding of VMI usage, accuracy of on-hand records, and use of performance indicators all contributed to improved hospital operations, with overall mean scores ranging between 4.01 and 4.70 and relatively small standard deviations

indicating consistency in responses. Although some variability was noted in areas such as IT infrastructure and record keeping, the overall mean score for VMI was 4.24, with 66.04% of respondents and the overall standard deviation on statements on vendor managed inventory was 0.1094. This affirmed that VMI significantly affected supply chain performance, findings that align with earlier studies such as Ominde et al. (2022),

Performance of Level Five Hospitals

The descriptive statistics results for the dependent variable are shown in table 2 below.

Table 2: Descriptive statistics for Performance of Level five hospitals

Statement	1	2	3	4	5	Mean	Std Dev.
Our hospital has the quality of goods and services has improved as a result of reliable lead times by suppliers of raw materials.	3% N(6)	2.8% N (6)	5.6% N(12)	70% N(147)	19% N(40)	3.24	1.248
The service of our hospital resulting from predictable frequency of supplies of raw materials.	1.4% N (3)	10.6% N(22)	30.9% N(65)	30.9% N(65)	26.1% N(55)	4.58	1.243
Our hospital has improved resources because of lean procurement strategies in service process.	11.3% N(24)	5.6% N(12)	11.3% N(24)	35.9% N(75)	35.9% N(75)	4.109	1.219
Our hospital has improved resources because of implementing proper process design in the service of hospital.	1.4% N (3)	14.1% N(30)	28.2% N(59)	28.2% N(59)	28.2% N(59)	4.05	0.853
There are minimal complaints concerning the quality of goods and services offered	2.8% N (4)	4.9% N(10)	24.6% N(52)	42.9% N(90)	24.6% N(52)	4.29	1.052
Our hospital has integrated the use of IT in its management of workers' resulting to improved human capital.	1.4% N (3)	4.9% N(10)	9.1% N(19)	31% N(65)	53.5% N(112)	3.88	1.019
The cost of service is always less than the total sales	1.4% N (3)	12% N(25)	29% N(61)	29% N(61)	29% N(61)	4.70	0.850
I am satisfied that our level five hospital had reduced cost due to the minimal complaints concerning the quality of goods and services	6% N(13)	12% N(25)	29% N(61)	29% N(61)	24% N(50)	4.73	0.1094
Our hospital has ensured flexibility and reliability of operations	6.3% N(13)	6.3% N(13)	12.7% N(27)	41.5% N(87)	33.1% N(70)	3.50	1.010

Key: N = 210 Strongly Disagree =1, Disagree = 2, Neutral = 3, Agree = 4, Strongly Agree = 5

The average mean of 3.79 and a standard deviation of 1.061. From the study results, the majority 46.8% (98) of the respondents agreed with the statements measuring performance of

level five hospital, with another 24.8% (52) of the respondents strongly agreeing. This is because leverage creates competitive advantage in level five hospitals. However, a few 24.8% (52) of the respondents were undecided, on this variable. Only a few 0.4% (1) of the respondents strongly disagreed with the statements measuring performance of level five hospitals in Kenya. This finding is in line with the findings of Rogerson and Parry (2020).

Inferential Data Analysis

The study conducted further inferential analysis to analyze the interrelationships of the research variables.

Correlation

A correlation analysis for the construct Vendor managed inventory was conducted to establish how Vendor managed inventory correlated with performance of level five hospitals. Table 3 shows that the Pearson correlation coefficient was 0.769. These findings indicate the presence of a strong positive linear relationship between Vendor managed inventory and performance of level five hospitals. This result is in line with the outcome of Steele and Grajo (2023).

Table 3: Correlation Analysis for Vendor Managed Inventory

Variables		Performance of Level five hospitals	Vendor managed inventory
Performance of Level five hospitals	Pearson Correlation	1	.769**
	Sig. (2-tailed)		.000
	N	210	210
Vendor managed inventory	Pearson Correlation	.769**	1
	Sig. (2-tailed)	.000	
	N	210	210

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

Regression Analysis

The hypothesis was tested using a univariate regression model as shown below:

H_{O1}: *Vendor managed inventory has no significant influence on Performance of Level five hospitals in Kenya.*

$$Y = \beta_0 + \beta_1 X_1 + \mathscr{E}$$

The histogram in figure 2 indicates that the data was normally distributed. The residual describes the error in the fit of the model to the i^{th} observation yi and are used to explain the adequacy of the fitted model. According to Muazu (2019), analysis of the residual is frequently helpful in checking the assumption that errors are normally distributed with constant variance and in determining whether additional terms in the model would be useful.

Level five hospitals normal distribution

Global Journal of Purchasing and Procurement Management
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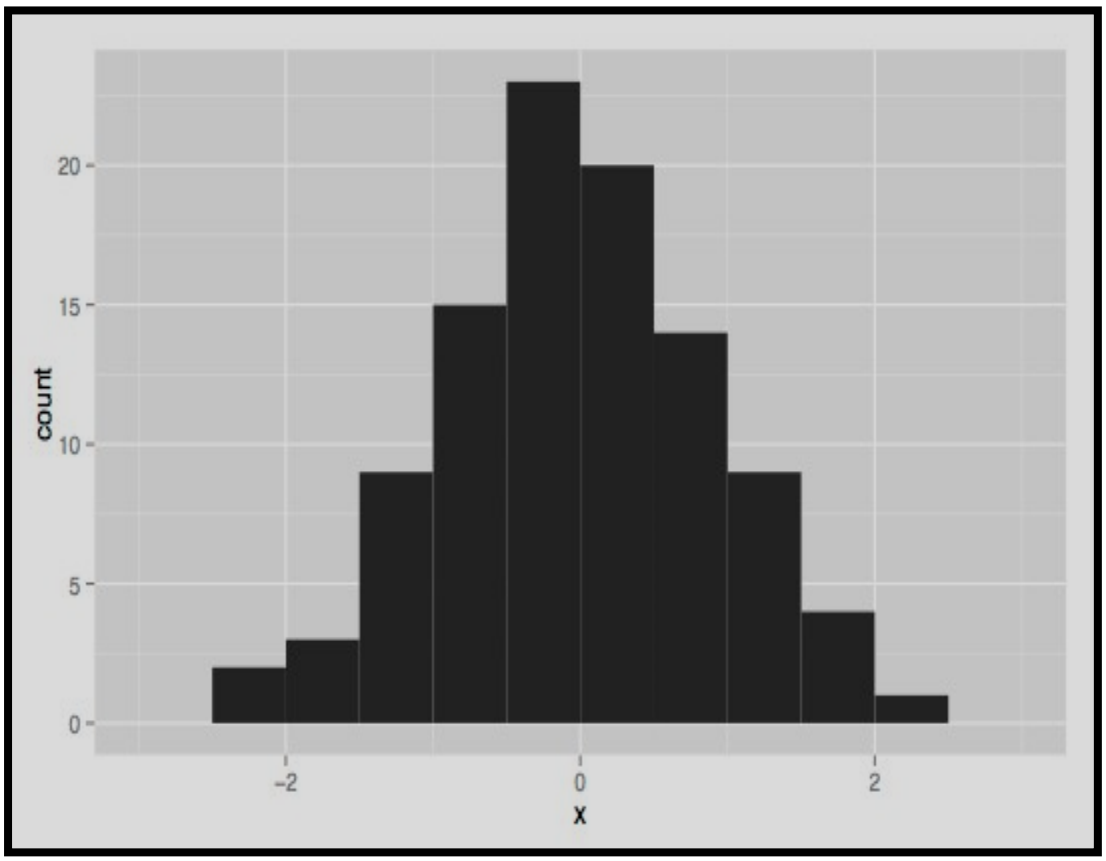

Figure 2: Histogram Vendor Managed Inventory on Performance of Level Five Hospitals

The linear regression model shows R^2=0.469 which means that about 46.9 percent of the total variance in the performance of level five hospitals in Kenya can be explained by vendor managed inventory. The result is shown in table 3.

Table 3: Model Summary of Vendor Managed Inventory

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.685[a]	.469	.466	.64249

a. Predictors: (Constant), Vendor managed inventory
b. Dependent Variable: Performance of Level five hospitals

Further test on the ANOVA shows that the significance of the F-statistic is less than 0.05 (F=160.092, p<0.05) as indicated in Table 4. This is an implication that vendor managed inventory has a significant influence on performance of level five hospitals.

Table 4: ANOVA of Vendor Managed Inventory

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	66.090	1	66.090	160.92	.000[b]
	Residual	74.715	209	4.12		
	Total	**140.805**	**210**			

a. Dependent Variable: Performance of Level five hospitals
b. Predictors: (Constant), Vendor managed inventory

Presented in Table 5 are the coefficients and t-statistics of the resulting model. The constant term β_0=4.84, implies that if vendor managed inventory is held constant, then there will be a positive performance of level five hospitals in Kenya by 4.84. The regression coefficient for vendor managed inventory was positive and significant (β_1 =0. 061 p<0.05), with a t-value of 3.556. This implies that for every unit increase in vendor managed inventory, performance of level five hospitals is predicted to increase by 0.224 units.

Table 5: Coefficients of Vendor Managed Inventory

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	.794	.181		4.384	.000
	Vendor managed inventory	.769	.061	.685	12.653	.000
a. Dependent Variable: Performance of Health hospitals						

Performance of Level five hospitals = .769 + 0.769 Vendor managed inventory

The results from Tables 3 to 5 confirmed that vendor managed inventory (VMI) significantly influences the performance of Level Five hospitals in Kenya, leading to the rejection of the null hypothesis. The findings revealed that VMI contributes positively to hospital operations by enhancing responsiveness, resource readiness, and efficiency in unstable environments, consistent with Ominde et al. (2022). Similar conclusions were drawn by Kang, Lee, Hwang, Wei, and Huo (2021), who emphasized the importance of swift and dynamic supply chain processes in meeting the needs of vulnerable populations, while Ongeri and Osoro (2021) highlighted that effective supply chain responses mitigate risks and ensure timely delivery of essential health services.

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

The study's objective was to examine the effect of vendor managed inventory (VMI) on the performance of Level Five hospitals in Kenya, using purchase-to-pay, software practices, and automation processes as indicators. Findings revealed that hospitals have adopted lean procurement systems designed to be responsive to vulnerable populations by enabling quick evaluation of needs, close supplier partnerships, and flexible processes in transportation and dispatch. However, responsiveness to emergencies remains constrained by challenges such as inadequate information, poor funding, and limited resources, which hinder preparedness. Narratives from procurement managers highlighted that both natural disasters (disease outbreaks, floods, droughts) and manmade crises (conflicts, accidents, fires) have increased, necessitating strategies like modularization, shortened lead-times, prior transport planning, and postponement to enhance VMI effectiveness. Ultimately, regression analysis confirmed a significant positive relationship between VMI and hospital performance, leading to rejection of the null hypothesis and affirming that VMI strengthens responsiveness, reduces delays, and improves resource utilization in serving vulnerable populations.

Conclusion

The study concluded that vendor managed inventory (VMI) has a positive and significant effect on the performance of Level Five hospitals in Kenya, with lean procurement systems designed

to quickly address the needs of vulnerable populations. Despite this responsiveness, challenges such as inadequate resources, poor funding, and lack of information hinder hospitals' ability to react swiftly to emergencies, exposing gaps in preparedness. Rising natural and manmade disruptions; including disease outbreaks, floods, droughts, conflicts, and accidents, have intensified the need for efficient inventory systems. To strengthen VMI, hospitals have adopted strategies such as modularization, postponement, shortened lead times, and prior transport planning, driven by the imperative to save lives, donor pressures, and the growing frequency of emergencies.

Recommendations

The study found that most Level Five hospitals in Kenya had only partially implemented lean procurement practices, limiting their responsiveness to vulnerable populations. It recommended that procurement managers fully adopt these practices by building strategic collaborations with industry players such as freight forwarders, carriers, and critical suppliers to enhance efficiency and precision in service delivery. Despite increased resource allocations, Kenya still lacks a strong culture of preparedness, clear legal frameworks, and coordination, while Rwanda's preparedness efforts offer useful lessons. Given the volatile and complex environment in which hospitals operate, the study further advised adopting resilient lean procurement systems that integrate agility across the value chain, with hybrid approaches that allow hospitals to switch between lean and agile strategies depending on situational demands.

Areas for Further Studies

Future research on vendor managed inventory (VMI) should extend beyond Level Five hospitals to other public and private sectors for comparative insights. Studies could explore additional lean procurement components and moderating variables, gather data from multiple informants to reduce bias, and apply varied methodologies. Further investigations may also consider donor and beneficiary perspectives, specialized health supply chains such as medical or relief procurement, and upstream processes like fundraising and donation management to provide a holistic view of VMI across the entire supply chain.

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