

## **E-Supply Chain Management Practices and Operational Performance of Hospitals of Kiambu County in Kenya**

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**ABSTRACT:** *Health care supply chain management is vital to ensure good service to patients in a cost-optimized manner. In Kenya inadequacies and inefficiencies such: chronic stock outs of medicine, pilferage of medicine in public hospitals, expired stocks, late deliveries, lengthy periods during treatment; plague the Health Care supply chain system. This study examined the effect of E-supply chain practices on operational efficiency of hospitals in the County of Kiambu in Kenya, in a survey of 39 hospitals. The study revealed that adoption of the hospital management information system; Electronic procurement; and E-logistics practices; significantly and positively affects operational performance. The study observes that most public hospitals have not adopted E-supply chain practices; and avers this could explain the challenges facing public hospitals such as long queues, pilferage and long queues in public hospitals. The study recommends adoption of E-supply chain Practices; and invites researchers to examine the shallow adoption of E-supply chain practices in Public Hospitals.*

**KEY WORDS:** E-supply chain practices, Operational Performance, E-procurement, health care supply chain

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### **INTRODUCTION**

The health care supply chain, often described as very complex, is associated with the with processes and resources targeting the movement of medicine, surgical equipment, vaccines and other products and services required by health care professionals in delivery of Medical care to patients (Arora & Gigras, 2018). Pasandideh and Fathian (2017) postulate that the Health care supply chain comprises; The Pharmaceutical supply chain, the medical equipment supply chain,

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the patient care supply chain, and the blood bank supply chain. The overarching role of the Health care supply chain is to deliver health care to patients. According to Arora and Grigas (2018) when well managed the health care supply chain delivers medicine, medical equipment, patient care resources and related resources at the at right time, minimizes inventory wastage, in order to maximize patient care. It can thus be deduced that the key role of the Health care supply chain management has the major objective of ensuring superior patient care at affordable cost and time. Health care institutions across the globe have adopted various, albeit similar, supply chain practices in bid to improve the health care outcomes. For instance, in Colombia, Uribe, Sarache and Gutierrez (2019) note that variety of Supply chain Management Practices exist, including; Inventory management practices, supplier management, waste management practices, distribution practices, and customer relationship management.

In Malaysia, Sahroni and Ridwat (2020) further elucidate the importance of supply chain practices in the healthcare setup: Vendor management inventory and just in time inventory practices are given prominence, while ICT and customer Service management receives equal attention. The lack of proper inventory practice, and lack of Information integration was observed to lead to delays in pharmaceutical sections of hospitals, patients taking long while seeking service, medical errors and duplicities of operations and tests. In Europe, Supply chain management practices appear to receive renewed importance out of the disruption and shortages encountered during the COVID 19 pandemic. One practice receiving this attention is the need to leveraging long-term buyer-supplier relationships, as these were found to be more effective in securing medical inventories as well as supplier development practice such as “extended upstream procurement or resource sharing among hospitals” as these lead to improved supply chain capabilities especially in cases of supply chain disruptions such as the one occasioned by the COVID-19 pandemic (Spieske, Gerbhardt, & Birkel 2022).

. In Turkey for Instance, Just as in China (Queiroz et al., 2020), Pamucar, Torkayesh, and Biswas (2022) aver that shortages of essential inventories in Hospitals can lead to shut down of the health supply chain, as was witnessed during the covid 19 pandemic when supply chain disruptions led to shortage of essential items such as masks due to the high consumption rate face masks and face shields and uncertain supplies. Accordingly, health care centers have to give premium to Supplier selection and supplier management. In Turkey, a new Supplier selection approach, a multi-criteria framework based on applying fuzzy rough numbers, is proposed by Pamucar, Torkayesh and Biswas (2022) for use during supplier selection for processing of subjectivity and uncertainty information during the selection of suppliers under sustainability and resiliency. Similarly, in Bangladesh, supply chain practices such as Supplier Selection, Customer Service Management and Integration of Hospital supply chains have been observed to contribute towards cost and overall operational efficiency (Habib et al 2022).

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Most of Africa's Hospitals, especially Public hospitals have ineffective service delivery systems characterized by dysfunctional information systems, poor logistics and operation support functions, lack of medicines, pilferage of medicine for commercial use (WHO 2013). Strong supply chains could contribute towards reversing this phenomenon of failing health systems in Africa. UNICEF (2015) postulates that investments aimed at strengthening Africa's medical supply chains have led to improved medical inventory visibility, increased storage and distribution capacity as well as immediate and long-term cost-saving in the health care system. In South Africa, Bvuchete, Grobbelaar and Eeden (2018) advocate for supply chain visibility; using information technology to agilely capture and share supply chain information across all health care stakeholders; and demand driven supply chain management approaches; anchored on accurate and timely information on status of inventory, demand, and forecasts; as solutions to the cost and complexity issues facing the South African health care system.

In Kenya, according to Njunge (2023), inadequacies and inefficiencies plague the Health Care supply chain system. Common problems include: chronic stock outs of medicine, pilferage of medicine in public hospitals, Expired stocks, late deliveries, lengthy periods during treatment characterized by long queues in hospitals, and non-responsiveness during emergencies. Various solutions have been proposed to remedy these inefficiencies (Kariuki et al 2015; Njunge 2023; WHO, 2014). These include: improving visibility and coordination of the county health supply chain (Njunge, 2023 & UNICEF, 2014)) automation of inventory procedures to manage the sheer variety and number of products required to address health needs that makes it difficult to maintain updated records of consumption patterns and stock levels, Procurement and Supplier Relationship management to ensure supply and quality of medicines delivered to hospitals (Odhiambo 2014). In County of Kiambu, the operational performance in-terms of ability to deliver services to patients has been a long standing issue. According to Wainaina (2023) and Njenga, Kamau and Mugo (2023), the common challenges have often been drug shortage, pilferage, equipment shortage and malfunctioning.

**Statement of the Problem**

In Kenya, the Health care supply chain has been reported to be inadequate and inefficient (MOH, 2014). Common problems that have been reported include: chronic stock outs of medicine, pilferage of medicine in public hospitals, Expired stocks, late deliveries, lengthy periods during treatment characterized by long queues in hospitals, and non-responsiveness during emergencies (Mwiti, 2022 & Mutai, 2015). In Kiambu hospitals, poor patient services due to acute drug and equipment shortages and malfunctioning medical equipment have been reported (Wainaina, 2023 & Njenga, Kamau & Mugo, 2023). This indicates that hospitals in the Kenyan Health care supply chain are operationally inefficient, which results in loss of funds, and poor customer service, and even death or mistreatment of patients. Muya & Kimando (2018) and MOH (2014) have attempted to investigate the state of health care services in Kenyan Hospitals. Little empirical evidence exists of studies that have examined the relationship between supply chain practices and operational

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performance of hospitals in Kenya. Thus a need exists to study the operational efficiency of hospitals in Kenya, from the perceptive of supply chain practices.

### **Research Objective and Research Question**

The objective of the study was to assess the effect of e-supply chain practices on operational performance of hospitals in the County of Kiambu. The study sought to answer the question: How do e-supply chain practices affect operational performance of hospitals in the County of Kiambu.

## **LITERATURE REVIEW**

### **Theoretical Review: The Resource Based View and E-supply Chain Management**

The (RBV) resource based theory of Barney (1991) and Wernerfert (1984) suggests that resources of an organization generate capabilities to increase business performance (Walker 2012). The resources of an organization include: Physical resources, Human capital resources, and Organizational capital resources, including technology (Dubey 2018) According to Xu et al (2014) an organization leverages its resources consisting of all tangible and intangible assets, to develop agility, and adaptability to achieve competitive advantage. In this thinking, the E-supply chain management consists of application of various supply chain technologies to improve the operations of supply chain activities (Turban et al., 2012) These technologies include: Supply Chain Replenishment, E-Procurement, Supply Chain Monitoring and Control Using RFID, Inventory Management Using Wireless Devices, Collaborative Planning, and E-Logistics (Turban, 2012 & Chafey, 2015).

In the Resource Based View, the E-supply chain Tools for E-supply Chain management portend great efficiencies in improving the operational performance of hospitals plagued by chronic stock outs of medicine, pilferage of medicine in public hospitals, Expired stocks, late deliveries, lengthy periods during treatment characterized by long queues in hospitals, and non-responsiveness during emergencies (Mwiti 2022). The E-supply chain management tool introduce process visibility, inventory visibility and control, procurement efficiency that could greatly improve the operational performance of hospitals.

### **Empirical Review: E-Supply Chain Management Practices**

Oteki (2021) examined the influence of E-Supplier Management Practices on Supply Chain Performance of Sugar Processing Firms in Kenya. The study established a strong influence and recommended that Sugar processing firms' management should ensure working Websites, working internal and external mail and also provide their suppliers with access credentials to company electronic procurement portal to increase buyer and supplier access to information to enhance E-supplier management practices. Kamoni, Rotich and Ochiri (2018) examined the impact of E-Procurement on the procurement performance of Mega projects in the energy sector in Kenya. Using descriptive and inferential (Regression) analysis, the census on 47 mega projects,

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Publication of the European Centre for Research Training and Development-UK found a significant influence of E-procurement on procurement performance of mega projects in the energy sector in Kenya. The study also found a shallow application of E-procurement.

A similarly oriented study by Faheem and Siddiqui (2019) examines The Impact of E-Procurement Practices on Supply Chain Performance. The case study of B2B Procurement in Pakistani Industry established that electronic design and electronic evaluation shown positive and significant impact on supply chain performance. The study advocates integration among supply chain members is equally important as to focus on joint learning practice because it leads to augment the supply chain performance. A somewhat different study sought to examine the influence of e-inventory management systems on the performance of supermarkets in Nairobi County, Kenya. Specifically, the study sought to examine the effect of electronic data interchange, electronic point of sale, bar coding and radio frequency identification on performance of supermarkets in Nairobi County. The study by Lusweti and Achuora (2019) established a positive significant relationship between e-inventory management systems and performance of supermarkets.

In Taiwan, Hsu, Tsai and Chang (2013) examined the relationship between E-Procurement and Supply Chain Performance. Empirical data collected from 108 Taiwanese enterprises shows that partner relationships, information sharing, and supply chain integration can represent the processes through which e-procurement contributes to supply chain performance. A similar study in Kenya by Waithaka and Kimani (2021) sought to establish the influence of electronic procurement practices on supply chain performance. The study established that e-procurement is positively related with performance of supply chain function of County Governments in Kenya.

Research on E-supply Chain studies are deficient as pertains the objectives of this study as they are fragmented in approach. Kamoni et al (2022) examines e-procurement from the perspective of mega projects procurement in Kenya, Waithaka and Kimani study E-procurement from the perspective of County Government performance in Kenya, while Hsu et al (2013) studies impact of e-procurement of firms in Taiwan. Other related studies: Oteki (2021) and Lusweti and Achuora (2019) study related concepts of E-Supply chain management, namely: E-supplier Management and E-Inventory management.

**Conceptual Framework.**

The conceptual framework of this study, shown as figure 1.



Independent Variables

Dependent Variable

**Figure 1: Conceptual Framework**

**METHODOLOGY**

The study adopted a descriptive research design. According to Dag and Petter (2015) descriptive research portrays an accurate profile of persons, events, or situations. This will be essential in understanding the relationship between supply chain practices practiced in Kiambu Hospitals and their impact on operational performance of these hospitals. The population of study was the 39 Level 4 and above health facilities in Kiambu County as shown on table 3.1. These were the unit of analysis while the unit of observation were the supply chain managers or their equivalent in these hospitals. The study adopted a census approach.

Table 3.1: Population of study.

Category	Number
Public Level 4/5/6	18
Mission/ Faith Based	11
Private	10
Total	39

The study collected, using semi structured questionnaires, primary data for statistical analysis. According to Maina (2012) Primary data is data which is collected afresh and for the first time, and thus happens to be original in character. A pilot study, involving Five Hospitals in the County of Nairobi was conducted to ensure validity and reliability of the questionnaire as recommended by Dikko (2016) who asserted that the accuracy of data to be collected largely depended on the data collection instruments in terms of validity and reliability. To test reliability the study relied on the Cronbach’s alpha ( $\alpha$ ); E-supply chain practices had a value of 0.7 which is deemed acceptable as recommended by (Ritter, 2010).



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To answer the research questions, as to whether a significant statistical relationship exists between the dependent variables and the dependent variable, the study relied on linear regression analysis. According to Fields (2013), regression is used in to predict the dependent variable from a known value of independent variable(s). The following regression model:  $Y = \beta_0 + \beta_1 X_1 + \varepsilon$ ; where;  $Y$  = Operational Performance of Hospitals;  $\beta_0$  = constant (coefficient of intercept);  $X_1$ , is the independent variable: E-supply chain practices; and  $\beta_1$ , is the regression coefficient.

**RESULTS AND DISCUSSION****Response Rate**

A total of 39 questionnaires were issued during the data collection process. A total of 27 questionnaires were returned fully filled. This represents a response rate of 69.23%. This according to Dikko (2016) could be deemed sufficient for data analysis. Table 4.2 shows the response rate. This comprised response from 12 private hospitals and 15 public hospitals.

**Table 4.2: Response rate**

	<b>Issued questionnaires</b>	<b>Returned Questionnaires</b>	<b>Non-Responsive</b>
Frequencies	39	27	12
Percentage	100	69.23	30.77

**Years of Experience of Respondents**

Analysis shows that majority of the respondents, supply chain officers, 51.8%, had worked in the organization for a period of between 5 to 6 years; while 14.8%, 18.5%, and 14.8% had worked in the hospital between: 1-2 years, 3-4 years, and 7-8 years respectively. This indicates that majority of the respondents were adequately conversant with the operations of the hospitals and could give accurate data concerning the aspects of this study. The results of this analysis is shown on table 4.3

**Table 4.3: Years of experience of Respondents**

<b>Period</b>	<b>Percentage</b>
1-2 Years	14.8
3-4 Years	18.5
5-6 Years	51.8
7-8 Years	14.8

**E-Supply Chain Practices and Operational Performance of Hospitals in county of Kiambu**

The study examined the application of E-Supply chain practices and the performance of Hospitals in the County of Kiambu. The E-supply chain practices include use of ERP systems, E-Procurement and E-logistics system. Towards this end, the study assessed the number of hospital

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Publication of the European Centre for Research Training and Development-UK functions managed over the hospital management system, the number of procurement function conducted electronically, and nature of automation of logistics services. The descriptive and inferential findings are provided below.

### **Descriptive Statistics on E-Supply Chain Practices**

The analysis shows that in 15 hospitals, (public hospitals) only 1 hospital function, (Revenue collection/billing) was conducted over the Hospital Management system. In private hospitals, the analysis shows that the Hospital Management system is applied over several functions: in 8 private hospitals, two functions are run over the HMS, while in 1 and 2 hospitals, 4 and 5 functions respectively are conducted on the HMS. On use of E-procurement Hospitals, all the 15 public hospitals surveyed, applied only one aspect of E-procurement: website advertising of procurement opportunities. The analysis indicates that private hospitals conducted 2, 3, and 4 procurement processes electronically in 8, 3, and 1 hospitals respectively. In all the 15 public hospitals surveyed in this study, the logistics function was not managed real time. In 9 and 3 private hospitals, 1 and 2 aspects of the logistics functions were managed electronically.

### **Regression Analysis of Operational Performance on E-supply Chain Practices.**

The study conducted a regression analysis of aspects of operational performance directly related to E-supply chain practices using the regression equation,  $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon$ : Where; Y is operational Performance of hospitals in Kiambu county (Average time take to check out),  $\beta_0$  is the intercept,  $\beta_1$  and  $\beta_2$  and  $\beta_3$  is the change in Operational performance occasioned by a unit change in  $X_1$  (Number of Functions conducted over HMS), and  $X_2$  (Number of Procurement Process conducted electronically) and  $X_3$  (No of Logistics Functions monitored real time). The regression analysis yielded a p-value of 0.000, which is less than 0.05, at 95% confidence interval. This indicates that E-Supply Chain practices have a significant influence on operational performance, (Indicated by Average time taken to check out), of Hospitals in the County of Kiambu. The regression analysis yields a coefficient of determination ( $R^2$ ) of 0.853 which implies that 85.3% of operational performance (hospital stay) is influenced by E-supply chain management practices such as use of the HMS, E-procurement and E-logistics. The regression model from this analysis is: Operational performance (Average time to check out) = 101.750 + 17.2 (Number of Functions on HMS) - 42 (Number of Procurement Process conducted electronically) - 8.1 (Number of logistics functions monitored real time). This indicates that adoption of E-supply chain management practices leads to reduced time of stay in the hospital when seeking medical services. The Results of the regression analysis are summarized in table 4.5.



**Table 4.5: Regression of Operational Performance on E-supply chain Practices.**

<b>R</b>	<b>R<sup>2</sup></b>
.923	.852

F=44.424, Sig=.000, Coefficients: Constant (B=101.750, sig=.000), HMS (B=-17.20, sig= .000), E-procurement (B=-42,sig .000) and E-logistics (-8.083, sig 0.000)

## **DISCUSSION ON FINDINGS ON OPERATIONAL PERFORMANCE AND E-SUPPLY CHAIN PRACTICES**

The results indicate that incremental processing of hospital functions on the hospital management system; as well as incremental conduct of Procurement processes electronically; and monitoring logistics functions online: improves the operational performance of hospitals. This augers well with the findings of Oteki (2021) and Kamoni, Rotich and Ochiri (2018) that organizations benefit with incremental adoption of collaborative E-supply chain process, in the hospital set up, organizations that adopt more of their processes and functions on electronic systems benefit from improved visibility and control of processes thus benefit improved process cycle times and ability to respond to changes in circumstances. For instance a doctor is able to prescribe medication having full view of medical inventories as well as raise requisition easily within the system in case of low stock levels.

This study establishes that public hospitals are largely operating manual systems: with only billing and revenue collection function being managed on the HMS and only one procurement process (Advertising) being conducted electronically. This means that public hospitals thus fail to benefit from the capabilities of collaborative systems such as the HMS ERP systems, and E-procurement systems. In turn they thus fail to benefit from the opportunity to improve hospital efficiency. This finding perhaps explains the phenomenon where public Hospitals in the country, including in county Kiambu, suffer perennial challenges such as: chronic stock outs of medicine, pilferage of medicine in public hospitals, Expired stocks, late deliveries, and lengthy periods during treatment characterized by long queues in hospitals, and non-responsiveness during emergencies (Mwiti, 2022 & Mutai, 2015). According to this study's findings, these challenges could be alleviated on adoption of E-supply chain practices.

### **Implication to Research and Practice**

The study concurs with extant literature that portends that adoption of E-supply chain practices could derive operational benefits for firms. The study also concurs with the principle of the Resource Based View that resources of an organization could be portent tools to drive operational efficiency. The study fills the gap on extant literature by presenting the empirical analysis of adoption of E-supply chain practices on operational efficiency of Hospitals in the County of Kiambu in Kenya. The study has established that Public hospitals have a very shallow adoption of

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E-supply chain practices, and thus recommends to the managers of public hospitals to consider implementing the supply chain practices; particularly the practices that entail: use of Hospital management systems (where the goal would be to have all functions conducted over the ERP); conduct more procurement processes electronically (Beyond advertising procurement opportunities). These would introduce operational efficiencies that would result in reduced cases of drug stock outs; as well as reduce time spent by patients seeking medical attention.

## CONCLUSION

This study examined the effect of E-supply chain management practices on operational performance of hospitals in the county of Kiambu. This study established a significant effect of E-Supply chain practices on operational performance of hospitals in the county of Kiambu. The study found that the conduct of more hospital functions on the Hospital management system; and conduct of more procurement electronically: leads to a reduction in time to check out and reduction of cases of drug stock outs. The study additionally observes that adoption of E-supply chain practices in public hospitals is shallow; with automation of hospital functions and conduct of procurement processes electronically almost non-existent. Notably, private hospitals have adopted E-supply chain practices to an impressive level; perhaps driven by benefits that the E-supply chain practices portend such as process visibility, reduced costs, and shorter timelines that contribute to the overall efficiency of organizations scores.

## Future Research

The study has established that public hospitals have a shallow adoption of E-supply chain practices. The study thus invites researchers and academicians to empirically examine this phenomenon with a view of explaining the cause of this phenomenon and propose solutions to the shallow adoption of E-supply chain practices. Further the study found that these variables could not explain fully the aspect of operational performance. Therefore this study invites scholars to establish the empirical significance of other variables that could affect operational efficiency of hospitals. The study also invites other scholars to examine the concept of operational efficiency in other counties of Kenya.

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**LIST OF HOSPITALS IN KIAMBU COUNTY**

1	AIC Kijabe Hospital
2	Edelvale Trust Hospital
3	Gatundu Level 5 Hospital
4	Gatundu Sub-County Hospital
5	Gathanga Hospital
6	Hawa Memorial Hospital
7	Jamaa Hospital – Kiambu
8	Jumuia Hospital
9	Kiambu County Hospital
10	Kiambu Level 5 Hospital
11	Kigumo Sub-County Hospital
12	Kikuyu Eye Hospital
13	Kikuyu Hospital
14	Kikuyu Sub-County Hospital
15	Lari Sub-County Hospital
16	Limuru Sub-County Hospital
17	Maragua Sub-County Hospital
18	Mary Help of the Sick Hospital – Thika
19	Menonite Hospital – Githumu
20	Nazareth Hospital – Ruiru
21	Nazareth Hospital – Kiambu
22	Ndeiya Sub-County Hospital
23	PCEA Kikuyu Hospital
24	Premier Hospital – Ruiru
25	Ruiru District Hospital
26	St. John's Hospital – Tigoni
27	St. Joseph Hospital – Karuri
28	Thika Level 5 Hospital
29	Thika Nursing Home
30	Tigoni Hospital
31	Tigoni Sub-County Hospital
32	Wangige Sub-county Hospita
33	Kenyatta University Teaching and Refferal Hospital
34	Plains View Hospital
5	Jomo Kenyatta University of Agriculture and Technology Hospital

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36	Hawa Memorial Hospital
37	Jamaa Hospital – Kiambu
38	Jumuia Hospital
39	Mary Help of the Sick Hospital – Thika