



INFLUENCE OF INVENTORY MANAGEMENT TECHNIQUES ON THE PERFORMANCE OF PUBLIC HEALTH HOSPITALS IN KISUMU COUNTY, KENYA.

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Abstract

Inventory management technique is the systematic methods used to organize the availability of goods for the firm's customers. Poor inventory management techniques have seen patients missing drugs and basic commodities in public hospitals and this has led to morbidity from ailments that could easily be managed. Cost implications are soaring and wastes are becoming a burden in public hospitals due to inappropriate inventory management techniques being adopted by these facilities. The general objective of the study was to assess influence of inventory management techniques on performance of public hospitals in Kisumu County. The specific objectives of the study were; to establish the influence of ABC system on the performance of public health hospitals in Kisumu County, to examine the influence of Economic Order Quantity on the performance of public health hospitals in Kisumu County and to investigate the influence of Just In Time on the performance of public health hospitals in Kisumu County. The study's findings will help researchers better understand inventory management strategies and how they impact the County's public hospitals' success. The study's results would also be useful to policymakers in terms of providing knowledge for designing environmentally sustainable policies and procedures for obtaining inventory and managing its amounts. Furthermore, the results will aid practitioners in achieving effective inventory management at all times, as they will direct decision-making by those tasked with formulating strategies to address inventory problems. The study targeted 2961 individuals, who are composed of 268 management staffs, 2072 clinical officers, 118 stores/supplies staffs and 503 support staffs, in all the public hospitals in Kisumu County. Using the stratified sampling process, the study selected 352 respondents equally distributed across all levels of management, driven by the Yamane (1967) formula. To address the research questions, a descriptive research design was used to collect and analyze data. The research was conducted from October 2018 to December 2020. The Lean Theory and the Theory of Constraints were used as foundations for this research. The research focused on inventory management practices and how they affect public hospital efficiency in Kisumu County. Primary data was collected using semi-structured questionnaires. Secondary data was gathered from the existing hospital records and reviewed documents. Analysis of descriptive statistics was done using measure of central tendencies whereas regression analysis was used for inferential statistics. Data was presented in descriptive statistics. The ABC scheme, EOQ, and JIT techniques had a positive and important impact on the efficiency of public health hospitals in Kisumu County, according to the study (p value <0.05). The study recommended that the management of public hospitals in Kisumu County should ensure that ABC systems are implemented in order to enhance hospital efficiency. Also the management of the public hospitals in Kisumu County should ensure that they adopt EOQ technique in order to enhance the hospital performance. Further, the management of the public hospitals in Kisumu County should ensure that they adopt JIT technique in order to better the hospital performance and finally the management of the public hospitals in Kisumu County should ensure that they adopt appropriate inventory management techniques for the improvement of the hospital performance.

Keywords:

Inventory management techniques;
Performance;
ABC system;
Economic Order Quantity;
Just In Time.

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1. Introduction

Inventory management is a part of supply chain management, which is concerned with the control of products as they move from suppliers to warehouses and then to retail outlets. It is in charge of overseeing non-capitalized assets and inventory products (Donnell & Cole 2017). Inventory is the amount of products, materials, or parts that a company has on hand in a store/warehouse or elsewhere at any given time. To assist them in placing orders or preventing losses, management needs to know the correct amounts of inventory that the company requires at any given time. Management of the firm should know the number of units of the firm's products that are available for satisfying customer's orders. This means that inventory counts are used by all kinds of companies to provide answers (Baron & Berman, 2010). One of the most important supply chain management techniques is inventory management. It is a tool for organizing the supply of products for a company's customers, including sales items, spare parts, and consumables (Tungo, 2014). ABC analysis, Economic Order Quantity (EOQ), and the Just in Time method are just a few of the inventory management strategies available.

Public hospitals in Kenya use various inventory management techniques to manage their inventories. Gatwiri (2018) conducted a study to find out which inventory management techniques are being used by public hospitals in the republic of Kenya. The study findings revealed that to hold inventories as follows; Kenyan public hospitals use various inventory management techniques, but the most commonly used techniques are the ABC analysis technique, JIT technique and the EOQ technique. This study therefore picked on the most commonly used techniques in the public hospitals.

1.1 Statement of the problem

Public hospitals in Kenya are mandated by the constitution to provide affordable and the highest attainable standards of health to the citizenry without discrimination of any kind (Constitution of Kenya, 2010). The same obligations are encompassed in international and regional human rights instruments including the International Covenant on Economic Social and Cultural Rights, and the Human Charter on Human Rights which are both ratified by the Kenyan government (KNCHR, 2017). However this mandate has been frustrated by various issues including inventory management challenges which has seen patients missing basic commodities including essential drugs and other basic medical necessities (Office of the Auditor General, 2012). Previous studies and reports reviewed by the researcher show that performance of public hospitals is being affected by inventory management challenges. An analysis carried out at KNH revealed that the pharmacy did not have some vital and essential drugs for a period of three months. This has been associated with long and bureaucratic procurement processes, suppliers' unwillingness to supply due to delayed payments, inaccurate forecasts, poor supply chain practices among others (Office of the Auditor General, 2012). Mbiriri et al (2018) conducted a study on influence of inventory management systems on service delivery in public hospitals in Nairobi County, Kenya. The study findings showed that service delivery in public hospitals in Nairobi, Kenya is influenced positively by Vendor managed inventory system, Radio Frequency Identification system and Just In Time systems. Mansah, (2015) conducted a study in Ghana to find out the effects inventory management practices have on service delivery at St. Martin's Hospital. One of the objectives of the study was to find out the effects of inventory management techniques on the hospital's service delivery level. The study concluded that inventory control techniques of the hospital have an impact on the health care delivery.

1.2 Research Objectives

The research objectives are as follows;

- i. To establish the influence of ABC system on the performance of public health hospitals in Kisumu County.
- ii. To examine the influence of Economic Order Quantity on the performance of public health hospitals in Kisumu County.
- iii. To investigate the influence of Just In Time on the performance of public health hospitals in Kisumu County.

1.3 Research Questions

This section deals with the formulation of research questions that helped to achieve the objectives of the study. They are:

- i. What is the influence of ABC system on performance of public hospitals in Kisumu County?
- ii. What is the influence of Economic Order Quantity on performance of public health hospitals in Kisumu County?
- iii. What is the influence of Just In Time on performance of public health hospitals in Kisumu County?

2. Research Method

2.1 Review of Theories

2.1.1 Lean Theory

Lean theory is a development of Just In Time concepts. The theory reduces waste in the manufacturing process by eliminating buffer stock (Green & Inman, 2005). Inventory leanness has a positive impact on a company's performance and is the most effective inventory management method. Companies that are leaner than the industry

average have a positive return on their leanness (Eroglu & Hofer, 2011). The theory explains how producers can achieve more flexibility in their purchasing decisions, maximize on-hand inventory, and minimize inventory carrying costs. According to academic studies, companies that use lean supply chain practices to maximize inventory achieve high levels of asset utilization and customer satisfaction, resulting in increased growth, profitability, and market share (Waller, Tangari & Williams, 2008). The theory has been criticized because it can only be applied when there is close and long-term cooperation and knowledge exchange between a company and its trading partners. The theory was relevant to this study since it postulates that when an organization uses an inventory management technique that embraces zero or minimal inventory levels then cost benefits are achieved. In the specific objectives of the study, the researcher investigated how JIT which is associated with stockless operations affects cost implications of public health facilities and the findings supported the theory.

2.1.2 Theory of Constraints

Dr. Eliyahu Goldratt developed the theory of constraints, a management philosophy that systematically focuses efforts, resources, and attention on the "machine constraints." This restriction or bottleneck limits the entire system's performance while also serving as the primary leverage point for improving it. TOC refers to defining and handling constraints that result in On-Time In Full (OTIF) delivery to consumers, stock out elimination, reduced cycle times and thus inventories, and higher net profit. Every device must have a bottleneck or "constraint" that prevents it from achieving its full potential. This may be a specific computer, an employee, shelf space, inventory, or cash. (Theory of Constraints Institute 2019). The theory of constraints is a technique for minimizing inventory that is applied to output (Cooper, 2006). The theory of constraints is a management philosophy that focuses on improving efficiency by focusing on the weakest ring (s) in the chain. Both production and service sector firms need to focus on understanding their own structure in terms of processes to enable them survive the ever stiffening competition. This makes TOC a vital methodology for solving and structuring problems. This theory was relevant to the study since it distinctly identified inventories and inventory management techniques as one of the possible "constraints" that may impede operations of the firm. The aim of the study was to see if this was the case in Kisumu County's public health hospitals, and if so, to figure out which technique was causing problems in the facilities. The findings revealed that of the three inventory management techniques under the study, none of them is constraining the operations of public health facilities in the county.

2.2 Research design

The study used a descriptive survey research design to discover and describe the relationship between the study's variables. This allowed the researcher to investigate the relationship between inventory management techniques and public health hospital performance in Kisumu County, Kenya (Mugenda & Mugenda, 2003).

2.3 Target Population

A population is a group of people, cases, or artifacts that share certain measurable characteristics (Mugenda & Mugenda, 2003). The study targeted 2961 individuals serving across the public healthcare institutions in Kisumu County, the targeted individuals those in management, stores, clinical and support services. Kisumu County has a total of 112 public hospitals which includes; 1 teaching and referral hospital, 5 county referrals, 14 Sub County hospitals and 92 primary care hospitals (Kisumu County Annual Development Plan 2017-2018).

2.4 Description of the Sample and Sampling Procedures

A sample is a deliberately chosen subset of the available population from which the researcher will collect data. The sampling technique is a methodology for choosing the number of people for a sample in such a way that the people chosen reflect the wider population from which they were chosen (Mugenda & Mugenda, 2003). The total number of people in the sample is 352, and the researcher used a proportionate stratified sampling methodology. The sample size was calculated using the Yamane (1967) formula, with a margin of error of 0.05.

$$n = N / (1 + Ne^2)$$

Where

n= sample size, N = population size, and e = Margin of error (MoE).

$$n = 2961 / (1 + 2961(0.05)^2)$$

$$n = 2961 / 8.4025$$

$$n = 352$$

As a result, the study's sample size was 352 people. The number of respondents from each level of management was chosen using stratified sampling. The sample size is summarized in Table 3.2.

Sample size for each level of management calculation was done as below:

$$\text{Management staff} = \frac{268}{2961} \times 352 = 32 \text{ respondents}$$

$$\text{Clinician} = \frac{2072}{2961} \times 352 = 246 \text{ respondents}$$

$$\text{Store/ supply chain staff} = \frac{118}{2961} \times 352 = 14 \text{ respondents}$$

$$\text{Support staff} = \frac{503}{2961} \times 352 = 60 \text{ respondents}$$

Table 1: Sample size

Level of management	Target population	Sample size
Management staff	268	32
Clinicians	2072	246
Store/Supply chain staff	118	14
Support staff	503	60
Total	2961	352

Source: Kisumu County AWP 2020-2021 plan

2.5 Description of Research Instruments

In the chosen public hospitals, questionnaires were used to obtain primary data from respondents. The survey was semi-structured, with open-ended and closed-ended questions that collected both quantitative and qualitative data. Data abstraction from an existing related record was used to obtain secondary data. A Likert scale was used to guide respondents so that precise empirical answers can be obtained. (Mwangangi et al, 2015). The questionnaire as a data collection instrument was used because it has minimum intervention bias from the researcher, furthermore it saved on resources since the physical presence of the researcher is not mandatory (Zikmund, 2003; Powney & Watts, 2018). A, B, and C were the three parts of the questionnaire. Section A was created to collect demographic variables as well as the respondents' basic background information. Section B was used to collect multidimensional variables that will be used to evaluate inventory management activities, while section C was used to evaluate operational efficiency.

2.6 Description of Data Analysis Procedures

The respondents' questionnaires were collected at the agreed-upon time and arranged to obtain data. Statistical Package for Social Sciences (SPSS) version 20 was used to evaluate the data in order to address the three research questions. The information gathered was evaluated using descriptive and inferential statistics. Percentage, frequency, mean, and standard deviation were all used in descriptive statistics. Inferential data, on the other hand, involved multiple linear regression. The following regression equation was used to show the relationship between inventory management techniques and performance of public hospitals in Kisumu County, Kenya.

$$Y = \beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_3x_3 + \epsilon$$

Where;

Y = performance of public hospitals

β_0 = constant (coefficient of intercept)

$\beta_1, \beta_2, \beta_3$ = regression coefficients of the three variables (ABC system, EOQ technique and JIT technique)

x_1 = ABC system

x_2 = EOQ technique

x_3 = JIT technique

ϵ = error term

Tables, maps, and graphs were used to show the data results in order to provide a clear image of the study findings.

3. Results and Analysis (10pt)

3.1. Influence of ABC system on the performance of public health hospitals in Kisumu County

The first objective of the study was to establish the influence of ABC system on the performance of public health hospitals in Kisumu County. Table 2 display the informative results.

Table 2. Descriptive statistics on ABC system

Statement	N	Mean	Std. Deviation
Using ABC method leads to efficient resource management	343	4.60	.491
Using ABC method reduces on holding costs	343	4.94	.245
Using ABC eliminates wastes associated with obsolescence and expiry of supplies	343	4.13	.341
Using ABC leads to increased number of clients served	343	4.60	.491
Overall results	343	4.57	0.392

Key: 1.0-1.4 Strongly Disagree; 1.5-2.4 Disagree; 2.5-3.4 Neutral; 3.5-4.4 Agree and 4.5-5.0 Strongly Agree.

Table 2 shows that respondents strongly agreed that using the ABC approach contributes to efficient resource management (mean=4.60; standard deviation=.491), decreases holding costs (mean=4.94; standard deviation=.245), and increases the number of clients served (mean=4.60; std.dev.=.491). Furthermore, the respondents concluded that

using ABC reduces waste associated with supply obsolescence and expiration (mean=4.13; standard deviation=.341). The respondents strongly agreed that the ABC framework had an effect on the efficiency of public health hospitals in Kisumu County, based on the overall ranking.

3.2. Economic Order Quantity and performance of public health hospitals in Kisumu County

The second objective of the study was to examine the influence of Economic Order Quantity on the performance of public health hospitals in Kisumu County. The table 3 that follow show the descriptive statistics.

Table 3: Descriptive statistics on Economic Order Quantity

Statement	N	Mean	Std. Deviation
The use of EOQ ensures uninterrupted operations	343	4.80	.404
The use of EOQ leads to obsolescence and expiry of items	343	4.36	.479
The use of EOQ eliminates stock outs	343	4.53	.485
EOQ leads to increased number of clients served	343	4.59	.500
EOQ eliminates wastes associated with obsolescence and expiry of supplies	343	4.87	.341
EOQ method reduces on holding costs	343	4.77	.424
EOQ method leads to efficient resource management	343	4.85	.353
Overall results	343	4.68	0.427

Key: 1.0-1-4 strongly disagree; 1.5-2.4 Disagree; 2.5-3.4- Neutral; 3.5-4.4 Agree and 4.5-5.0 Strongly agree.

Table 3 shows that respondents strongly agreed that using EOQ ensures uninterrupted operations (mean=4.80; std.dev.=.404), that using EOQ eliminates stock outs (mean=4.53; std.dev.=.485), that using EOQ leads to an increase in the number of clients served (mean=4.59; std.dev.=.500), that using EOQ eliminates wastes associated with obsolescence and The respondents also accepted that using EOQ causes item obsolescence and expiration (mean=4.36; std.dev.=.479).The overall result of the EOQ (mean=4.68; std.dev.=.27) indicated a strong agreement that EOQ had influence on performance of public health hospitals in Kisumu County.

3.3 Just In Time and performance of public health hospitals in Kisumu County.

The final objective of this study was to investigate the influence of Just In Time on the performance of public health hospitals in Kisumu County. The descriptive result was shown in Table 4.

Table 4: Descriptive statistics on Just In Time

Statement	N	Mean	Std. Deviation
The use of JIT eliminates wastes associated with obsolescence and expiry of supplies	343	4.50	.501
Using JIT method disrupts operations due to stock outs	343	4.85	.353
JIT method improves the delivery time of supplies	343	4.48	.500
Use of JIT method reduces some costs such as storage and handling costs	343	4.94	.245
JIT method leads to efficient resource management	343	4.85	.353
JIT method leads to effective resource management	343	4.41	.492
Overall result	343	4.67	0.407

Key: 1.0-1-4 strongly disagree; 1.5-2.4 Disagree; 2.5-3.4- Neutral; 3.5-4.4 Agree and 4.5-5.0 Strongly agree.

The respondents strongly agreed(mean=4.50; std.dev.=.501), that using JIT reduces wastes associated with obsolescence and supply expiration, as shown in table 4.13using JIT method disrupts operations due to stock outs (mean=4.85; std.dev.=.353),use of JIT method reduces some costs such as storage and handling costs (mean=4.94; std.dev.=.245) and JIT method leads to efficient resource management (mean=4.85; std.dev.=.353). Also, the respondents agreed that JIT method improves the delivery time of supplies (mean=4.48; std.dev.=.500) and JIT method leads to effective resource management (mean=4.41; std.dev.=.492). The overall results shows that

respondents strongly agreed that JIT had influence on performance of public health hospitals in Kisumu County (mean=4.67; std.dev.=.407).

3.4 Inventory management techniques on the performance of public health hospitals in Kisumu County, Kenya.

The general objective of this study was to determine the influence of inventory management techniques on the performance of public health hospitals in Kisumu County, Kenya. Table 5 summarized the findings of the report.

Table 5: Descriptive statistics on the performance of performance of public health hospitals in Kisumu County, Kenya.

Statement	N	Mean	Std. Deviation
reduces some costs such as storage and handling costs	343	4.41	.492
Reduces lead time of supplies delivery	343	5.00	.000
Improves efficiency in resource management	343	4.85	.353
Better waste management	343	4.41	.492
Improves efficiency of service delivery	343	4.64	.274
Increases the number of clients served	343	4.77	.191
Better service delivery	343	4.64	.193
Overall results	343	4.67	0.285

Key: 1.0-1.4 strongly disagree; 1.5-2.4 Disagree; 2.5-3.4- Neutral; 3.5-4.4 Agree and 4.5-5.0 Strongly agree.

Table 5 shows that the respondents strongly agreed that inventory management techniques reduce supply lead times (mean=5.00; std.dev.=.000), improve resource management efficiency (mean=4.85; std.dev.=.353), improve service delivery efficiency (mean=4.64; std.dev.=.274), increase the number of clients served (mean=4.77; std.dev.=.191), and improve customer service (mean= Reduces certain costs, such as storage and processing costs (mean=4.41; std.dev.=.692) and Better waste management (mean=4.41; std.dev.=.692), according to the respondents. The overall results shows that respondents strongly agreed inventory management techniques had influence on performance of public health hospitals in Kisumu County (Mean=4.67; std.dev.=.285)

3.5 Regression results

Multiple regression analysis was carried out to determine the level of significance of inventory management techniques on the performance of public health hospitals in Kisumu County, Kenya. Tables 6, 7 and 8 display the regression results.

Table 6. Model summary of Inventory management techniques and performance of public health hospitals in Kisumu County, Kenya.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.977 ^a	.954	.953	.04537

a. Predictors: (Constant), Just In Time technique, ABC system, Economic Order Quantity technique
In Kisumu County, Kenya, there was a clear positive relationship between inventory management techniques and public health hospital results, as shown in Table 4.15. (p value<05; R=.977) Inventory management techniques (ABC scheme, EOQ, and JIT techniques) led to 95.4 percent difference in output of public health hospitals in Kisumu County, Kenya, according to the R square. Other factors not included in the report led to 4.6 percent of the success in public health hospitals, according to the findings.

Table 7. ANOVA test of Inventory management techniques and performance of public health hospitals in Kisumu County, Kenya.

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	14.345	3	4.782	2322.581	.000 ^b
1 Residual	.698	339	.002		
Total	15.043	342			

a. Dependent Variable: performance

b. Predictors: (Constant), Just In Time technique, ABC system, Economic Order Quantity technique
Inventory Management Techniques had a statistically important impact on the efficiency of public health hospitals in Kisumu (F=2322.581; p value=.000), according to Table 4.16. The results show that the data are suitable for

drawing conclusions; the independent variables (ABC method, EOQ, and JIT techniques) are excellent predictors of the dependent variable (performance)

Table 8. Coefficients of Inventory management techniques and performance of public health hospitals in Kisumu County, Kenya.

Model	Unstandardized Coefficients		Standardized	t	Sig.
	B	Std. Error	Coefficients Beta		
(Constant)	.790	.057		13.918	.000
ABC system	.191	.008	.282	23.636	.000
1 Economic Order Quantity technique	.048	.011	.057	4.297	.000
Just In Time technique	.597	.009	.877	66.534	.000

a. Dependent Variable: performance

Table 8 shows that the just in time is the most predictor of the performance, followed by ABC systems and then economic order quantity with the B values of .597, .191, and .048 respectively. The study also found that inventory management strategies (ABC systems, Economic Order Quantity, and Just In Time) had a substantial impact on efficiency (p values less than .05). The regression model for the above result was:

$$\text{Performance} = 0.790 + 0.191 * \text{ABC system} + 0.048 * \text{EOQ} + 0.597 * \text{JIT} + \varepsilon \dots \dots \dots (\text{Equation 1})$$

The findings show that the ABC method and output have a positive significant relationship ($t=23.636$; $p=0.000$; $p<0.05$). Output improved by 0.191 when the ABC system was increased by one. According to the findings, there was a positive and important relationship between EOQ and results ($t= 4.297$; $p= 0.000$; $p<0.05$). The level of performance increased by 0.048 whenever EOQ was increased by one unit. JIT was also strongly and substantially linked to success ($t=66.534$; $p=0.000$; $p<0.05$). The level of output improved by 0.597 whenever JIT was increased by one unit.

4. Conclusion

On the first objective, the study reported that the respondents strongly agreed that ABC system had influence on performance of the public health hospitals in Kisumu County (Mean=4.57; std. dev.=.392). Therefore, the study concluded that ABC systems had positive and significant influence on performance of public health hospitals in Kisumu County, Kenya. Secondly, the study concluded that EOQ techniques had positive and significant influence on performance of public health hospitals in Kisumu County, Kenya. This is because the overall result showed that EOQ (mean=4.68; std.dev.=.27) indicated a strong agreement that EOQ had influence on performance of public health hospitals in Kisumu County. Thirdly, the overall results showed that respondents strongly agreed that JIT had influence on performance of public health hospitals in Kisumu County (mean=4.67; std.dev.=.407). Therefore, the study concluded that JIT technique had positive and significant influence on performance of public health hospitals in Kisumu County, Kenya. Finally, the study concluded that inventory management techniques had positive and significant influence on performance of public health hospitals in Kisumu County, Kenya. This is supported by the overall results that showed that respondents strongly agreed inventory management techniques had influence on performance of public health hospitals in Kisumu County (Mean=4.67; std.dev.=.285).

5. Recommendations of the study

The study's findings led to the following recommendations:

To begin, the management of Kisumu County's public hospitals should ensure that ABC systems are implemented to enhance hospital efficiency. Second, the management of Kisumu County's public hospitals should ensure that the EOQ technique is used to improve hospital results. Thirdly, in order to improve hospital efficiency, the management of public hospitals in Kisumu County should ensure that JIT is implemented. Finally, the study recommended that the management of Kisumu County's public hospitals ensure that effective inventory management strategies are implemented in order to increase hospital efficiency.

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