INVENTORY MANAGEMENT SYSTEMS AND SUPPLY CHAIN

PERFORMANCE IN PUBLIC HOSPITALS IN NAIROBI, KENYA

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A RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILMENT OF THE

REQUIREMENTS FOR THE AWARD OF MASTERS OF BUSINESS

ADMINISTRATION, SCHOOL OF BUSINESS, UNIVERSITY OF NAIROBI

NOVEMBER, 2015

DECLARATION

This research project is my original work and has not been presented for examination in any other university.

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This research project has been submitted for examination with my approval as the candidate's university supervisor.

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DEDICATION

Special dedication to my parents (Mr/ Mrs Waithaka Mwanu) for efforts and contribution toward my education.

ACKNOWLEDGMENT

I thank the Almighty for the opportunity to undertake this research project.

I acknowledge the contribution, support and guidance of my supervisor, particularly for

his time and commitment on the progress of this research project.

Finally, I thank my family Members, (Nyawira Mithamo, Phineas Waithaka and Ethan

Mithamo for their moral support and encouragement.

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ABSTRACT

The study of the Inventory Management Systems and Supply Chain Performance was carried out to assess the impact of inventory management systems on supply chain performance in Public Hospitals in Nairobi, Kenya. Descriptive research method and case study were employed in carrying out the study. The population of the study was eight Public Hospitals (8). Data were generated using questionnaire, observations, books, journals and the internet. Data were presented in tables and analyzed using simple percentages. Chi-Square tests and linear regression was used in the hypotheses testing. From the analyses, it was discovered that inventory management systems and levels of integration adopted, impacts on supply chain performance within the Public Hospitals. The findings indicated that there were significant relationship between inventory management systems and supply chain integration, and supply chain performance. Inventory management systems and supply chain integration has a significant effect on supply chain performance. There is highly positive correlation between inventory management systems and supply chain performance. The study concluded that Inventory Management systems and high level of supply integration are vital in supply chain performance. The study recommended that Public Hospitals should ensure a proper inventory management systems and integration is implemented to control the costs, and the current supply chain integration practices to be reviewed and redesigned to fit the evolving dynamic market environment while all stakeholders in inventory management are involved in the management of inventory processes.

Key words: Inventory management systems, supply chain integration, supply chain performance

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Operations Management is process whereby resources, flowing within a defined system, are combined and transformed by a controlled manner to add value in accordance with policies communicated by management (Kamar and Suresh, 2009). Operations management consist of five components which include process design, planning and control, project management, quality and supply chain management. The Operations management has three levels namely strategy, system and process level. System level is involved in integrating the process element (Stevenson 2004). Integration of process and system elements under the operations strategy combines and synthesizes processes and systems to achieve competitive advantage.

Supply Chain Management is major component of operations management that focuses on behavior of information flow through a supply chain, inventory management, and Planning. The key supply chain players include suppliers, Transformation process and customer. Supply chain management contribution to operation performance consist purchasing, buyer-seller collaboration, cost reduction, make-buy analysis, vendor scheduling and supplier certification (Bowersox et al. 2002). According to Buffa and Sarin (1987) there are several reasons for inventory Management. Too much stock could lead in tied capital, increase in holding cost, and deterioration of materials, obsolescence and theft. On the other hand, shortage of materials can lead to interruption of services and products for sales; poor customer relations and underutilized machines and equipments. The problem of inventory management systems exists in the public hospitals in Kenya.

Inventory management as a function of supply chain management is employed in selection of the appropriate inventory management systems applicable in different public hospitals.

1.1.1 Inventory Management Systems

An inventory management system is the set of policies and controls that monitor levels of inventory and determine what levels should be maintained, when stock should be replenished, and how large orders should be (Waters, 2003). Inventory is the stock of any item or resource used in an organization. Inventory management involves ordering, receiving, storing, issuing, and reordering limited items. Firms keep a supply of inventory to maintain independence of operations, meet variation in product demand, and allow flexibility in production scheduling, provide a safeguard for variation in raw material delivery time, take advantage of economic purchase order size and anticipation of price changes. In making any decision that affects inventory size, one must consider holding (or carrying) costs which includes the costs for storage facilities, handling, insurance, pilferage, breakage, obsolescence, depreciation, taxes, and the opportunity cost of capital; Setup (or production change) costs; Ordering costs and Shortage costs (Zipkin, 2000).

Inventory management systems applied depends on dependent demand system and independent demand system. Dependent demand inventory control techniques utilize material requirements planning logic. Dependent demand system involves just in time system, the Material planning requirement, vendor managed inventory system and a Just in time material planning requirement hybrid system. Independent demand inventory control procedures rely upon unbiased forecasts of uncertain demand. Demand and lead

times are treated as random variables. In the pull system, operating units order items from a warehouse or supplier according to local determination of need. In the push system, a central authority orders items from supplier and determines the quantities that will be shipped to the operating unit, based on the annual distribution plan and on information transmitted to the warehouse about need at the operating unit. Push system have feature of a dependent demand, a plan is set for distribution to operating units, and procurement is done to carry out that plan (Waters , 2003).

Zipkin (2000), independent demand system includes single period inventory system and multi-period inventory system. A single-period inventory system is where procurement is carried out once each year for all items. Multi-period Inventory Systems include two models; Fixed–order quantity model which is an inventory control model where the amount requisitioned is fixed and the actual ordering is triggered by inventory dropping to a specified level of inventory(perpetual system). Fixed–time period model an inventory control model that specifies inventory is ordered at the end of a predetermined time period (also referred periodic system, periodic review system and fixed order interval system). The interval of time between orders is fixed and the order quantity varies. Multi-period inventory systems are designed to ensure that an item will be available on an ongoing basis throughout the year, (Waters, 2003).

1.1.2 Supply Chain Performance

Supply Chain Management is the process of planning, implementing, and controlling the operations of the supply chain with the purpose to satisfy customer requirements as efficiently as possible or spans all movement and storage of raw materials, work-in

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progress inventory, and finished goods from point of origin to point of consumption (Bowersox et al. 2002). Supply chain management addresses the management of materials and information across the entire chain from suppliers to producers, distributors, retailers, and customers. A "chain" can be defined as a connected series of events or actions, especially which lead to a final result. The series of events, production transportation, storage and availability of supplies for use to satisfy specific needs constitutes the supply Chain (Bowersox et al. 2002).

The management of the supply aims to manage, coordinate, develop standards and benchmarks ensure all work satisfactorily and ideal balance between supply of goods and consumption. Supply chain management being accounTable for planning and controlling the flow of materials, which aims to optimize the use of organization resources (Arnold, 1999). Supply Chain Management focus on behavior of information flow through a supply chain (Lee et al., 1997), inventory management (Zipkin, 2000) and planning and operations management of a supply chain based on queuing systems (Raghavan and Viswanadham, 2001; Song and Yao, 2002).

The objective of supply chain management performance is to provide a high velocity flow of high quality, relevant information that will enable suppliers to provide an uninterrupted and timed flow of materials to customers (Zinn *et al*, 2002).Supply chain is involved in inventory management through purchasing or procurement, inventory control, receiving, warehousing, production scheduling and transportation (Federgruen, 1984b). The main aim of supply chain in inventory management systems is to optimize materials cost, capital costs, and overhead expenses, high level of service, quality

assurance, and low level of tied-up capital and support of other functions. Supply chain performance influences the inventory management system through procurement, demand management, Transportation, Customer service, warehousing and storage. The key supply chain performance measures include plan, source, make/ assemble and deliver.

1.1.3 Inventory Management Systems and Supply Chain Performance

Inventory management systems relates with supply chain factors. Procurement relates with buyers and sellers and is in a higher, strategic level activity (Bowersox et al. 2002). Procurement focus on organization capacity stimulates various perspectives continuous supply; minimize inventory investment, quality improvement, supplier development and pricing and purchasing discount.

The main aim of accumulating physical supply inventory in organization is to realize purchase economies (Towill 1982). Demand management facilitate demand forecasts based on sales history, scheduled orders, scheduled marketing activities and customer information (Veinnot, 1966). The forecast incorporate feedback from customer to integrate the influence of combined demand generation activities i.e. advertising. Demand forecasting aim to increase customer satisfaction, reduce stock out, scheduling production, lowering safety stock requirements, managing shipping, improving pricing and promotion management.

Transportation focuses in logistics of physical movement inventory and network. A direct relationship exists between transportation and level of inventory and number of warehouse required (Aghezzaf, 2001). Customer service depends on decision inventory, transportation and warehousing. Logistics decisions about availability and inventory lead time are critical to customer service. Warehousing is firm's logistics system that stores

stock. Improving inventory turns and reducing time to market, the role of distribution focuses on filling orders rapidly orders rapidly and efficiently.

1.1.4 Public Hospitals in Kenya

In Kenya, (ROK, 2011) there were over 4,700 health facilitates and Public sector accounting for about 51 percent of the facilities. The public sector facilitates include National Referral Hospitals, Provincial General Hospitals, District Hospitals, Health Centers and Dispensaries.

Kenyatta National Hospital based in Nairobi City County and Moi Referral and Teaching Hospital in Eldoret are only National Referral Hospitals in Kenya. The provincial level acts as an intermediary between the national central level and the districts. They oversee the implementation of health policy at the district level, maintain quality standards, and coordinate and control all district health activities (RoK, 2001). District hospitals concentrate on the delivery of health care services. Health centre and dispensaries provide preventive and curative services. Privately owned and operated Hospital and clinics Faith- based organization's hospital and Clinics supplement government organizations, Health service provision by 30 percent and 40 percent of the hospital beds in Kenya (ROK, 2011).

Public healthcare institutions in Kenya are influenced by environment it operates to gain competitive position in the markets. The Health institutions have many supplier of different product ranging from Clinical and technical Items. The main customers are the Doctors, Nurses, Support staff, Supplier and Patients. The customer demand high level

service level in delivery of clinical services i.e timely delivery of service and items, flexible procurement policy, high quality products and cost effective items.

Public health institutions supply chain management operates under the Public Procurement and Disposal Act, 2005 created the Public Procurement Oversight Authority and the Public Procurement Advisory Board. The PPOA is mandated with the responsibility of ensuring that procurement procedures established under the Act are complied with; implementation and Monitoring the procurement system and reporting ; Initiating public procurement policy.The supplier are involved in supply chain are local and international depending the product availability in the country (http://www.ppoa.go.ke/). The model of transport include road, air and water depend on the nature of the item(s). The type of inventory management systems currently in use include mix of annual purchasing, scheduled purchasing and perpetual purchasing.

1.2 Statement of the Problem

Inventory management systems impact on quality service delivery, cost and flexibility. Inventory ties up capital and therefore an increase in cost per unit. The effect is impacted through supply chain performance. Supply chain performance is outcomes of appropriate inventory management systems (Meng 2006).

The urgency of the public hospitals inventory management systems issues involved in supply chain evolving nature of supply is of greater importance. Supply side is not constant due to nature of demand, product usage and service level required by organization. The demand side of products is affected by the emerging health problems

and new different product developments while the issue of service level in public hospitals is critical (Wong et al 2005).

On a global perspective, Vikram et al (2012) conducted a study on inventory management systems and supply chain collaboration that assume sTable supply side. The researcher finding concluded that inventory management departments were more willing to have vendor managed inventory system to maintain consistent supply and collaboration amongst stakeholders. A related study by Adeyemi et al (2010) focused on inventory management optimization tool in Coca-Cola Bottling industry in Nigeria. The researcher concluded that right quantity, quality and timing of inventory is achieved by use appropriate inventory management systems.

Richey et al (2009) conducted a study that sought to understand supply chain integration drivers and firms supply chain performance. The study concluded that firms with a desire to improve, operating in a challenging competitive environment experience high levels of supply chain performance through developing effective supply chain linkages.

On local perspective, Ng'ang'a (2013) also conducted a study on inventory management systems concept. The study focused on effectiveness of inventory management in Ministry of State for Provincial Administration and internal security in Nairobi. The study concluded that delay in procurement and frequent stock outs affected the organization performance. The effect of supply chain performance also is not considered beyond unsatisfied customer. A study on situation in which supply is evolving and demand is uncertain would enhance understanding impacts of inventory management systems on supply chain performance.

These studies focus on various sectors of the economy. The contextual issues in public health sector may be better understood by having a specific in-depth study. This study will seek to answer the following questions. Which inventory management systems are in use in Public Hospital? What is the impact of inventory management systems adopted on Supply Chain performance?

1.3 Objectives of the Study

To answer the above research questions the following are specific objectives to be achieved.

  i.   To establish inventory management systems in use in Public Hospitals.

 ii.   To determine the relationship between inventory management systems and supply chain performance.

1.4 Value of Study

The value of this study will show importance to do study within the area of inventory management systems and impacts on supply chain performance in Public Hospitals. The study is valuable because it involves a working procedure of how to be more effective in running inventory management systems and its impacts to supply chain performance.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews the theoretical literature from past studies on the concepts and practices in inventory management. The Literature was reviewed along three themes: Inventory management systems, Supply chain performance, and Supply Chain integration. The summary of this literature review was set out and a conceptual framework proposed.

2.2 Inventory Management Systems

Inventory Management systems have been identified and relationships with performance put in focus (Augustine 2013). Just in time as inventory management is described (Kros et al 2006). Inventory management cost and effect on supply chain is analyzed (Meng 2006).The papers bring out the fact that inventory management is important input in service delivery and cost reduction.

A paper by Augustine (2013) reports on investigation of the impact of proper inventory management on organizational performances. The study suggests a link between inventory management and productivity. The empirical study used sampling method to select the study sample from population. The study concluded from the findings that highly positive correction between good inventory management and organizational cost reduction. However, he noted that management should closely monitor and manipulate inventory system to maintain production consistency for organizational productivity.

However, having conducted his study in Nigerian Bottling Company, it can be presumed that this would apply to Kenyan health service sector context would be of significance. Kros et al (2006) empirical study sought to analyze the impact of just in time an inventory management system. The study suggests a connection between just in time inventory management system and process improvements that lead to inventory reduction. The empirical study used sampling method to select sector to examine measures of inventory management performance.

The researcher findings concluded that suppliers from three sectors indicated mixed results in the impact just in time implementation on the inventory performance measures. The suggest consistency with other paper conducted on just in time as practice to enhance productivity and minimizing cost. From Management perspective the finding were very important because very little research had been done on how JIT systems can be modified in order to meet the needs of different industries. Since the study was conducted in the United States of America, the same would need to be evaluated in the Kenyan health service sector context.

A paper by Meng (2006) aimed at identifying cost factors, assessing cost components, calculating economic order quantity and effect of inventory on supply chain. The study suggests connection between inventory management cost and performance. The empirical study was conducted in Sandviks Electricity plant. The study the finding concluded that effective inventory Management, procurement goal would be achieved and whole supply chain optimized. Since the study was conducted in Sweden energy service sector, similar test with data from Kenya health service sector to test this hypothesis would be of value.

2.3 Supply Chain Performance

This theme explores two researcher papers; Supply chain performances have been identified and relationships with inventory parameters focused Ganeshan et al (2001). Wong et al (2005) identified volatility and seasonality of product and its impact to the supply chain Management.

A paper by Ganeshan et al (2001) focused on the impact of forecast errors, mode of communication and planning frequency and management techniques on the performance of an expanded and comprehensive retail supply chain. The study suggests links between inventory parameter and supply chain performance. The empirical study used case study to link the input and output variable of single chemical product used as household cleaner and simulation method to analyze the data. The study found out that all the three inventory parameter had a significant effect on performance. Increasing forecasting errors and re-planning frequency decrease service, return on investment, and increase cycle time. Mode of communication that facilitates exchange of information between echelons in the supply chain yields a higher level of service when compared to the scenario where the entities in different echelons plan material flows independently. From Management perspective the inventory management parameters had a significant effect on supply chain performance and thought that the result would be similar in other industries having different parameter.

In the study, supply chain performance conducted in United States of America focused on issues such as forecast, planning and exchange communication. Such factors would need to be evaluated in the context of a Kenyan Hospital.

A paper by Wong et al (2005) sought to investigate demand and supply chain management practices effectiveness. The study indicates relationship between the levels volatility and seasonality of products supply and supply chain management practices. The empirical study used longitudinal and in-depth case study for data collection. The study finding concluded that there main supply chain management practices in term of ordering behaviour are one off, just in time and mixed model, and one dominate others. However, the study noted that supply chain management is not yet capable of managing the level of volatility and seasonality. Since the study was conducted in Denmark toy industry. This study will seek to find out if the same is true in the case of health service sector in Kenya.

2.4 Supply Chain Integration

This theme explores two research papers; Integration and distant as types of supply chain management are identified and cost, delivery, design, and logistics services as operational competency focused (Halley and Beaulieu 2009). The relationship between supply chain management alignment, and Suppliers and customer integration put in focus (Zailani and Rajagopal 2005).

Halley and Beaulieu (2009) in their paper sought to know how a more thorough integration of the supply chain may be associated with greater mastery of operational competencies. The paper suggests relationship between supply chain management practices and the development of operational competencies. The empirical paper used sampling method to select firms and mail survey was carried out among Canadian manufacturing companies. The study findings concluded that supply chain management

practices may be either integrated or distant with upstream or downstream partners and highly integrated supply practices mastered an operational competency in logistic services. The study is consistent with study conducted by Zailani and Rajagopal (2005) on integration of supply chain management dimensions.

In the study was conducted in Canada where supply chain management practices and operational competencies i.e. cost, delivery, logistic services and design were focused. Such concepts would need to be evaluated in context of a Kenyan health service sector. A paper by Zailani and Rajagopal (2005) aimed at establishing relationship between supply chain management practices, and integration with customer and suppliers. The paper suggests connection between supplier and customer integration, and improved operations performance through information sharing, cross functional behaviors, strategic customer and supplier relationship. The conceptual paper was carried out in United States of America and East Asia Companies. The study found out that potential benefits of integrating the supply chain would be realized only if the interrelationships among different parts of the supply chain are recognized, and proper alignment is ensured between the design and execution of the company's competitive strategy. Since the study was conducted in United States of America and East Asia, a similar study in the Kenyan context would be of value.

2.5 Literature Review Summary and Conceptual Framework of the Study

The Literature review was summarized along three themes: Study and Type, Focus, Gap and The proposed study. The summary of this literature review is set out below.

Table 2.1: Present the Summary of the Literature Review

Study and Type	Focus	Gap	The proposed study
Augustine (2013) Empirical Study	Inventory management and productivity	Geographical context	Examine the concepts using research data in Kenyan context
Kros et al (2006) Empirical study	Just in time inventory management system and process improvements.	Geographical context	Examine just in time inventory system in Kenyan Context.
Meng (2006) Empirical study	Relationship between Inventory management cost and performance	Geographical context	Examine the concepts using research data in Kenyan context
Ganeshan et al (2001)Empirical study	Relationship between inventory parameter and supply chain performance.	Geographical context	Examine the concepts using research data in Kenyan context
Wong et al (2005) Empirical study	The levels volatility and seasonality of products and supply chain practices.	Geographical context	Examine the concepts using research data in Kenyan context
Halley and Beaulieu (2009) Empirical study	Relationship between supply chain management practices and the development of operational competencies.	Geographical context	Examine the practices using research data in Kenyan context
Zailani and Rajagopal 2005) Conceptual study	Supplier and customer integration and improved operations performance	Geographical context	Examine the practices using research data in Kenyan context

2.5.1 Conceptual Framework of the Study

Figure 1.2 Shows a conceptual model derived from the literature. In this model Supply chain performance is a function of the input from the inventory management systems over and above what the firm function.

Figure 2.1: Conceptual Framework

Inventory Management systems		Supply Chain Performance
. Perpetual inventory system . Periodic inventory system . Hybrid inventory system	**H1** **H2** → **Supply Chain Integration** . Integration . Distance	. Cost . Service delivery
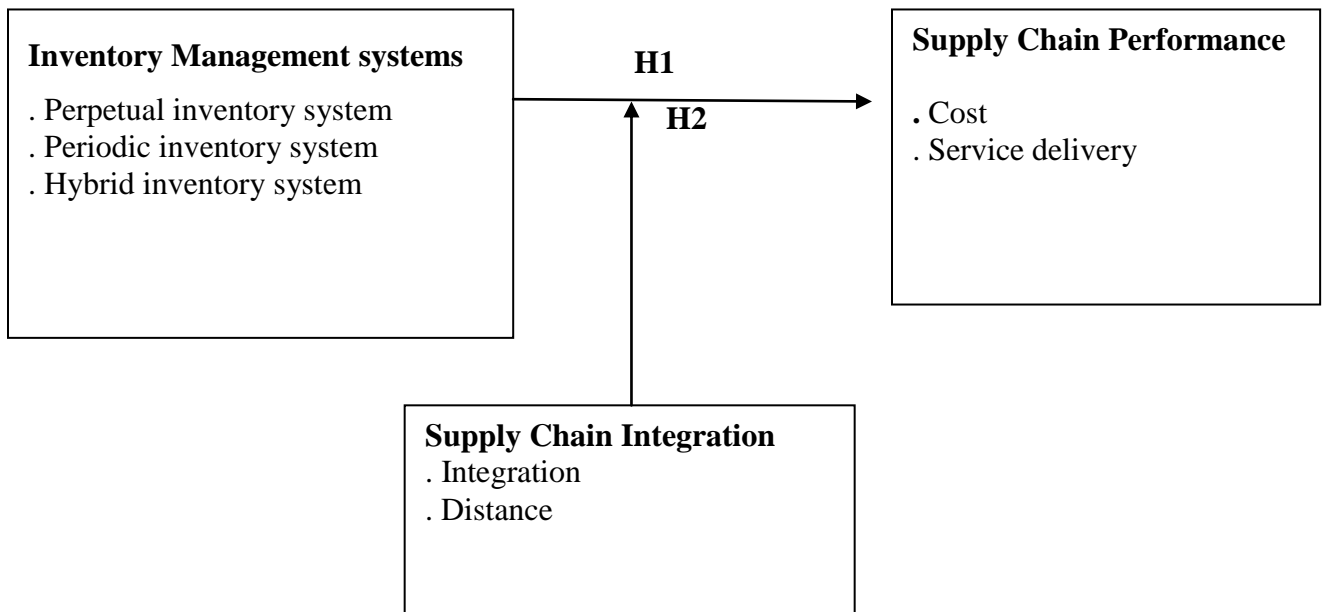
Source: Author (2014)

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter discusses the methodology that was used in obtaining and analyzing data, and reporting the results of the study objectives. This section describes the research design, the target population and the sampling method, procedure of data collection and data analysis in general.

3.2 Research Design

This was a formalized cross-sectional research design. The study was descriptive and focused on Public Hospitals in Nairobi, Kenya. The unit of analysis was individual public hospitals. According to Cooper and Emory (1995), a descriptive study is used when the what, who, where or how of a phenomenon is the focus of the proposed study. The type of the study aids in fact finding and can be used to formulate principles of knowledge and solutions to problems. Descriptive studies present data in a meaningful form thus helping to understand the characteristics of a given group in a given situation (Kerlinger 1999). The descriptive design was effectively used by Situma (2006) in a study of the turnaround strategy adopted at Kenya Commercial Bank.

3.3 Population of the Study

The target population includes all eight Public Hospitals within Nairobi. www.e**health**.or.ke). The nature of the Nairobi city county provides ideal social economic issues thus no influence to study results. The study focused on major Public Hospital with semi-autonomous supply chain management department. The elements were drawn from the internet for the purpose of sampling (www.e**health**.or.ke)

3.4 Sampling Design

 Fowler (2002) explains that stratification means that specific characteristics of individuals are represented in the sample and the sample reflects the true proportion in the population of individuals with certain characteristics. A census sampling design was used to draw the respondent from all the eight public hospitals within Nairobi. The use of the census sampling method was appropriate as it increase confidence interval and maximum chance of identifying of negative feedback for researcher. The respondents of the research includes procurement managers, clinical users, pharmacy user, technical users, and administrative users in public Hospitals within Nairobi. The researcher randomly selected 80 employees from procurement and user department. Each public Hospital had 10 respondents from procurement and each user department as shown in Table 3.1.

Table 3.1: Sample Framework

Respondents	No. of Respondents	Total Respondents
Procurement Managers	2	16
Clinical users	2	16
Pharmacy users	2	16
Technical users	2	16
Administrative users	2	16

3.5 Data Collection

This study used primary data. For primary data, the researcher focused on procurement managers, clinical users, pharmacy users, technical users, and administrative users to collect firsthand information from the organization selected. The questions were seeking

indicators of inventory Management Systems, Supply chain integration, and supply chain performance in public hospitals within Nairobi. The indicators of inventory management systems were obtained from (Kros et al 2006; Augustine 2013, and Meng 2006) and was to find out different inventory Management systems. Indicators of supply chain performance were obtained from (Ganeshan et al 2001, and Wong et al 2005) and were seeking to find out the operational performance outcome of inventory management system after interacting with supply chain integration. Indicators of supply chain integration were obtained from (Halley and Beaulieu 2009, and Zailani and Rajagopal 2005) and were seeking to find out different levels of integration within public hospitals. This was from the perception of procurement manager and the user consumers.

The questionnaires were administered on a 'drop and pick later' technique. To collect data, the researcher distributed the questionnaires to the respondents. The primary data was efficient to the research because it is reliable and accurate (Mugenda & Mugenda 2003).

3.6 Data Analysis

Data involved semantic differential and likert scales. Computation of descriptive statistics was performed. The mean, the standard deviation and the correlation coefficient, the coefficient of determination of the variables indicators, obtained objectively. The outcome was used to interpret the predicted equation.

Table 3.2: A summary of the computed mean and standard deviation

Hospital	Inventory Management systems	Supply Chain Integration	Supply Chain performance	
			Mean	Standard deviation
Hospital 1				
Hospital 2				
Hospital 3				
Hospital 4				
Hospital 5				
Hospital 6				
Hospital 7				
Hospital 8				

The study outcome was also achieved through regression analysis, by determining coefficient of determination. This is as indicated in the equation below:

$$Y = ß_0 + ß_1x_1 + ß_2x_2 + ß_3x_3 + ß_4x_4 + ß_5x_5 + e$$

Prediction equations;

$$Y = ß_0 + ß_1x_1 + ß_2x_2 + ß_3x_3 \qquad \text{(i)}$$

$$Y = ß_0 + ß_4x_4 + ß_5x_5 \qquad \text{(ii)}$$

$$Y = ß_0 + ß_1x_1 + ß_2x_2 + ß_3x_3 + ß_4x_4 + ß_5x_5 \qquad \text{(iii)}$$

Where: Y refers to Supply Chain Performance

$ß_0$ is a constant, the intercept between x and y axis

$ß_{1.........} ß_5$ are the correlation coefficients;

X_1- Input is Perpetual inventory system

X_2 – Input is Periodic inventory system

X_3 – Input is Hybrid inventory system

X_4 –Integration

X_5 –Distance

e- the error term

CHAPTER FOUR

DATA ANALYSIS, INTERPRETATION AND DISCUSSION

4.1 Introduction

This chapter presents research findings of the study which have been discussed under thematic sections in line with the study objectives. This section describes questionnaire response rate, inventory management systems, level of integration and summary of supply chain performance mean and standard deviation. Descriptive statistics and tabulations were used to analyse the data collected. Descriptive statistics involves percentage while tabulations were basically pie chart and bar graphs. Regression model was conducted and estimated.

4.1.1 Response Rate

Out of the eighty questionnaires sent out, seventy two responses were received back for data analysis. All the seventy two responses were non defective and ultimately valid for analysis obtaining a response rate of 90%. According to Mugenda and Mugenda (1999), a response rate of 50% is adequate for analysis and reporting while response rate of 60% is good and a response rate above 70% is excellent. The provision of this data focused on different public hospitals where the names have been disguised for confidentiality and ethical consideration. This is as indicated in Table 4.1.

Table 4.1: Analysis of Returned Questionnaires

Hospitals	No. of Questionnaires administered	Number of questionnaires Returned	Functional Questionnaires	Response Rate in %
Hospital 1	10	10	10	100
Hospital 2	10	9	9	90
Hospital 3	10	9	9	90
Hospital 4	10	8	8	80
Hospital 5	10	9	9	90
Hospital 6	10	10	10	100
Hospital 7	10	9	9	90
Hospital 8	10	8	8	80
Total	**80**	**72**	**72**	**90**

Source: Survey data 2014

The Table 4.1 indicates that in the two hospitals total number of questionnaires were all received back with 100% response rate, while four hospitals with 90% response rate and two hospitals with 80% response rate. The response rate can be explained due to the equal number of questionnaires administered to the public hospital. In general, an average response rate of 90% was achieved.

4.2 Result and Discussion

The data collected was then reconstructed by variables and source hospitals identified by references. Multi-item constructs were aggregated into variable values while the variables values were aggregated by participating hospital. Variable presumed discrete values categorized as integration and an aggregate mean for measurement questions computed. By use of the mean obtained, the mean significantly above 1in a scale of negative 3-3

was categorized as high, aggregate mean between 0-1 as low and aggregate mean below

0 was not significantly above the median value of zero, was categorized as distant.

Continuous values in nature namely inventory management systems and supply chain

performance were also aggregated to means and standard deviation for every hospital. In

terms of the variable of inventory management systems, sharing is as per the figure 4.1

Figure 4.1: Inventory Management Systems
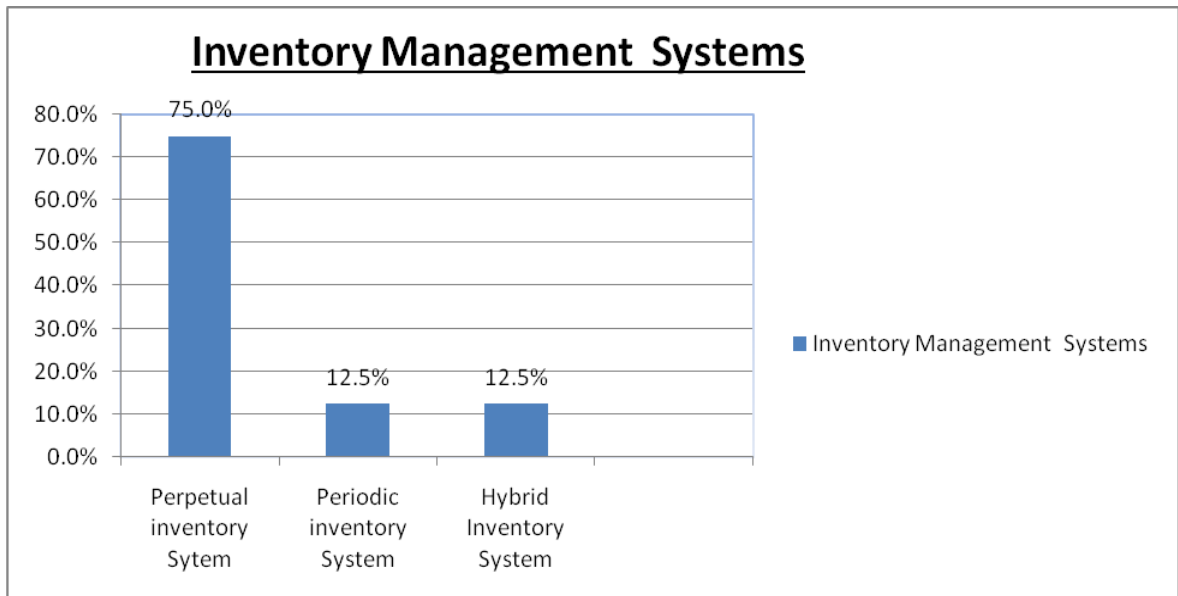
Source: Survey Data 2014

Figure 4.1 indicates that perpetual inventory system was more operational across many

hospitals with a response rate of 75.0%, periodic inventory system and hybrid inventory

system with a response rate of 12.5% each. In terms of level of Hospital integration,

62.5% of the Hospitals had high level of integration while 37.5% of the hospitals had low

level of integration as indicated in figure 4.2.

Figure 4.2: Level of Supply Chain integration
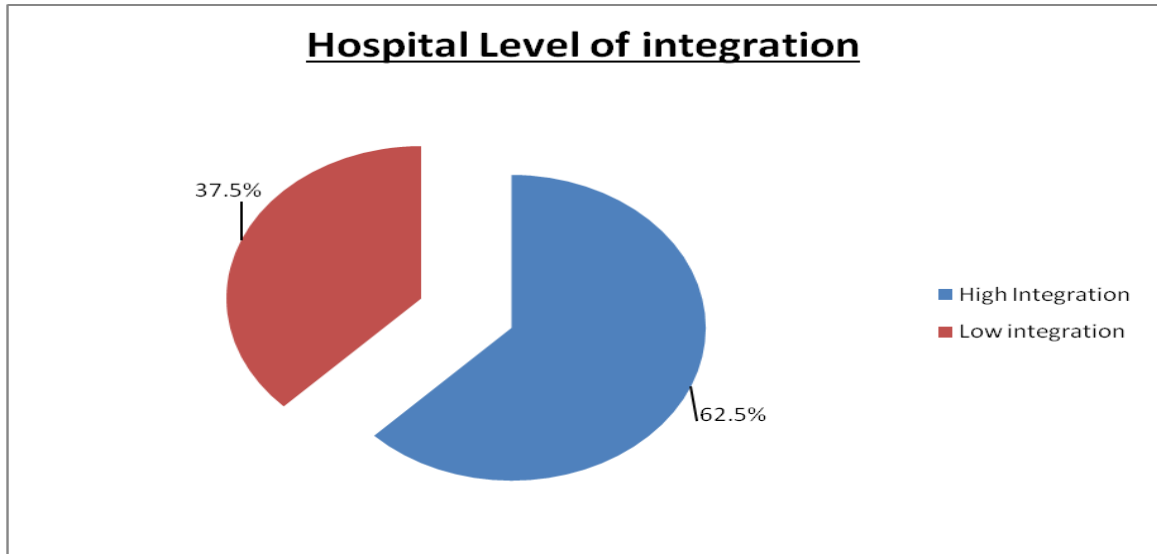
Source : Survey Data 2014

A summary of the computed mean and standard deviation is tabulated in Table 4.2 which presents the inventory management system, level of integration and supply chain performance variables.

Table 4.2: Summary of Mean and Standard Deviation

Hospital	Inventory Management systems	Level of Supply chain integration	Supply Chain Performance	
			Mean	STD
Hospital 1	Perpetual Inventory System	High Integration	3.35	0.244
Hospital 2	Perpetual Inventory System	High Integration	3.63	0.229
Hospital 3	Perpetual Inventory System	High Integration	2.99	0.298
Hospital 4	Perpetual Inventory System	High Integration	2.81	0.358
Hospital 5	Hybrid Inventory System	High Integration	3.50	0.200
Hospital 6	Periodic Inventory system	Low integration	3.18	0.232
Hospital 7	Perpetual Inventory System	Low integration	3.17	0.238
Hospital 8	Perpetual Inventory System	Low integration	2.82	0.285

Source: Survey Data 2014

From the finding shown in Table 4.2, on the respondent level respondent level of agreement the various aspect of inventory management system and supply chain performance, the study found that majority of the respondent agreed that in hospital one, two , three and four there was perpetual inventory system and high integration , in hospital seven and eight there perpetual inventory system and low level of integration , in hospital five respondent agreed that there was hybrid inventory system and high integration whereas in hospital 6 there was periodic inventory system and low integration .

Table 4.3: Inventory Management Systems and Supply Chain Performance

Inventory Management system	High Supply Chain performance	Low Supply Chain performance	Total
Perpetual Expected /Observed	2	4	6
Periodic Expected/ Observed	0	1	1
Hybrid Expected /Observed	1	0	1
Total	3	5	8
Source : Survey data			

Source: Survey Data 2014

Table 4.3 shows the study finding on the cross tabulation between inventory management and supply chain performance, from the finding the study found that most of the respondent indicated perpetual inventory Management and low supply Chain performance.

Table 4.4: Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.845(a)	71	.044

Source: Survey Data 2014

Table 4.4 shows the chi-square results on inventory management and supply chain performance. The Pearson Chi-square Value was 7.8 and the associated P- value (Asymptote Significant Value) was 0.044. This value is less than 0.05 indicating that there is evidence against the null hypotheses and therefore we reject it. A conclusion can therefore be drawn that there is significant relationship between Inventory Management and Supply Chain Performance.

Table 4.5: Level of Supply Chain Integration and Supply Chain Performance

Level of Supply Chain Integration	High Supply Chain performance	Low Supply Chain performance	Total
High Supply Chain Integration	3	2	5
Low Supply Chain Integration	0	3	3
Total	3	5	8

Source: Survey Data 2014

Table 4.5 show the study finding on the cross tabulation between level of supply chain integration and supply chain performance. From the finding, the study found that most of the respondent indicated high supply chain integration and high supply chain performance. This is an indication that high level of supply chain integration led to high supply chain performance.

Table 4.6: Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.745(a)	71	.027

Source: Survey Data 2014

The Pearson Chi-square Value was 3.7 and the associated P- value (Asymptote Significant Value) was 0.027. This value is less than 0.05 indicating that there is evidence against the null hypotheses and therefore we reject it. A conclusion can therefore be drawn that level of supply chain integration significantly influence supply chain performance.

4.3 Regression Analysis

In this study, a multiple regression analysis was conducted to test the influence among predictor variables. The research used statistical package for social sciences (SPSS V 20) to code, enter and compute the measurements of the multiple regressions.

Table 4.7: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.833[a]	.693	.672	.09915

Source: Survey Data 2014

Adjusted R squared is coefficient of determination which tells us the variation in the dependent variable due to changes in the independent variable: From the findings in the above Table the value of adjusted R squared was 0.672, an indication that there was variation of 67.2 percent on supply chain performance due to changes in inventory management system at 95 percent confidence interval . This shows that 67.2 percent changes in supply chain performance could be accounted to changes in inventory

management system. R is the correlation coefficient which shows the relationship between the study variables, from the findings shown in the Table above there was a strong positive relationship between the study variables as shown by 0.833.

Table 4.8: ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.236	1	2.236	14.036	.000[b]
	Residual	11.13	70	0.159		
	Total	13.366	71			

Source: Survey Data 2014

From the ANOVA statics in Table above, the processed data which is the population parameters, had a significance level of 0.0% which shows that the data is ideal for making a conclusion on the population's parameter as the value of significance (p-value) is less than 5%. The calculated value was greater than the critical value (14.036 > 1.984) an indication that inventory management system significantly influence supply chain performance.

Table 4.9: Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig
		B	Std. Error	Beta		
1	(Constant)	.732	.206		3.549	.001
	Inventory management system	.128	.052	.044	2.452	.003

Source: Survey Data 2014

From the data in the above Table the established regression equation was

$Y = 0.732 + 0.128\ X_1$

From the above regression equation it was revealed that holding inventory management system to a constant zero, supply chain performance would be at 0.732, a unit increase in

inventory management system would lead to increase in supply chain performance by a factor of 0.128.

Table 4.3: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.918[a]	.843	.810	.42123

Source: Survey Data 2014

Adjusted R squared is coefficient of determination which tells us the variation in the dependent variable due to changes in the independent variable. From the findings in the above Table the value of adjusted R squared was 0.810 an indication that there was variation of 81 percent on supply chain performance due to changes in inventory management system and supply chain integration at 95 percent confidence interval . This shows that 81 percent changes in supply chain performance could be accounted to changes in inventory management system and supply chain integration. R is the correlation coefficient which shows the relationship between the study variables, from the findings shown in the Table above there was a positive relationship between the study variables as shown by 0.918.

Table 4.4: ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.324	2	.662	3.731	.016[b]
	Residual	12.213	69	.177		
	Total	13.537	71			

Source: Survey Data 2014

From the ANOVA statics in Table above, the processed data which is the population parameters, had a significance level of 1.6% which shows that the data is ideal for making a conclusion on the population's parameter as the value of significance (p-value) is less than 5%. The calculated value was greater than the critical value (3.731> 1.984) an indication that inventory management system and supply chain integration signicantly influence supply chain performance.

Table 4.5: Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig
		B	Std. Error	Beta		
1	(Constant)	.594	.218		2.730	.008
	Inventory management system	.170	.066	.299	2.578	.012
	Supply chain integration	.108	.047	.193	2.607	.013

Source: Survey Data 2014

From the data in the above Table the established regression equation was

$Y = 0.594 + 0.170\ X_1 + 0.108\ X_2$

From the above regression equation it was revealed that holding inventory management system and supply chain integration to a constant zero, supply chain performance would be at 0.594, a unit increase in inventory management system would lead to increase in the supply chain performance by a factors of 0.170, further unit increase in supply chain integration would lead to increase in supply chain performance by factors of 0.108. All the variables were significant ($p<0.05$).

4.4 Discriminant Analysis

Table 4.6: Eigen Value

Function	Eigen value	% of Variance	Cumulative %	Canonical Correlation
1	3.099[a]	94.9	94.9	.869

Source: Survey Data 2014

An Eigen value indicates the proportion of variance explained (Between-groups sums of squares divided by within-groups sums of squares). A large Eigen value is associated with a strong function. The canonical relation is a correlation between the discriminant scores and the levels of the dependent variable. A high correlation indicates a function that discriminates well. The present correlation of 0.869 is extremely high.

Table 4.7: Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.209	97.892	71	.000

Source: Survey Data 2014

Wilks' Lambda is the ratio of within-groups sums of squares to the total sums of squares. This is the proportion of the total variance in the discriminant scores not explained by differences among groups. A lambda of 1.00 occurs when observed group means are equal (all the variance is explained by factors other than difference between those means), while a small lambda occurs when within-groups variability is small compared to the total variability. A small lambda indicates that group means appear to differ. The associated significance value indicates whether the difference is significant. Here, the Lambda of 0.209 has a significant value (Sig. = 0.000); thus, the group means appear to differ.

4.5 Discussion

Result from this study established that the supply chain performance depends on inventory management systems within the organization. This concurs with the findings of Augustine (2013) that highly positive correlation between good inventory management and organizational cost reduction. Meng (2006) arguments also support this finding that effective inventory management, procurement goals would be achieved and whole supply chain optimized. The study exposed that high level of integration was popular at 62.5 % of the public hospitals. This is in line with Halley and Beaulieu (2009) that supply chain management practices may be either integrated or distant with upstream or downstream partners and highly integrated supply practices mastered and operational competency in logistic services.

Zailani and Rajagopal (2005) supported that potential benefit of integrating the supply chain would be realized only if the interrelationships among different parts of the supply chain are recognized and proper alignment for company's competitive strategy. The study established that there was low relationship between inventory management and level of integration. This is supported by the arguments of Wong et al (2005) that supply chain management is not yet capable of managing the level of volatility and seasonality in term of ordering behavior.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

From the analysis and data collected, the following discussions, conclusion and recommendations were made. The responses were based on the objectives of the study. The study sought to establish inventory management systems in use in Public Hospital and to determine the relationship between inventory management systems and supply chain performance.

5.2 Summary of Findings

The study revealed that continuous values in nature namely inventory management systems and supply chain performance. The study found that perpetual inventory system was more operational across many hospitals with a response rate of 75.0%, periodic inventory system and hybrid inventory system with a response rate of 12.5% each. The study established that 62.5% of the Hospitals had high level of integration while 37.5% of the hospitals had low level of integration.

The study established that majority of the respondent agreed that in hospital one, two , three and four there was perpetual inventory system and high integration , in hospital seven and eight there perpetual inventory system and low level of integration , in hospital five respondent agreed that there was hybrid inventory system and high integration whereas in hospital 6 there was periodic inventory system and low integration .

On the relationship between inventory management and supply chain performance, from the finding the study found that most of the respondent indicated perpetual inventory

management and high supply chain performance. From the finding on chi-square on the inventory management and supply chain performance, the Pearson Chi-square Value was 7.8 and the associated P- value (Asymptote Significant Value) was 0.044. The study found that there is significant relationship between Inventory Management and Supply Chain Performance.

From the finding on the level of supply chain integration and supply chain performance. The study found that most of the respondent indicated High Supply Chain Integration and high supply chain performance and low supply chain integration and low supply chain performance. This is an indication that high level of supply chain integration led to high supply chain performance. The Pearson Chi-square Value was 3.7 and the associated P-value (Asymptote Significant Value) was 0.027. The study established that that level of supply chain integration significantly influence supply chain performance.

From the finding on the regression analsyis , the study found that 67.2 percent on supply chain performance due to changes in inventory management system; this is an indication that 67.2 percent changes in supply chain performance could be accounted to changes in inventory management system. The study established that there was strong relationship between supply chain performance and inventory management system as shown by correlation coefficient   of   0.833. From the ANOVA statistic, the study found that inventory management system signicantly influence supply chain performance.

The study revealed that 81 percent   changes in supply chain performance could be accounted to changes in inventory management system and supply chain integration. The

study revealed that there was strong positive relationship between supply chain performance and inventory management system and supply chain integration as shown by strong correlation coefficient of 0.918. From the ANOVA statistic the study revealed that that inventory management system and supply chain integration significantly influence supply chain performance.

5.3 Conclusion

The study findings, it can be concluded that inventory management systems and level of integration adopted impacts on supply chain performance within the public hospital in Nairobi, Kenya. Finally, it can be concluded that inventory management systems are key in influencing supply chain performance. For better supply chain interrelationship, a high level of supply chain integration is the way forward toward achieving the benefits of integration in supply chain.

5.4 Recommendations

Based on the findings drawn from the study, the researcher makes the following recommendation:

i. The public hospitals should ensure that a proper inventory management system is implemented.

ii. Public Hospitals should ensure integration of different inventory management systems in inventory management to control the costs involved.

iii. The current supply chain integration practices need to be reviewed and redesigned to fit the evolving dynamic market environment.

iv. All stakeholders in inventory management should be involved in the management of inventory processes.

From the study and related conclusions, the researcher recommends further research in the following areas:

i.   Studies on inventory management system and supply chain performance in private sector in Kenya and globally.

ii.   Replication of the study after sometime with the same public hospitals to compare the result.

iii. How to select the appropriate inventory Management systems in public Hospitals.

5.5 Limitations of the Study

Limitation in the study was respondent were busy during working hours thus limiting number of questionnaires returned. Few respondents had fear to provide information that could be used for confidentiality policies in the hospital. In conclusion supply chain performance in public hospitals is influenced by political, environmental, social cultural, economic, technological and legal factors that are not brought out in the study.

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Appendix 1: Questionnaire

Dear Respondent,

This questionnaire is designed to collect information aimed at assessing the impact of inventory management systems on supply chain performance in public hospitals in Kenya. The information obtained will be used strictly for academic purposes and it will be treated with utmost confidentiality. I kindly request you to fill this questionnaire.

Reference No…………………………………………..

(Tick (√) in the appropriate box provided)

1. Which statement best describe what happens in our hospital inventory management? (Please tick)

Procurement of all inventories is carried out once each year	
Items requisition is fixed and actual ordering is triggered by inventory dropping to a specified level.	
Inventory is ordered at the end of a predetermined time period	
The right inventory is requisitioned when needed and delivered at the right time, at the right place, and in the exact amount, without the safety net of inventory	
Hospital provides inventory information to suppliers of different product and the supplier takes full responsibility for maintaining an agreed inventory of the material.	
Inventory is procured throughout the year	

2. The statements describe what may or may not be happening in our hospital and the numbered space provides a descriptive qualification of these statements below:

a) Please indicate by ticking at this appropriate number what in your perception would describe best this subject- Information on inventory management.

Not shared with   Shared with

supplier at all

-3	-2	-1	0	1	2	3	Suppliers

b) Please indicate by ticking at this appropriate number what in your perception would describe best this subject- Decision of suppliers

Described on procurement forum

| -3 | -2 | -1 | 0 | 1 | 2 | 3 |

Described by cross functional forum

c) Please indicate by ticking at this appropriate number what in your perception would describe best this subject- Decision on pricing

Provided before Technical specifications

| -3 | -2 | -1 | 0 | 1 | 2 | 3 |

Provided only after technical specifications

d) Please indicate by ticking at this appropriate number what in your perception would describe best this subject- Job description for key logistic positions?

Not written and disseminated at all

| -3 | -2 | -1 | 0 | 1 | 2 | 3 |

Written and disseminated to stakeholders

e) Please indicate by ticking at this appropriate number what in your perception would describe best this subject- Inventory management process mapping and situation analysis?

Conducted by procurement only

| -3 | -2 | -1 | 0 | 1 | 2 | 3 |

Conducted by a team

f) Please indicate by ticking at this appropriate number what in your perception would describe best this subject- Inventory Procurement process and planning

Difficult and long

| -3 | -2 | -1 | 0 | 1 | 2 | 3 |

Flexible and short

g) Please indicate by ticking at this appropriate number what in your perception would describe best this subject- System levels that defines the relationship of suppliers and user

Many system levels	-3	-2	-1	0	1	2	3	Few system levels

h) Please indicate by ticking at this appropriate number what in your perception would describe best this subject- Inventory management reports are shared up and down the supply chain with stakeholders

Not Shared amongst the stakeholders at all	-3	-2	-1	0	1	2	3	Shared amongst the stakeholders

i) Please indicate by ticking at this appropriate number what in your perception would describe best this subject-Hospital Logistics, technical working groups and committees meetings

Infrequent meetings	-3	-2	-1	0	1	2	3	Regular meetings

j) Please indicate by ticking at this appropriate number what in your perception would describe best this subject- Inventory management objective indicators

Shared only by procurement	-3	-2	-1	0	1	2	3	Shared by stakeholders

3. Indicate how often, you required an item but were out of stock? (Please tick)

  1 out of 2   ☐

  1 out of 5   ☐

  1 out of 10   ☐

  1 out of 20   ☐

4. Please indicate your perception of your hospital's performance in relation to other Hospitals in the same range by; - (Please tick in spaces provided against each row the column).

	Much worse	Worse	About the same	Better	Much better
Inventory related Cost Management					
Level of expired inventories in the stores					
Demand planning and forecasting of inventories					
Level of inventories Holding in all store					
Timely inventory delivery to users					
Handling the late orders					
Hospital communication with suppliers					
Relationship between procurement unit and user departments					
Relationship between Procurement unit and suppliers					
Sharing of inventory information cross stakeholders					
Levels of user department complaint on inventory issues					
Level of inventory management automation by use of modern technology					

Thank you very much for your time and co-operation