THE INTERNATIONAL JOURNAL OF HUMANITIES & SOCIAL STUDIES

Success Strategies for Efficient Healthcare Supply Chain Management: The Experiences of Tertiary Hospitals in South-South Nigeria

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Abstract:
Access to improved healthcare, shortage of life-saving commodities and the increased costs of handling medical stocks remain the major operational problems of public hospitals in less-developed countries. A key challenge for mitigating these problems is how to make the management of hospital commodity supplies more efficient. Using the mixed methods design, this study explores the success strategies for efficient healthcare supply chain management in South-South Nigeria. Two hundred and forty-four (244) randomly-selected procurement, central stores, and audit unit officers; working in six tertiary hospitals constituted the study participants. Relevant qualitative and quantitative data were gathered and analysed for the study. Results shows that success in efficiency of managing medical supply chain is significantly influenced by important strategies, namely: flexible procurement, logistics out sourcing, good stock management, and supplier selection attributes. The study highlights some policy implications.

Keywords: Supply chain management, flexible procurement, logistics outsourcing, inventory management

1. Introduction

A supply chain could be thought of as a virtual network of organisations that are involved, through upstream and downstream linkages, in different processes that create value by making products and services available to the ultimate customer (Christopher, 1992). In the context of public sector healthcare, the supply chain reflect a system of interrelated activities required for the flow of drugs, vaccines, equipment, consumables and services to satisfy the needs of those who serve patients and the information systems necessary to monitor these activities (Toba, Tomasini &Yang, 2011).

The importance of supply chain management (SCM) in public sector health systems, particularly in less-developed nations is increasingly acknowledged (Daniel, David & Weidong, 2013). The management of supply chain is considered a priority and a challenge for public health policy and decision makers,given the increasing number of health products, programs and patients. Therefore, the core value of supply chain management is to provide products to usersat the right place and time, in the right condition and quality, and for the right cost. This implies that public health supply chain must properly coordinate all activities within the material supply value chain. When coordination fails, inventories build up and the leanness and cost efficiency of material flow suffers (Turhan & Vayvay, 2012). Surveys have shown that public hospitals that strategically coordinates their supply chain tend to achieve efficiency in many operational areas. Statistics discloses, for instance, a 25% inventory cost reduction, 30% increase in on-time delivery, and a nine-fold reduction in out of stock rate (Efficient Healthcare Consumer Response (EHCR) 2001; Express Healthcare, 2011).

Efficient supply chain in this context relates to the time, cost and flexibility necessary to deliver an order to the last mile user. By time, it implies the delivery speed and consistency of order delivery (Fitzsimmons &Sullivan, 2006). Obviously, the hospital would expect fast delivery from its material vendors, yet quick delivery has no value if it lacks consistency from one order to the other. To achieve a balanced supply operation, suppliers usually focus on consistency of service delivery first and subsequently seek to improvion delivery speed afterwards (Turker, 2004).

Product or service delivery cost is another important aspect of SCM efficiency that demands hospital's attention. A health commodity supplier would like to ensure that the cost of achieving efficient order fulfillment is inversely proportional to its

expected gain. This implies that the time value of rapid order delivery should not be sacrificed by the attendant cost of delivering an order (Rushton, Croucher & Baker, 2009). Changes in hospitals' need and occasional malfunction of service process could also pose serious efficiency problems. If not properly addressed, it could result in increased costs for the hospital, or lead to dissatisfaction and switching intention.

The flexibility with which a supply organisation accommodates and addresses process malfunction or operational failures constitutes another measure of efficient SCM (Daniel et al.,2013). In supply chain function, operational failure refers to a situation where a worker does not have the right supplies, equipment, information, or people needed to complete work tasks. This could be as a result of equipment failure, late deliveries, inadequate reagent supply, inaccurate invoice documentation, and lack of information needed to complete a supplier order (Turker, 2004). When such failure occurs, the agility of recovery also constitutes an essential measure of operational efficiency. Thus, supply chain operational efficiency is concerned with how best a hospital handles all aspects of its supply operations on a daily basis with minimal utilization of available resources (Stevenson, 2012; Turker, 2004).

In Nigeria, the need to resourcefully manage hospital supplies is crucial given the current uncoordinated state of public health supply chain (Federal Ministry of Health 2010). Thus, this paperargues that by efficiently managing the supply chain function, public healthcare systems are likely to gain significant improvement in their procurement, storage, and other logistics functions. Improvement in healthcare supplies, even in small measures, can yield considerable resource savings that could be used for other purposes. This can be in the form of hospital expansion, increased access to essential medicine, and provision of free services to the host community. With efficient SCM, the totality of public health operation and sustainability of health commodity supplies could be enhanced. The results could be seen in terms of reduced cost, reduced delivery lead-time variability, improved service level, more satisfied patients, and better work flow for hospital employees (Umoh, 2012; Claassen, Weele & Raaij, 2008; Kuk, 2004; Disney, Potter & Gardner, 2003).

Although, the potentials in efficient management of supply chain is widely acknowledged theoretically, little is known about the strategies necessary to drive its success for public healthcare organizations. This is in terms of the conditions under which supply chain management will result in efficiency, and what to include in the planning process. Consequently, in their struggle to make SCM work, many public health institutions particularly in South- South part of Nigeria have found it difficult to reap the suggested benefits of efficient supply chain management in practice. For instance, a pre-study observation by the author suggests that despite the implementation of SCM, the selection of the ultimate/prime supplier of healthcare products and materials are still based on attributes that do not encourage strategic collaboration such as the dependence on bidding costs and financial capability.

Similarly, the outcome of health commodity quantification in many public hospitals are fraught with poor quality of source data. In other words, the average monthly consumption data on which the estimation of commodity need largely depends, is in accurately calculated for reasons ranging from lack of skill/know-how, complacency, and other human-related factors. These have often led to managerial inefficiencies that sometimes result in stock-outages, increased administrative costs, low order-fill rate, and longer replenishment lead time for essential drugs, vaccines and medical consumables. Consequently, it may not be out of place to state that the factors necessary for efficient management of commodity supplies in the healthcare sector are still not sufficiently understood, additional research is therefore necessary.

This study is therefore aimed at exploring the experiences of supply chain executives in tertiary hospitals in order to identify the success strategies for achieving efficient healthcare supply chain in South-South Nigeria. In specific terms, the study examines how flexible procurement, logistics outsourcing, stock management and good housekeeping, and supplier selection influences efficient hospital supply operation.

2. Methodology

2.1. The Sample

This study was based on the mixed methods design. It combines the strength of both quantitative and qualitative research approaches in one study (Creswell & Clark, 2010; Hair, Anderson, Tatham, & Black, 2009). The quantitative approach entails the collection of primary data through a structured questionnaire, and analyzing data numerically. The semi-structured interviews were carried out to collect qualitative data from key respondents. The use of quantitative and qualitative methods in combination provides a better understanding of the research problem than either used individually (Hair et al, 2009).A census of all384middle and lower level supply chain managers constituted the study participants. They were drawn from the six tertiary hospitals in the South-South region of Nigeria. These hospitals were considered for the study because: a) they were all federally- owned hospitals, b) their SCM activities were somewhat homogenous, c) they operate at apex level of healthcare, and d) confined to handling issues of medical supply chain at a strategic level.

2.2. Instruments

The questionnaire was developed and tested (pilot study) for validity and reliability. Inputs were taken from extensive review of relevant literature, conceptual models and pre-survey discussions with healthcare supply chain practitioners. The questionnaire consisted of 65 statements designed to prompt responses on the strategies that ensure success for efficient health commodity supply chain. Personal interview (face-to face) was carried out for head of procurement, store and warehousing units of

the hospitals. The interviews were carried out to explore the personal experiences of key supply chain managers in the tertiary hospitals. They were also conducted to gain insight into what success strategies were adopted to ensure efficient healthcare commodity supply chain. A typical interview session lasted between 30- 45 minutes. A total of 244 managers responded to the structured questionnaire which gave a 64 percent response rate.

2.3. Measures

The pre-validated questionnaire and semi-structured interview schedule was used to collect data on efficient health care supply chain management (the dependent variable) and the success strategies (the independent variable). A compendium of items exploring the success strategies focused on flexible procurement, logistics outsourcing, stock management approach, and supplier selection attributes. Efficiency was measured in terms of how the entire hospital supply chain performs. Based on the review of supply chain literature and pre-study discussion with practitioners, three indicators were used: (a) Costs efficiency- total cost of holding stocks at medical stores in a given point in time (b) delivery timeliness- defined as total elapse time between order placement and order delivery, and (c) delivery quality i.e. the proportion of rejects from the sample population of ordered items received.

2.4. Data Analysis Techniques

Data produced at the descriptive stage of the analysis were converted into summaries and used for estimating relationship between variables. Consequently, the Hierarchical linear modeling- an advance form of ordinary least square regression was utilized to estimate the contributions or effects of each explanatory variables towards predicting changes in the dependent variable, and to assess the overall fit of the research model. Qualitative data gathered through in-depth interview (IDI) were transcribed verbatim from source and presented by categorizing responses in line with emerging themes.

3. Results and Discussion

3.1. Descriptive Analysis

A range of success strategies might be associated with efficient hospital supply chain management. In order to identify these strategies, respondents were asked to state how important some flexible procurement, logistics outsourcing, stock management, and supplier selection strategies were as they involve daily to manage hospital supplies. Mean and standard deviation was used to analyse the results. The mean score of $\geq$ 3.00, derived by dividing the sum of the scale by 5, was used as a threshold for making decision. Consequently, the higher the mean score, the more the respondents tended to approve the statement. Results are shown on Table 1

With regard to flexible procurement, material need analysis (quantification) had the highest mean score (Mean=4.34, SD= 0.92) and could therefore be rated highly important. Open contract negotiation (Mean = 4.12, SD= 0.81), post-delivery verification(Mean = 4.03, SD=0.78) and transparent tendering (Mean = 3.41, SD=1.16)were also considered important amongst hospital supply chai managers as indicated in Table 1.

How Important Are the Following Strategies for Achieving Success of Your Supply Chain Management Efficiency?	Mean	SD
Flexible procurement strategy		
Quantification (material needs analysis)	4.34	0.92
Open contracting	4.12	0.81
Post-delivery verification/audit	4.03	0.78
Tender integrity (transparent tendering)	3.41	1.16
Logistics outsourcing strategy		
Storage and distribution outsourcing	3.51	0.93
Material/drugs repackaging outsourcing	3.23	1.37
Warehouse and stores management outsourcing	2.40	1.43
Stock management strategy		
ABC-based stock classification	4.23	0.82
Good housekeeping	3.78	0.92
Stock expiry prevention/control	3.17	1.57
Use of ICT	1.26	2.52
Physical stock review/audit	1.14	2.83

How Important Are the Following Strategies for Achieving Success of Your Supply Chain Management Efficiency?	Mean	SD
Supplier selection strategy		
Delivery quality	4.05	0.97
Delivery lead-time	3.99	0.88
Quotation cost	3.14	1.32
Performance history	2.11	1.68

Table 1: Success Strategies for Efficient Health Commodity Supply Chain (N=244)
Note: 5= Very Important, 1= Not At All Important, Mean Score of > 3.00
Taken As Decision Threshold

Respondents seemed to envision that hospital supply chain could be strengthened to deliver the right quality of medical products to last-mile users, at the right time, the right form and minimal costs, when: a) contract for supply of medicine and medical equipment are open to transparent and competitive bidding processes; b) the items selected for procurement emanate from rigorous process of user-need analysis (quantification);and c) materials received into storeroom are subjected to post-delivery inspection, verification and audit. An excerpt from one interview respondent also corroborated this finding:Well, procurement practices in this hospital depends on the type of project at hand. That is, whether you are procuring consumable items like latex gloves, sensitive reagents or capital intensive and specialized device like the X-ray machine. For a capital item, we procure through a bidding process, starting from what we call need analysis, through sourcing, and of course you must have had fund budgeted for that purpose, preparation of standard bidding documents, and advertisement which gives room for competitive bidding. All these we do in consonance with the requirements of section 24 of the National Procurement Act 2007. When the bids are collected, we open and register the bids, we evaluate the content and their quotation and ask for the contractor that becomes the best bidder to come in and make supply within 14 days. Whatever we do in this unit follows standard bidding regulations for goods from the Bureau of Public Procurement which is an agency of the federal government… we don't work in isolation, but in conformity with the Procurement Act, 2007 (Procurement Officer, Federal Medical Centre, Yenagoa)

Similarly,Table 1 also disclosed that storage and distribution (Mean=3.51, SD=0.93), and material/drugs repackaging(Mean=3.23, SD=1.37) were two important logistic functions that were outsourced to 3PL firms. The outsourcing of warehousing function t (Mean=2.40, SD=1.43) was not important to achieving supply chain efficiency amongst the surveyed respondents. All storage and inventory management strategies had significant mean score except ICT usage (Mean=1.26, SD=2.52) and physical stock review and audit (Mean=1.14, SD=2.83). Though arguably, respondents may have perceived that efficiency in hospital supply chain could be achieved in as much as medical inventory is classified following the ABC rule, effort is made to minimize the risk of stock expiry, and good housekeeping practices are adhered to. With reference to good housekeeping, the finding in this study seemed consistent with that of Hani, Basri & Winarso, (2013). The authors reported that as a measure of efficiency, good housekeeping elongates the potency of stored medicine, test kits, reagents and medical consumables. In terms of supplier selection as a success strategy, respondents tend to attach the greatest value on deliveryquality (Mean=4.05, SD=0.97). Performance history appear to be not a very important attribute for successful management of healthcare supply chain amongst respondents under study.

3.2. Multivariate Analysis- Predictors of Efficient Medical Supply Chain Management
In order to construct a simple model that can predict overall success of hospital supply chain management efficiency, hierarchical linear analysis was performed. To do this, the dependent variable used was supply chain management efficiency success, and the strategies for success were flexible procurement, logistics outsourcing, stock management approach, and supplier selection attributes. The results are summarized in Table 2.

	Determinants	Beta Estimate	Std. Error	t-Ratio	Sig
	Intercept (α)	-2.323	0.811	-2.864	0.005
	Flexible procurement strategy				
	Quantification (material needs analysis)	0.223**	0.085	2.624	0.008
	Open contracting	0.212**	0.100	2.120	0.002
	Tender integrity (transparent tendering)	0.182*	0.082	2.220	0.034
	Post-delivery verification/audit	0.214**	0.093	2.301	0.007
	Logistics outsourcing strategy				
	Storage and distribution outsourcing	0.163*	0.043	3.791	0.032
	Warehouse and stores outsourcing	-0.027	0.219	-0.123	0.569
	Material/drugs repackaging outsourcing	0.234**	0.061	3.386	0.008
	Stock managementstrategy				

Determinants	Beta Estimate	Std. Error	t-Ratio	Sig
ABC-based stock classification	0.363**	0.154	2.357	0.001
Physical stock review/audit	-0.102	0.221	-0.464	0.149
Good housekeeping practices	0.235*	0.087	2.701	0.002
Stock expiry prevention/control	0.232**	0.065	3.569	0.006
Use of ICT	0.242	0.293	0.826	0.168
Supplier selection strategy				
Delivery lead-time	0.270**	0.078	3.462	0.003
Delivery quality	0.158*	0.064	2.469	0.015
Quotation cost	0.016	0.148	0.108	0.538
Performance history	-0.041	0.183	0.022	0.104
R	.838			
R²	.833			
Adjusted. R²	.348			
Standard Error	3.73251			
D-Watson	1.630			
F Value	180.228			

Table 2: Model Predicting Supply Chain Management Efficiency Success
Note: Dependent Variable (Supply Chain Management Efficiency)
Regression Coefficient Is Significant At *P < 0.05, ** P < 0.01

The model having eleven (11) significant independent constructs was found to predict overall efficiency of supply chain management success in healthcare. An impressive 0.838 (83.8%) coefficient of determination (R^2) can also be observed on the model.It signifies a strong relationship between the predictors (Success strategies) and SCM efficiency. The rexult also indicates the adjusted coefficient of determination (adjusted R^2) as 0.833. This implies that the fitted model and its predictor variables altogether explains about 83.3% (the capacity of the independent variable to forecast the dependent one is expressed in per cent)of variance in hospital SCM efficiency. The balance of 16.7% could be attributed to either chance error or exogenous variables not considered in the study. The overall model fit seems satisfactory with F-statistics =180.228at 5% criticalleveland p-value ($p<0.0001$). Thus, the result can be generalized. In other words, this model is a good description of the relations between the dependent and predictor variables. The DurbinWatson statistic which measured the presence of serialcorrelation in the variables showed 1.630, indicating that a relatively small autocorrelation existed among the variables in the model; this was so given the acceptable DW value of 2.0.

In summary, the results imply that a percentage increase in any of the success factors could stimulate proportional increase in supply chain management efficiency rating. In other words, by increasing the accuracy and timeliness wherein customer order, inventory level, and market information are shared amongst supply partners by one percent, tertiary hospitals could derive huge improvement in hospital supply efficiency. Thus, healthcare professionals could achieve desired level of supply chain management efficiency by implementing series of strategies revealed by the findings in this study.

4. Conclusion

Seeking to gain operational efficiency through SCM is considered a strategic path that should be taken by all firms, particularly healthcare delivery organisations. Daily, public hospitals are struggling with the challenge of increased costs of healthcare provision as they try to keep up with expectation from patients. Therefore, healthcare supply chain must be efficient and integrated to remain competitive and live up to its social obligation. An important means of achieving sound healthcare delivery at minimal costs, at the right quality and at the right time, to the last-mile users is supply chain management. This study has provided relevant findings to ensure that Nigerian tertiary hospitals achieve operational efficiency in medical supplies and therefore improve on access to essential healthcare delivery.

In conclusion, the most important findings in this study are: First, hospitals could have improved supply operations in terms of delivery timeliness, delivery quality, and reduced operating costs if they manage their medical stores effectively; strategically select their suppliers; embrace flexible procurement; and outsource some logistics functions to third party private firms. Second, the exchange of accurate and timely information regarding inventory position and costs, incoming orders, and demand data along the supply chain network is capable of enhancing efficient supply operations. Third, the sharing of relevant information can be facilitated by robust integration of information technologies, entering into strategic collaboration with suppliers, as well as ensuring the use of the right criteria for selecting commodity vendors.

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