



## Optimizing Operational Performance of Pharmaceutical and Health Companies in Nigeria through Efficient Materials Management Practices

Osirim Monday <sup>1\*</sup>, Okoronkwo Ngozi Augustine <sup>2</sup>, Ahiakwo Ukachukwu Simon <sup>3</sup>

<sup>1</sup> Department of Accountancy, Ken Saro Wiwa Polytechnic, Bori, Rivers State, Nigeria

<sup>2</sup> Department of Clinical Pharmacy and Pharmacy Administration, Abia State University, Uturu, Nigeria

<sup>3</sup> Department of Accountancy, Ken Saro Wiwa Polytechnic, Bori, Rivers State Nigeria

\* Corresponding Author: **Osirim Monday**

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### Abstract

Efficient management of raw materials, drugs, active pharmaceutical ingredients (APIs), and other medical materials and devices could result in an improved operational performance of pharmaceutical companies. Thus this paper seeks to investigate the relationship between materials management and operational performance of listed pharmaceutical companies in Nigeria on one hand and on the hand to provide information on material management practices that improves operational performance of the firms. Primary data was generated through structured thematic questionnaire responded to by 120 management and executive staff members of four (4) firms purposively selected out of the ten (10) listed pharmaceutical and health companies. Data collected was analyzed using descriptive statistics - weighted mean, standard deviation, correlation analysis and multiple regression statistical tools. The study revealed that the explanatory variables (materials management and its proxies) exert significant positive effect on operational performance measured using waste reduction, cost reduction and customers service satisfaction of the sampled firms. Therefore, this study concluded that materials management has positive and significant effect on operational performance of pharmaceutical firms in Nigeria, specifically when measured in terms of waste reduction, cost reduction and customers' service satisfaction. The study recommended that pharmaceutical companies need to ensure optimal control and efficient management of materials by establishing a specialized and independent materials and inventory management department that will solely be in charge of managing the materials and other pharmaceutical inventories.

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### 1. Introduction

In accounting, materials generally refer to the assets or items used up in the production of a company's products or services which they sell to consumers. This includes raw materials, components, or supplies that are directly utilized to make the finished products which in the case of pharmaceutical firms may include drugs, vaccines, and other medications or medical devices. Thus pharmaceutical materials are substances or ingredients used in the production of pharmaceutical products and most of these ingredients are sourced from outside Nigeria due to various factors and constraints which include non-unavailability of such materials in the local market, poor quality of few available materials, inefficient management of materials because of lack of expertise, among other factors. Most of the raw materials are imported mainly from India and China due to lack of functional petrochemical industry (Business Day, 2021) <sup>[4]</sup>. The cost of pharmaceutical materials just like other materials are classified as direct cost and recorded as an expense in the statement of profit or loss account when such materials are consumed/transformed during the manufacturing process to create finished products. The value of materials is recorded as inventory on the statement

of financial position until they are consumed and once used up, they are expensed.

The management of raw materials and other medical supplies in the pharmaceutical industry is imperative given the sensitive and vital nature of the industry to the health need of the society. Raw materials are the input goods or inventory that a company needs to manufacture its products and for pharmaceutical firms these include natural raw materials like leaves, flowers, fruits, fungi and seeds, synthetic materials and biologics. Other materials and supplies include oil, honey, corn, grain, minerals, bottles, plastics, etc. Common types of primary raw materials for pharmaceutical packaging include bottles, blister packs, sachets, vials, ampoules, and prefilled syringes. The secondary packaging is the outer packaging which provides extra protection and some kinds of aesthetics to the primary packaging. Before use, such materials must be qualified and inspected to ensure best practices. Thus raw material qualification is the process of establishing the source, identity, purity, biological safety and general suitability of a given raw materials prior to deploying it for intended purposes(s).

The role of the pharmaceutical industry in a nation's economy cannot be waved aside and this makes efficient management of materials very essential. There are evidences in less advanced economies like Nigeria that the pharmaceutical industry play a vital role in the overall health needs of the citizens (Urias, 2017) <sup>[19]</sup>. According to a report commissioned by the International Federation of Pharmaceutical Manufacturers and Associations (IFRMA), the pharmaceutical sector continues to contribute to the global economy in all regions. Owing to its relevance in the overall welfare and health needs of the public, it is therefore important to pay rapt attention to developmental issues affecting the pharmaceutical sector especially in the area of materials management. Thus adequate plans for the continuous availability of materials must be made not only to guarantee the continued survival of the pharmaceutical sector but to ensure operational efficiency of firms operating in the health and pharmaceutical industry.

Material constitutes a large percentage of every firm's expenditure. Researchers assert that materials are responsible for over 50% of the annual earnings in enterprises (Ogbadu, 2009; Ondiek, 2009) <sup>[13, 15]</sup> and pharmaceutical firms are no exemption. Managing materials especially raw materials for preparing drugs and vaccines involves formulating and adhering to a consistent performance strategy in order to improve quality of products, reduce costs of operation, satisfy customers, reduce waste as well as seek to enhance the overall operational performance of the firm. Efficient materials management practices is consequently imperative for a pharmaceutical and other firms in order to optimize the use of constrained available materials and other resources, manage and also to eliminate non-value added costs. Such optimization of material resources might contributes to the improvement in market demand and customer satisfaction in an intense competitive business environment.

#### **Statement of the problems and the missing gap:**

Pharmaceutical, health and other businesses in Nigeria face a significant obstacle as a result of constant increase in the cost of operation, which requires them to take steps to reduce waste of materials, reduce costs and explore ways of enhancing customers' satisfaction and product quality. Pharmaceutical firms in Nigeria are faced with other issues that border on efficient production of drugs and other medical

products. These challenges arise from the unabated importation of pharmaceutical raw materials from overseas and the inefficient management of these imported materials as well as those sourced internally.. The sector is constrained by lack of adequate raw materials, inadequate modern technology for management of pharmaceutical materials, inadequate human capacity involved in the production and management of materials, among other things. Increase in exchange rates has also affected the cost of pharmaceutical raw materials coupled with rising cost of production.

The pharmaceutical supply chains which involve sourcing for raw materials, manufacturing, distribution, and delivery medications to patients is also faced with other challenges that may result in delays, shortages and wastage of materials if not efficiently managed thus necessitating effective collaboration and meticulous materials and inventory management throughout the supply chain. Among the 10 supply chain and materials management issues identified by Operations Research for Health Care in 2014, lack of coordination of materials and supply chains, poor inventory and order management, ineffective warehouse management and drugs expiration are common issues encountered by pharmaceutical firms globally.

Every pharmaceutical firm that intends to continue in business has to continually work to reduce waste, cut cost, improve quality, satisfy customers and generally improve materials management to boost operational performance. Empirical research studies in materials management are relatively few in developing countries as Nigeria. Few studies carried out in Nigeria used profitability as a measure of organizational performance. This study deviated from this practice by using operational performance measures such as waste reduction, cost reduction and customers' service satisfaction. As a result, the objective of this study was to investigate the association between materials management and operational performance in Nigerian pharmaceutical and health firms listed on the Nigerian Stock Exchange.

## **2 Literature Review**

### **2.1 Materials Management**

Materials play important role in every business including pharmaceutical businesses as raw materials like leaves, seeds, etc are needed in the production of drugs, syrups, anti-biotics vaccines and other medical products and as such, should be available at the appropriate time, right quantity, place and price. Too much or too little amount of materials could be detrimental to the company. Hence there is a need for materials management so as to control the flow of materials in the most optimal manner. Many scholars have defined and given clear explanation to the concept of materials management and some of those definitions are reviewed.

De Rose (1956) <sup>[7]</sup> defined materials management as "the planning, directing, controlling and coordinating of all those activities concerned with materials and inventory requirements from point of their inception to their introduction into the manufacturing process. Besides, he asserted that materials management starts with the determination of material quality and quantity, and ends with issuance to production in time to meet customers demand at a reduced cost. This definition however have been criticized for its vagueness and lack of precision as planning, directing, controlling, coordinating and organizing are part and parcel of management itself.

Materials management is a method that put together the

stream of supplies into and out of an organization to accomplish a height of service which guarantee that accurate materials are on hand at the right place, at the right time, in the right quantity and quality and at the right cost (Rahman, 2014). It comprises the function of procurement, material treatment and storage, production and inventory management, packaging, transportation and associated information system and their use during supply, manufacturing, services and distribution. Materials management gets together tasks for shaping manufacturing necessities which include scheduling of manufacturing procedure, procurement, storage and administration of materials (Wild, 1995; Ondiek, 2009) <sup>[15]</sup>. Banjoko (2000) asserted that the key objective of material management are to

ensure that the exact items are procured and are on hand for the manufacturing operations at the exact time, exact place and at the cheapest cost.

Chase *et al*; (2009) <sup>[6]</sup> explained that the concept of materials management encompasses the total system technique to the management of the entire flow of materials, and services from raw materials suppliers through factories and warehouses to the end users. These explanations provide a clear scope of material management to include material requirements planning, materials resource planning, production control, materials procurement, inventory management, storage and warehouse management, distribution of finished goods at minimum cost at due time among others. (Osotimehin, 2006) <sup>[17]</sup>.

**Table 1:** Top ten (10) supply chain management issues as noted by Operations Research for Health Care (2014) faced most pharmaceutical companies include:

SN	Supply chain issues	Description
1	Lack of Coordination	Fragmentation/lack of materials resource coordination
2	Inventory Management	Poor inventory and materials management, stock outs, etc
3.	Lack of Demand Information	Demand information is often not known
4.	Human Resource Dependence	Lack of expertise and poor personnel capacity
5	Poor Order Management	Poor planning, ordering and follow up
6.	Shortages avoidance	Shortages of drugs, vaccines, etc
7.	Expiration	Expiration of drugs, vaccines and other medications
8.	Temperature control	Poor temperature control of drugs and vaccines
9.	Warehouse Management	Poor warehouse control and management
10.	Shipment visibility	Poor shipment control and management of drugs, etc

#### Adapted from: Operations Research for Health Care (2014) Report

As noted in a 2005 Kaiser Family Foundation report, the pharmaceutical supply chains strategies that would ensure that materials and drugs inventory are available and distributed to patients include: the production of quality drugs by pharmaceutical firms, transfer of those drugs to wholesale distributors; efficient storage of the drugs and vaccines, quality and utilization management checks and pharmacies dispensing the drugs to patients who are expected to take the them based on prescription.

#### 2.1.2 Pharmaceutical materials

The primary materials for pharmaceutical firms include pharmaceutical raw materials, packaging materials, active pharmaceutical ingredients (APIs), excipients, solvents, chemicals, drug packaging materials, etc. The type of packaging that is selected for a specific drug will depend on factors such as, the degree of protection that is needed for the drugs/medications, the dosage (that will affect the size), etc. In pharmaceutical materials packaging, four essentials criteria for an optimal solution are required which are durability of the packaging materials and its high quality assurance, tamper proof, secured and eco-friendly materials and of course such materials must be in compliance with relevant regulations.

By definition, active pharmaceutical ingredients (APIs) are the key components of a drugs/medicine that produce the desired therapeutic effect. Excipients, solvents, disintegrants, lubricants, coatings, colourants, etc are other key components of pharmaceutical materials and other materials and chemicals commonly used in pharmaceuticals are: acetone, ethanol, methanol, sodium hydroxide, hydrochloric acid inter alia.

#### 2.2 Theoretic Review

In this paper, the interdependence between the economic management of resources and health is outlined and the main theory in health economics and management is well analyzed. The paper is thus anchored on a blend of neoclassical and kaizen costing theories. In line with the neoclassical model, the rational decisions that firms like pharmaceutical firms, other firms, individuals, body of individuals and even the decision by a nation's policy makers about the economy, investment and management of resources are controlled by market exchange through the forces of demand and supply. Kaizen costing theory on the other hand relates to the continuous improvement process especially in the management of materials. Such improvement process could result in improved operational performance of firms. Applying kaizen costing theory to the operation of pharmaceutical firms, it guarantees that products, drugs, vaccines and other medications meet and surpass customers' expectations in terms of quality, pricing and functionality so as to maintain the competitiveness of the drugs, vaccines or other medical products. This may be accomplished by sequentially eliminating all procedures that would increase the production costs of the product without increase its value accordingly (Rof, 2012) <sup>[18]</sup>. This cost reduction and continuous improvement approach have produced enormous improvements in Japan where it was first developed and tested and around the globe and it has helped in the areas of materials management.

#### 2.3 Empirical Review

Okereke, *et al* (2021) <sup>[14]</sup> carried out a study on why Nigeria must strengthen its local pharmaceutical manufacturing capacity. The study which is mainly a review of the pharmaceutical sector stated that with over 115 registered

pharmaceutical manufacturers in Nigeria, the country still relies on other countries for the supply of active pharmaceutical ingredients and excipients as significant attention has not been given to the local production of raw materials, pharmaceutical dosage formulations, or processing equipment, which has resulted in a decline in the country's pharmaceutical manufacturing capacity. They called for a close attention to be paid to developmental issues affecting this sector owing to the overall importance of the industry.

**Ikoni and Chukwu (2017)** <sup>[10]</sup> investigated the various production constraints experienced by selected quoted pharmaceutical companies in Nigeria in time of recession. Specifically, the study investigated the extent to which labour and materials constraints affects industrial production using Pearson Product Moment Correlation. The findings showed that material constraint has a negative relationship with industrial production. Based on the findings, the study concluded that there is a significant effect of production constraints in a recessed economy and recommended that government should fix the power sector because power is the back bone for industrialization and also government should more regularly enforce quality standards in pharmaceutical companies so as to main standards and to reduce substandard products.

**Buyse (2010)** <sup>[5]</sup> examined the impact of economic recession on the pharmaceutical sector in 29 European countries. The objectives of the study were to analyze the impact of global recession on consumption of medicines and pharmaceutical expenditures and prices, and to investigate the medicines that were affected the most and the least by the recession in the countries. Linear regression analysis was used to establish the relationship between decline in Dp and pharmaceutical consumption in the European region. Findings showed that despite the fact that economic recession affected many countries, very few countries showed decline in pharmaceutical consumptions.

**Ogbadu (2009)** <sup>[13]</sup> investigated the effect of materials management on profitability of Benue Breweries Limited. Survey research design was used, and random sampling technique was adopted to administered copies of questionnaire on respondents, and data were tested using chi-square. The study reported a significant positive relationship between materials management and profitability. **Adeyemi and salami (2010)** <sup>[1]</sup> carried out a study on inventory, a dimension of materials management as a tool for optimizing resources in Ilorin Plant of Coca – Cola Bottling Company. Analyzed data was generated using Economic Order Quantity model, variance and Chi-square. They reported a positive relationship between inventory management and the survival of manufacturing firm.

**Egberi and Egberi (2011)** <sup>[8]</sup> investigated the association between inventory management and firms' profitability in Eternit Limited. Data were sourced with structured questionnaire. The study reported significant positive relationship between inventory management and firm's profitability. **Saolu, Agorzie and Mondy** investigated the effect of materials management on profitability in the manufacturing industry in Nigeria. Structured questionnaire responded to by 100 employees was the source of data. The study reported a positive and significant increase in profitability of the studied firms due to efficient materials management. **Nwosu (2014)** <sup>[12]</sup> examined the effect of material management on profitability of Nigerian Breweries and Guinness Nigeria Plc. Data were sourced through oral

interview and questionnaire responded to by a sample of 368 employees from the two firms. The study concluded that materials management makes a significant contribution to firms' profitability.

**Ibgbulam and Okories** undertook an assessment of materials management and profitability of an enterprise. The study reported that materials management contributes to firms' profitability and thus recommended its adoption by firms. The study concludes that materials management practices have significant effect on firm 99%), poor transportation system (mean of 4.0, 97.1%), lack of trained personnel (mean of 4.2, 93.1%), poor relationship with vendors in the sector (mean of 3.9, 91.1%) and poor ICT facilities (mean of 3.8, 91.7%). Thus it was recommended that Government at the Federal and State segment should step up efforts at providing adequate power supply and solve the issue of poor transportation network through mass investment on rail transportation.

**Agorzie et al; (2020)** <sup>[2]</sup> investigated the effect of materials management practices on operational performance of selected quoted food, beverages and breweries firms in South Western Nigeria. The study concludes that materials management practices have significant effect on firms' operational performance. The study also identifies the number of challenges faced by firms in the efforts to adopt material management practices and the five most serious among them are: inadequate power supply (mean of 4.4, 99%), poor transportation system ( mean of 4.0, 97.1%), lack of trained personnel (mean of 4.2, 93.1%), poor relationship with vendors in the sector (mean of 3.9, 91.1%) and poor ICT facilities (mean of 3.8, 91.7%). Thus it was recommended that Government at the Federal and State level should step up efforts at providing adequate power supply and solve the issue of poor transportation network through mass investment on rail transportation.

**Research/Knowledge Gap:** There is a noticeable gap in literature as most of the studies not only used profitability as proxy for measuring organizational performance; concentration was more on food and beverage companies. This study is a deviation from the popular norm as instead of using profitability to measure organization's performance, the focus is on other dimensions of operational performance which are waste reduction, cost reduction and customers' satisfaction. In addition, the industry in focus is the pharmaceutical and health companies listed in the Nigerian Stock Exchange as against the popular use of manufacturing firms.

### 3. Methodology

A descriptive and survey research designs were adopted to structure the research to show how all key variables of the research synchronize as well as to address the main research questions that were used. The population of the study was ten (10) health sector firms listed on the Nigeria Stock Exchange (NSE Factbook, 2017/nse.com.ng including Evans Pharmaceuticals Plc, Neimeth International Pharmaceuticals Plc, Pharma-Deko Plc, Fidson Healthcare Plc, May & Baker Nig. Plc, among others. Four (4) of the firms were purposively selected and used for the study based on accessibility of information. Due to their direct involvement in material handling, six departments; production, purchasing, quality control, warehousing/store, finance and transportation were purposively selected and used for data collection. 120 managers, assistant managers and supervisors



were purposively selected as sample size for the study due to their direct involvement in material handling in their various departments. Data collected using questionnaire drawn using 5-point likert interval option of Strongly Disagree (SD) = 1, Disagree (D) = 2, Undecided (U) = 3, Agree (A) = 4, and Strongly Agree (SA) = 5 was analyzed using descriptive statistics, correlation and multiple regression statistical tools. Cronbach's alpha for the constructs was 0.812 which is

acceptable as the lower benchmark is suggested to be 0.70.

### 3.1 Model specification

The multiple linear regression function and model of the effect of materials management approaches (MMA) on operational efficiency/performance of the study are as stated in a functional form:

$$OPP = f(MMA)$$

Econometrically, it could be re-written as:

$$WAR = \beta_0 + \beta_1 MRP + \beta_2 MUR + \beta_3 VMI + \beta_4 INL + \beta_5 SOF + \beta_6 SCU + U \dots \dots \dots (i)$$

$$COR = \beta_0 + \beta_1 MRP + \beta_2 MUR + \beta_3 VMI + \beta_4 INL + \beta_5 SOF + \beta_6 SCU + U \dots \dots \dots (ii)$$

$$CUS = \beta_0 + \beta_1 MRP + \beta_2 MUR + \beta_3 VMI + \beta_4 INL + \beta_5 SOF + \beta_6 SCU + U \dots \dots \dots (iii)$$

Where: OPP = Operational performance

$\beta_0$  = Constant

$\beta_1$ ----- $\beta_6$  = Coefficient of the predictor variables (MRP, MUR, VMI, INL, SOF, SCU)

MRP = Material resource planning

MUR = Material usage rate

VMI = Visual material inspection

INL = Inventory level

SOF = Stock out frequencies

SCU = Storage capacity utilization

WAR = Waste reduction

COR = Cost reduction

CUS = Customers' satisfaction

U = Error term

### 3.2 Measurement of variables

For the purpose of this study, the criterion (explained) variables and proxies for operational performance were measured using waste reduction, cost reduction and customers' satisfaction while the predictor - explanatory - variables and proxies for materials management were measured using material requirement planning, material usage rates, visual material inspection, storage capacity utilization, stock out frequencies and inventory level:

#### Operational definition of the predictor variables

**Materials resource planning (MRP):** It is material requirement planning, scheduling and inventory control and management system used to manage manufacturing processes and the material resource of an organization.

**Material usage rates (MUR):** It is the analyses of the rate at

which materials are being used in an organization.

**Visual material inspection (VMI):** It is the physical verification and inspection of materials to ensure their quality and determine the actual quantity. **Storage capacity utilization (SCU):** It involves the monitoring of the usage of storage space. **Inventory levels:** It is the tracking of the quantity of materials in stock. **Stockout frequencies:** It measures how often materials are not available when needed.

**4. Empirical Results** Data collected were tested with both descriptive (mean and standard deviation) and inferential (multiple regression) statistics tools. The objective was to make inference about the studied population through statistical test of hypothesis at 5% significant level. Thus the decision rule is to reject the null hypothesis if the value of the p-value calculated is greater than P- critical.

**Table 2:** Descriptive statistics of the variables of study

Variables	Mean	Std dev.	Min.	Max.
WAR	0.19340	0.21657	0.47065	0.97544
COR	48.76421	20.32214	5.46473	95.00606
CUS	0.15765	0.19765	0.27189	0.78536
MRP	81.61378	52.66475	9.55264	223.08297
MUR	23.97865	34.57146	0.08601	134.24234
VMI	74.24345	76.43565	1.28476	31.87665
IL	0.54895	0.01456	0.01878	1.68396
SOF	14.78653	12.85654	12.67289	16.45312
SCU	74.72685	74.89196	1.30073	32.32426

Source: Generated by the researcher using (SPSS Version 21)

Table 4 above provides a summary of the descriptive statistics for the variables of the study. The table reveals that waste reduction of the surveyed companies have been averaged 19.34% and having a range of a minimum of 47.65% and a maximum of 97.54%. This means that for every

one Naira worth of investment in materials management, the industry had worst reduced waste by 47.65kobo (average of 19.34%), reduce cost by 54.65 kobo (average of 48.76%), improved customers service by 15.77%, and had best earned a maximum of 97.54 kobo, 95.01kobo and 0.78.54 kobo

respectively as a result of waste reduction, cost reduction and improved customers service occasioned by efficient

management of materials.

**Table 3:** Correlation Coefficients of the Variables

Variables	WAR	COR	CUS	MRP	MUR	VMI	IL	SOF	SCU
WAR	1.000								
COR	0.2408	1.000							
CUS	0.7124	0.3053	1.000						
MRP	1.1875	0.1254	0.1753	1.000					
MUR	0.0572	0.7321	0.2446	0.2587	1.000				
VMI	0.0701	0.0081	0.3414	0.7242	0.3154	1.000			
IL	0.1540	0.00945	0.4367	0.5245	0.0365	0.2564	1.000		
SOF	1.2543	0.4462	0.2253	0.35432	0.5321	0.5132	0.0072	1.000	
SCU	0.0672	0.0071	0.3392	0.7112	0.30123	0.4100	0.02356	0.0284	1.000

Source: Generated by the researcher using (SPSS Version 21)

From the above Table, the values on the diagonal are all 1.000, indicating that each variable is perfectly self-correlated. The correlations within the explanatory variables prove lack of multi-collinearity as the highest correlations coefficient is that material resource planning (MRP) with a positive value of 0.7242.

**Table 4:** Regression Results of the Impact of the Predictor Variables on Operational Performance

Equation	Obs	Pharms	RMSE	R <sup>2</sup>	F	p-value
WAR	120	4	0.246323	0.2464	2.8754	0.0314
COR	120	4	10.143656	0.7134	21.2655	0.0001
CUS	120	4	0.164786	0.3767	4.8965	0.0004

Source: Generated by the researcher using (Stata Version 12)

The regression result in Table 4.3 shows the coefficient of determination R<sup>2</sup> of 24.64% indicating that the variable considered in the model accounts for about 24.64% variation in the criterion variable which is waste reduction (WAR). The remaining of the variation is due to other factors or variables not highlighted in this model. The p-value of 0.0314 < 0.05 for a 95% confidence level indicates the non-acceptance of the null hypothesis which means that the explanatory variables have significant impact on the explained variable (WAR). Thus considering both correlation and regression outcomes, it can be concluded that there is a significant relationship between the two variables.

In evaluating model 2, based on the regression equation, the coefficient of determination (R<sup>2</sup>) is 0.7134 (71.34%). This indicate that the variables considered in the model accounts for 71.34% of variation in the explained variable (COR). The p-value of 0.0001 which is less than 5% for a 95% confidence level implies the non-acceptance of the null hypothesis. This means that the explanatory variables have significant impact on the explained variable as the lower the p-value, the higher the relevance of the variable. It is thus concluded that that there is a significant association between the discrete components of materials management and operational performance measured using cost reduction.

In evaluating model 3, based on the regression result in table 4.3, the coefficients of determination, R<sup>2</sup> is 0.3767 meaning the variables considered in the model accounts for 37.67% variation in the explained variable while the remaining variation is due to other factors not considered in the model. The p-value of this model is 0.0004 < 5% for a 95% confidence level. Thus, the null hypothesis is not accepted suggesting that the explanatory variables have significant impact on the explained variable. We therefore conclude

based on the correlation and regression result that there is a significant relationship between the discrete components of materials management and operational performance measured by customers service satisfaction (CUS).

## 5. Summary, Conclusion and Recommendations

### 5.1 Summary

Efficient materials management is sine qua non to all types of businesses including pharmaceutical firms. It is pivotal to the growth and continued sustainability of the pharmaceutical sectors especially in Nigeria where material management practices is abysmally poor due to lack of expertise, infrastructure, and technology among other factors. Literatures were extensively reviewed conceptually, theoretically and empirically and a simple model was drawn functionally and econometrically. Research findings show that there is a positive and significant correlation between materials management and operational performance of pharmaceutical firms in Nigeria. This finding agrees with most of the reviewed literature which reveals a positive and significant association between materials management and organizational performance and thus meeting our a priori expectation.

### 5.2 Conclusion

Based on analysis the following conclusions are drawn: There is a positive and significant relationship between materials management and operational performance of the surveyed pharmaceutical firms in Nigeria. This implies that when a company adopts the following materials management practices: material resource planning, material usage rates, visual and physical inspection of materials, effective storage capacity utilization, maintain optimum levels of inventory with no stock out, sales are likely to increase, waste and costs will likely reduce. Quality assurance would be guaranteed. Besides, there might be improved customers' service satisfaction and all leading to improved operational performance of the company.

### 5.3 Recommendations

On the basis of the research findings, the following recommendations are apt:

1. There is a dire need to for pharmaceutical companies in Nigeria to build capacity in the areas of inventory and materials control and management. The issue of order management, warehouse management and fragmentation of materials should be given keen attention and to achieve this, pharmaceutical firms like other firms, no matter their size

(small, medium size, large size) should as a matter of necessity and urgency establish a specialized and independent materials and inventory management department that will solely be in charge of managing the materials./inventory of the organization.

2. Stock out, high and low inventory level must be avoided. The objective of having optimal levels of inventory should be pursued using the economic order quantity and other inventory and materials management modes. In addition, there should be periodic inventory taking to discover in time slow moving materials to avoid over investment in such materials. In case of dwindling demand for some slow moving and about to be expired drugs and other medications, prices should be slashed or written down to promote quick sales.

3. To strengthen global health, pharmaceutical deliveries/supply chain should be made to work optimally through shipment and consignment inspection, quality assurance of raw materials and the finished drugs or vaccines, utilizing the services of professionals and of course the deployment of artificial intelligence, other technologies and discrete event simulation for capacity and purchase and sales order management so as to track the percentage of orders that are fulfilled from existing inventory.

**Conflict of Interest:** The authors hereby declare that there is no conflict or competing interest in this manuscript.

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