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INVENTORY MANAGEMENT AND PROFITABILITY OF LISTED PHARMACEUTICAL COMPANIES IN NIGERIA

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Abstract

This study examined the effect of inventory management on profitability of listed pharmaceutical companies in Nigeria. However, the specific objectives were to examine the effect of inventory turnover on gross profit margin of listed pharmaceutical companies in Nigeria, to access the effect of inventory holding cost on gross profit margin of listed pharmaceutical companies in Nigeria and to determine the effect of economic order quantity on gross profit margin of listed pharmaceutical companies in Nigeria. The study adopted an ex-post facto research design and utilized a panel data of seventy (70) pooled observations gathered from seven (7) listed pharmaceutical firms in Nigeria over ten (10)-year period (2014-2023) and employed a panel multiple regression technique to analyze the data via E-views 10.0 statistical package. The study findings revealed that inventory turnover has a significant positive relationship (Coeff. = 0.414078 {0.0005}) with gross profit margin of listed pharmaceutical firms in Nigeria while inventory holding cost has a significant negative relationship (Coeff. = -3.100747 {0.0298}) with gross profit margin of listed pharmaceutical firms in Nigeria. It also revealed that economic order quantity has a non-significant negative relationship (Coeff. = -0.000525 {0.4067}) with gross profit margin of listed pharmaceutical firms in Nigeria. The study provided conclusive evidence on the importance of effective inventory management in driving profitability in the pharmaceutical industry. The recommendations made included that listed pharmaceutical firms in Nigeria should implement cost-saving measures to reduce their inventory holding costs. This can be achieved by renegotiating storage contracts, implementing just-in-time inventory systems, and reducing inventory obsolescence..

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Introduction

Inventory management is the process of overseeing and controlling the flow of goods or products within a business. It involves the planning, organizing, and tracking of inventory levels to ensure that the right quantities of items are available at the right time and at the right place (Obeidat, 2021). Effective inventory management is essential for businesses to meet customer demand, minimize costs, and optimize operational efficiency. Parma and Shukla, (2021) postulated that inventory management is a critical aspect of operations for pharmaceutical companies, as it directly impacts profitability and overall financial performance. In the context of listed pharmaceutical companies in Nigeria, efficient inventory management practices can significantly influence their success in a competitive market (Golas, 2020). The pharmaceutical industry in Nigeria is one of the largest and most important sectors, catering to the healthcare needs of the population. With increasing demand for healthcare products and services, pharmaceutical companies face challenges in managing their

inventory effectively to meet customer demands while minimizing costs (Mensah et al., 2019).

Effective inventory management involves maintaining optimal levels of stock to ensure timely availability of products, reducing holding costs, and avoiding stockouts (Dave et al., 2021). For pharmaceutical companies, this is crucial as the industry is characterized by stringent regulations, expiration dates for certain products, and the need for proper storage conditions. Listed pharmaceutical companies in Nigeria are subject to scrutiny from regulatory bodies, investors, and stakeholders regarding their financial performance. Golas (2020), recorded that profitability is a key metric that reflects the company's ability to generate revenue and manage costs efficiently. Efficient inventory management practices can contribute to improved profitability through reduced wastage, lower carrying costs, and increased sales due to product availability (Mensah et al., 2019).

Therefore, studying the relationship between inventory management practices and the profitability of listed pharmaceutical companies in Nigeria is essential to understand the impact of inventory management on financial performance. Bagshaw (2019) stated that evaluating factors such as inventory turnover, days of sales of inventory, and gross margin, researchers can gain insights into how inventory management practices influence the profitability of pharmaceutical companies in Nigeria.

Statement of the Problem

The relationship between inventory management and business profitability poses a critical challenge for listed companies for instance the pharmaceutical companies. The issue at hand revolves around the inefficiencies and operational complexities that arise from suboptimal inventory management strategies within these companies. Inadequate inventory control practices may lead to stockouts, overstocking, or inaccurate demand forecasting, ultimately affecting the financial performance and bottom line of pharmaceutical companies as opined by Obeidat, (2021). These challenges are compounded by the stringent regulatory requirements and quality standards imposed on the pharmaceutical sector in Nigeria, which further hinder effective inventory management practices and compliance with industry regulations. Moreover, the dynamic nature of the market, characterized by intense competition, changing consumer preferences, and external economic factors, adds complexity to the inventory management-profitability relationship, necessitating a deeper understanding of how inventory-related decisions impact the overall financial health of listed pharmaceutical firms in Nigeria (Bagshaw, 2019).

Furthermore, the issue of inventory management and its impact on the profitability of listed pharmaceutical companies in Nigeria underscores the broader concern of sustainable business operations and long-term growth prospects (Dave et al., 2021). Inaccurate demand forecasting, inefficient inventory turnover, and lack of coordination in supply chain management can erode profit margins, reduce liquidity, and impede investment in research and development initiatives for pharmaceutical companies (Onikoyi and Ojo, 2019). Golas, (2020) recorded that the inability to strike a balance between maintaining adequate inventory levels and optimizing working capital utilization can result in increased costs, decreased revenue, and diminished competitiveness in the market.

Thus, the central problem lies in the need to enhance inventory management practices to align with strategic business objectives and improve financial performance while navigating the complex regulatory landscape and industry dynamics inherent in the Nigerian pharmaceutical sector (Parmar& Shukla, 2021). Addressing this problem requires a comprehensive analysis of inventory control mechanisms, process efficiencies, technology integration, and organizational capabilities to foster a sustainable and profitable business model for listed pharmaceutical companies operating in Nigeria.

Objectives of the Study

The main objective of this study was to evaluate the effect of inventory management on profitability of listed pharmaceutical companies in Nigeria. However, this was carefully achieved through the following specific objectives:

1. To examine the effect of inventory turnover on gross profit margin of listed pharmaceutical companies in Nigeria
2. To access the effect of inventory holding cost on gross profit margin of listed pharmaceutical companies in Nigeria.
3. To determine the effect of Economic order quantity on gross profit margin of listed pharmaceutical companies in Nigeria

Research Questions

This study sought to provide reliable answers to the following questions;

1. What is the effect of inventory turnover on gross profit margin of listed pharmaceutical companies in Nigeria?
2. How does inventory holding cost affect gross profit margin of listed pharmaceutical companies in Nigeria?
3. To what magnitude of effect does economic order quantity have on gross profit margin of listed pharmaceutical companies in Nigeria?

Research Hypotheses

Based on the research objectives and the research questions, the following null hypotheses were formulated for the study.

Ho_1: There is no significant relationship between inventory turnover and gross profit margin of listed pharmaceutical companies in Nigeria.

Ho_2: No significant relationship exists between inventory holding cost and gross profit margin of listed pharmaceutical companies in Nigeria.

Ho_3: Economic order quantity has no significant relationship with gross profit margin of listed pharmaceutical companies in Nigeria.

Scope of the Study

Content scope: This study examined the relationship between inventory management and profitability of Pharmaceutical companies listed on the floor of the Nigerian Exchange Group (NGX). The independent variable (inventory management) was proxied by inventory turnover, inventory holding cost and Economic order quantity (EOQ), while the dependent variable (profitability) was proxied gross profit margin.

Geographical scope: This study focused on listed pharmaceutical companies on the floor of Nigerian exchange group (NGX) for the period of 10 years, that is from 2014 to 2023.

Unit scope: The unit of analysis of this study consisted of seven pharmaceutical companies listed on the floor of the Nigerian Exchange group (NGX). They include; Ekocorp PLC, Fidson Healthcare PLC, Glaxo Smithline PLC, May and Baker Nigeria PLC, Morison industries PLC, Neimeth international pharmaceuticals PLC and Pharma-Deko PLC.

LITERATURE REVIEW

Conceptual Framework

Independent Variable **Dependent Variable**

(Inventory management) (Profitability)

Source: Researcher's Conceptualization (2025).

Concept of Inventory Management

Kakeeto et al., (2020) recorded that inventory management refers to the process of storing, ordering, and selling of goods and services. The discipline also involves the management of various supplies and processes. One of the most critical aspects of inventory management is managing the flow of raw materials from their procurement to finished products. Inventory management plays a critical role in the profitability and operational efficiency of pharmaceutical firms in Nigeria. It involves the planning, control, and optimization of inventory levels to ensure that the right amount of stock is available at the right time while minimizing costs and maximizing profitability (Parma and Shukla, 2021) as all businesses that are profitable have goal achievement as their toppriority (Okurebia& Udo, 2023).Effective inventory management in pharmaceutical firms requires striking a delicate balance between maintaining adequate stock levels to meet customer demand and avoiding excess inventory that ties up capital and incurs holding costs. Onikoyi and Ojo, (2019) exposed that implementing sound inventory management practices, such as utilizing tools like Economic Order Quantity (EOQ) calculations, Just-In-Time (JIT) inventory systems, and ABC analysis, pharmaceutical companies can streamline their supply chain operations and enhance overall profitability.

Inventory management in the pharmaceutical industry in Nigeria extends beyond the traditional focus on cost control and supply chain optimization. It encompasses considerations related to demand forecasting, market trends, regulatory changes, and product life cycles. Pharmaceutical firms need to proactively manage their inventory levels based on demand fluctuations, seasonal variations, and emerging healthcare needs in the Nigerian market as opined by Mensah et al., (2019). This requires leveraging data analytics, technology solutions, and collaboration with suppliers and distributors to adapt quickly to changing market dynamics while maintaining sustainable inventory practices. By aligning inventory management strategies with market insights and regulatory requirements, pharmaceutical companies can improve their competitiveness, sustainability, and profitability in a dynamic and challenging business environment (Parma and Shukla, 2021).

Dimensions of Inventory Management

Inventory Turnover

Inventory turnover is a fundamental financial metric that measures how efficiently a company manages its inventory by evaluating the rate at which inventory is sold and replenished over a specific

period. Usman et al., (2020) stated that it is a crucial indicator of a company's operational performance, supply chain management effectiveness, and overall inventory control. At its core, inventory turnover reflects the frequency with which a company's inventory is sold and replaced within a certain time frame, typically a year. A high inventory turnover ratio signifies that a company is effectively converting its inventory into sales and generating revenue, while a low ratio may indicate excessive inventory levels, slow-moving goods, or potential liquidity issues (Akinola et al., (2024).

A high inventory turnover ratio is generally viewed favourably as it suggests that a company is efficiently managing its inventory and quickly converting it into sales. This can lead to reduced carrying costs, lower obsolescence risks, improved cash flow, and increased profitability. On the other hand, a low inventory turnover ratio may indicate overstocking, slow-moving inventory, deteriorating demand trends, or inefficiencies in supply chain operations as postulated by Obeidat, (2020). It is important to note that the optimal inventory turnover ratio varies across industries and business models. For instance, industries with perishable goods or fast-changing consumer preferences may require higher turnover rates to avoid wastage or obsolescence. Conversely, manufacturers of durable goods or capital equipment may have lower turnover ratios due to longer product life cycles and specialized customer requirements (Kamau and Kagiri, (2020). According to Obeidat, (2020) analyzing inventory turnover trends over time can provide valuable insights into a company's inventory management practices, supply chain efficiency, and overall business performance.

Inventory Holding Cost

Inventory holding cost, also known as carrying cost or holding cost, refers to the expenses associated with storing and maintaining inventory over a period of time. Inventory holding costs are typically expressed as a percentage of the inventory's value or as a fixed amount per unit. Accurate calculation of inventory holding costs is essential for businesses to optimize their inventory management and minimize unnecessary expenses.Inventory holding cost in the context of pharmaceutical companies refers to the expenses incurred in storing and managing inventory over a specific period. These costs are critical for businesses in the pharmaceutical industry, given the diverse range of products they deal with, including raw materials, active pharmaceutical ingredients (APIs), intermediates, finished goods, and packaging materials. Goronduste et al., (2019) explained that storage costs play a significant role in inventory holding costs for pharmaceutical companies, as many products require specialized storage conditions like temperature-controlled environments. Rent, utilities, maintenance, and security of these facilities contribute to the overall holding costs. In addition to storage costs, insurance is another key component of inventory holding costs in pharmaceutical companies.

Economic Order Quantity (EOQ)

Economic Order Quantity (EOQ) is a fundamental concept in inventory management and supply chain optimization. It represents the optimal quantity of inventory that a company should order at any given time to minimize its total inventory costs. The EOQ model takes into account the trade-off between the costs of ordering inventory (such as transportation and handling costs) and the costs of holding inventory (such as storage and maintenance costs). Economic Order Quantity (EOQ) is a vital concept in inventory control that aims to determine the optimal quantity of goods a business should order to minimize total inventory costs. EOQ is based on the idea that there is an optimal balance between ordering costs and holding costs for inventory (Althagi, 2020). Ordering costs include expenses such as placing orders, transportation, and processing invoices, while holding costs consist of expenses related to storing and managing inventory, such as storage, insurance, and obsolescence. By calculating EOQ, businesses can identify the most cost-effective order quantity that

will help them maintain an adequate level of inventory without excessive holding costs. The goal is to strike a balance between carrying too much inventory, leading to high holding costs, and carrying too little, resulting in stockouts and potential lost sales. Achieving the optimal EOQ allows companies to streamline their inventory levels, reduce costs, and enhance overall profitability (Althagi, 2020).

The Concept of Profitability

Profitability is a fundamental concept in business and finance that refers to the ability of a company or organization to generate earnings or profits from its operations. It is a measure of how effectively a company uses its resources to produce goods or services that generate revenue, while also managing its costs and expenses to maximize its profits. At its core, profitability is about creating value for stakeholders, including shareholders, employees, customers, and suppliers. Companies that are profitable are able to reinvest their earnings in the business, pay dividends to shareholders, and reward employees for their hard work and contributions. Profitability is also a key indicator of a company's financial health and its ability to sustain itself over the long term. There are several factors that can impact a company's profitability, including its revenue growth, cost structure, pricing strategy, and operating efficiency. Companies that are able to generate strong revenue growth, while also managing their costs and expenses effectively, are more likely to be profitable. Additionally, companies that are able to differentiate themselves from their competitors through innovative products, services, or business models are also more likely to be profitable (Golas, 2020).

Profitability can be measured in a variety of ways, including through the use of financial metrics such as gross margin, operating margin, and net profit margin. Gross margin, for example, is a measure of a company's profitability at the product or service level, and is calculated by dividing gross profit by revenue. Operating margin, on the other hand, is a measure of a company's profitability at the operating level, and is calculated by dividing operating income by revenue. Net profit margin, meanwhile, is a measure of a company's overall profitability, and is calculated by dividing net income by revenue. In addition to these financial metrics, companies can also use non-financial metrics to measure their profitability, such as customer satisfaction, employee engagement, and market share. These metrics can provide valuable insights into a company's underlying profitability drivers, and can help companies to identify areas for improvement. Profitability is also closely tied to a company's return on investment (ROI), which is a measure of the return generated by a company's investments, relative to their cost. Companies that are able to generate strong returns on investment are more likely to be profitable, as they are able to earn a return on their investments that exceeds their cost of capital as stated by Dave et al., (2021). Kungu, (2020) mentioned that profitability is not just important for companies, but also for investors, creditors, and other stakeholders. Investors, for example, use profitability metrics to evaluate a company's potential for future growth and returns. Creditors, meanwhile, use profitability metrics to assess a company's ability to repay its debts. By focusing on profitability, companies can create value for their stakeholders, while also ensuring their long-term sustainability.

Dimension of Profitability

Gross Profit Margin

Gross profit margin is a financial metric that measures the percentage of a company's revenue that exceeds its cost of goods sold (COGS). In other words, it indicates how efficiently a company is producing goods or services before accounting for other operating expenses such as selling, general, and administrative costs. Gross profit margin is a fundamental concept in accounting and finance that plays a crucial role in inventory management and profitability of listed pharmaceutical companies in

Nigeria. It is a metric that measures the difference between revenue and the cost of goods sold, expressed as a percentage of revenue. In other words, gross profit margin represents the profit earned by a company from the sale of its products or services, before deducting operating expenses, taxes, and other non-operating items by Bagshaw et al., (2019).

In the context of inventory management, gross profit margin is a critical metric that helps pharmaceutical companies in Nigeria to evaluate the profitability of their products. Ali et al., (2020) propounded that analysing the gross profit margin of each product, companies can identify which products are generating the highest profits and which ones are not performing well. This information can be used to make informed decisions about inventory management, such as which products to stock more of, which products to discontinue, and how to optimize pricing strategies.

For listed pharmaceutical companies in Nigeria, gross profit margin is a key performance indicator (KPI) that is closely watched by investors and analysts. A high gross profit margin indicates that a company is able to maintain high prices for its products while keeping costs under control. This can be a sign of a company's strong market position, effective cost management, and ability to generate profits. On the other hand, a low gross profit margin can indicate that a company is facing intense competition, struggling with cost management, or experiencing declining demand for its products (Althagafi, 2020).

Relationship between Inventory Management and Gross Profit Margin

Effective inventory management plays an important role in the financial performance of pharmaceutical companies, especially concerning their gross profit margin. Proper inventory management involves maintaining optimal inventory levels to meet demand while minimizing holding costs. For pharmaceutical companies, carrying excess inventory can lead to higher storage costs, obsolescence, and wastage. On the other hand, inadequate inventory levels can result in stockouts, lost sales, and dissatisfied customers. By managing inventory levels effectively, companies can control costs and enhance gross profit margins by reducing unnecessary expenses and maximizing sales opportunities (Sonkoand Akinlabi, 2020). Inventory turnover ratio, which measures how quickly a company sells its inventory and replaces it over a specific period, is a critical metric in evaluating inventory management efficiency. High inventory turnover indicates that a company is selling products quickly, minimizing holding costs, and efficiently utilizing resources.

In the pharmaceutical sector, efficient inventory turnover is essential for maintaining cash flow, reducing carrying costs, and improving gross profit margins through increased sales velocity and operational efficiency (Bah et al., 2023). Accurate demand forecasting and product mix optimization are essential components of effective inventory management in pharmaceutical companies. Sonko and Akinlabi (2020), opined that by analysing historical data, market trends, and customer preferences, companies can anticipate demand patterns, optimize their product portfolios, and align inventory levels with expected sales volumes. Effective demand forecasting helps reduce stockouts, minimize excess inventory, and enhance gross profit margins by ensuring the right products are available at the right time to meet customer needs efficiently. Strong supplier relationships and efficient supply chain management are vital for maintaining optimal inventory levels, controlling costs, and improving gross profit margins in pharmaceutical companies. Collaborating closely with reliable suppliers, negotiating favourable terms, and implementing supply chain best practices can help streamline procurement processes, reduce lead times, and enhance inventory management effectiveness (Gokhale and Kaloji, 2019).

Sonkoand Akinlabi, (2020) concluded that the relationship between inventory management and gross profit margin in listed pharmaceutical companies in Nigeria is multifaceted and critical to their overall financial performance and competitiveness in the market. By adopting sound inventory management

practices, optimizing supply chain operations, leveraging technology, and making data-driven decisions, pharmaceutical companies can enhance their operational efficiency, control costs, improve customer satisfaction, and ultimately drive higher gross profit margins for sustainable growth and success in the industry.

Theoretical Framework

The Agency Theory (Michael C. Jensen and William H. Meckling, 1976).

Agency Theory, as developed by Michael Jensen and William Meckling in (1976) provides a valuable framework for understanding the relationship between inventory management and profitability of listed pharmaceutical companies in Nigeria. The theory focuses on the principal-agent relationship within organizations, where conflicts of interest may arise between company owners (principals) and managers (agents).In the phase of inventory management in pharmaceutical companies, the agency theory suggests that there may be a divergence of goals between shareholders seeking to maximize profitability and managers responsible for day-to-day operations, including decisions related to inventory levels(Kungu, 2020).Managers may prioritize objectives such as minimizing stockouts or maintaining high levels of safety stock, which can lead to increased holding costs and inefficiencies that affect profitability. Agency theory underscores the importance of aligning the interests of both principals and agents to mitigate agency problems and improve organizational performance. In the case of pharmaceutical companies in Nigeria, effective inventory management practices can serve as a mechanism for aligning the interests of shareholders and managers towards maximizing profitability. By implementing transparent reporting systems, performance-based incentives, and clear communication channels, companies can ensure that inventory decisions are made in the best interest of the firm's financial health.

Moreover, agency theory highlights the role of monitoring and control mechanisms in influencing managerial behavior with regards to inventory management. Pharmaceutical companies can implement governance structures, such as board oversight, internal controls, and performance evaluation systems, to reduce agency costs associated with suboptimalinventory management practices. By holding managers accountable for their decisions and incentivizing value-creating behaviors, companies can enhance profitability through improved inventory control and cost management.

Empirical Framework

Ubabudu*et al.,*(2024), investigatedthe effectiveness of inventory management on the profitability of manufacturing sectors in Nigeria: Bottling Company, Kaduna. Inventory management plays a crucial role in the profitability of manufacturing sectors, including the Nigeria Bottling Company in Kaduna. The study aimed to assess the effectiveness of inventory management on the profitability of manufacturing sectors in Nigeria Bottling Company, Kaduna. The study is quantitative and utilizes both primary and secondary data. A survey instrument was developed to collect primary data from a sample of 100 managers and employees within the Nigeria Bottling Company, Kaduna. Additionally, secondary data was collected from annual reports and financial statements of the company. The primary data collected was analysed using statistical techniques such as descriptive statistics and regression analysis, while the secondary data was analysed using content analysis. This mixed-method approach allowed for a comprehensive examination of the effectiveness of inventory management on the profitability of the manufacturing sectors in the Nigeria Bottling Company, Kaduna. From the result of data analysis, the hypothesis there is a positive relationship between inventory management and prompt delivery in manufacturing sectors (Nigerian Bottling Company)

Kaduna, was rejected and the alternate was accepted. The study concludes that although inventory management is a key factor in prompt service delivery, it is not the only factor. The organization must balance its operations by putting in place important management and operational policies that support service delivery. Some of which are recommended to include the implementation of advanced inventory management techniques, enhancing demand forecasting and production planning processes, among other things.

Bah *et al.,* (2023), researched on an empirical evidence of the impact of inventory management on the profitability of manufacturing companies. This study examined the impact of inventory management on the profitability of a manufacturing company. A case study research design was applied on the inventory system of a reputable manufacturing company. The secondary data employed in this study was collected from the financial statement the company for the period 2015-2020, in which the data were analysed using the Multiple linear regression model. The result shows that Raw Material Cost and Storage Cost are having negative and insignificant relationship on the profitability of a manufacturing company. On the other hand, Inventory Conversion Period is having a positive and significant relationship on the Returns on Assets. The study therefore recommended that the management of manufacturing companies need to adopt proper inventory management systems in order to control raw materials costs, reduced the working capital cycle, and minimize storage cost such as holding costs, ordering costs among others hence increasing company profitability.

METHODOLOGY

This section focused on the methods and procedures used in collecting and analysing data for the study (Attih, 2024; Attih et al., 2023; Essien et al., 2023). It consists of research design, population of the study, sample size and sampling procedure, sampling technique, sources and method of data collection, method of data analysis, model specification, and measurement/ operationalization of variables.

Research Design

This study adopted an ex-post facto research design. This design was suitable because the data for the analysis had already existed, leaving no room for the researcher to manipulate the variables under study.

Population of the Study

According to Eke and Udonde (2023), population is the totality of all elements (human and material) being studied. In this study, the population comprised of 7 pharmaceutical firms listed on the floor of the Nigerian Exchange Group from 2014 to 2023. These firms were as follows: Ekocorp PLC, Fidson Healthcare PLC, Glaxo Smithline PLC, May and Baker Nigeria PLC, Morison industries PLC, Neimeth international pharmaceuticals PLC and Pharma-Deko PLC.

These pharmaceutical companies were selected because they were continuously listed by Nigeria stock exchange group (NGX) during the period (2014-2023) and their financial statements and reports are available and have been consistently submitted to Nigeria stock exchange for the period under study.

Sample Size Determination and Sampling Procedure

Since the study population was sizeable enough to handle. The sample size of 7 Pharmaceutical firms were also selected for the study. The sample size of the study and the population were the same. Thus, complete enumeration was used to obtain the data for the study. According to Udonde, Akpan and

Awah (2021), complete enumeration is used when the assembled sample has the same proportion of individuals as the entire population.

That means n=N

Where;

n= sample size and N= population

Sources and Method of Data Collection

The data for the dependent and independent variables were extracted from financial reports of sampled listed pharmaceutical firms in Nigeria using contents analysis method and collated with the aid of Microsoft excel software. The panel data methodology was adopted because the study combined time series and cross-sectional data that is, seven (7) cross-sectional observations for each year and ten-time series for each pharmaceutical firm regressor and explained variables, a total of seventy (70) pooled observations.

Method of Data Analysis

The study utilized robust regression to analyse the cause-effect linkage between the dependent variable and the independent variables, as well as to evaluate the formulated hypotheses. This approach was chosen due to the presence of variances in the error term and the inability of the data to follow the standardized regression assumptions, that is, linearity, homoscedasticity, normality and independence of data. The decision was based on 5% level of significance.

Accept null hypothesis (Ho) if probability value (i.e. P-value or Sig.) is greater than or equals to (≥) stated 5% level of significance (α); otherwise, reject and accept alternate hypothesis (H_1), if p-value or sig calculated is less than 5% level of significance.

Model Specification

The model for this study was adopted from the study of Matope and Vaye, (2022) but modified to suit the hypotheses of this study. Hence, the author specified the econometric function as;

GPM_{it} = $f(IT, IHC, EOQ,)$

GPM_{it} = $\beta_0 + \beta_1 IT_{it} + \beta_2 IHC_{it} + \beta_3 EOQ_{it} + \mu_{it}$

Where;

GPM = Gross profit margin of listed pharmaceutical companies in Nigeria.

IT = Inventory turnover of listed pharmaceutical companies in Nigeria.

IHC = Inventory holding cost of listed pharmaceutical companies in Nigeria.

EOQ = Economic order quantity of listed pharmaceutical companies in Nigeria.

β_0 = Intercept or regression constant.

$\beta_1, \beta_2, \beta_3$ = Regression coefficients to be estimated.

μ = Stochastic error term.

$_{it}$ = Error term.

Measurement/Operationalization of Variables

Table 3.1 depicts the measurement of the variables defined in the model above.**Table**

Table 3.1 Measurement of Variables

Concept	Proxy	Measurement	Source
Inventory management *(Independent variable)*	Inventory turnover (IT)	$\frac{\text{Cost of goods sold}}{\text{Average inventory}}$	Akinola et al., (2024)
	Inventory holding cost (IHC)	Average inventory × holding cost rate	Mensah et al., (2019) Obeidat, (2021).
	Economic order quantity (EOQ)	√(2 x Annual Demand x Ordering Cost) ÷ Carrying Cost	Gokhale and Kaloji et al.,(2019).
Profitability *(Dependent variable)*	Gross profit margin (GPM)	Gross profit ÷ revenue × 100%	Golas, (2020). Kungu, (2020).

Source: Researcher's Compilation, (2025).

DATA PRESENTATION, ANALYSIS AND DISCUSSION OF FINDINGS

Data Presentation

The data comprise a panel data of seventy (70) pooled observations across seven (7) listed pharmaceutical firms in Nigeria for ten (10)-year period (2014-2023). The data include the dependent variable –Gross profit margin of listed pharmaceutical firms in Nigeria and the independent variables which were inventory turnover (IT), inventory holding cost (IHC) and economic order quantity (EOQ) of listed pharmaceutical firms in Nigeria

Data Analysis

Various statistical techniques were utilized in the analysis of data. These include descriptive statistics, regression assumption tests and simple linear regression analysis. The results from the Ordinary least squares regression analysis were used in the testing of the research hypotheses as stated in the first section of this work.

1. **Descriptive Statistics**

This was conducted to understand the behaviour of the data using various statistics including mean, standard deviation, skewness, and kurtosis. The result for the descriptive statistics analysis is as presented in Table 4.1 below;

Table 4.1 Descriptive Statistics Results

G P M I T I H C E O Q

Mean	7.923676	21.22971	1192738.	2557.493
Median	7.818395	22.38456	521812.5	2329.198
Maximum	23.46395	29.52949	5191284.	4886.982
Minimum	0.449530	5.725473	65467.00	1042.183
Std. Dev.	5.445423	5.498026	1382573.	982.4627
Skewness	0.657198	-0.687466	1.527834	0.328868
Kurtosis	3.148585	2.651692	4.307079	2.226174
Jarque-Bera	5.103333	5.867622	32.21623	3.008319
Probability	0.077952	0.053194	0.000000	0.222204
Sum	554.6573	1486.080	83491657	179024.5
Sum Sq. Dev.	2046.032	2085.752	1.326514	66601078
Observations	70	70	70	70

Source: Researcher's computation (2025)

Table 4.1 above shows that Gross profit margin (GPM), inventory turnover (IT), inventory holding cost (IHC) and economic order quantity (EOQ) of listed pharmaceutical firms in Nigeria have mean scores of approximately 7.923%, 21.22 times, ₦1.19million and 2,557 units respectively. This indicates the central or average values for these variables from 2014 to 2023. The median values obtained for Gross profit margin (GPM), inventory turnover (IT), inventory holding cost (IHC) and economic order quantity (EOQ) of listed pharmaceutical firms in Nigeria were approximately 7.818%, 22.38 times, ₦0.521million and 2,329 units respectively. These constitute the middle values for the distributions of these variables under the period covered in this study (2014-2023).

In terms of the level of variability and dispersion in the distribution of these variables, the standard deviations obtained for the variables- Gross profit margin (GPM), inventory turnover (IT), inventory holding cost (IHC) and economic order quantity (EOQ) of listed pharmaceutical firms in Nigeria were 5.445, 5.498, 1382573 and 982.46 respectively. This indicates varying levels of variability in the distribution with inventory holding cost (IHC) indicating high variations in the distributions. Similarly, the skewness values obtained for these variables were 0.657, -0.687, 1.527, 0.328 respectively. This quantifies the asymmetry of the distributions.

In addition, the Kurtosis values obtained for Gross profit margin (GPM), inventory turnover (IT), inventory holding cost (IHC) and economic order quantity (EOQ) of listed pharmaceutical firms in Nigeria were given as approximately 3, 3, 4 and 2 respectively. Since the values of the kurtosis are greater than zero (0), it indicates a leptokurtic distribution, hence the presence of outliers in the data.

2. Model Evaluation

The suitability of the data was assessed through coefficient and residuals diagnostics. These include normality test, multicollinearity test and heteroscedasticity test.

1. Normality Test

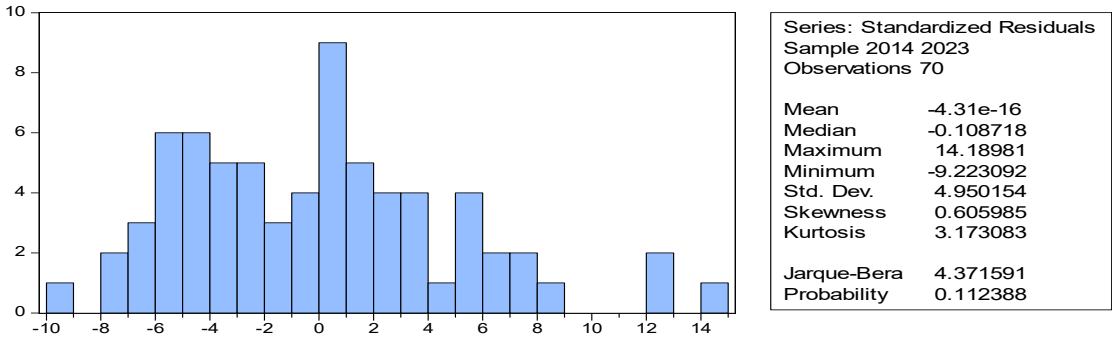

Fig. 4.1 Jarque-Bera Normality test results

Source: E-views 10.0 Output in Appendix 2

A significant Jarque-Bera test result implies that the data do not follow a normal distribution. On the other hand, a non-significant result indicates that there is insufficient evidence to reject the assumption of normality. If the p-value associated with the Jarque-Bera test is below a predetermined significance level ($p<0.05$), then we reject the null hypothesis and conclude that the data do not follow a normal distribution. With a p-value of 0.112388, there is sufficient evidence to conclude that the data were normally distributed.

2. Multicollinearity Test

In examining the association among the variables, the study employed the Spearman Rank Correlation Coefficient (correlation matrix), and the results are presented in the table below**.**

Table 4.2 Spearman's Rank Correlation Matrix

	GPM	**IT**	**IHC**	**EOQ**
GPM	1.000000	0.438723	0.170746	-0.120184
IT	0.438723	1.000000	0.143838	-0.043602
IHC	0.170746	0.143838	1.000000	-0.168772
EOQ	-0.120184	-0.043602	-0.168772	1.000000

Source: E-views 10.0 Output (2025)

The correlation analysis showed that all independent variables- inventory turnover (IT), inventory holding cost (IHC) and economic order quantity (EOQ) of listed pharmaceutical firms in Nigeria over the period under study have coefficients lesser than 0.80 respectively confirming absence of multicollinearity issues.

3. Heteroscedasticity Test

Table 4.3 Cross-section dependence/ Heteroscedasticity test

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	11.83001	2 1	0.9441

Pesaran scaled LM	-2.495084	0.0126
Pesaran CD	-1.831293	0.0671

Source: E-views 10.0 Output (2025)

The statistics and probability value associated with the Breusch-Pagan LM test otherwise known as the Breusch-Pagan Godfrey test help determine whether there is evidence of heteroscedasticity in the regression model. A low p-value ($p<0.05$) suggests evidence against the null hypothesis in favour of the alternate hypothesis which indicates the presence of heteroscedasticity in the regression model. With a p-value of 0.9441, there is sufficient evidence accept the null hypothesis, thus, conclude that the predictor variables were homoscedastic.

4. Autocorrelation

Autocorrelation tests examine whether the residuals are independently distributed or if there is a systematic pattern of dependence. The Durbin-Watson statistic is commonly used to test for autocorrelation, with values close to 2 indicating no significant autocorrelation. The Durbin-Watson statistic value of 1.563850 suggests a mild positive autocorrelation present in the residuals of the regression model.

Test of Hypotheses

Each of the hypotheses in this study was tested based on the result obtained from the panel multiple regression analysis. The result that relates to these hypotheses is summarized in table 4.5 below;

Table 4.4 Panel Multiple Regression Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.845727	2.917190	3.289912	0.0018
IT	0.414078	0.113490	3.648588	0.0005
IHC	-3.100747	4.576307	-2.678535	0.0298
EOQ	-0.000525	0.000629	-0.834980	0.4067

R-squared	0.173631	Mean dependent var	7.923676
Adjusted R-squared	0.136069	S.D. dependent var	5.445423
S.E. of regression	5.061407	Akaike info criterion	6.136611
Sum squared resid	1690.777	Schwarz criterion	6.265097
Log likelihood	-210.7814	Hannan-Quinn criter.	6.187647
F-statistic	4.622485	Durbin-Watson stat	1.563850
Prob(F-statistic)	0.005381		

Source: Researcher's computation using E-views 10.0 (2025)

The multiple regression line is as written below:

$GPM = 0.845727 + 0.414078*IT - 3.100747*IHC - 0.000525*EOQ + \mu$

Based on the regression result above, when the independent variables- inventory turnover (IT), inventory holding cost (IHC) and economic order quantity (EOQ) of listed pharmaceutical firms in Nigeria are held constant (equal Zero), the dependent variable– Gross profit margin increased at a constant average of approximately 0.8457% over the years. However, a one percent rise in inventory turnover (IT) increases gross profit margin by approximately 0.414% while a similar variation in inventory holding cost (IHC) and economic order quantity (EOQ) decreases gross profit margin by approximately 3.10% and 0.00052% respectively.

Hypothesis One

H_0: There is no significant relationship between inventory turnover and gross profit margin of listed pharmaceutical companies in Nigeria

H_1: There is no significant relationship between inventory turnover and gross profit margin of listed pharmaceutical companies in Nigeria

By way of testing whether the variations in gross profit margin of listed pharmaceutical firms in Nigeria caused by inventory turnover is significant. The T-test was carried out at .05 significance level with Ttab of 1.995 given at $T_{0.05,7}$. From the result above, the Tcal of 3.648588 is greater than Ttab given at $T_{0.05,7}$. Hence, the null hypothesis which states there is no significant relationship between inventory turnover and gross profit margin of listed pharmaceutical companies in Nigeria fails to hold, thus rejected, and the alternative hypothesis accepted. The null hypothesis is further rejected given that at $T_{0.05,7}$, its probability value (p-value = 0.0005) is less than 0.05.

Hypothesis Two

H_0: No significant relationship exists between inventory holding cost and gross profit margin of listed pharmaceutical companies in Nigeria

H_1: Significant relationship exists between inventory holding cost and gross profit margin of listed pharmaceutical companies in Nigeria

For inventory holding cost, the T-test was also employed at .05 significance level with Ttab of 1.995 given at $T_{0.05,7}$. From the results as shown in table 4.5, the Tcal of 2.678535 is greater than Ttab given at $T_{0.05,7}$. Hence, the null hypothesis which states no significant relationship exists between inventory holding cost and gross profit margin of listed pharmaceutical companies in Nigeria fails to hold, thus rejected, and the alternative hypothesis accepted. The null hypothesis is further rejected given that at $T_{0.05,7}$, its probability value (p-value = 0.0298) is less than 0.05.

Hypothesis Three

H_0: Economic order quantity has no significant relationship with gross profit margin of listed pharmaceutical companies in Nigeria

H_1: Economic order quantity has significant relationship with gross profit margin of listed pharmaceutical companies in Nigeria

In addition, the T-test was also employed for economic order quantity at .05 significance level with Ttab of 1.995 given at $T_{0.05,7}$. From the results as shown in table 4.5, the Tcal of 0.8349 is less than Ttab given at $T_{0.05,7}$. Hence, the null hypothesis which states thatEconomic order quantity (EOQ) has no significant relationship with gross profit margin of listed pharmaceutical companies in Nigeriaholds, thus accepted, and the alternative hypothesis rejected. The null hypothesis is further accepted given that at $T_{0.05,7}$, its probability value (p-value = 0.04067) is greater than 0.05.

Discussion of Findings

Inventory Turnover and Gross Profit Margin

The finding that inventory turnover has a significant positive relationship with gross profit margin of listed pharmaceutical firms in Nigeria is consistent with theoretical expectations. A higher inventory turnover ratio indicates that a company is selling its inventory more quickly, which can lead to increased liquidity, reduced holding costs, and increased profitability. This is particularly important in the pharmaceutical industry, where inventory obsolescence and expiration can result in significant losses. The positive coefficient of 0.414078 suggests that a one-unit increase in inventory turnover is associated with a 0.414078-unit increase in gross profit margin, holding all other variables constant. This finding highlights the importance of efficient inventory management in enhancing the profitability of listed pharmaceutical firms in Nigeria. Obeidat (2021) found a significant positive relationship between inventory turnover and return on assets. Similarly, Bah et al. (2023) found that inventory turnover has a positive significant relationship with return on assets.

Inventory Holding Cost and Gross Profit Margin

The finding that inventory holding cost has a significant negative relationship with gross profit margin of listed pharmaceutical firms in Nigeria is also consistent with theoretical expectations. A higher inventory holding cost can erode a company's profitability by increasing its costs and reducing its gross profit margin. This is particularly relevant in the pharmaceutical industry, where inventory holding costs can be significant due to the need for climate-controlled storage and handling of perishable products. The negative coefficient of -3.100747 suggests that a one-unit increase in inventory holding cost is associated with a 3.100747-unit decrease in gross profit margin, holding all other variables constant. This finding underscores the importance of minimizing inventory holding costs in order to enhance the profitability of listed pharmaceutical firms in Nigeria. For example, Gołaś (2020) found that increasing inventory days for raw and other materials had a negative impact on return on total assets. Similarly, Anisere-Hameed &Bodunde (2021) found that inventory management has a significant effect on return on asset, investment, net operating margin, and net income of manufacturing firms in Nigeria. These studies suggest that high inventory holding costs can erode profitability.

Economic Order Quantity and Gross Profit Margin

The finding that economic order quantity has a non-significant negative relationship with gross profit margin of listed pharmaceutical firms in Nigeria is unexpected. A higher economic order quantity is typically expected to reduce inventory costs and increase profitability. However, the non-significant coefficient of -0.000525 suggests that economic order quantity does not have a statistically significant impact on gross profit margin. This finding may be due to the fact that listed pharmaceutical firms in Nigeria may not be optimizing their economic order quantities, or that other factors such as inventory holding costs and inventory turnover may be more important drivers of profitability. Further research is needed to explore this finding in more detail. This is consistent with the study by Ali et al. (2022),

which found that inventory turnover ratio does not impact operating profits statistically in a significant way. Similarly, Salman et al. (2023) found that inventory turnover and capital work in progress do not significantly affect return on equity and return on assets. These studies suggest that economic order quantity may not have a significant impact on profitability.

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary of the Study

This present study examined the effect of inventory management on profitability of listed pharmaceutical firms in Nigeria. The study covered ten (10)-year period with particular emphasis on inventory turnover (IT), inventory holding cost (IHC) and economic order quantity (EOQ). Gross profit margin however represented the dependent variable (profitability). Below is a summary of findings gathered through a panel of simple linear regression analysis;

1. Inventory turnover has a significant positive relationship (Coeff. = 0.414078 {0.0005}) with gross profit margin of listed pharmaceutical firms in Nigeria.
2. Inventory holding cost has a significant negative relationship (Coeff. = -3.100747 {0.0298}) with gross profit margin of listed pharmaceutical firms in Nigeria.
3. Economic order quantity has a non-significant negative relationship (Coeff. = -0.000525 {0.4067}) with gross profit margin of listed pharmaceutical firms in Nigeria.

Conclusion

This study examined the effect of inventory management on the profitability of listed pharmaceutical firms in Nigeria. The findings of this study highlight the importance of effective inventory management in driving profitability in the pharmaceutical industry. Inventory management is a critical component of supply chain management, and its impact on profitability cannot be overstated. By optimizing inventory levels, reducing inventory holding costs, and improving inventory turnover, pharmaceutical firms can improve their profitability and remain competitive in the market. This study contributes to the existing literature on inventory management and profitability, providing insights into the relationship between these variables in the context of the Nigerian pharmaceutical industry.

Recommendations

The following recommendations are in line with the findings of this study

1. Listed pharmaceutical firms in Nigeria should implement strategies to improve their inventory turnover rates. This can be achieved by optimizing inventory levels, reducing lead times, and improving forecasting accuracy.
2. Listed pharmaceutical firms in Nigeria should implement cost-saving measures to reduce their inventory holding costs. This can be achieved by renegotiating storage contracts, implementing just-in-time inventory systems, and reducing inventory obsolescence.
3. Listed pharmaceutical firms in Nigeria should re-evaluate their economic order quantity strategies to ensure that they are optimizing their inventory orders. This can be achieved by conducting regular reviews of inventory demand and supply, and adjusting economic order quantities accordingly.

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