



Effect of Inventory Management and Financial Performance of Manufacturing Firms in Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The study examines the effect of inventory management on the financial performance of selected manufacturing firms in Nigeria. The ex-post facto design was adopted in this study. 56 listed manufacturing firms in the Nigerian Stock Market were selected as the population of the study. Eleven (11) companies were selected using a purposive sampling method. Multiple Ordinary Least Square regression technique, specifically the panel regression model was applied in testing the hypotheses of the study. Firstly, the study revealed that cash conversion cycle has a negative significant effect on return on assets of listed manufacturing firms in Nigeria. The second hypothesis tested showed that account receivable turnover has a positive significant impact on

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return on assets of listed manufacturing firms in Nigeria. The third hypothesis tested that indicated that account payable turnover has a positive significant effect on return on assets of listed manufacturing firms in Nigeria. Consequently, the recommendations of the study that manufacturing firms in Nigeria should speed up the conversion of finished into sales. Through putting in place appropriate marketing strategies that ensure quick sales of product to attract more revenues and profit, this can be achieved. Again, manufacturing firms should strive to retain only credit worthy customers who would ensure prompt payment of account receivables. By so doing, quick returns would be enhanced and profitability of manufacturing firms boosted. In conclusion, the manufacturing firms should strive to achieve timely payment of credit purchases as this would aid the suppliers have greater confidence in entrusting more raw materials to the firms on credit basis with the positive effect of boosting their inventories, increased sales and profit.

Keywords: Organizational performance; inventory management; financial performance; stock market; cash conversion; account payable turnover; account receivable turnover; marketing strategies; revenue; business; inventory control; inventory costs; operational performance; company performance.

1. INTRODUCTION

Inventory did not previously have access to the required control measures. In fact, having too much inventory was seen as a sign of affluence. At that time, management saw overstocking as important to and beneficial to businesses. Nowadays, the adoption of effective and efficient inventory control measures by businesses is trending. Inventory control is more and more seen as a strategy for making optimum use of resources and enhancing the general organizational efficiency of enterprises.

Inventory management system aid organizations to identify distinct requests, sells on occasion and available product in a limited amount to keep inventory costs down and to build a positive goodwill to enhance prompt restocking of inventories. Globally, inventory control is still a critical constituent of every enterprises owing to the fact that ineffective inventory systems could lead to forfeiture of clients and revenues of companies whereas efficient inventory control brings about increase in sales for the business. Inventory comprises both items that would be utilized in the creation of products that would be sold and items held in the normal course of business. Considering that inventory control is directly related to production in any organization, it implies that managing inventory has effect on an organization's profitability either directly or indirectly. Inventory control connotes ensuring that the right materials are available in the quality and quantity, at the right place and at the right time. As a result of the expensive nature of inventory, its control and management is challenging. Effective inventory control is necessary to deliver excellent customer service.

Inventory control involves the processing and application of control within the economic framework to ensure great standards of customer service though preventing the accumulation of large inventories that could sewer funds and results in losses. An enterprise's inventory of raw materials is often considered current assets because of the frequency of consumption in a given year.

Inventory must be physically verified before it is captured in the statement of financial activities of an enterprise hence the need for periodic stock-take. It is expected that a manufacturing firm must have a given quantity of finished goods, work-in-progress and raw materials irrespective of the size of the company because of the profit motive of the establishment. Inventory management entails keeping track of stock levels, estimating demand for the future and ascertaining when and how to place orders. Therefore, inventory policies connote a collection of policies and regulations that keep track of the level of stocks, take decision regarding when to restock and state the size of orders at any point in time. Inventory is one of the manufacturing company's crucial assets. It is observed that about 60%-70% of the total funds used by many manufacturing companies are in the form of current assets with inventory having the most significant component consisting of raw materials, work-in-progress and finished goods. Poorly managed inventories frequently have a detrimental effect on a company's profitability and in the long-run lead to an organization's liquidation. Keeping enough high-quality stock to meet customers demand while at the same time reducing the expenses of maintaining inventory is the main objective of inventory. Considering

the fact that it cost a lot of money to tie down excess capital in inventory, the management must strive to make frantic effort to make best inventory decision. So, in this study, we look at the relationship between inventory management and financial performance of chosen Nigerian manufacturing companies that are publicly traded.

1.1 Statement of the Problem

In the working capital arrangement of business, inventory is given much priority. Effective inventory management guarantees the protection of the company from low productivity and low production quality. It protects the company from forfeiture of customers, loss of profit and inability to perform their corporate social responsibility. Though some enterprises frequently assert that they manage their inventory properly, a myriad of challenges still subsist which include but not limited to supply shortages, sharp reduction in productivity and poor customers satisfaction. Companies need resources and inventory is one of them. Considering that inventory is very rare, it must be well managed to ensure sustained existence and buoyance of an enterprise. The price of obtaining these inventories is also crucial because having too few of them could result shortage and manufacturing bottleneck, while having too many will tie up cash and increase the danger of obsolescence. In the light of this, the study strives to examine how inventory management affects the financial performance of manufacturing firms in Nigeria.

1.2 Objectives of the Study

The general objective of the study is to access the effect of inventory management on the financial performance of manufacturing firms in Nigeria. In specific terms, the study pursues the following objectives:

- i. determine the effect of cash conversion cycle on return on assets of selected firms in Nigeria.
- ii. examine the effect of account receivable turnover on return on return of assets of selected firms in Nigeria.
- iii. identify the effect of account payable turnover on return of assets of selected firms in Nigeria.

1.3 Research Hypotheses

The following research hypotheses for the study are in null form.

- i. There is no significant effect of cash conversion cycle on return of assets of manufacturing firms in Nigeria.
- ii. There is no significant effect of account receivable turnover on return of assets of manufacturing firms in Nigeria.
- iii. There is no significant effect of account payable turnover on return of assets of manufacturing firms in Nigeria.

2. REVIEW OF RELATED LITERATURE

2.1 Conceptual Issues

2.1.1 Concept of inventory

Raw materials utilized in production as well as finished commodities that are offered for sale are both included in inventories. One of a company's most valuable assets is its inventory because turnover is one of the main ways it generates revenue and, consequently, profits for its shareholders. In a larger sense, inventory might include inputs like money, energy, people, equipment, and raw materials. It can also include inputs like parts, components, and finished things, as well as interim stages of the production process like partially finished products or work in progress. Though the maintenance cost of inventory is very high, effective inventory is needed for offering excellent customer service. To maintain a high degree of customer service while at the same time preventing excessive inventory levels that can drain funds and result in losses, effective inventory management tools are provided.

2.1.2 Types of inventories

The following classification apply to inventories in manufacturing businesses.

a. Raw materials – materials used in the production of finished products or various components that make up the product. These can be created or obtained by a company directly, or they can buy them from a supplier. Additionally, it refers to the raw resources that a business uses as an input or resource to create its finished goods. In either case, raw materials are seen as a type of inventory and should be properly recorded and kept in a secure location.

b. Work-in- Progress: These are components or unfinished goods that are actively being produced but are not yet ready for retail sales. Since the things that are being manufactured are

not yet finished commodities and can be counted and documented in the books of account, it is typically utilized by businesses that manufacture products. c. Finished Goods: Products that are finished and ready to be used or sold are referred to as finished goods. The corporation may produce finished goods in-house or buy them as finished goods from a source. It is the final stage of the manufacturing process. The products are prepared for distribution, usage, or consumption. After this point, the seller is not required to process any more parts of the products.

Maintenance, Repair, and Operations (MRO) inventory: This is an additional category of inventory that does not belong to the company's raw materials, work-in-progress or finished goods. These inventories are maintained and reported as existing control measures. Such a collection is known as a tool inventory and includes things like safety gear or repair tools.

Concept of Inventory Management. Inventory management is the process of ordering, storing, using and selling a company's inventory. This covers the storage and processing of such products as well as the management of raw materials, components, and completed commodities. Therefore, inventory management is a technique for monitoring the movement of inventories. It starts with the purchase of commodities and storage of those materials and proceeds to the flow of raw materials or stocks and extends to the manufacturing unit, or to the outflow of raw materials or stock to reach the market, as appropriate. Manual procedure or automated system can be applied in inventory management. Inventory management is an integration of information, transportation, acquisition, inspection, materials handling, warehousing, packing, control of supplies, and maintaining of securities of inventories. Inventory management seeks to maximize the movement of commodities, information and other related resources like people and energy from the point of origin to the site of final consumption.

2.1.3 Concept of financial performance

A firm's performance is described as the process by which a company's resources, including people, materials, equipment, and money, are used to achieve organizational goals to the fullest. Performance and profit are sometimes used synonymously, yet they have distinct differences. Performance, as opposed to

profit, refers to an organization's capacity to realize a return on all of the resources it uses to conduct business. Profit is an organization's total income earned. A term called "firm performance" describes an organization's capacity for doing business profitably. By utilizing the existing resources to meet the anticipated profit target, it gauges a company's level of efficiency. Financial performance mainly reflects the results of business activities within a given operating cycle, which shows the business's general performance over a period of time. It demonstrates the level of performance of a company given the quantity of resources consumed in the course of business operation and equally goes to show how resources employed are used to ensure profit generation and sustenance of shareholders wealth. Financial ratios are most often used performance assessment in the field of finance and statistical analysis, even if the evaluation of the firm's financial performance takes into consideration many other types of metrics.

2.1.4 Measures of financial performance

The indicators listed below are frequently present in the financial statements. They are among the most crucial for managers and other critical organization stakeholders to understand. i. Gross profit margin or profitability ratio calculates the portion of revenue that remains after deducting cost of goods sold. Operating costs, interest costs and taxes are not included in the cost of goods sold which only includes the direct cost of production. On the hand, a product's or line of product's gross profit margin is a measure of profitability that excludes accounting overheads.

Formula for Gross Profit Margin: $(\text{Revenue} - \text{Cost of Sales} / \text{Revenue}) \times 100$. ii. Net profit Margin: Net profit margin is a profitability ratio that measures what percentage of revenue and other outcome is left after subtracting all cost for goods sold, operating expenses, interests and taxes. Net profit differs from gross profit margin as a measure of profitability for the business in general, taking into consideration not only the cost of goods but other expenses. Formula for Net profit Margin: $\text{Net Profit} / \text{Revenue} \times 100$. iii. Working Capital: Working capital is a measure of the business's available operating liquidity, which can be used to fund day to day operations. Formula for working capital: $\text{Current assets} - \text{current liabilities}$. iv. Current Ratio: Current Ratio is liquidity ratio that helps you to understand whether a business can pay its short-term

obligation – that is obligations due within one year – with its current assets and liabilities, Formula for current ratio: current assets – current liabilities. **iv. Quick Ratio:** The quick ratio is also known as acid test ratio is another type of liquidity ratio that measures a business ability to handle short-term obligations. The quick ratio uses only highly liquid current assets such as cash, marketable securities and account receivables in its numerator.

2.1.5 Aims of inventory management

The objectives of inventory management are briefly discussed as follows: a. Availability of materials: Inventory management first and foremost aims at ensuring that materials are made available at all times any time it is required by the production department without any interruption. It is therefore advised that a buffer stock of all essential items are ready to ensure continuity in production. b. Control of production level: Proper inventory control helps to increase and maintain a buffer stock of raw materials to meet any contingency and control. c. Economy in purchasing: An appropriate inventory management brings several advantages and economy in scale purchasing. Management makes every attempt to purchase the inventories in bulk and takes advantage of favourable market conditions. d. Better customer services: To meet the demand for quality of goods, it is the responsibility of the going-concerned to produce sufficient stock of finished goods at the proper time to ensure the execution of order of customers. It will improve the image of the firm. e. Inventory wastage: Effective inventory control would aim at reducing wastage, pilferage, obsolescence and other incidental costs.

2.1.6 Stages of inventory management: purchasing

This implies purchasing of raw materials and turning them into finished products. It could mean purchasing products to sell them without assemblage. Production – involves conversion of raw materials into finished goods available for sale. Holding Stock: This stage involves storing the raw materials before they are manufactured and the finished goods before they are sold. Sales: This stage includes making the stock available to the customers and in turn receiving payment. Reporting: which involves knowing how much was put into the business and how much money it makes on each sale.

2.1.7 Inventory management technique

Inventory management technique help in tracking and controlling the inventory orders, their usage and storage along with the management of finished goods that are ready for sale. Inventory management is one area of business that management should not ignore. The various types of inventory techniques that help in efficient inventory management are briefly discussed below: **ABC Analysis:** It is an inventory management technique where inventory items are classified into three categories namely A, B and C. The items in the A category of inventory are closely controlled as it consist of high price inventory which may be less in number but are very expensive. The items in category B are relatively lesser expensive inventory as compared to the A category and the number in the B category is moderate. Therefore, the control level is also moderate. The category C consists of high number of inventory items that requires lesser investment, therefore the control is minimum. **ABC analysis stands for Always Better Analysis. Just-in-Time Method:** Just-in-Time technique of inventory control method of inventory ensure that the company does not keep excess inventory in hand. The firm maintains only the quantity of needed during production. The company orders further inventory when the old stock of inventory is lose to replenishment. This is a little risky method of inventory management because a little delay in ordering new inventory can lead to stock out situation. Thus, this method requires proper planning so that new orders can be timely placed. **Economic Order Quantity (EOQ):** This technique focuses on deciding, regarding how much quantity of inventory should the company order at a particular time and when they should place the order. In this model, the store manager will reorder the inventory when it reaches the minimum level. With the EOQ model, the organization is able to place the right quantity of inventory. **Minimum Safety Stocks:** The minimum safety stock is the level of inventory that an organization maintains to avoid the stock-out situation. It is the level when we pace new order before the existing inventory is over.

2.1.8 Inventory management software

Many firms today, make use of computer application software in the management of inventory. Particularly manufacturing firms who operates at a corporate level should embrace the use of computers. Inventory management

software is a software that is used for tracking inventory levels, orders, sales, and deliveries. It can also be used by other manufacturing industry to create a work order, bill of materials and other related documents. Companies used inventory management software to avoid products, over stock and outages. It is a tool for organizing inventory data that before was generally stored in hard copy form or in spreadsheets. Choosing an inventory management system that is right for your business can be a tricky process. But here are few pillar features of good inventory. Real-time-tracking: Synchronizes a live inventory figure across all sales channels and warehouse. Forecasting: Uses past sales data to project estimated inventory requirements into the future. Purchasing: Helps manage all suppliers and purchase orders for quick and easy stock replenishment. Cloud-based: Accessed from anywhere with data never being overwritten by team members making changes.

2.2 Theoretical Framework

2.2.1 Theory of constraints

“This theory emphasizes focus on effectively managing the capacity and capability of these constraint to improve productivity and this can be achieved by manufacturing firms and applying appropriate inventory control practices. Theory of constraints is a methodology whose basis is applied to production for the minimization of the inventory” [1]. In view of the fact that this study examines the effect of inventory control on the performance of manufacturing firms, this study therefore settles for this theory.

2.2.2 Empirical review

Inventory management and financial success have been the subject of several studies. Kolawole, Akomolafe, and Olusipe [2], used International Breweries PLC as a case study to assess the link between inventory control and manufacturing companies' profitability in Nigeria. The study employed gross profit as a stand-in for profitability (the dependent variable), while raw material, work-in-progress, and finished goods inventories were only a few of the inventory management-related variables that were used as explanatory variables to represent inventory management. The company's annual reports from 2002 to 2011 were used to gather secondary data for the study.

As a statistical tool for data analysis, they used straightforward linear regression procedures. The findings demonstrated that inventory management had a significant impact on International Breweries PLC's profitability in Nigeria. Ndubuisi et al. [3] looked at the connection between inventory control and the financial success of breweries in Nigeria from 2010 to 2016. The study employed inventory conversion period as the independent variable and ROA, revenue growth, and ROE as proxies for financial performance (the dependent variable). The NSE fact book and the annual reports of the seven sampled brewers were used to compile secondary data for the study. For data analysis, they used the Strata version 13 software and the OLS regression approach. The findings showed a substantial positive association between inventory conversion period, ROA, and revenue growth, but a positive but insignificant relationship between inventory conversion period, and ROE. For the years 2007 to 2014, Bawa, Asamoh, and Kissi [4] looked into how inventory management affected the performance of companies listed on the Ghana Stock Exchange. For example, they used return of assets and inventory conversion period as stand-ins for inventory management (an independent variable) and performance (a dependent variable), respectively.

3. METHODOLOGY

The research design used in the study is *ex post facto*. Fifty-six (56) manufacturing companies that are publicly traded on the Nigerian Exchange Group make up the study's sample. The financial statements of two chosen companies in Nigeria are examined cross-sectionally in this study. Two specified, hand-picked manufacturing companies in Nigeria make up the sample size. Information was gleaned from the financial statements of 11 specialized Nigerian manufacturing firms. Other sources to enrich the literature included published reports on inventory management, published scholarly papers, textbooks and other materials in existence adopted in explaining the researched variables. The names of the company are attached in appendix I for perusal. This study used the Panel regression to examine the effect of inventory management and financial performance of selected listed manufacturing firms in Nigeria. This study was designed to cover a period of 16 years (2012-2021). The results of the data analysis and hypotheses testing is done using Stata-13 Computation in

order to present reliable evidence upon which the conclusion of the study was drawn.

3.1 Model Specification

This study examines the effect of inventory management of selected listed manufacturing firms in Nigeria. In order to accomplish this, three variables were identified in the study and these are dependent and independent variables include; Cash conversion cycle, Account Receivable Turnover, Account Payable Turnover. On the other hand, the dependent variable is financial performance.

The model is shown below:

$$Y = a+bx$$

$$CCC= a+b ROA$$

$$ART = a+b ROA$$

$$APT= a+b ROA$$

Where;

$$Y= \text{Financial performance}$$

$$Y1= \text{Inventory Management}$$

$$X1= \text{CCC}$$

$$X2= \text{ART}$$

$$X3= \text{APT}$$

Where:

$$IM= \text{Inventory Management}$$

$$CCC= \text{Cash Conversion Cycle}$$

$$ART= \text{Account Receivable Turnover}$$

$$APT= \text{Account Payable Turnover}$$

$$FSZ = \text{Firm size (log of total assets) as control variable}$$

Mathematical form:

$$Y = a+bx$$

$$ROA= a+b CCC. \quad (1)$$

$$ROA= a+b ART \quad (2)$$

$$ROA= a+b APT \quad (3)$$

In Econometric form

$$Y= \beta_0 + \beta_1x + e/y$$

$$ROA= \beta_0 + \beta_1 CCCit+ \beta_2 ARTit+ \beta_3 APTit+ FSZit + \quad (4)$$

4. RESULTS AND DISCUSSION

4.1 Data Presentation and Analysis

In this section, analyses of the data presented in appendix I of the study are done with the aid of Stata. The analysis of data is presented in the subsequent sections: This section of the chapter presents the descriptive statistics of the data extracted from the annual financial statement of the listed manufacturing firms that are sampled for the study. The correlation analysis is done in the subsequent section, as well as the regression analysis.

4.1.1 Descriptive statistics

The descriptive statistics for both the dependent and independent variables are presented in Table 1.

Table 1 presents the descriptive statistics of all the variables. The number of observations for the study is 110.

Return on assets (ROA) recorded a minimum and maximum value of 0.001854 and 0.958652. ROA also recorded a mean of 0.167245 and a standard deviation of 0.1911358. Cash Conversion Cycle (CCC) reveals a mean of 82.50909 with a deviation of 36.49224 days. CCC further revealed a minimum (-12) and maximum (178) number of days respectively. Account Receivable Turnover ratio (ART) reveals a mean of 0.4139963 with a deviation of 0.2240859 ratio. ART further revealed minimum (0.0699947) and maximum (0.982806) ratios respectively. Account Payable Turnover ratio (APT) reveals a mean of 0.3478784 with a deviation of 0.2109975 ratio. APT further revealed minimum (0.0170208) and maximum (0.9157462) ratios respectively. Finally, Firm Size (FSZ) reveals a mean log of 6.211606 with a deviation of 0.5934503. FSZ further revealed a minimum and maximum value of 5.065863 and 7.96116 respectively.

To test for stationarity of data, the Skewness statistics are used. The ratio of skewness to its standard error can be used as a test of normality. According to Berenson and Levine, [5] you can reject normality if the ratio is less than -2 or greater than +2. A large positive value for skewness indicates a long right tail; an extremely negative value indicates a long left tail; which is an indication of non-normality of data. The data set for all the variables reveal skewness statistic

Table 1. Descriptive statistics table

	ROA	CCC	ART	APT	FSZ
Mean	0.167245	82.50909	0.4139963	0.3478784	6.211606
Maximum	0.958652	178	0.982806	0.9157462	7.96116
Minimum	0.001854	-12	0.0699947	0.0170208	5.065863
Std. Dev.	0.191358	36.49224	0.2240859	0.2109975	0.5934503
Skewness	0.4000	0.8139	0.1385	0.9009	0.1048
Observations	110	110	110	110	

Source: Stata Output

values that are between the range of -2 and +2 which means that all the data values are within the accepted skewness range for normality thus all the data are normalized.

4.1.2 Data diagnostic test

4.1.2.1 Correlation analysis

This section of the chapter presents in the table below the result of the correlation analysis between the independent variables.

Table 2. Correlations table

	CCC	ART	APT
CCC	1.000		
ART	-0.1180	1.000	
APT	-0.1588	0.5031	1.000

Source: Stata output

Table 2 shows the correlation for all the independent variables to ensure the test for multicollinearity of the independent variable since they consist of unranked data. "Correlation considers two variables at a time to determine how they relate to each other. These types of checks are necessary because high correlation cause problems about the relative contribution of each predictor to the success of the model" [6]. The correlation matrix above shows the absence

of multicollinearity among the explanatory. All the variables show a low correlation with the highest correlation estimated at 0.70 between ROA and FA. Correlation statistics that are above 0.75 are considered harmful for analysis (see Gujarati and Sangeeta, [6]) but this is not the case with the current study.

4.1.3 Multi-collinearity test

To avoid running a spurious regression, a stationarity test is carried out to ensure that the variables employed in this study are mean-reverting i.e. stationary. For this purpose, the Variance Inflation Factor.

Results for the ROA model in Table 3 above reveal VIF statistics values of less than 10 for the model, which proves that the set of independent variables data are free from multicollinearity issues. This means that the regression result can be adopted given the fact the model is robust enough to ensure that the allowable error is within or less than the accepted limit of 0.05.

4.1.4 Regression of the estimated model

This section of the chapter presents the results produced by the three model summaries for further analysis.

Table 3. Multi-collinearity

Test	Test STAT	FRQ Model
Multicollinearity	Variance Inflation Factor (VIF)	1.02<10 Mean Centered

Source: Stata output

Table 4. Pre regression estimation test

	Statistic	P-value
i.	Hausman Test Decision	0.6539 Random effect model

Source: STATA Output

Table 5. ROA model summary

Variable	Coefficient	Prob.
C	1.185478	0.001
CCC	-.0000445	0.896
ART	.0928152	0.294
APT	.1201148	0.130
FSZ	-.1762466	0.002
R-squared within	0.1641	
R-squared between	0.1103	
Overall R-squared	0.1065	
Wald chi2	17.57	
Prob(chi2-statistic)	0.0015	

Source: Stata output

To enable the study to choose between the pooled model, fixed-effect model, and the random effect model, the Hausman test is conducted with the comparable results/table. The result of the Hausman correlation test from Table 4 above shows a probability value of $0.6539 > 0.05$ which is not significant thus informs the preference of the random-effect model from the Hausman test. Thus, the random effect model is analyzed Table 5:

Table 5, presents the regression result between CCC, ART, APT and ROA controlled FSZ. From the model summary table above, the following information can be distilled.

The R2 within which measures the level of variation of the dependent variable caused by the independent variables within each panel group stood at 0.1641. This means that, within each group, the R2 value of approximately 0.1641 indicates that 16.41% of the variation in the return on assets (ROA) of listed manufacturing firms can be explained by a variation in CCC, ART, and APT while the remaining 83.59% (i.e. $100 - R2$) could be accounted by other variables not included in this model.

The R2 between the panel groups reveals a statistic of 0.1103. This means that there is $0.0583 (0.1641 - 0.1103)$ variation between the levels at which each panel group CCC, ART, and APT data contribute to variation in ROA data of the group panel data.

The overall R2 Reveal a statistic of 0.1065. This means that, the overall manufacturing firms' CCC, ART and APT contribute to 10.65% variation in the return on assets (ROA) of listed manufacturing firms while the remaining 90.35% (i.e. $100 - R2$) could be accounted by other variables not included in this model.

The regression results as presented in Table 4 above shows that when all the independent variables are held stationary or without the variable intercept model; the ROA variable is estimated at 1.185478. This simply implies that when all independent variables are held constant, there will be increase in the ROA of listed manufacturing firms up to the tune of 1.185478 units occasioned by factors not incorporated in this study. Thus, a unit increase in CCC will lead to decrease in ROA by 0.004%. But a unit increase in ART will lead to increase in ROA by 9%. Also, a unit increase in APT will lead to increase in ROA by 12%.

Finally, the result shows that there is a significant variation of Wald statistics (17.57) at a probability value of 0.0015 which means the model as a whole is statistically fit.

4.1.5 Test of hypotheses

The hypotheses outlined in chapter one of the study are hereby tested;

HO₁: Cash conversion cycle does not significantly affect return on assets of listed manufacturing firms in Nigeria.

To test the significance of the model, the decision rule stated in chapter 3 is used. Since the calculated probability value for CCC ($0.896 > 0.05$) against ROA is greater than the accepted probability value of 0.05. The null hypothesis is accepted and the alternative rejected thus; cash conversion cycle does not significantly affect return on assets of listed manufacturing firms in Nigeria.

HO₂: Account receivable turnover does not significantly affect return on assets of listed manufacturing firms in Nigeria.

To test the significance of the model, the decision rule stated in chapter 3 is used. Since the calculated probability value for ART ($0.294 > 0.05$) against ROA is greater than the accepted probability value of 0.05. The null hypothesis is accepted and the alternative rejected thus; account receivable turnover does not significantly affect return on assets of listed manufacturing firms in Nigeria.

HO₃: Account payable turnover does not significantly affect return on assets of listed manufacturing firms in Nigeria.

To test the significance of the model, the decision rule stated in chapter 3 is used. Since the calculated probability value for APT ($0.130 > 0.05$) against ROA is greater than the accepted probability value of 0.05. The null hypothesis is accepted and the alternative rejected thus; account payable turnover does not significantly affect return on assets of listed manufacturing firms in Nigeria.

4.1.6 Test of hypotheses

The results of the hypotheses test are indicated below:

HO₁: Cash conversion cycle does not significantly affect return on assets of listed manufacturing firms in Nigeria.

To test the significance of the model, the decision rule stated in chapter 3 is used. Since the calculated probability value for CCC ($0.896 > 0.05$) against ROA is greater than the accepted probability value of 0.05. The null hypothesis is accepted and the alternative rejected thus; cash conversion cycle does not significantly affect return on assets of listed manufacturing firms in Nigeria.

HO₂: Account receivable turnover does not significantly affect return on assets of listed manufacturing firms in Nigeria.

To test the significance of the model, the decision rule stated in chapter 3 is used. Since the calculated probability value for ART ($0.294 > 0.05$) against ROA is greater than the accepted probability value of 0.05. The null hypothesis is accepted and the alternative rejected thus; account receivable turnover does not significantly affect return on assets of listed manufacturing firms in Nigeria.

HO₃: Account payable turnover does not significantly affect return on assets of listed manufacturing firms in Nigeria.

To test the significance of the model, the decision rule stated in chapter 3 is used. Since the calculated probability value for APT ($0.130 > 0.05$) against ROA is greater than the accepted probability value of 0.05. The null hypothesis is accepted and the alternative rejected thus; account payable turnover does not significantly affect return on assets of listed manufacturing firms in Nigeria.

4.1.7 Discussion and interpretation of results

Three research objectives were set to ascertain the effect of inventory turnover on profitability of listed manufacturing firms in Nigeria. The study hypotheses tested revealed that, cash conversion cycle, account receivable turnover, and account payable turnover does not significantly affect return on assets of listed manufacturing firms in Nigeria. The study findings conform to that of Thogori and Gathenya [7] who carried out "an investigation on the role of inventory management on customer satisfaction among manufacturing firms in Kenya. The research was carried out at Demonte Kenya since the company has a well laid down supply chain inventory information sharing system that is linked to the customer in real time to enhance inventory management. A census was carried on all 50 employees at Demonte Kenya who were involved in the supply chain management activities. Questionnaire, interview guide and observation guide were used to collect the data. The result revealed that the entire respondent indicated that the company experienced shortages of inventory. They therefore concluded that manufacturing firms had poor inventory management systems and that had greatly impacted on their ability to satisfy their customers' needs thus resulting to a lower sale turnover".

5. SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings

The following are the summary of the major findings of this study arrived at through the test of the research hypotheses earlier formulated in this study. Cash conversion cycle has a negative relationship with return on assets of listed manufacturing firms in Nigeria. Also, Cash

conversion cycle does not significantly affect return on assets of listed manufacturing firms in Nigeria. Account receivable turnover has a positive relationship with return on assets of listed manufacturing firms in Nigeria. But account receivable turnover does not significantly affect return on assets of listed manufacturing firms in Nigeria. Account payable turnover has a positive relationship with return on assets of listed manufacturing firms in Nigeria. But account payable turnover does not significantly affect return on assets of listed manufacturing firms in Nigeria.

5.2 Conclusion

Based on the findings of this study from the test of the three research hypotheses earlier formulated in the study, the researcher has therefore come to the following conclusions outlined in respect to each hypothesis: Cash conversion cycle has a negative significant effect on return on assets of listed manufacturing firms in Nigeria. Account receivable turnover has a positive significant effect on return on assets of listed manufacturing firms in Nigeria. Account payable turnover has a positive significant effect on return on assets of listed manufacturing firms in Nigeria.

5.3 Recommendations

In consonance with this study's findings, the following recommendations become imperative: Manufacturing firms in Nigeria should speed up conversion of finished goods into sales. This can be done through putting in place good marketing strategies that ensure quick sales of products to attract more revenue and profit. The firms should ensure that only credit worthy customers are given goods on credit to ensure prompt account receivables. This will boast quick returns and increase the profit of the firms. Also, the manufacturing firms should improve on timely payment of credit purchases. This will enable suppliers have more confidence in entrusting more raw material to the firms on credit which will boast their inventories as well increase sales and profit.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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APPENDIX 1

List of Stata tables

Notes:

. regress ROA CCC ART APT FSZ

Source	SS	df	MS	Number of obs =	110
				F(4, 105) =	3.33
Model	.449383308	4	.112345827	Prob > F =	0.0131
Residual	3.54196402	105	.033732991	R-squared =	0.1126
				Adj R-squared =	0.0788
Total	3.99134733	109	.036617865	Root MSE =	.18367

ROA	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
CCC	.0001939	.0004928	0.39	0.695	-.0007831	.001171
ART	.0805079	.0914931	0.88	0.381	-.1009059	.2619217
APT	.103653	.1069959	0.97	0.335	-.1085002	.3158062
FSZ	-.0744015	.0329447	-2.26	0.026	-.1397247	-.0090783
_cons	.5440074	.2294055	2.37	0.020	.0891387	.9988762

. xtset PANELID YEAR, yearly
 panel variable: PANELID (strongly balanced)
 time variable: YEAR, 2012 to 2021
 delta: 1 year

. xtreg ROA CCC ART APT FSZ, fe

Fixed-effects (within) regression	Number of obs =	110
Group variable: PANELID	Number of groups =	11
R-sq: within = 0.1667	Obs per group: min =	10
between = 0.1096	avg =	10.0
overall = 0.1038	max =	10
	F(4,95) =	4.75
corr(u_i, Xb) = -0.5775	Prob > F =	0.0015

ROA	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
CCC	-.0000684	.0003449	-0.20	0.843	-.000753	.0006162
ART	.108367	.0920921	1.18	0.242	-.0744589	.2911929
APT	.1217953	.0803744	1.52	0.133	-.0377679	.2813586
FSZ	-.240127	.0700816	-3.43	0.001	-.3792565	-.1009974
_cons	1.577229	.4361298	3.62	0.000	.7114018	2.443056

sigma_u	.17981401
sigma_e	.12234063
rho	.68357016 (fraction of variance due to u_i)

F test that all u_i=0: F(10, 95) = 14.16 Prob > F = 0.0000

. estimates store fixed

. xtreg ROA CCC ART APT FSZ, re

Random-effects GLS regression Number of obs = 110
 Group variable: PANELID Number of groups = 11

R-sq: within = 0.1641 Obs per group: min = 10
 between = 0.1103 avg = 10.0
 overall = 0.1065 max = 10

Wald chi2(4) = 17.57
 corr(u_i, X) = 0 (assumed) Prob > chi2 = 0.0015

```
-----+-----
```

ROA	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
CCC	-.0000445	.0003416	-0.13	0.896	-.0007141	.0006251
ART	.0928152	.0884312	1.05	0.294	-.0805066	.2661371
APT	.1201148	.0792491	1.52	0.130	-.0352107	.2754402
FSZ	-.1762466	.0563956	-3.13	0.002	-.2867799	-.0657132
_cons	1.185478	.3579123	3.31	0.001	.4839827	1.886973

```
-----+-----
```

sigma_u | .17482612
 sigma_e | .12234063
 rho | .67127676 (fraction of variance due to u_i)

```
-----+-----
```

. estimates store random

. hausman fixed .

```
---- Coefficients ----
```

	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	fixed	random	Difference	S.E.
CCC	-.0000684	-.0000445	-.0000239	.000047
ART	.108367	.0928152	.0155517	.0257077
APT	.1217953	.1201148	.0016806	.0134019
FSZ	-.240127	-.1762466	-.0638804	.0416049

```
-----+-----
```

b = consistent under Ho and Ha; obtained from xtreg
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

$$\begin{aligned} \text{chi2}(4) &= (b-B)'[(V_b-V_B)^{-1}](b-B) \\ &= 2.45 \\ \text{Prob}>\text{chi2} &= 0.6539 \end{aligned}$$

. xtreg ROA CCC ART APT FSZ, re

Random-effects GLS regression Number of obs = 110
 Group variable: PANELID Number of groups = 11

R-sq: within = 0.1641 Obs per group: min = 10
 between = 0.1103 avg = 10.0

overall = 0.1065 max = 10

corr(u_i, X) = 0 (assumed) Wald chi2(4) = 17.57 Prob > chi2 = 0.0015

```

-----
      ROA |   Coef.  Std. Err.   z  P>|z|  [95% Conf. Interval]
-----+-----
      CCC | -.0000445  .0003416  -0.13  0.896  -.0007141  .0006251
      ART | .0928152  .0884312   1.05  0.294  -.0805066  .2661371
      APT | .1201148  .0792491   1.52  0.130  -.0352107  .2754402
      FSZ | -.1762466  .0563956  -3.13  0.002  -.2867799  -.0657132
  _cons |  1.185478  .3579123   3.31  0.001  .4839827  1.886973
-----+-----
sigma_u | .17482612
sigma_e | .12234063
  rho   | .67127676 (fraction of variance due to u_i)
-----

```

Notes:

. summarize ROA CCC ART APT FSZ

```

Variable |   Obs   Mean  Std. Dev.   Min    Max
-----+-----
  ROA    |   110  .1672453  .191358  .0018539  .9586521
  CCC    |   110  82.50909  36.49224    -12     178
  ART    |   110  .4139963  .2240859  .0699947  .982806
  APT    |   110  .3478784  .2109975  .0170208  .9157462
  FSZ    |   110  6.211606  .5934503  5.065863  7.96116

```

. sktest ROA CCC ART APT FSZ

```

           Skewness/Kurtosis tests for Normality
                ----- joint -----
Variable |  Obs  Pr(Skewness)  Pr(Kurtosis)  adj chi2(2)  Prob>chi2
-----+-----
  ROA    |  110   0.4000      0.0001      39.46      0.0000
  CCC    |  110   0.8139      0.7358      0.17      0.9188
  ART    |  110   0.1385      0.0066      8.50      0.0143
  APT    |  110   0.9009      0.1802     10.92      0.0042
  FSZ    |  110   0.1048      0.2159      8.44      0.0147

```

. correlate CCC ART APT
(obs=110)

```

      |   CCC   ART   APT
-----+-----
  CCC |  1.0000
  ART | -0.1180  1.0000
  APT | -0.1588  0.5031  1.0000

```

. estat vif

Variable	VIF	1/VIF
ART	1.03	0.971613
CCC	1.02	0.981525
FSZ	1.02	0.982481
Mean VIF	1.02	

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