

Working Capital Efficiency and Financial Performance of Listed Pharmaceutical Companies in Nigeria

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ABSTRACT

This study investigates the relationship between working capital efficiency and financial performance among listed pharmaceutical companies in Nigeria. The analysis uses Data Envelopment Analysis (DEA) to assess the efficiency of these companies, considering both their operational scale and financial performance. The study distinguishes between technical efficiency and scale efficiency, providing a nuanced understanding of how working capital management impacts overall financial performance. The study also reveals varying returns to scale among the entities: PZC, FHP, and GSK show constant returns to scale (CRS) in one measure but face decreasing returns to scale (DRS) in another, suggesting potential inefficiencies when scaling up. In contrast, MBP, MIP, and NIP exhibit increasing returns to scale (IRS), indicating opportunities for efficiency gains through expansion. Recommendations, including the need for PZC and FHP to manage growth carefully to sustain efficiency, while entities like MBP, MIP, and NIP should consider scaling operations to leverage IRS. PDK, with its low efficiency and DRS, requires immediate process optimization and cautious scaling strategies to ultimately improve financial performance.

Keywords: *working capital efficiency, return to scale, financial performance, sales growth.*

P-ISSN: 2315-9391 AJAF June 2026, 9(2) 1-17

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1. INTRODUCTION

Working capital efficiency is observed equally in manufacturing, industrial, and service-oriented organizations. However, the performance and stability of the company today are based on firm-specific elements like market share, innovation, cost control, and management abilities. According to Kalluru & Bhat (2009), operational efficiency refers to a company's ability to minimize unfavorable inefficiencies and optimize resource capacities to provide customers with high-quality goods and services. Supply chain management, skilled and competent labour, appropriate technology advancement, appropriate procurement, return to scale of the businesses, and many other factors all contribute to an organization's operational efficiency. Comparatively speaking to their peers in the industry, more efficient businesses typically maintain higher levels of output and operating performance stability (Mills and Schumann, 1985).

Operational efficiency can be measured through the Total Asset Turnover ratio, which measures a company's ability to generate sales given its investment in total assets. Furthermore, Fixed-Asset Turnover and Equity Turnover are also measures of operational efficiency, as employed in this study. These ratios measure a company's ability to generate sales given its investment in total equity and express whether the firm is managing operational costs efficiently, which ultimately influences its profitability (Rao & Lakew, 2012).

Operational efficiency measures achieved by a company can be used to formulate an operational strategy to enable a company to meet its corporate objectives and goals by enhancing the distribution of available resources to maximize the outputs of the company (Reid & Sanders, 2007). Managers are particularly interested in operating efficiency because it will help their companies perform better. On the other hand, policymakers need to safeguard the financial system's stability and evaluate how market structure affects performance. Businesses that run more efficiently may anticipate increased productivity and, as a result, profitability. As a result, customers should expect more equitable and superior pricing, high-calibre services, increased security, and dependable financial systems (Berger, Hunter & Timme, 1993).

Companies are established to reach and accomplish some specific goals. Nevertheless, these goals differ from one company to the other. In the achievement of the profitability objective, companies often sell on credit to customers or buy on credit from suppliers, thereby creating accounts receivable or accounts payable, i.e. debtor and creditor relationships. The survival of manufacturing companies depends largely on the ability to effectively manage credit to continue to be liquid to maintain and sustain daily operations (Yahaya, 2016). The determination of an appropriate balance or an optimal mix between the volume of debt and credit is crucial as it prevents companies from holding excess idle cash balances or running short of cash (illiquid) required to take care of the company's daily routine operating activities (Uyar, 2009). This requires putting in place some mechanisms to ensure an optimal balance between short-term assets and short-term liabilities; this mechanism is called working capital management.

For manufacturing companies where raw materials and other parts are purchased from vendors as well as finished goods are sold to customers on credit, the general and best practice is to develop strategies for paying vendors (suppliers) for a longer period and collecting payments from customers within the shortest period (Madugba & Ogbonnaya, 2016). This scenario is technically known as working capital management. It is documented that managers can increase their company's financial performance by improving working capital management. An excessive level of current assets may hurt a company's profitability, whereas a low level of

current assets may lead to a reduction in liquidity and stockouts, resulting in difficulties in maintaining smooth operations (Daniya, Baba, Kolo & Abdulrahman, 2018).

According to Yahaya and Bala (2015), working capital management involves the planning and controlling of all aspects of current assets, including cash, inventories, marketable securities, and accounts receivable, as well as current liabilities. Working capital is simply the difference between current assets and current liabilities. Thus, working capital management is an attempt to manage and control the current assets and current liabilities to maximize profitability and maintain an appropriate level of liquidity in a company. Ajayi, Abogun, and Odediran (2017) pointed out that a company's current asset consists of raw materials, work in progress, finished goods or inventories, account receivables, cash, and bank balances, which are short-term in nature and are utilized for production and sales which are convertible into cash within one accounting period. On the other hand, current liabilities refer to obligations that need to be paid within one accounting period or not beyond the business operating cycle (Kasozi, 2017).

Deloof (2003) opined that management of working capital is a strategy that aims at maintaining an optimal mix between each of the working capital components of cash, receivables, inventory, and payables towards creating value and competitive advantage in businesses. This shows that effective working management is critical to competitive advantage and improved financial performance, thereby creating value for shareholders. This has brought more attention to the investment that firms make in short-term assets, and the resources used with maturities of under one year, which represent the main share of items on a company's financial position (Uwaoma & David, 2017). The effective management of working capital is crucial because it has a great influence on the financial performance of a company (Deloof, 2003). Failure to manage working capital effectively and efficiently may lead to the failure of a company.

The very essence of working capital management is to ensure adequate liquidity and the profitability of a company. Ajayi, Abogunn, and Odediran (2017) stated that managerial decisions that concern liquidity and positively affect profitability are very challenging decisions to make. Liquidity decisions are geared at ensuring that a company can meet its short-term obligations and that there is continued cash flow that guarantees profitability (Abubakar, Umaru, Olaifa, & Olumuyiwa, 2020). Every company needs to make decisions that ensure that the right amount of liquidity is maintained at any point in time that is sufficient to cater to operating expenses and settle maturing debts promptly. Indeed, every company, regardless of its size or nature of business, needs to maintain the right amount of working capital.

Without good working capital management, an asset-liability mismatch may occur, which increases the firm's profitability in the short run but may create a risk of insolvency in the long run (Uyar, 2009). Therefore, attaining an optimal mix of working capital involves careful examination and management of the working capital components, which is crucial to a firm's profitability. Daniya, Baba, Kolo, and Abdulrahman (2018) opined that efficient management of working capital is fundamental to organizations as it plays a crucial role in enhancing profitability. The management of working capital is the most crucial factor for maintaining the liquidity, survival, solvency, and profitability of a business (Mukhopadhyay, 2004). It is on this note that Uyar (2009) stated that working capital management has become a vital issue in most organizations, with financial managers trying to identify the key fundamental working capital drivers and the optimal working capital to hold to minimize risk and uncertainty, thereby improving the overall performance of their businesses. Working capital management, therefore, could help businesses minimize risk and enhance profitability.

The key components of working capital are inventories, accounts payable, accounts receivable, and cash (Deloof, 2003). According to Daniya, Baba, Kolo, and Abdulrahman (2018), inventory management has to do with the management of raw materials, work in progress, and

stocks of finished goods. Account receivables management relates to the management of the collection of debts owed to a company by its customers, and account payables management concerns the management of suppliers from whom raw materials have been purchased on credit. Cash management involves determining the right amount of liquid cash to be held by a company at any time (Akinleye & Adeboye, 2019). Eya (2016) emphasized that the success of any company depends heavily on the ability of the managers to effectively manage its receivables, inventories, and payables.

The most commonly used measure of short-term assets and liabilities is the Cash Conversion Cycle (CCC). CCC refers to the period between the expenditure on the acquisition of raw materials and the collection from the sales of finished goods (Uwaoma & David, 2017; Mabandla & Makoni, 2019). CCC elements such as Inventory Conversion Period (ICP), Average Collection Period (ACP), and Average Payment Period (APP) are often used as proxies of working capital management. However, for this study, CCC proxies are Days' Inventories Outstanding (DIO), Days' Sales Outstanding (DSO), and Days' Payables Outstanding (DPO).

It is clear from the foregoing that the management of working capital means that company financial managers take deliberate and conscious actions to reduce the timing of accounts receivable, deferring the period of accounts payable, keeping the least inventory as well and investing idle cash without compromising liquidity, which results in enhanced financial performance.

According to Fatihudin, Jusni, and Mochklas (2018), financial performance is a measure of how much a company can create returns, profit, or revenue in monetary terms over a certain period, usually one year. It reflects a company's financial well-being measured in a financial year. It is paramount and a matter of necessity for financial managers of companies to manage working capital effectively to enhance their company's financial performance (Mabandla & Makoni, 2019).

It is clear from the foregoing that working capital management may have far-reaching implications on the financial performance of companies. Theoretically, the relationship between working capital management and a firm's financial performance is underpinned and explained by working capital management. The working capital management theory holds that management's ability to cause an optimal balance between the different components of working capital is critical to competitive advantage, performance, and survival of the company while the resource base theory explains how individual managers with unique abilities and capacity manipulate resources that facilitate and track opportunities within the available scarce resources to achieve growth, as well as the psyche of making payments and recovering of receivables as at when due which cumulates to enhance financial performance.

Manufacturing companies in Nigeria, including listed pharmaceutical companies, have faced turbulent times that have caused the collapse of many of the companies. This is partly due to the harsh operating environment, including high competition from local and foreign companies, and the challenge of adequate power supply, resulting in huge expenses incurred in running plants, among others. This is besides the global financial crisis that significantly affected the sector. Uwaoma and David (2017) stated that the financial crisis and the recession that took place in 2007-2008, as well as increased competition in the business environment, have brought to the forefront the need for proper working capital management by companies.

It is in the face of several challenges which include unfavorable operating environment, inadequate funds, epileptic power supply, and high interest rates on bank loans that have challenged the manufacturing companies in Nigeria and the need to exploit opportunities to augment performance and assure the survival of companies in the competitive business

environment, that this study examined working capital operational efficiency and performance of listed pharmaceutical companies in Nigeria.

2. LITERATURE REVIEW

2.1 Conceptual Review

2.1.1 Working Capital Efficiency

Working capital efficiency refers to the ability of a firm to effectively utilize its short-term assets and liabilities to maximize operational output and improve organizational performance. It involves the efficient management of inventories, accounts receivable, accounts payable and cash resources in such a way that adequate liquidity is maintained without compromising profitability. Deloof (2003) viewed working capital management as the process of maintaining an optimal balance among the components of working capital to create value and sustain competitive advantage.

Efficient working capital management enables firms to reduce unnecessary costs, improve liquidity and enhance operational effectiveness. According to Uyar (2009), firms with efficient working capital policies are able to maintain sufficient cash flow for day-to-day activities while simultaneously maximizing returns. Thus, working capital efficiency contributes significantly to corporate growth and survival.

In manufacturing firms, especially pharmaceutical companies, efficient management of inventories and credit policies is essential because production processes involve substantial investment in raw materials and finished goods. Consequently, effective working capital practices are indispensable for ensuring uninterrupted production and sustaining organizational competitiveness.

2.1.2 Organizational Performance

Organizational performance refers to the extent to which a firm achieves its objectives through the efficient utilization of available resources. Traditionally, performance has been measured using financial indicators such as return on assets, return on equity and earnings per share. However, Kaplan and Norton (1992) argued that organizational performance should not be limited to financial measures alone but should also encompass non-financial dimensions that reflect operational efficiency and long-term sustainability.

Performance in manufacturing organizations may be evaluated using indicators such as sales growth, productivity, technological advancement and product quality. These indicators provide a broader assessment of organizational effectiveness and resource utilization. In the pharmaceutical industry, organizational performance is influenced by factors such as innovation, production efficiency, quality standards and market competitiveness.

2.1.3 Working Capital Efficiency and Organizational Performance

The relationship between working capital efficiency and organizational performance has attracted considerable attention in the literature. Efficient utilization of working capital resources enhances liquidity, minimizes operational costs and improves productivity, thereby contributing to superior performance. Firms that maintain optimal inventory levels, accelerate debt collection and effectively manage payables are more likely to achieve sustainable growth and profitability.

According to Mukhopadhyay (2004), effective working capital management constitutes an important determinant of corporate performance because it facilitates smooth operations and reduces the likelihood of financial distress. Similarly, Daniya, Baba, Kolo and Abdulrahman (2018) observed that efficient working capital practices contribute significantly to organizational success through improved resource allocation and operational effectiveness.

Therefore, efficient working capital management provides firms with the capacity to maximize output, improve productivity and enhance overall organizational performance.

2.2 Theoretical Review

2.2.1 Working Capital Management Theory

This study is anchored on Working Capital Management Theory. The theory emphasizes the importance of maintaining an optimal balance between current assets and current liabilities to ensure liquidity and enhance organizational performance. The theory posits that efficient management of inventories, receivables and payables contributes to value creation and corporate sustainability.

According to Deloof (2003), firms that effectively manage working capital components are capable of reducing financing costs and improving operational performance. The theory therefore provides a framework for understanding how efficient utilization of short-term resources contributes to enhanced organizational performance.

2.2.2 Resource-Based Theory

Resource-Based Theory (RBT), developed by Wernerfelt (1984), explains organizational performance from the perspective of internal resources and capabilities. The theory argues that firms possessing valuable, rare, inimitable and non-substitutable resources are likely to achieve superior performance and sustain competitive advantage.

In the context of this study, efficient management of working capital resources constitutes a strategic capability that enables firms to optimize production activities and improve performance. The theory therefore supports the argument that differences in organizational performance among pharmaceutical companies can be attributed partly to differences in the efficiency with which resources are managed.

The Resource-Based Theory complements the Working Capital Management Theory by emphasizing the strategic role of resource utilization in achieving organizational objectives. Consequently, both theories provide a suitable foundation for explaining the relationship between working capital efficiency and organizational performance.

2.3 Empirical Review

Several empirical studies have investigated the relationship between working capital management and organizational performance across different sectors and countries. However, their findings remain inconclusive, thereby providing justification for further investigation.

2.3.1 Studies Reporting Positive Relationship

Mabandla and Makoni (2019) investigated the relationship between working capital management and financial performance of twelve food and beverage companies listed on the Johannesburg Stock Exchange over the period 2007–2016. Using various econometric techniques, the study found that inventory conversion period and average payment period exerted positive effects on profitability, while average collection period negatively affected profitability.

Similarly, Suleiman, Abdu and Khalid (2019) examined the effect of working capital management on the profitability of nine listed consumer goods companies in Nigeria using panel regression techniques. The study established that trade receivables positively and significantly influenced return on assets. Likewise, Abubakar, Umaru, Olaifa and Olumuyiwa (2020) reported that cash conversion cycle significantly improved the financial performance of selected quoted firms in Nigeria.

Using Structural Equation Modelling, Ismail, Adamu and Aliyu (2020) found that accounts payable period and cash conversion cycle positively affected the performance of quoted conglomerate companies in Nigeria. Their findings further revealed a significant overall effect of working capital management on return on assets, return on equity and return on investment.

Furthermore, Okoye, Erin, Modebe and Achugamonu (2020) examined forty companies listed on the Nigerian Exchange Group and observed that cash conversion cycle, average payment period and inventory conversion period had significant positive effects on return on assets. Abbas and Isiaka (2021) equally reported that working capital management significantly influenced the earnings per share of non-financial companies quoted on the Nigerian Exchange Group.

2.3.2 Studies Reporting Negative Relationship

Some empirical studies have documented negative effects of working capital management on performance. Daniya, Baba, Kolo and Abdulrahman (2018) investigated listed conglomerate companies in Nigeria and found that debtors' collection period and creditors' payment period were negatively associated with return on investment.

Similarly, Akinleye and Adeboye (2019) reported that average collection period and average payment period exerted negative effects on return on capital employed and earnings per share respectively among listed manufacturing firms in Nigeria. Their findings suggest that prolonged collection and payment periods may adversely affect organizational performance.

Joshua, Osuma, Ikpefan, Agbeyangi and Isibor (2021) also found that trade and other receivables exhibited a significant negative relationship with profit after tax among listed Small and Medium Enterprises in Nigeria. This finding indicates that inefficient management of receivables could impair performance.

2.3.3 Studies Reporting Mixed Findings

Despite the extensive literature, empirical findings remain mixed. Uwaoma and David (2017) reported strong relationships between investing and financing policies and return on assets but found insignificant relationships with return on equity. Likewise, Abubakar et al. (2020) observed that while cash conversion cycle positively affected financial performance, debt-equity ratio and inventory conversion period exerted insignificant effects.

The divergence in empirical findings may be attributed to differences in methodology, sectoral coverage, variables employed and periods covered. Most previous studies relied on conventional analytical techniques such as Ordinary Least Squares (OLS), panel regression and Structural Equation Modelling. Consequently, evidence regarding efficiency performance and return-to-scale characteristics of firms remains relatively limited.

2.3.4 Research Gap

A review of the existing literature reveals several gaps. First, most previous studies focused on the relationship between working capital management and financial performance using accounting-based indicators such as return on assets, return on equity and earnings per share. Second, conventional regression techniques dominated the literature, with limited application of Data Envelopment Analysis (DEA) in evaluating efficiency levels and scale characteristics of firms.

Third, empirical evidence on the efficiency performance of listed pharmaceutical companies in Nigeria remains scarce. Existing studies largely concentrated on manufacturing firms, conglomerates, consumer goods companies and small and medium enterprises. Consequently, little is known about the extent to which pharmaceutical companies efficiently utilize working capital resources to enhance organizational performance.

Therefore, this study differs from previous studies by employing Data Envelopment Analysis to assess the efficiency and return-to-scale characteristics of listed pharmaceutical companies in Nigeria. In doing so, the study contributes to the literature by providing empirical evidence on working capital efficiency and organizational performance within the Nigerian pharmaceutical industry.

3. METHODOLOGY

3.1 Research Design

This study adopted a descriptive research design. The design was considered appropriate because it facilitates the examination of the efficiency performance of pharmaceutical companies without manipulating the variables under investigation. The design also permits the use of secondary data obtained from published financial reports and enables the evaluation of the relative efficiency of the sampled firms through Data Envelopment Analysis (DEA).

3.2 Population and Sample Size

The population of the study comprised all pharmaceutical companies listed on the Nigerian Exchange Group (NGX). However, seven listed pharmaceutical companies with complete and accessible data during the study period were selected. These companies are: Fidson Healthcare Plc (FHP); GlaxoSmithKline Consumer Nigeria Plc (GSK); May and Baker Nigeria Plc (MBP); Morison Industries Plc (MIP); Neimeth International Pharmaceuticals Plc (NIP); Pharma-Deko Plc (PDK); and PZ Cussons Nigeria Plc (PZC).

Given the manageable number of firms, a census sampling technique was employed, thereby eliminating sampling bias and ensuring adequate representation of the population.

3.3 Sources of Data

The study relied exclusively on secondary data obtained from the annual reports and accounts of the sampled companies. Additional information was sourced from reports of the Pharmaceutical Manufacturers Group of Manufacturers Association of Nigeria (PMG-MAN), the Nigerian Exchange Group (NGX), and publications of the National Bureau of Statistics (NBS). The study covered a five-year period from 2020 to 2025.

3.4 Measurement of Variables

In evaluating working capital efficiency and performance, the study employed three input variables and one output variable.

Input Variables

- i. Imported Raw Materials (IRM);
- ii. Local Raw Materials (LRM);
- iii. Modern Production Technology (MPT).

Output Variable

- i. Quality Drug Produced (QDP).

The selected variables were adopted because they reflect the productive capacity and operational efficiency of pharmaceutical companies. The output variable represents organizational performance, while the input variables represent the resources employed in achieving such performance.

3.5 Model Specification

This study employed Data Envelopment Analysis (DEA) to estimate the technical efficiency and scale efficiency of listed pharmaceutical companies in Nigeria. The pharmaceutical companies constitute the Decision-Making Units (DMUs), while Imported Raw Materials (IRM), Local Raw Materials (LRM), and Modern Production Technology (MPT) are specified as inputs and Quality Drug Produced (QDP) represents the output variable.

3.5.1 Input Variables

[X_1 =IRM]

[X_2 =LRM]

[X_3 =MPT]

where:

(IRM) = Imported Raw Materials;

(LRM) = Local Raw Materials;

(MPT) = Modern Production Technology.

3.5.2 Output Variable

[Y_1 = QDP]

where:

(QDP) = Quality Drug Produced.

3.5.3 CCR (Constant Returns to Scale) Model

For each pharmaceutical company (o), the efficiency score is given as:

[$h_o = \{v_1IRM_o + v_2LRM_o + v_3MPT_o\}$]

Subject to:

[$\{v_1IRM_j + v_2LRM_j + v_3MPT_j\}, j=1, 2, 7$]

[u_1, v_1, v_2, v_3]

where:

(u_1) = weight attached to Quality Drug Produced;

(v_1) = weight attached to Imported Raw Materials;

(v_2) = weight attached to Local Raw Materials;

(v_3) = weight attached to Modern Production Technology;

(j) = pharmaceutical companies under study.

The input-oriented linear programming form of the CCR model is:

Subject to: []

[$_1IRM_1 + _2IRM_2 + \dots + _7IRM_7 \leq IRM_o$]

[$_1LRM_1 + _2LRM_2 + \dots + _7LRM_7 \leq LRM_o$]

[$_1MPT_1 + _2MPT_2 + \dots + _7MPT_7 \leq MPT_o$]

[$_1QDP_1 + _2QDP_2 + \dots + _7QDP_7 \leq QDP_o$]

[$_j, j=1, 2, 7$]

where:

[] = technical efficiency score;

[$_j$] = intensity variables.

3.5.4 BCC (Variable Returns to Scale) Model

The Banker-Charnes-Cooper model is specified as: []

Subject to:

[$_1IRM_1 + \dots + _7IRM_7 \leq IRM_o$]

[$_1LRM_1 + \dots + _7LRM_7 \leq LRM_o$]

[$_1MPT_1 + \dots + _7MPT_7 \leq MPT_o$]

[$_1QDP_1 + \dots + _7QDP_7 \leq QDP_o$]

[$\sum_{j=1}^7 _j = 1$]

[$_j$]

The convexity restriction

[$\sum_{j=1}^7 _j = 1$]

permits Variable Returns to Scale (VRS) and enables the estimation of pure technical efficiency.

Scale Efficiency Model

Scale efficiency is computed as:

[$SE = \{BCC \text{ Efficiency Score}\}$]

where:

($TE_{\{CCR\}}$) = overall technical efficiency under Constant Returns to Scale;

($PTE_{\{BCC\}}$) = pure technical efficiency under Variable Returns to Scale.

The values obtained are used to determine whether each pharmaceutical company operates under:

Constant Returns to Scale (CRS);
Increasing Returns to Scale (IRS); or
Decreasing Returns to Scale (DRS).

3.6 Input-Oriented and Output-Oriented DEA Models

The study utilized both input-oriented and output-oriented DEA models.

The input-oriented model evaluates the extent to which inputs can be minimized while maintaining a given level of output. Conversely, the output-oriented model assesses the extent to which output can be increased with the existing level of inputs.

These models enable the identification of technical efficiency, scale efficiency and return-to-scale characteristics of the sampled firms.

3.7 Analytical Technique

Data were analysed using Data Envelopment Analysis (DEA). The seven pharmaceutical companies were treated as Decision-Making Units (DMUs). Efficiency scores were estimated under both the CCR and BCC models. Scale efficiency and returns to scale were subsequently determined to ascertain whether the firms operated under constant returns to scale (CRS), increasing returns to scale (IRS), or decreasing returns to scale (DRS).

The findings obtained from the DEA models formed the basis for evaluating the efficiency performance of the sampled pharmaceutical companies and for drawing conclusions regarding their operational performance.

4.0 RESULTS AND DISCUSSION

Input for this study is the proxies of the financial performance measures (IRM, LRM, and MPT) of the listed pharmaceutical companies in the production process to enhance productivity, whereas output is the Quality Drug Produced (QDP). The seven (7) listed pharmaceutical companies in Nigeria were identified as Decision-Making Units (DMUs) for the Data Envelopment Analysis Model. The analysis is made based on the available data from the Pharmaceutical Manufacturers Group of Manufacturers Association of Nigeria (PMGMAN) and the National Bureau of Statistics (NBS), various reports from 2018-2021. Therefore, the scope of this data is limited to and not exceeding the aforementioned reports and year of coverage.

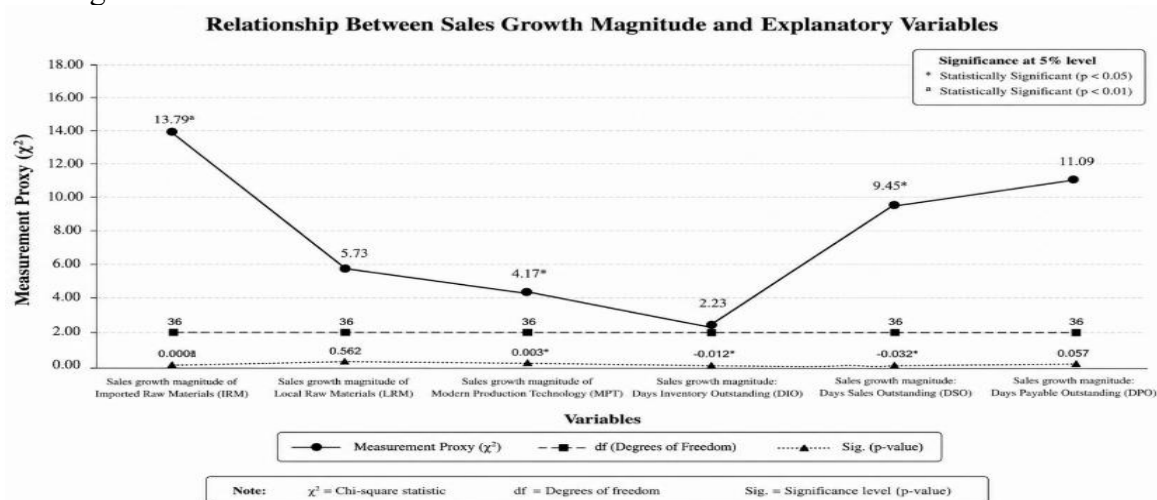


Fig1: Cross Tabulation Analysis for Dependent Variable and Independent Variables.

Source: Researcher's computation 2025.

The cross-tabulation result between the independent and dependent variables relationship can be seen in Fig1 above. The results show that the dependent variable, sales growth, and the independent variables have a significant relationship. According to the preliminary findings, sales growth, days of inventory outstanding, and sales outstanding following drug production are significantly correlated negatively. On the other hand, days of payables outstanding and sales growth have a significant positive relationship.

Table 2: Input-Output Squared Correlations Matrix.

	IRM	LRM	MPT	QDP
IRM	1			
LRM	0.200	1		
MPT	0.076	0.006	1	
QDP	0.390	0.002	0.235	1

Source: Researcher's computation 2025.

Table 2 above reveals that in the input-output relationship, there are no multicollinearity issues. There is a positive, non-mutually exclusive relationship between all the inputs used. As a result, it provided evidence for the measurement model's discriminant validity based on squared correlation with other variables. On the other hand, chi-square differences between the unconstrained and constrained models can also be used to assess and compare discriminant validity. Cross-tabulation of the combined models (models 1 and 2) is displayed in Fig1. For the chi-square difference of these two models fit, the covariance of variables in the constrained model was fixed at 1.0, whereas in the unconstrained model, the covariance between individual variables was freely correlated.

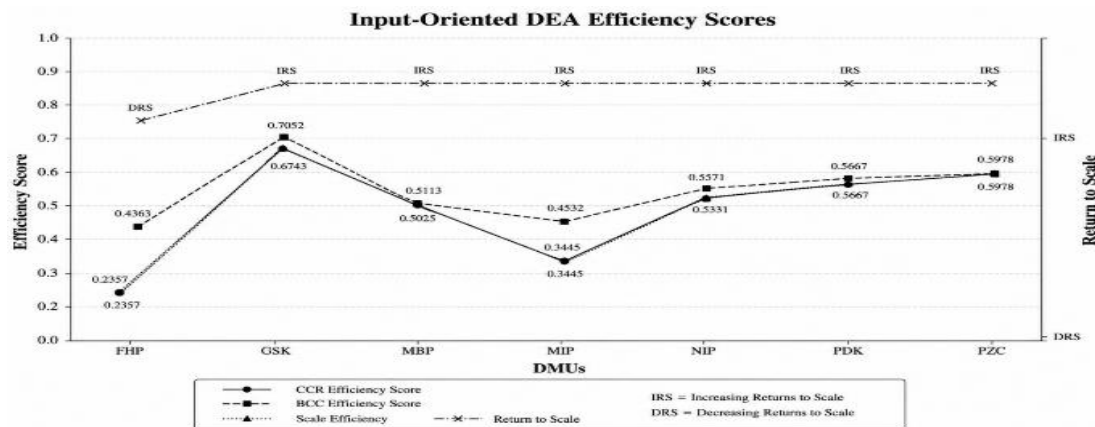


Fig3: Working Capital Scale and Return to Scale Efficiency

Source: Researchers Computation, 2025

The return to scale value indicates how sensitive an organization's output is to changes in its inputs. The DMUs' return to scale value is either DRS or IRS, as shown in the fig. According to DRS, as the DMU's input level increases, its output level decreases. In contrast, the IRS suggests that as input levels rise, so does DMU output. Fig3 shows that DRS only covers FHP, while IRS covers all other DMUs. This implies that increasing the input level would raise the

output level for all DMUs. With the highest BCC efficiency score of 0.7052 and CCR efficiency score of 0.6743, GSK makes the best use of its working capital. Furthermore, the high-efficiency scores of MBP, NIP, PDK, and PZC exceed 0.5. MIP and FHP, on the other hand, have the lowest efficiency scores, 0.3445 and 0.2357, respectively, indicating that they are not making the best use of their available working capital. Based on their IRS values, Fig3 indicates that every DMU, with the exception of FHP, is operating at peak efficiency. In light of its DRS value, FHP is not performing optimally, implying that a review of its working capital management is required in order to increase output and achieve an ideal size in terms of input and output.

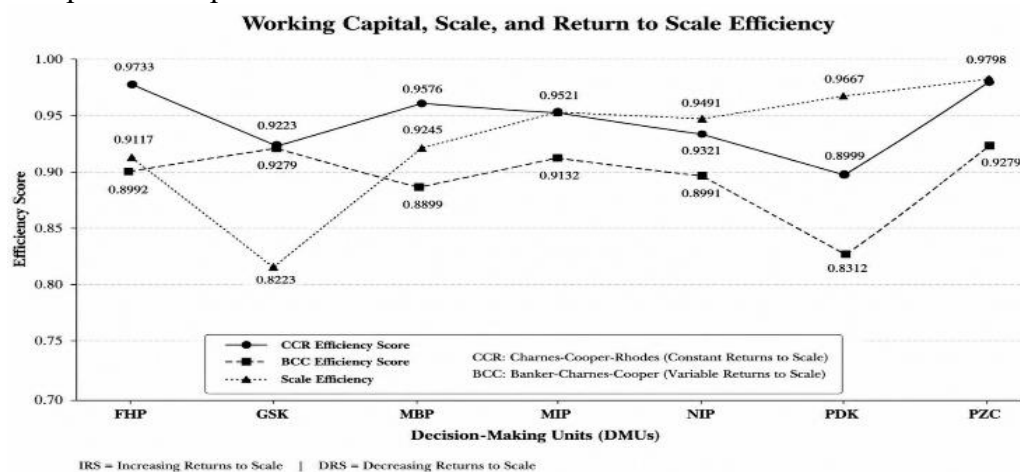


Fig4: Output Oriented

Source: Researchers Computation, 2025

Efficiency Scores: The CCR and BCC scores of all DMUs range from 0.8999 to 0.9798 and 0.8312 to 0.9279, respectively, indicating high-efficiency levels. **Scale Efficiency:** The majority of DMUs exhibit only slight scale inefficiencies, suggesting that while they are nearing their most productive scale, there is still room for improvement. **Return to Scale (RTS):** All Decision-Making Units (DMUs), except for GSK, exhibit an Internal Rate of Return (IRS), suggesting that most should enhance their efficiency by expanding their operations. GSK ought to use prudence as expanding its size may lead to unnecessary inefficiencies.

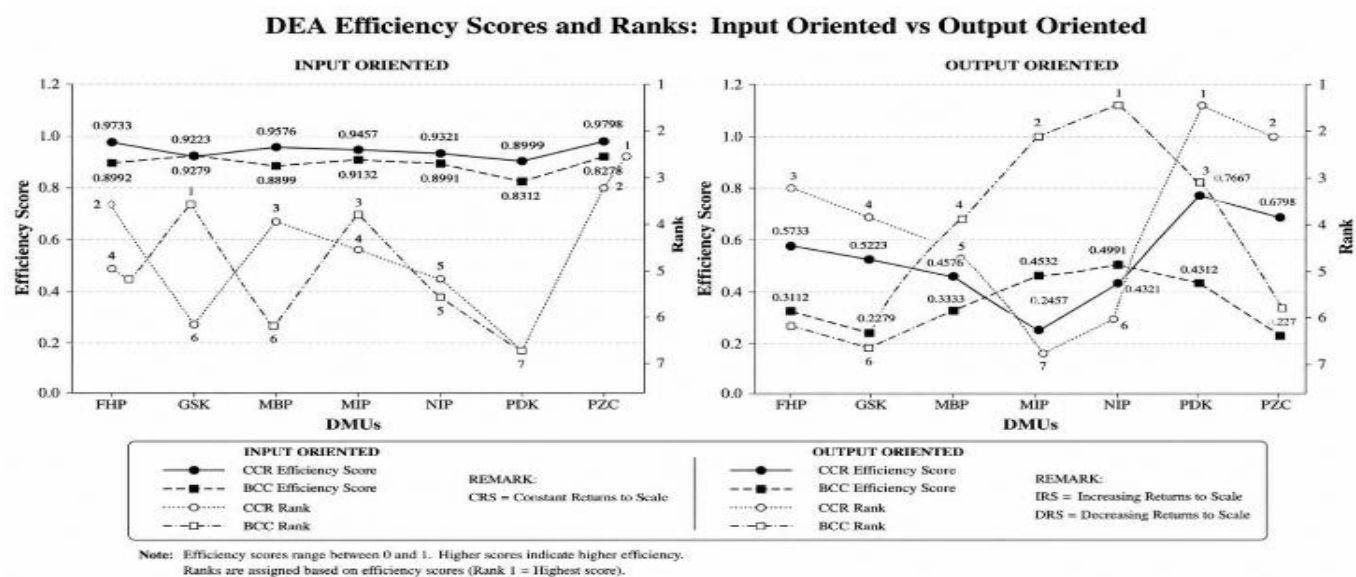


Fig5: Input/Output-Oriented

Source: Researchers Computation, 2025

Overall Efficiency

PZC has the highest efficiency score of 0.9798, ranking first. Its second score of 0.9278 places it second. Also efficient are FHP 2nd (0.9733) and 4th (0.8992), and MBP (3rd (0.9576) and 6th (0.8899). At 7th in both rankings, PDK has the lowest efficiency scores (0.8999 and 0.8312).

Return-to-scale

PZC and FHP have CRS in their first efficiency score, indicating optimal performance. However, their second measure shows DRS, suggesting that scaling up may cause inefficiencies.

The first efficiency measure with CRS ranks GSK 6th, but the second with DRS ranks it first. GSK may not be at its optimal scale in the first measure, but it's highly efficient in the second, despite diminishing returns to scale. MBP, MIP, and NIP all have IRS in their second efficiency scores, suggesting they could improve efficiency by scaling up. Additionally, CRS in the first measure indicates they are optimally scaled for that aspect. Like FHP and PZC, PDK starts under CRS and switches to DRS in the second. PDK has the lowest efficiency scores, suggesting inefficiency even at optimal scaling. Strengths and Flaws PZC consistently ranks near the top in both efficiency measures, but like FHP and GSK, its second measure has decreasing returns. FHP outperforms MBP in efficiency, but both are inefficient at larger scales. GSK leads in the second efficiency measure but not the first. MIP and NIP have moderate efficiency and can improve by scaling up operations, according to their IRS in the second measure. PDK is the least efficient and may be inefficient at scale. PZC is most efficient, then FHP and MBP. Adjusting the scale may benefit GSK and MBP, which perform differently depending on the measure. Most inefficient, PDK struggles with efficiency and scalability.

4.5 Comparative Efficiency Analysis

Fig5 presents the overall rankings of the pharmaceutical companies based on both input-oriented and output-oriented efficiency measures.

The results show that PZC consistently ranked among the most efficient firms in the sample. Fidson Healthcare Plc and May and Baker Nigeria Plc also demonstrated

relatively high levels of efficiency. On the other hand, Pharma-Deko Plc consistently recorded the lowest efficiency scores, indicating weak operational performance.

The analysis further reveals that some firms experienced Constant Returns to Scale (CRS) under one model and Increasing or Decreasing Returns to Scale under another. This indicates that efficiency performance varies according to the orientation of the DEA model employed. Overall, the findings suggest that efficient management of working capital resources enhances organizational performance among pharmaceutical companies in Nigeria. The results are broadly consistent with those of Ismail, Adamu and Aliyu (2020), Okoye, Erin, Modebe and Achugamonu (2020), and Abbas and Isiaka (2021), who reported that efficient resource management contributes significantly to improved organizational performance.

4.6 Discussion of Findings

The study established that significant variations exist in the efficiency performance of listed pharmaceutical companies in Nigeria. While PZ Cussons Nigeria Plc and GlaxoSmithKline Consumer Nigeria Plc demonstrated relatively high efficiency levels, Pharma-Deko Plc and Morison Industries Plc recorded comparatively low efficiency scores.

The return-to-scale analysis revealed that most firms operated under Increasing Returns to Scale, implying that expansion of productive capacity could enhance efficiency and performance. Conversely, firms operating under Decreasing Returns to Scale should exercise caution in expanding their operations, as excessive growth may generate inefficiencies.

These findings suggest that the performance of pharmaceutical companies depends largely on their ability to efficiently utilize available resources. Consequently, managers should prioritize effective resource allocation, technological improvement and process optimization to achieve sustainable performance.

5. CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings

This study examined the working capital efficiency and performance of listed pharmaceutical companies in Nigeria using Data Envelopment Analysis (DEA). The study employed both input-oriented and output-oriented models to evaluate technical efficiency, scale efficiency and returns to scale among seven pharmaceutical companies listed on the Nigerian Exchange Group.

The findings revealed that the sampled companies exhibited varying levels of efficiency. Under the input-oriented model, GlaxoSmithKline Consumer Nigeria Plc recorded the highest efficiency scores, while Fidson Healthcare Plc recorded the lowest efficiency level. Similarly, the output-oriented model showed that PZ Cussons Nigeria Plc performed better than the other firms, whereas Pharma-Deko Plc recorded the lowest efficiency score.

The return-to-scale analysis indicated that most of the firms operated under Increasing Returns to Scale (IRS), suggesting that expansion of operations could improve efficiency and performance. However, some firms exhibited Decreasing Returns to Scale (DRS), implying that further expansion may result in operational inefficiencies.

Overall, the findings demonstrated that efficient utilization of working capital resources contributes significantly to improved organizational performance among listed pharmaceutical companies in Nigeria.

5.2 Conclusion

Based on the empirical findings, the study concludes that working capital efficiency constitutes an important determinant of organizational performance among pharmaceutical companies in Nigeria. The results revealed considerable differences in the efficiency levels of the sampled firms, indicating that some firms utilized their resources more effectively than others.

The study further concludes that firms operating under Increasing Returns to Scale possess opportunities for improving performance through expansion of productive activities, whereas firms experiencing Decreasing Returns to Scale should focus on optimizing existing resources rather than increasing operational size.

Therefore, efficient resource allocation, effective management practices and continuous process improvement remain indispensable for sustaining performance and competitiveness within the Nigerian pharmaceutical industry.

5.3 Recommendations

Based on the findings and conclusions of the study, the following recommendations are made:

1. Pharmaceutical companies should strengthen their working capital management practices in order to improve resource utilization and enhance organizational performance.
2. Firms operating under Increasing Returns to Scale should strategically expand their productive capacity to exploit economies of scale and improve efficiency.
3. Companies exhibiting Decreasing Returns to Scale should concentrate on process optimization, technological improvement and cost reduction rather than pursuing rapid expansion.
4. Management should regularly evaluate efficiency performance using Data Envelopment Analysis to identify areas requiring improvement and facilitate effective resource allocation.
5. Greater investment should be directed towards modern production technologies and quality improvement initiatives to enhance productivity and competitiveness.
6. Managers should establish effective monitoring mechanisms aimed at minimizing operational inefficiencies and ensuring sustainable growth.

5.4 Contribution to Knowledge

This study contributes to the literature on working capital efficiency and organizational performance by employing Data Envelopment Analysis to evaluate the efficiency and return-to-scale characteristics of listed pharmaceutical companies in Nigeria. Unlike previous studies that predominantly utilized regression techniques and focused mainly on financial indicators, the present study provides additional insights into the efficiency performance of firms from a non-parametric perspective.

The study therefore extends existing knowledge by demonstrating that differences in organizational performance among pharmaceutical companies are attributable not only to financial factors but also to the efficiency with which resources are utilized.

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