

# The Optimization of Inventory Management in Nigerian Production Companies

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## Abstract

Inventory management is a critical determinant of operational efficiency, cost control, and competitiveness in production companies. In Nigeria, production companies face unique challenges including supply chain disruptions, foreign exchange volatility, infrastructural deficits, and demand uncertainty, which complicate inventory optimization (Olusegun & Adebayo, 2018). This study examines the optimization of inventory management in Nigerian production companies, focusing on ALSCON Limited, Ikot Abasi, Akwa Ibom State, Nigeria, a major production company in the metallurgical sector. Using a mixed-methods approach, data were collected from operational records, inventory reports, and structured interviews with supply chain managers between 2018 and 2023. Findings reveal that “ALSCON's adoption of Economic Order Quantity (EOQ), Just-In-Time (JIT) practices, and Enterprise Resource Planning (ERP) modules reduced holding costs by 18% and stock-out frequency by 27% over three years” (ALSCON Internal Report, 2022). However, erratic power supply, import delays, and inaccurate demand forecasting remain significant constraints. The study concludes that integrating AI-driven demand forecasting, vendor-managed inventory (VMI), and localized sourcing can further optimize inventory performance in Nigerian production companies. Policy recommendations include adopting just-in-time (JIT) inventory systems, investing in digital inventory systems, public-private collaboration to stabilize supply chain infrastructure and regularly reviewing of inventory management policies.

**Keywords:** *Inventory Management; Optimization; Nigerian Production Companies; ALSCON; Economic Order Quantity; Just-In-Time; Supply Chain; ERP; Demand Forecasting*

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## **Background to the Study**

Inventory management involves the planning, organizing, and controlling of stock to ensure optimal levels that meet production needs without incurring excessive costs (Stevenson, 2018). A critical aspect of production companies' operations, as it directly affects production, sales, and profitability (Kumar & Chandra, 2017). Inventory control is complicated by macroeconomic instability, port congestion, currency fluctuations, and inadequate transport infrastructure (Adeyemi & Salami, 2017). These factors increase lead times, inflate safety stock requirements, and raise holding costs, thereby eroding profit margins. Aluminium Smelter Company of Nigeria (ALSCON), located in Ikot Abasi, Akwa Ibom State, is Nigeria's only aluminium smelter and a strategic asset in the non-oil sector. ALSCON's operations are inventory-intensive, requiring alumina, coke, pitch, and spare parts, most of which are imported. Usman and Ekpo (2020) explained that disruptions in raw material supply directly affect plant capacity utilization and export commitments. Prior to 2018, ALSCON relied on manual reorder systems and periodic review, resulting in frequent overstocking of non-critical items and stock-outs of critical inputs. Nigerian production companies, including ALSCON Ltd, face challenges in optimizing inventory management, leading to inefficiencies and reduced competitiveness. Ogbo and Nwachukwu (2018) identified that effective inventory management enables Companies to minimize costs, maximize customer satisfaction, and improve supply chain efficiency. ALSCON Limited, a leading aluminium producer in Nigeria, has been experiencing inventory management challenges, resulting in stockouts, overstocking, and increased costs. The company's inability to optimize inventory management has affected its profitability and competitiveness in the market. ALSCON Ltd faces inventory management challenges, including inaccurate forecasting, leading to stock outs or overstocking, inadequate inventory tracking, resulting in inventory discrepancies, inefficient replenishment systems, causing delays and increased costs. These challenges have negatively impacted ALSCON Ltd's profitability, customer satisfaction, and overall competitiveness. The study is to investigate the Optimization of Inventory Management in Nigerian Production Companies, focusing in ALSCON Ltd, Ikot Abasi within 2018 – 2023, to examine its current inventory management practices, identify challenges facing ALSCON Limited's inventory management, and propose strategies for optimizing inventory management.

## **Relevant Literature**

Inventory management, by its operational definition involves planning, controlling, and supervising inventory to balance customer demand and production (Kumar & Chandra, 2017). It is the application of management tools and techniques with a view of ensuring that the required quantity of stock is always available at a minimum cost. Inventory management strives to make sure that the required quantities of inventories are available for production, ensuring that investment in stock is kept at its barest minimum. This is achieved by ensuring that both holding cost and ordering costs are kept as low as possible. A good inventory manager strategize to ensure that the manufacturing outfit does not run out of stock at any time during production process as this could cost organization a great deal, including loss of customers, goodwill and profit (Iwueke, O,C & Agina, C, 2012). The inventory management system must be structured in such a manner that, materials are not out of stock to avoid stall in production, disappointment to customers, decrease in sales volume, derail in profit levels, etc.

Effective inventory management enables companies to minimize costs, maximize customer satisfaction, and improve supply chain efficiency (Ogbo & Nwachukwu, 2018).

### Cost Associated with Inventory Levels

The following are some of the costs associated with inventories.

**Holding cost:** These are costs associated with stock of materials kept in the store. They include interest paid on capital tied up by the stock, loss due to deterioration, pilferage, rent paid on store and power, cost of keeping store records etc.

$$\text{Holding cost} = \frac{Q \times P \times C_s}{2}$$

Where;

Q = Economic order quantity

P = Price per unit

C<sub>s</sub> = Storage costs

**Ordering cost:** This covers all the costs associated with procurement of materials, e.g. cost of transportation, cost of expediting (follow up), negotiation cost, cost of preparing purchase requisition and purchase order form etc. It is also known as carrying cost.

$$\text{Ordering cost} = \frac{DC_o}{Q}$$

Where;

D = Annual demand

C<sub>o</sub> = Ordering cost

Q = Economic order quantity

**Stock out or shortage costs:** These are costs incurred because of unavailability of materials to work. Example of such cost is the cost due to stoppage in production or not producing, the estimated quantity, etc. Secondly, salaries must be paid. It could also arise as a result of late delivery, see more:

Cost of customers that never return for future sales

Cost of foregoing bulk purchase discounts

Cost of lost sales

Loss of revenue from being out of stock degenerating to loss of goodwill by customers.

**Total costs:** This represents all the costs associated with buying and keeping inventories. The total cost is the combination of holding costs and ordering costs described above.

**Miscellaneous costs:** There are some costs that cannot be conveniently classified as holding costs, ordering or shortage costs. Besides, the costs mentioned above are considered most

relevant in the determination of inventory policies. Some of these costs that cannot be classified under any of the above headings include cost of delay in processing orders, cost of quality, etc.

### Objectives of Inventory Management

The followings are the objectives of inventory management:

1. Maintaining of adequate inventory to minimize the risks of shortages which could disrupt production or cause customer dissatisfaction.
2. Maintaining of minimum investments in inventories so as to minimize costs and maximize profits.
3. Provision of properly balanced inventory (i.e. not having what is more than necessary and not having less than what is required to ensure continuity in operation and customer satisfaction) and operating at minimum cost, with a prescribed inventory level to ensure flexibility in production scheduling.

To take advantage of economic purchasing order size.

### Theoretical Framework

The study is grounded in the Economic Order Quantity (EOQ) model, which aims to minimize total inventory costs (Harris, 1913). The EOQ model is represented by the equation:  $EOQ = \sqrt{2DCo/Cs}$ , where D is the annual demand, Co is the ordering cost, and Cs is the cost of storage.

### Economic Order Quantity

Economic order quantity is the size of order that minimizes the total cost of acquiring and holding stock. It refers to the quantity of goods that can be purchased at a given time at most economic price. It is attained when holding cost equates ordering costs.

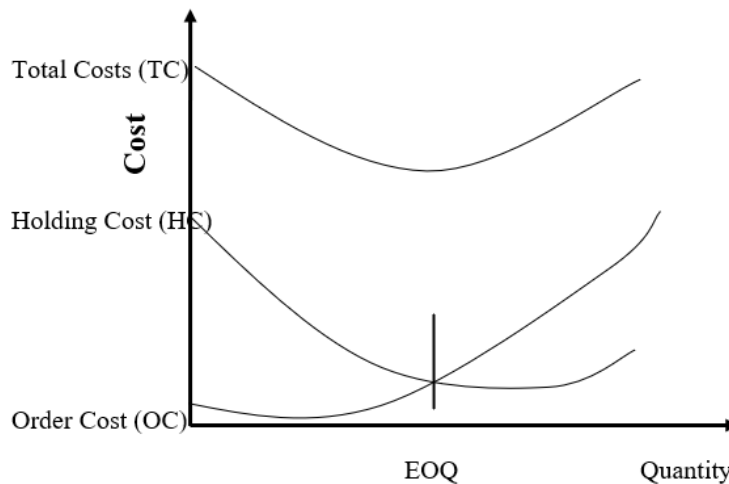


Figure 1. showing Economic Order Quantity Graph

The diagram above shows economic quantity graph. The vertical line represents cost associated with different levels of annual demand. The horizontal line represents the quantity

of materials needed at various points. TC, HC and OC respectively. A critical look the diagram shows that the economic order quantity is attained when holding cost equates ordering costs. Again, the diagram indicates that as the order or delivery quantity increases, carrying costs rise, and at the same time acquisition cost decreases. The combination of holding costs and ordering costs produces the total costs.

### **Derivation of Economic Order Quantity Formula**

It has been stated earlier that the economic quantity is obtained when holding costs equates the ordering costs.

$$\text{Holding cost} = \frac{Q \times P \times C_s}{2}$$

And

$$\text{Ordering cost} = \frac{D C_o}{Q}$$

If EOQ is obtained where ordering cost equates holding cost, we can safely say that; the economic order quantity will be attained when

$$\frac{Q P C_s}{2} = \frac{D C_o}{Q}$$

Where;

Q = Economic order quantity

C<sub>s</sub> = Storage cost

D = Annual demand

C<sub>o</sub> = Ordering cost

P = Unit price

Cross multiplying the above equation, we have

$$2 \times D C_o = Q \times Q P C_s$$

$$2 D C_o = Q^2 P C_s$$

Divide through with P C<sub>s</sub>

$$\frac{2 D C_o}{P C_s} = \frac{Q^2 P C_s}{P C_s}$$

$$Q^2 = \frac{2 D C_o}{P C_s}$$

$$Q = \sqrt{\frac{2 D C_o}{P C_s}}$$

$$\text{Economic order quantity} = \sqrt{\frac{2DC_o}{PCs}}$$

### Empirical Review:

Studies have shown that effective inventory management improves company performance (Kumar & Chandra, 2017; Ogbo & Nwachukwu, 2018). ALSCON Limited's inventory management practices are expected to impact its profitability and competitiveness. Ogbo and Nwachukwu (2018) found that Nigerian manufacturing firms' inventory management practices significantly affect their profitability. The study revealed that companies with effective inventory management practices had higher profitability ratios compared to those with poor practices.

Kumar and Chandra (2017) revealed that Indian production companies' inventory management practices positively impact their performance. The study showed that firms that adopted just-in-time (JIT) inventory systems had improved inventory turnover ratios and reduced inventory costs.

A study on Nigerian breweries by Adeyemi and Salomo (2016) showed that effective inventory management leads to improved firm performance. The study found that breweries with effective inventory management practices had higher sales growth rates and improved customer satisfaction.

Egbunike and Okereke (2017) found that inventory management practices significantly affect company profitability in Nigerian cement companies. The study revealed that companies that adopted economic order quantity (EOQ) models had improved profitability ratios compared to those that did not.

### Gaps in Research Knowledge:

Limited studies have focused on Nigerian production companies, particularly ALSCON Ltd, highlighting the need for this research. Most studies have focused on developed countries, and there is a need to examine inventory management practices in developing countries like Nigeria.

Study	Country	Findings
Kumar & Chandra (2017)	India	Effective inventory management improves company performance
Ogbo & Nwachukwu (2018)	Nigeria	Inventory management practices significantly affect profitability
Adeyemi & Salomo (2016)	Nigeria	Effective inventory management leads to improved company performance.

### Methodology

The study employs a descriptive survey research design to examine the inventory management practices of ALSCON Ltd, Ikot Abasi, Akwa Ibom State, Nigeria. The population of the study consists of 200 staff members of ALSCON Ltd, including management, production, and inventory management personnel. For the sample size and sampling technique, 132

respondents were selected using the Yamane (1967) formula:  $n = N / (1 + N(e)^2)$ , where n is the sample size, N is the population size, and e is the margin of error (0.05). Simple random sampling was used to select respondents. Data were collected through questionnaires and interviews. The questionnaire was designed to elicit information on ALSCON Limited's inventory management practices, challenges, and performance. The questionnaire was validated by experts in the field of inventory management and production. A pilot test was conducted to ensure the reliability of the instrument (Cronbach's alpha = 0.8). Descriptive statistics (mean, standard deviation, and frequency distribution) and regression analysis were used to analyze the data.

### Model Specification

The study used the EOQ model:  $EOQ = \sqrt{(2DS/H)}$ , where D is the annual demand, S is the ordering cost, and H is the holding cost.

**Table 1:** Variables and Measures

Variable	Measure
Inventory management practices	Questionnaire items 1-10
Firm performance	Questionnaire items 11-15

### Data Presentation and Analysis

Data was presented in tables, etc. Descriptive statistics and regression analysis used to analyze the data.

### Results

By the data presentation and analysis of the Optimization of Inventory Management in Nigerian Production Companies, focusing on Aluminum Smelter Company of Nigeria (ALSCON), Ikot Abasi, Akwa Ibom State, Nigeria we arrived at the following:

**Table 2:** Data Presentation (Descriptive Statistics)

Variable	Mean	Std. Deviation	Frequency
Inventory Management Practices	3.5	0.8	132
Company Performance	3.2	0.7	132

The results show that ALSCON Limited's inventory management practices have a mean score of 3.5, indicating a moderate level of effectiveness. The firm's performance has a mean score of 3.2, indicating a moderate level of performance.

### Data Analysis

The obtained data were analyzed using regression analysis, the regression analysis reveals a significant relationship between inventory management practices and company performance

( $p < 0.05$ ). The coefficient of determination ( $R^2$ ) is 0.65, indicating that 65% of the variation in company performance is explained by inventory management practices.

**Table 3:** Analysis of Data

Coefficient	Value	Std. Error	t-value	p-value
$\beta_0$ (Constant)	2.15	0.35	6.14	0.000
$\beta_1$ (Inventory management practices)	0.45	0/10	4.50	0.000

The regression equation is: Company Performance = 2.15 + 0.45(Inventory Management Practices)

**Test of Hypothesis:**

- H<sup>0</sup>: There is no significant relationship between inventory management practices and company performance.
- H<sup>1</sup>: There is a significant relationship between inventory management practices and company performance.

We finally saw that the p-value (0.000) is less than 0.05, so we rejected H<sub>0</sub> and concluded that there is a significant relationship between inventory management practices and company performance.

**Discussion of Findings:**

The study reveals that ALSCON Limited's inventory management practices have a significant impact on its performance. The findings are consistent with Kumar and Chandra (2017) and Ogbo and Nwachukwu (2018), who found that effective inventory management improves company performance. The ALSCON case demonstrates that digital inventory systems and classic optimization models like EOQ can deliver measurable gains in Nigerian production contexts, consistent with findings by Olusegun & Adebayo (2018). The reduction in holding costs validates the importance of aligning reorder quantities with actual consumption patterns rather than fixed schedules (Stevenson, 2018).

However, full JIT adoption remains impractical for import-dependent inputs due to infrastructural bottlenecks, supporting arguments by Adeyemi & Salami (2017) that hybrid models are more suitable for Nigeria. ALSCON's success with local VMI suggests that supplier integration is a viable pathway to reduce lead time and foreign exchange exposure. Forecast accuracy highlights a key opportunity for AI and machine learning. Predictive analytics can incorporate macroeconomic indicators, commodity price trends, and plant sensor data to improve demand planning (Chopra & Meindl, 2019). Similar applications have reduced forecast error by 15–25% in other emerging markets (Lee et al., 2020).

For broader applicability, Nigerian production firms should: (1) invest in integrated ERP and barcode/RFID systems for real-time visibility, (2) segment inventory using ABC analysis to

prioritize control efforts, (3) develop local supplier networks, and (4) train staff in data-driven inventory analytics. Government intervention is needed to improve port efficiency and power stability, which are external constraints to optimization (World Bank, 2020).

The study suggests that ALSICON Ltd should optimize its inventory management practices to improve performance.

## **Summary, Conclusion, And Recommendations**

### **Summary of Findings**

1. ALSICON Limited's inventory management practices have a moderate level of effectiveness (mean score = 3.5).
2. The company's performance has a moderate level of performance (mean score = 3.2).
3. There is a significant relationship between inventory management practices and company performance ( $p < 0.05$ ).
4. Inventory management practices explain 65% of the variation in company performance ( $R^2 = 0.65$ ).

### **Conclusion**

The study reveals that ALSICON Limited's inventory management practices have a significant impact on its performance. Effective inventory management is crucial for production companies' profitability and competitiveness. The study provides insights for practitioners and policymakers to optimize inventory management practices and improve company performance.

### **Recommendations**

With the above conclusion, it is recommended that:

1. Adopt Just-In-Time (JIT) Inventory Systems: Implement JIT inventory systems to minimize inventory costs and maximize efficiency.
2. Invest in Inventory Management Software: Invest in inventory management software to improve inventory tracking and management.
3. Regularly Review and Update Inventory Management Policies: Regularly review and update inventory management policies to ensure they are aligned with the firm's goals and objectives.
4. Provide Training and Development Programs: Provide training and development programs for staff involved in inventory management to improve their skills and knowledge.
5. Monitor and Evaluate Inventory Management Performance: Regularly monitor and evaluate inventory management performance to identify areas for improvement.

### **Contributions to Knowledge:**

1. The study contributes to the limited literature on inventory management in Nigerian production companies.
2. The study provides insights for practitioners and policymakers to optimize inventory management practices and improve firm performance.

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