International Journal of Public Administration and Management Research (IJPAMR), Vol. 11, No. 3, 2025.
Available online at http://journals.rcmss.com/index.php/ijpamr. ISSN:2350-2231(E) ISSN:2346-7215 (P)
Covered in Scopedatabase- https://sdbindex.com/Sourceid/00000429, google scholar, etc.
Ikaka, Beconson Fredrick, Undie, Godwin Ititim & Idor, Roy Michael, 2025, 11(3):40-51

Strategic Materials Management and Production Efficiency in Flour Mills Company, Calabar, Nigeria

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Abstract

This study examined the relationship between strategic materials management and production efficiency in Flour Mills Company, Calabar. A descriptive survey research design was adopted, targeting a population of 259 employees involved in procurement, inventory control, warehousing, production, and logistics. Using Taro Yamane's formula at a 5% margin of error, a sample size of 157 respondents was determined and selected through stratified random sampling to ensure fair departmental representation. Data were collected through a structured five-point Likert scale questionnaire and supported by secondary sources such as company records and relevant literature. The validity of the instrument was confirmed through expert review, while its reliability yielded a Cronbach's Alpha coefficient above the acceptable 0.70 threshold. Descriptive statistics (mean and standard deviation) were used to summarize responses, and multiple regression analysis was conducted using SPSS to test the influence of strategic materials management variables on production efficiency. The findings revealed that procurement planning, inventory control, and timely material availability each had a significant positive impact on production efficiency. The study concludes that effective materials management practices are critical to enhancing operational performance and sustaining competitiveness in the manufacturing sector.

Keywords: *Strategic Materials Management, Production Efficiency, Procurement Planning, Inventory Control, Operational Performance, Supply Chain Management.*

1.1 Introduction

Strategic materials management is vital for ensuring productivity and operational efficiency at Flour Mills Company, Calabar, especially in today's competitive environment. Efficient handling of materials from raw inputs like wheat to packaging helps minimize waste of time, money, and effort, which is crucial given current resource constraints. As noted by Dakhli and Lafhaj (2018), effective materials management supports both immediate production needs and long-term resource sustainability by ensuring timely, cost-effective, and quality-driven sourcing.

At Flour Mills Company, achieving optimal operational efficiency depends on the seamless integration of key functions like procurement, storage, production, and distribution. According to Kulkarni, Sharma, Hote, and Civil (2017), effective materials management involves coordinating

interconnected processes such as sales forecasting, purchasing, receiving, and shipping. Any disruption like a delay in procurement can disrupt the entire production flow and hinder the company's ability to meet customer demand, highlighting the need for efficient alignment of all materials management activities.

Bially (2015) describes materials management as the planning, procurement, and control of stock to ensure timely availability of materials. Effective operations management, as emphasized by Griffin (1991), is key to optimizing material flow by efficiently converting raw inputs into finished goods. In the context of flour milling, this means managing the sourcing, processing, and internal movement of wheat to ensure smooth production. Such coordination supports cost control, shortens production cycles, and improves product quality.

Rajeev, Shah, and Srivastava (2016) highlight that materials management requires a systematic, coordinated approach to sourcing, purchasing, storing, and distributing materials. For Flour Mills Company, this means procuring raw materials like wheat in optimal quantities and at the right price, storing them efficiently to avoid waste, and ensuring timely distribution to production. The company's success depends on maintaining an effective inventory system that balances cost control with uninterrupted production. As observed by Ikaka, Echadu, Igbang and Etta (2025), administrative efficiency of materials will not only ensure the delivery of high-quality services but also requires those responsible for service provision to demonstrate integrity, professionalism, and a deep understanding of both the services and the organization itself.

Production efficiency is the ability of a firm to maximize output while minimizing input costs by effectively utilizing resources such as raw materials, labor, and machinery to achieve production targets (Drucker, 1999). It focuses on optimizing manufacturing processes to reduce waste, improve product quality, and ensure cost-effective operations (Neely, 2005). At Flour Mills Company, Calabar, strategic materials management encompassing careful planning, timely procurement, storage, and use of raw materials like wheat, additives, and packaging is a key driver of production efficiency (Ambe & Badenhorst-Weiss, 2011).

Proper materials management ensures that inputs are available in the right quantity, quality, and timing, which reduces idle time, minimizes production disruptions, and improves workflow (Owolabi & Oginni, 2012). Inefficiencies such as supply delays or poor inventory control can disrupt operations, raise costs, and cause waste (Ajayi & Afolabi, 2009). Thus, strategies like real-time inventory tracking, accurate demand forecasting, and efficient supply chain coordination are crucial for boosting production efficiency at Flour Mills Company (Ubogu, 2020).

1.2 Statement of the problem

Despite the vital role of strategic materials management in boosting production efficiency, Flour Mills Company, Calabar tends to face ongoing challenges like production delays, inventory wastage, and underutilized resources. Inefficient procurement and poor inventory control often leading to material shortages or overstocking, disrupting production and raising costs. The lack of real-time data and technology integration hampers effective decision-making, while insufficient staff training further contributes to setbacks. This uncoordinated materials management system tends to delay access to necessary inputs, affecting customer satisfaction and delivery schedules. These challenges raise the question: could poor materials management be the root cause? Therefore, there is an urgent need to investigate the relationship between strategic materials management and production efficiency.

1.3 Objectives of the study

The main objective of the study was to examine the impact of strategic materials management on the production efficiency of Flour Mills Company, Calabar. However, the specific objectives are:

a. To examine the relationship between procurement planning and production efficiency in Flour Mills Company, Calabar.
b. To determine the extent to which inventory control practices influence production output.
c. To evaluate the effect of timely material availability on minimizing production downtime.

1.4 Research questions

a. How has procurement planning influenced production efficiency in Flour Mills Company, Calabar?
b. Has inventory control practices influence production output in Flour Mills Company, Calabar?
c. Has timely material availability on minimizing production downtime in Flour Mills Company, Calabar?

1.5 Research hypotheses

a. There is no relationship between procurement planning and production efficiency in Flour Mills Company, Calabar?
b. Inventory control practices have not influenced production output in Flour Mills Company, Calabar?
c. Timely material availability on minimizing production downtime in Flour Mills Company, Calabar?

2.1 Concept of Strategic Materials Management

Stukhart (2022) defines strategic materials management as the coordinated activities of planning, purchasing, expediting, transporting, storing, and issuing materials to ensure an efficient and timely flow. It ensures that the right quantity and quality of materials are procured at the right time and at a reasonable cost. Similarly, Ebole (2018) emphasizes that the primary goal of materials management is to effectively control material flow to meet production needs while minimizing delays and costs.

Christopher (2018) describes strategic materials management as a coordinated process involving planning, assessing needs, sourcing, purchasing, transporting, storing, and controlling materials to minimize waste and reduce costs, thereby optimizing profitability. He highlights that materials typically constitute 60–70% of a project's direct costs, with labor accounting for the remaining 30–40%. Inefficient materials management often leads to significant time and cost wastage, as noted by Ademeso and Windapo (2012) and Keitany et al., (2014). A well-structured materials management system ensures that the correct quality and quantity of materials are selected, procured, delivered, and handled on-site efficiently, cost-effectively, and on time (Ademeso & Windapo, 2012; Donyavi & Flanagan, 2009).

Mohammed et al. (2020) define materials management as an integrated process that oversees the flow of supplies into, within, and out of an organization to ensure materials are available at the right time, place, quantity, quality, and cost. It encompasses procurement, handling, storage, production and inventory control, packaging, transportation, and related information systems across

supply, manufacturing, and service distribution sectors. According to Ikaka (2022), materials management is responsible for acquiring high-quality products at the lowest cost and managing material flow from the external environment into the organization and back. It involves determining what materials are needed, in what quantity, when and where to obtain them, and at what cost. The process includes planning, organizing, directing, and controlling material activities, ensuring optimal coordination, movement, storage, and utilization to deliver quality services at minimal expense.

2.1.1 The role of strategic materials management in production efficiency

Materials management is the systematic control of the flow of materials from their initial purchase through internal operations to the point of service or product delivery (Lysons & Farrington, 2012). It encompasses activities such as procurement, inventory control, warehousing, material handling, and distribution. The effectiveness of these activities directly influences production processes, making materials management a critical determinant of production efficiency.

Inefficient materials management can result in stockouts, overstocking, delayed production schedules, and increased operational costs. Conversely, a well-functioning materials management system ensures timely availability of the right materials in the right quantity and quality, enabling smooth and uninterrupted production. According to Wild (2017), materials-related inefficiencies are among the most common causes of production downtime in manufacturing industries.

2.1.2 Components of strategic materials management

Strategic Materials management is a critical operational function involving various interconnected components that ensure the efficient flow, storage, and utilization of materials across an organization. Key elements include:

a. Materials Planning and Control: This involves forecasting material needs based on production schedules and inventory data to prevent shortages or excess (Stevenson, 2020).
b. Procurement: Focused on sourcing materials from reliable suppliers, it includes supplier selection, price negotiation, and purchase order management (Lysons & Farrington, 2012).
c. Inventory Management: Aims to maintain optimal stock levels using tools like EOQ, ABC analysis, and safety stock planning to balance availability and cost (Slack et al., 2020).
d. Receiving and Inspection: Ensures that incoming materials meet specifications and are properly documented before entering the system (Evans & Lindsay, 2017).
e. Storage and Warehousing: Involves organizing materials for easy access and protection from damage, supporting uninterrupted production (Wild, 2017).
f. Material Handling: Focuses on the safe and efficient movement of materials using manual or mechanized methods to reduce waste and delays (Chase et al., 2006).
g. Logistics and Distribution: Ensures timely delivery of raw materials to production and finished goods to customers, enhancing overall efficiency (Womack & Jones, 2003).
h. Waste Management and Disposal: Involves handling obsolete or defective items through recycling or safe disposal, aligning with sustainable practices (Ohno, 1988).

These components form a continuous strategic Materials Management Cycle, starting as presented in Fig 1 below which begins with forecasting and ending with waste disposal, each stage feeding into the next to support cost efficiency, productivity, and operational effectiveness.

FIG 1: Strategic Materials management cycle
Source: Authors' conceptual schema (2025)

2.2 Concept of production efficiency

Production efficiency refers to the ability of an organization to produce the maximum amount of output from a given set of inputs or to produce a desired output using the minimum possible inputs, with minimal waste or idle capacity (Farlex, 2020). It is a core component of operational performance and competitiveness in both manufacturing and service industries.

According to Chase, Jacobs, and Aquilano (2006), production efficiency is achieved when operations are streamlined, processes are optimized, and resources including labor, machinery, and materials are utilized without unnecessary waste. Production efficiency is often measured in terms of throughput, cycle time, cost per unit, and resource utilization. Organizations with high production efficiency can adapt quickly to changes in demand, reduce lead times, and offer competitive pricing all while maintaining product quality. As such, production efficiency is not only a goal but also a key driver of organizational sustainability and profitability (Slack et al, 2020).

2.3 Empirical Review

Earlier studies consistently agree on the positive link between material management and production efficiency. Adamu (2020) investigated the impact of material management on the performance of Benue Brewery companies using a survey of 151 respondents. Data analyzed through descriptive statistics and multiple regression revealed that inventory control and stock valuation positively and significantly influenced organizational performance ($p<0.05$). Although lead time had a negative effect, it remained statistically significant ($p<0.05$). The study concluded that effective material management enhances workplace efficiency and recommended reducing lead time to improve material acquisition and delivery.

Kisioya and Moronge (2019) studied the impact of material handling practices on the performance of large-scale manufacturing companies in Nairobi, Kenya. Using a descriptive survey design, data were collected from 188 firms through structured questionnaires and analyzed with SPSS. Regression analysis at a 5% significance level revealed that material stock control, handling automation, packaging, and logistics planning all had a significant positive effect on firm performance. The study achieved a 71.3% response rate and concluded that effective material handling practices enhance organizational performance.

Daniel (2019) examined the effect of materials management on organizational productivity in Nigeria, noting that many firms undervalue its role. The study aimed to identify solutions to material management challenges and assess its impact on profitability. Using a sample of 255 from a population of 705, data were collected via Likert-scale questionnaires and analyzed using Pearson correlation and regression analysis. Results showed that effective materials management enhances

profitability and prevents production interruptions through proper storage. The study recommended improved record-keeping and staff training to boost productivity.

Dagim (2018) studied the role of material management on organizational performance at the Commercial Bank of Ethiopia, using a descriptive design and census sampling of 80 employees involved in material management. Data were analyzed using descriptive statistics and narrative analysis. Findings revealed that while material planning is practiced, adherence to federal procurement regulations is weak. Inventory control was found to be inconsistent, with annual inventory checks delaying timely material tracking. The study concluded that material procurement practices lacked legal compliance and efficiency.

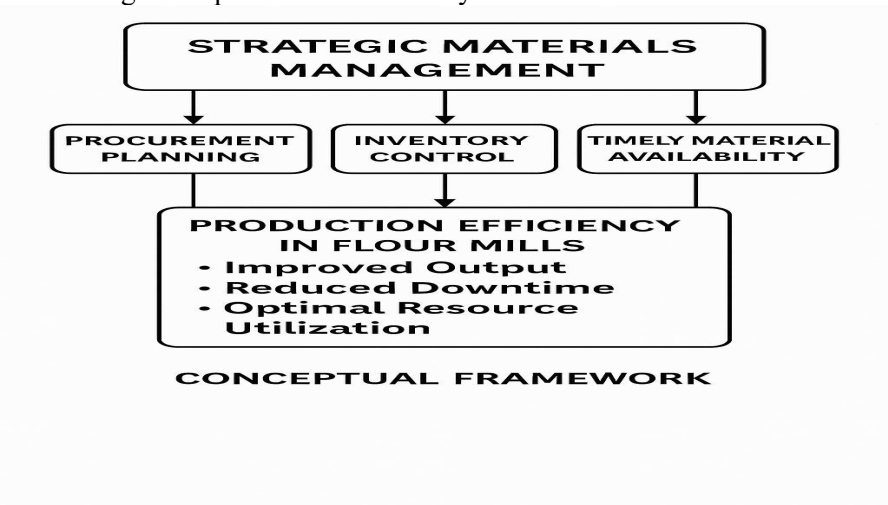

FIG 2: Conceptual framework
Source: Authors' conceptual schema (2025)

2.4 Theoretical framework

The Resource-Based View (RBV) Theory is a strategic management framework that emphasizes the importance of a firm's internal resources in achieving sustainable competitive advantage. Originating from Edith Penrose's (1959) work and later advanced by Wernerfelt (1984) and Barney (1991), the theory argues that firms differ in their resource endowments, and that resources must be valuable, rare, inimitable, and non-substitutable (VRIN) to be strategically significant. These resources include physical assets, human expertise, and organizational systems. For a firm like Flour Mills Company, Calabar, efficiently managing internal resources such as procurement systems, inventory controls, and logistics can drive production efficiency and cost savings. Thus, RBV provides a strong theoretical basis for linking strategic materials management to enhanced operational performance.

3.1 Research methodology

The study employed a descriptive survey design to explore the link between strategic materials management and production efficiency at Flour Mills Company, Calabar. The target population included 259 staff across procurement, inventory, warehousing, production, and logistics units. A sample size of 157 was derived using Taro Yamane's formula with a 5% margin of error, and stratified random sampling ensured proportional departmental representation. Data were collected from both primary and secondary sources: primary data via a structured five-point Likert-scale

questionnaire, and secondary data from company records and literature. Instrument validity was confirmed through expert review, while reliability, tested using Cronbach's Alpha, met the 0.70 threshold. Descriptive statistics (frequencies, means) was used to summarized the data, and multiple regression analysis, was used through SPSS, to assess the impact of strategic materials management on production efficiency.

Table 1: Sample Distribution by Department

Department	Population	Proportion (%)	Sample Size (n = 157)
Procurement	45	17.37%	27
Inventory/Warehousing	60	23.17%	36
Production	85	32.82%	52
Logistics/Distribution	39	15.06%	24
Quality Control	30	11.58%	18
Total	259	100%	157

Source: Filed Survey, (2025)

The data shows the distribution of a sample of 157 respondents drawn proportionally from a total population of 259 employees across five departments. The Production department, being the largest (32.82%), contributed the highest number of respondents (52), followed by Inventory/Warehousing with 36 respondents (23.17%), and Procurement with 27 (17.37%). Logistics/Distribution and Quality Control had 24 (15.06%) and 18 (11.58%) respondents, respectively. The sample accurately reflects the departmental proportions within the total population.

4.1 Data analysis

Table 2: Response Rate

Variables	Frequency	Percent (%)
Total number of questionnaires administered	157	100 (%)
Total number of copies correctly and returned	150	95.5(%)
Total number of copies incorrectly filled or not returned	7	4.5%

Source: Fieldwork (2025)

Out of the 157 (100 percent) distributed questionnaires, 150 were returned and found usable, representing a response rate of 95.5%, which is considered adequate for statistical analysis.

Table 3: Comprehensive Operational Data from Flour Mills Company, Calabar (Jan–May 2024)

Month	Procurement Planning Efficiency (%)	Inventory Accuracy (%)	Material Availability (%)	Production Output (Metric Tons)	Production Downtime (Hours)	Operational Cost per Unit (₦)	Production Efficiency Index (%)
January	78	82	84	4,120	12	880	71
February	86	88	89	4,570	8	830	79
March	72	79	76	3,850	15	910	66
April	91	92	93	4,950	5	790	86
May	75	81	80	4,100	13	870	70

Source: Fieldwork (2025)

The data in Table 3 highlights a strong link between effective procurement planning, accurate inventory, and material availability with improved production performance at Flour Mills Company, Calabar. From January to May 2024, months with higher procurement and inventory efficiency saw greater output and reduced downtime. Notably, April recorded peak performance with high

procurement (91%), inventory accuracy (92%), and material availability (93%), leading to the highest output (4,950 metric tons) and lowest downtime (5 hours). In contrast, March showed the weakest performance, with lower efficiency levels and the least output. These trends emphasize that strategic materials management directly enhances production efficiency and reduces operational disruptions.

Table 4: Descriptive Statistics showing the Relationship Between Procurement Planning and Production Efficiency

Statement	Mean	Std. Dev
Procurement is guided by accurate demand forecasts	4.12	0.78
Suppliers are selected based on quality and reliability	4.25	0.66
Procurement lead times are consistently monitored and improved	4.06	0.81
Procurement contributes to minimizing stock-out incidents	4.18	0.74

Source: Field survey, 2025

Table 4 shows a strong agreement among respondents that procurement practices at Flour Mills Company, Calabar are effective. Supplier selection based on quality and reliability received the highest mean (4.25), followed by procurement's role in minimizing stock-outs (4.18). Demand forecasting (4.12) and lead time monitoring (4.06) also scored highly, though with slightly more variability. Overall, the results indicate that procurement activities are well-managed and contribute positively to production efficiency.

Table 5: Regression Analysis showing the Relationship Between Procurement Planning and Production Efficiency

Model Variable	B Coefficient	Std. Error	t-value	p-value
Constant	2.305	0.418	5.514	0.000
Procurement Planning (X_1)	0.476	0.092	5.174	0.000

Source: Field survey, 2025

There is a significant positive relationship between procurement planning and production efficiency ($p < 0.05$). This implies that improving procurement processes results in better production performance.

Table 6: Descriptive Statistics Determining the Extent to Which Inventory Control Practices Influences Production Output

Statement	Mean	Std. Dev
Inventory levels are regularly reviewed and adjusted	4.10	0.71
Inventory software is used for real-time stock tracking	3.88	0.83
Overstock and understock issues are promptly addressed	4.01	0.79
Safety stock levels are maintained to ensure uninterrupted production	4.15	0.76

Source: Field survey, 2025

Table 6 indicates that respondents generally agree that inventory management at Flour Mills Company, Calabar is well maintained. Regular review and adjustment of inventory levels (mean 4.10) and maintaining safety stock to avoid production interruptions (mean 4.15) are particularly emphasized. Real-time stock tracking via inventory software has a slightly lower mean of 3.88, suggesting some room for improvement. Prompt handling of overstock and understock issues also scores positively at 4.01, reflecting effective inventory control practices overall.

Table 7: Regression Analysis showing the Extent to Which Inventory Control Practices Influences Production Output

Model Variable	B Coefficient	Std. Error	t-value	p-value
Constant	1.895	0.532	3.561	0.001
Inventory Control (X_2)	0.534	0.105	5.086	0.000

Source: Field survey, 2025

Inventory control practices have a statistically significant positive influence on production output ($p < 0.05$). Efficient inventory management increases production continuity and output levels.

Table 8: Descriptive Statistics showing the Effect of Timely Material Availability on Minimizing Production Downtime

Statement	Mean	Std. Dev
Materials are available when needed for production	4.28	0.64
Lead time reductions have improved production scheduling	4.20	0.72
Emergency procurement is minimized through timely delivery	4.03	0.81
Suppliers meet delivery timelines consistently	4.10	0.70

Source: Field survey, 2025

The data in Table 8 shows strong agreement that materials are reliably available for production, with a high mean of 4.28. Respondents also acknowledge that reduced lead times have positively impacted production scheduling (mean 4.20). Timely deliveries help minimize emergency procurement (mean 4.03), and suppliers generally meet delivery deadlines consistently (mean 4.10), indicating effective materials availability and supplier performance.

Table 9: Regression Analysis showing the Effect of Timely Material Availability on Minimizing Production Downtime

Model Variable	B Coefficient	Std. Error	t-value	p-value
Constant	2.102	0.479	4.388	0.000
Timely Material Availability (X_3)	0.495	0.098	5.051	0.000

Source: Field survey, 2025

There is a statistically significant relationship between timely material availability and reduced production downtime ($p < 0.05$). Ensuring that materials arrive on schedule directly contributes to smoother operations and fewer production halts.

Table 10: Model Summary of the Regression Analysis

Model Summary	Value
R (Multiple Correlation)	0.811
R Square (R^2)	0.658
Adjusted R Square	0.642
Std. Error of the Estimate	0.482
F-Statistic	41.125
Significance (p-value)	0.000

Source: Field survey, 2025

The regression model is statistically significant ($p < 0.05$), and the independent variables explain 65.8% of the variation in production efficiency. This affirms the relevance of procurement planning, inventory control, and timely material availability in driving operational performance.

Table 11: Summary of the Regression Analysis

Variable	Coefficient (B)	Std. Error	t-Value	p-Value	Interpretation
Procurement Planning (X_1)	0.476	0.092	5.174	0.000	Significant positive effect on efficiency
Inventory Control (X_2)	0.534	0.105	5.086	0.000	Significant positive effect on output
Timely Material Availability (X_3)	0.495	0.098	5.051	0.000	Significant reduction in downtime
Model R	0.811				Strong correlation overall
R^2 (Coefficient of Determination)	0.658				65.8% of the variation explained
F-Statistic	41.125			0.000	Overall model is statistically significant

Source: Field survey, 2025

The regression analysis shows a strong and significant link between strategic materials management and production efficiency at Flour Mills Company, Calabar. Procurement planning, inventory control, and timely material availability all had positive, statistically significant effects on production efficiency, with coefficients of 0.476, 0.534, and 0.495 respectively ($p = 0.000$ for all). This means that effective procurement, proper inventory management, and timely access to materials play key roles in enhancing output and reducing downtime. The model's R-squared value of 0.658 indicates that these three factors collectively explain about 65.8% of the variation in production efficiency, while the F-statistic of 41.125 ($p < 0.001$) confirms the model's reliability.

4.2 Discussion of findings

The findings revealed that:
Procurement Planning has a significant positive relationship with production efficiency ($\beta = 0.476$, $p < 0.05$). Proper planning and supplier coordination enhance the seamless flow of raw materials, improving production cycles. Inventory Control Practices significantly influence production output ($\beta = 0.534$, $p < 0.05$). Efficient stock monitoring and reduction of overstocking/stockouts contributed to stable and higher production volumes. Timely Material Availability plays a critical role in minimizing downtime ($\beta = 0.495$, $p < 0.05$). Ensuring materials are available when needed helped avoid delays, thereby sustaining consistent production operations.

5.1 Conclusion

The study concludes that strategic materials management is crucial for enhancing production efficiency in manufacturing firms. Key factors such as procurement planning, inventory control, and timely material availability drive smooth operations, minimize downtime, and optimize resource use. For Flour Mills Company, Calabar, improving materials management practices can significantly boost production output and cost-effectiveness, essential for competitiveness in the Agro-processing industry.

5.2 Recommendations

Based on the findings, the following recommendations are made:

a. Invest in advanced procurement systems that enable real-time forecasting, vendor assessment, and demand-driven sourcing to ensure consistent material availability.
b. Fully implement technologies like Enterprise Resource Planning (ERP) and automated inventory tracking to manage stock levels, reduce excess inventory, and prevent losses.
c. Adopt Just-In-Time (JIT) delivery within the supply chain to receive materials precisely when needed, avoiding overstock and obsolescence.
d. Utilize data analytics in materials management to detect trends, accurately forecast demand, and optimize resource allocation.

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