

Materials Management and Productivity Maximization in Selected Small Aluminium Firms in Enugu State, Nigeria

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Abstract

For firms today, the ultimate goal is to boost productivity and revenues through better approaches towards value conveyance as well as continuous improvements. Improved production and productivity are thus imperative to achieving customer retention and loyalty, hence objectivity. To achieve this, however, organisations must adapt to regularly changing customers' aspirations, tastes, preferences, and wants. Therefore, this study examines material management and productivity maximization. The specific objectives are to (i) assess materials management on product standardization; and (ii) examine the effect of materials management on product value. The study used a descriptive survey research design with managers (owners of businesses), staff and customers of selected fifteen (15) small aluminum firms in Enugu, Nigeria as the population. The sample size adopted for this study is one hundred (110), and structured questionnaires were administered and analyzed using percentage mean scores. The result reveals that product standardization was influenced by the efficiency of materials management in selected aluminum firms, as the grand mean obtained was 3.71. Also, it was shown that product value was significantly and positively affected by a firm's ability to effectively and efficiently manage its materials, as the grand mean obtained was 3.73. The study concludes that Materials management being a strong frontier for profit improvement through cost control, contributes to increased production and productivity and thus customer satisfaction through adherence to standardized products. It was recommended that aluminum firms should conduct customer satisfaction surveys regularly to ensure that expected value is transferred to customers at all times.

Keywords: Materials, Production, Management, Productivity, Standardization.

Introduction

In the emerging and ever challenging business environment, it has become imperative for firms to discover better approaches of value conveyance to their customers and clients. The increasing requirements for firms to offer cost and quality-based products worldwide have given rise to the need to implement more efficient productive measures. Among various industries, small and medium-sized enterprises (SMEs) play a crucial role in the production and distribution of goods, providing employment and driving economic activities.

The aluminum manufacturing industry is one such sector that significantly contributes to Nigeria's industrial growth. They manufacture products such as roofing sheets, window frames, doors, and other aluminum-based products. In their efforts towards contributing to the nation's economy, they face considerable challenges in terms of material management, product standardization, and product quality. These challenges often affect their ability to maintain consistent product quality and meet market demands for standardized products. Material management, a critical aspect of production, refers to the efficient planning, procurement, handling, and utilization of raw materials in the manufacturing process. Effective material management ensures that the right quality and quantity of materials are available at the right time, minimizing waste, reducing costs, and maintaining a smooth production flow. In the context of small aluminum firms, material management directly influences product quality, as the type, quality, and consistency of materials used can determine the final product's performance and adherence to industry standards.

Product standardization, on the other hand, involves ensuring that products meet predetermined specifications and quality criteria, which are crucial for building consumer trust and establishing a brand reputation. For small aluminum firms in Nigeria, the lack of proper material management practices can lead to variations in product quality, resulting in non-standardized products that fail to meet industry requirements. Koutsou and Foteini (2021) argue that standardization improves product reliability and safety, which is particularly important in construction and infrastructure applications where aluminum products are widely used. Small aluminum firms in Nigeria, however, often face difficulties in implementing standardized production processes due to inconsistent material quality, poor infrastructure, and lack of skilled labor.

In Nigeria, apart from the perceived high performance recorded by some large and medium sized manufacturing firms, others have not been able to operate so profitably. This tends to imply that the successful firms might have used effective innovative production strategy in achieving corporate goals and objectives. The role of material management in product quality has been highlighted in several studies. For example, Lee and Lee (2018) emphasize that poor material management practices can lead to defects in products, such as poor surface finishes, dimensional inaccuracies, or inadequate strength, which undermine product quality.

Statement of the Problem

In Nigeria, small aluminum firms play important role in the production of aluminum products used across various sectors such as other firms within the same manufacturing sector, automotive, construction, and packaging. Despite this, these firms often face challenges in maintaining consistent product quality and achieving product standardization due to inefficiencies in the management of their materials. Material handling is often hindered by inefficiencies in the operational systems. When poorly done, it leads to congestion at ports, delays in shipments, and high transportation costs (Adebayo, 2021). Inadequate materials management practices, such as poor inventory control, unreliable

procurement, and suboptimal supplier relationships, can result in variations in raw materials quality, production delays, and inconsistencies in product quality.

Product standardization and quality are essential for small firms, whether they produce aluminum or other things. This is to help them remain competitive in the market, maintain customer satisfaction, as well as to meet regulatory standards. However, many of these firms operate with limited resources, which may hinder their ability to implement robust materials management systems. As a result, they often struggle with issues such as material wastage, production bottlenecks, and a lack of uniformity in product quality. This study seeks to explore the effects of materials management practices on the standardization of products and overall product quality in selected small aluminum firms in Enugu State, Nigeria.

Objectives of the study

The general objective of the study is to investigate material management and productivity maximization. However, the specific objectives are to:

1. Determine the effect of material management on product standardization in selected aluminum firms in Enugu State
2. Examine the impact of material management on product quality in selected aluminum firms in Enugu State.

Literature Review

Material Management

Materials include sub-assemblies, components, raw materials, etc. Materials management as a process starts with the supplier (Bially, 2015): It begins from the point of entry into the organisation as components and raw materials. The receipt function begins with the receipts of delivery note from the supplier (Heinritz, 2011). The purchase order copies are then received and properly checked for quality and other specifications in line with the firm's requirements. After, the material inspection job is done. In the context of small firms, material management is particularly challenging due to limited resources, lack of technology, and reliance on local suppliers, which may not always provide high-quality materials. Bhatti and Ali (2019) hold that effective material management practices, such as proper inventory control, timely procurement, and quality assurance procedures, directly influence the consistency and quality of products in manufacturing industries; this is to ensure that the right item is purchased and made available to the manufacturing operations at the right time, at the right place and at the minimum cost. Lee and Lee (2018) emphasize that poor material management practices can lead to defects in products, such as poor surface finishes, dimensional inaccuracies, or inadequate strength, which undermine product quality.

Koutsou and Foteini (2021) argue that standardization improves product reliability and safety, which is particularly important in construction and infrastructure applications where aluminum products are widely used. Small aluminum firms in Nigeria, however, often face

difficulties in implementing standardized production processes due to inconsistent material quality, poor infrastructure, and lack of skilled labor. The objective of material management centers around material problems solving from a total organisational point of view through performance control of various material functions, controlling material flow, provision of adequate and efficient communication network (Lenders, 1992).

Theoretical Framework

Lean Theory

The term "Lean" was coined by John Krafcik in 1988 and defined by James Womack and Daniel Jones in 1996. Its production system was conceived on waste reduction, touch time, value streams, incremental and continuous improvement, as well as standardized products. According to Womack and Jones (1996), the system uses a production mechanism that enhances production through less manpower, reduced time, and space, and minimal equipment, while ensuring that customers receive their exact product specification. Value-addition activities are centered on things customers' willingness to pay and consider all other activities as waste. For firms, implementation of the lean philosophy gives them the chance to improve their value delivering capabilities, remaining competitive, reduce operational cost, and enhance profitability.

The theory is an extension of the Just-in-Time philosophy. The theory aims at minimizing waste in the production process and eliminates buffer stock (Green & Inman, 2005). Inventory leanness is the best inventory control tool and affects positively the profitability of a firm. It elaborates the flexibility gains of manufacturing firms while taking decisions on orders, eliminates inventory carrying costs and reduces the stocks of inventory held on site. Scholarly studies show that firms successfully optimize inventory through lean supply chains methods in order to achieve high customer satisfaction, increased asset utilization levels which leads to increased market share, profitability and improved growth.

Trujillo-Barrera (2014) views leanness as involving five elements: value: the value element emphasizes that businesses should first determine whether the application of lean technique will generate expected value or not prior to making such changes. The second principle is the principle of flow, for this principle, firms should first understand the flow of inventory in their warehouse for business as well as economic value addition to customers. Next is the principle of pull which states that once an organization knows the flow of inventory and how to eliminate inventory waste, pulling inventory at customers' request, becomes a natural phenomenon. The fourth principle involves a rigorous and continuous evaluation of inventory flow which enhances effective demand management. It is the principle of responsiveness which allows a firm to adapt and respond quickly to market changes. It helps to keep the firm's inventory at appropriate levels, preventing obsolete inventory and reducing unnecessary storage costs. The last principle is perfection. It demands continuous improvement of a firm's inventory management processes; which will result in improved efficiency, cycle time, quality and cost. The principle lays greater emphasis on absolute waste reduction, which is likely to make top management to close

down any part of the firm that proves unprofitable in the short run but may be essential to the firm's bequest.

Empirical Review

Kayiranga, Nyamweya and Shukla (2020) examined the contribution of material management practices on performance of construction of project. Specifically, the present research assessed the effects of material estimation costs on project performance, the effect of procurement on performance of construction project and examined the effect of inventory control on performance of construction projects. Both descriptive and correlational research designs were adopted where qualitative and quantitative approaches were applied. Data collection instruments that used were questionnaire, interview guide and documentary analysis. The target population was 200 contractors and 180 subcontractors. The sample size was 195 respondents. Furthermore, information was analyzed using Statistical Package for Social Sciences version 21.0. Results evidenced a positive and significant correlation between material estimation cost and performance of construction project at Baraka Properties was 0.518. A positive and significant correlation of 0.884 was also obtained between procurement process and project performance. Egwuatu, (2020) investigated the effect of material management and organizational productivity in breweries industry South-East in Nigeria. The study aims to examine the effect of material control and organizational productivity of brewer industry and to examine the relationship between material planning strategy and organizational productivity of brewer industry South-East in Nigeria. Relevant conceptual theoretical and empirical literature was reviewed. The study was anchored on Inventory Management Theory. Descriptive survey research design was adopted. The study was carried out in Southeast, Nigeria. The population Sample size calculation was employed to determine the sample size of 328. Results showed that material control has a significant positive influence on organizational productivity in Nigeria brewer industries South-East. Material planning strategy has a positive significant effect on organizational productivity in Nigeria brewer South-East. The study concludes that material management positive significant effect on organizational productivity in Nigeria brewer South-East. The works showed a link between Materials and inventory management and organisational productivity. However, these works were based outside Nigeria. Therefore, the gap here is that within the purview of the reviewed works, not so much could be claimed to have been said about material management and its effect on productivity in terms of improved product quality; as well as product standardization in Nigeria especially within the Aluminum firms in Enugu State. This has therefore created a sectoral gap which justifies this work.

Methodology

A descriptive survey was used to obtain information that explains the current state of the variables and to describe "what exists" concerning conditions in a situation. The study targeted all managers, staff of selected aluminum firms in addition to some customers met

at the spot during distribution of instrument as its population. The choice of customers as part of the respondents for this study is based on the fact that product quality is only measured in terms of the value received by customers of the products. Therefore, the study employed cluster technique of sampling in which the entire population was divided into clusters and groups, and the samples of these clusters were selected on convenience basis. The sample size adopted for this study is one hundred and ten (110). The study used structured questionnaire as instrument for data collection for the study; the questionnaire was designed and administered physically while some were administered electronically through Google Forms. Google Form is a modern way of sending questionnaires electronically through Google Mail and receiving responses without meeting the respondents physically.

The questionnaire had close-ended questions and options for the respondents to choose from. The options were rated on a five-point scale of Strongly Agree () Agree () Disagree () Strongly Disagree (). The instrument was divided in two sections, A and B. Section A dealt with the background/demographic information about the respondents. Section B consists of question items that expounded the specific objectives and research questions. Data collected for the study will be analyzed using mean scores, percentages, and frequencies.

Data Analysis

This segment deals with the presentation, analysis and interpretation of data got from the administered questionnaire on the research Material Management and Productivity Maximization in Selected aluminum firms in Enugu, Nigeria. Since the study adopted a descriptive survey, the study distributed One hundred and ten (110) questionnaires administered to managers (owners of the firms), staff, and customers present. The companies sampled were six (6) from Enugu South Local Government; six (6) from Enugu North Local Government and three (3) from Enugu East LGA. One hundred and ten (110) responses were obtained from the instrument administered. The questionnaires were made up of two sections, which are Section A and Section B. Section A was demographic characteristics. In contrast, section B contains two (2) research questions and five (5) items, each as a tentative statement given a total of ten question items (10) to get possible responses from the respondents; this is to enable the researchers analyze and draw conclusion, interpret and make decisions as stated in methodology segment through the responses from respondents.

Data Presentation, Analysis and Interpretations

Section A, deals with the demographic data of the respondents; it will be analyzed using percentage (%). It positively affects materials management and productivity maximization indicators in selected aluminum firms.

Demographic Analysis of Respondents

Gender		
Variable	Frequency	Percentage
Male	87	79.09
Female	23	20.91
Total	110	100
Location Distribution		
Enugu South (Ugwuaji, Maryland, Kenyatta area)	49	44.55
Enugu North (Agbani Rd, Coal Camp, Obiagu axis)	38	34.55
Enugu East (Abakpa, Thinkers Corner, Emene)	23	20.91
Total	110	100
Categories		
Staff	76	69.09
Managers/Owners of business	15	13.64
Customers	19	17.27
Total	110	100
Educational Qualification		
Ph.D.	0	0
M.Sc. or Equivalent	12	10.91
First Degree or Equivalent	69	62.73
Others	29	26.36
Total	110	100
Age		
17-25 Years	16	14.55
26-35 Years	32	29.09
36-45 Years	46	41.82
46 Years and above	16	14.55
Total	110	100

Source: Field Survey, 2024

Interpretation

Table 1 represents the distribution of the respondents' gender; 79% were male, while 21% were female (because aluminum /manufacturing industry is gender biased and favours male workforce than female).

Table 2 above represents the location of the firms that were sampled in study: 6 firms from Enugu South axis 49 (44.5%); 6 firms from Enugu North axis 38 (34.55%) and 3 firms from Enugu East axis 23 (20.9%).

Table 3 indicates that the categories of respondents through the structural questionnaire were as follows: Of the 110 retrieved, 76(69%) were staff, 15 (14%) were workshop/business owners, and customers comprised 19(17%).

Table 4 signifies the academic qualifications of the respondents: 12(11%) were Masters Degree holders, 69(63%) of the respondents hold a First Degree and its equivalent and 29 (26%) of the respondents hold other degrees that were not specified in the instrument. However, none of the respondents had a PhD.

Table 5 above shows the age distribution of the respondents: 17-25 years are 16 (15%), 26-35 years are 32(29%), while 36-45 years 45(42%), while 46 years and above were 16(15%) of the respondent.

SECTION B: Analysis and Presentation of Data

Question 1) What is the effect of materials management on product standardization?

S/N	Items	SA	A	UD	D	SD	Mean	Rmks
1.	Regulation of procurement standards	54 (23.89%)	32 (18.6%)	3 (30%)	12 (18.75%)	9 (13.64%)		
2.	Efficiency of product delivery	51(32.5%)	39 (11.7%)	0 (7.8%)	14 (7.8%)	6 (39.0%)		
3.	Product storage regulation	43 (55.8%)	31 (14.3%)	4 (11.7%)	12 (5.2%)	10 (13.0%)		
4.	Efficiency of inventory	47 (18.2%)	17 (9.1%)	3 (7.8%)	17 (3.9%)	27 (61.0%)		
5.	Efficiency of production flow	31 (40.3%)	53 (16.9%)	0 (19.5%)	9 (15.6%)	14 (7.8%)		
	TOTAL	1130	688	30	128	66	2042/550	
	GRAND MEAN						3.71	Accept

Source: Field Survey, 2024

Interpretation

The above table shows the question from research question one. It was observed that the mean value obtained from the response on material management and product standardization was 3.71, which is above the 2.5 mean value decision rule; it implies therefore that product standardization as a variable of productivity is significantly influenced by material management in the selected aluminum companies.

Question 2) what is the effect of material management on product quality?

S/N	Items	SA	A	UD	D	SD	Mean	Remark
1.	Unrestricted production process	42 (20%)	31 (15.4%)	1 (9.1%)	16 (34.8%)	20 (23.5%)		110
2.	Curbs production delays	37 (17.9%)	41 (20.4%)	5 (45.5%)	8 (17.4%)	19 (22.4%)		110
3.	Enhances raw materials supplies	46 (22.2%)	42 (20.9%)	3 (27.3%)	6 (13%)	13 (15.3%)		110
4.	Boosts raw material standardization	51 (24.6%)	28 (13.9%)	2 (18.2%)	10 (21.7%)	19 (22.4%)		110
5.	Enhances product process control	31 (15%)	59 (29.4%)	0 (0%)	6 (13%)	14 (16.5%)		110
	TOTAL	1035	804	33	92	85		
	GRAND MEAN						3.73	Accept

Source: Field Survey, 2024

Interpretation

The above table shows the question items from research question 2. It also shows that the grand mean value obtained from the effect of materials management on product quality which is above 2.5 mean value decision rule, it therefore implies that unrestricted production process, reduction of production delay, enhanced raw material supply, as well as enhanced production process control as variables of product quality is significantly influenced by efficient management of materials. The grand mean for the table was 3.73 which is above 2.5 mean value decision rule, this implies that the question "What is the effect of materials management on product quality, is affirmed.

Discussion of Findings

Table 1 of the study represent question 1 and items which reveals that product standardization is significantly influenced by materials management in aluminum firms as the grand mean obtained was 3.71 which is within the benchmark judgment of 2.5 value. This agrees with the literature from Koutsou and Foteini (2021) who argued that standardization improves product reliability and safety, which is particularly important in construction and infrastructure applications where aluminum products are widely used. Small aluminum firms in Nigeria, however, often face difficulties in implementing standardized production processes due to inconsistent material quality, poor infrastructure, and lack of skilled labor.

Similarly, table 2 falls within the benchmark judgment with the mean value of 3.73 on effect of materials management on product quality in Aluminum firms. This is in line with the work by Bhatti and Ali (2019) that effective material management practices, such as proper inventory control, timely procurement, and quality assurance procedures, directly influence the consistency and quality of products in manufacturing industries. In the context of small firms, material management is particularly challenging due to limited resources, lack of technology, and reliance on local suppliers, which may not always provide high-quality materials.

Conclusions

Proper management of materials plays a critical role in maximizing productivity within small aluminum firms in Nigeria. This is because an organization can hardly survive the poor management of its materials. The evidence indicates that effective materials management strategies such as inventory control, procurement, and materials planning, are key to optimizing production processes and maximizing organisation's output.

Research reveals that many small aluminum firms in Nigeria struggle with inefficient inventory systems, resulting in issues like stockouts, overstocking, and misallocation of resources. Such inefficiencies directly affect the cost of production, leading to higher operational costs, reduced profitability, and an inability to meet market demand in a timely manner. The lack of well-established procurement and materials planning systems

exacerbates these inefficiencies, often causing small firms to rely on reactive procurement practices rather than strategically sourcing materials at optimal prices.

Maximization of productivity in small aluminum firms in Nigeria is intricately linked to the effective management of materials; if materials are purchased too early, organisation's capital may likely be locked up and substantive charges for inventory of such materials accrue. Materials may be stolen or suffer value reduction during storage unless adequate care is taken. It may involve additional cost as well as more delays where materials needed for specific production are not readily available.

Recommendations

1. That maintaining standardization of organizational products may be difficult if material management decision is not efficient; considering that inconsistency in production process; non-compliance with healthy regulations and proper product packaging among other negative production vices hinder achievement of productivity objective. If work stops at a work-centre or production process is faulted, all pending orders are breached; and efficient customer satisfaction is only achieved through timely response to customers' orders with quality products. Therefore, efficiency should be aimed at in taking material management decision.
2. Being mindful of product quality, Management should ensure that customers' expectations in terms of products quality is met and timely too through strict conformity to agreed standards, elimination of production delays, efficient control of production process, as well as maintenance of raw material supply chain, among others.

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