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# EVALUATING THE IMPACT OF MATERIALS HANDLING PRACTICES ON ORGANIZATIONAL PROFITABILITY AND PERCEPTION: EVIDENCE FROM NIGERIAN BOTTLING COMPANY, OWERRI, IMO STATE

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## Keywords

Water absorption  
Impact strength  
Flexural strength  
Compression strength  
Regression analysis

## Abstract

This study investigates the influence of materials handling (MH) practices on organizational profitability and employee perception within the Nigerian Bottling Company (NBC), Owerri, Imo State, Nigeria. Despite the operational significance of MH in manufacturing, empirical research remains limited on how internal stakeholders perceive these practices and how such perceptions align with organizational outcomes. Adopting a descriptive survey design, data were collected through structured questionnaires and interviews from a purposive sample of 52 staff members across seven departments. The study employed Latent Class Analysis (LCA) to identify unobserved subgroups of employees based on their MH-related perceptions, and Structural Equation Modeling (SEM) to assess the relationships between latent constructs, including MH quality and perceived profitability. Findings revealed two contrasting latent classes: one comprised primarily of junior, female, and highly educated staff who viewed MH systems as inefficient and unimpactful; and another comprising senior, male staff with technical backgrounds who viewed MH as effective and profit-contributing. While SEM results showed strong factor loadings for MH quality indicators such as maintenance, handler qualification, and professionalism these did not significantly predict profitability perceptions. Instead, whether MH operations were led by a qualified manager significantly influenced perceived profitability. These results highlight a perceptual asymmetry within the organization and underscore the importance of leadership, communication, and employee inclusion. The study affirms the Sociotechnical Systems Theory and the Resource-Based View by illustrating that optimizing both technical processes and human systems is critical for organizational success. Policy recommendations include leadership training, preventive maintenance, perceptual alignment strategies, and gender-sensitive engagement practices.

## 1. Introduction

Composite materials typically exhibit better mechanical properties compared to their constituent materials. These materials are formed by combining a matrix or binder with reinforcement. Common matrix materials include polymers; reinforcement can come from fibres and particles. The proportion of reinforcement in a composite significantly influences its physical and mechanical characteristics. Fibre can be synthetic, like glass fibre, or sourced from natural materials like plant biomass. Over the years, synthetic fibre has found extensive applications in industries like aerospace and automotive due to its high strength and lightweight nature. However, there is growing global concern regarding synthetic fibre's environmental and economic drawbacks, including their non-biodegradable nature, pollution, greenhouse gas emissions, and high production costs. As a result, there is a rising interest in researching natural fibre particles as sustainable and effective alternatives to synthetic fibres for lightweight polymer composite applications. Various natural fibre

particles, such as coconut, wheat, flax, and sisal, have been studied and shown to be effective reinforcements for polymer composites.

Additionally, research has demonstrated enhancements in the mechanical properties of polymer composites by adjusting factors like the weight fraction of fibre particles. One study found that tensile, compressive, and flexural strength increased by up to 30% with fibre particle loading but decreased with further loading. Tests on sisal/epoxy composites indicated that flexural properties improved as fibre loading increased. An investigation into how the percentage content affects the flexural and impact properties of a Phoenix sp. fibre particle-reinforced epoxy composite found that both properties improved as the fibre loading increased to 40% [15]. Similarly, research on a rice straw polyester composite indicated that the impact strength rose with higher fibre volume content [16]. However, the fibres from *Newbouldia laevis* plants have not been extensively studied for use in polymer composites. This plant, native to tropical Africa and referred to as 'Ogiris' in Eastern Nigeria, is noted for its high crude fibre content and significant medicinal properties [17]. This study experimentally examined the impact of the fibre particle weight fraction on various properties, including water absorption rate, mass density, impact strength, flexural strength, and compressive strength of a *Newbouldia laevis* fibre particle reinforced polymer composite. The findings suggest *Newbouldia laevis* fibre particles could be a promising reinforcement material for lightweight polymer composite applications.

## 2. Methodology

Materials handling (MH) is a vital operational function in manufacturing and distribution industries, where the efficient movement, protection, storage, and control of materials significantly influence productivity, cost-efficiency, and profitability. In industrial settings such as the Nigerian Bottling Company (NBC) in Owerri, Imo State, effective MH practices ensure smooth workflows, reduce wastage, optimize labour, and support timely production cycles (Albert et al., 2018). Despite its importance, MH remains under-optimized in many developing economies, with persistent challenges including poor equipment, low skill levels, and inadequate technology integration.

A growing body of literature underscores the multifaceted nature of materials handling practices and their influence on firm performance. For example, Kisioya and Moronge (2019) found that material stock control, automation, logistics planning, and packaging practices significantly enhanced the performance of manufacturing firms in Nairobi. Similarly, Albert et al. (2018) demonstrated that effective materials management improved cost efficiency, project timelines, and quality control in the Nigerian construction sector. These studies highlight the strategic value of MH practices but often focus more on project-based or infrastructure outcomes, leaving employee perceptions and internal dynamics less explored. The work by Dza and Kyeremeh (2018) examined the warehousing and materials handling challenges within Ghana's civil service and found a near-total absence of automation, limited training, and resistance to safety protocols.

These systemic deficiencies are echoed in Aasonaa (2022), who identified theft, poor planning, and lack of technical expertise as key constraints to effective materials management on construction sites in Ghana. Both studies call for modernized, technology-driven systems, yet their focus remains within public or infrastructural contexts. On the technology front, Chawla et al. (2019) offered a comprehensive review of Automated Guided Vehicles (AGVs) in Flexible Manufacturing Systems (FMS), stressing their role in optimizing guide path configuration, scheduling, and routing to enhance handling efficiency. Similarly, Aron et al. (2023) proposed a conceptual Cloud Material Handling System (CMHS) that integrates cloud computing, machine learning, and real-time analytics to dynamically allocate materials handling resources, thereby improving logistics resilience and sustainability. These advanced models, while innovative, tend to overlook organizational culture and employee-level implementation realities in developing regions.

From a risk management perspective, Arezes et al. (2011) highlighted the limited awareness and inconsistent application of materials handling risk assessment tools among health and safety professionals in Portugal, with many practitioners unfamiliar with established methods such as the National Institute for Occupational Safety and Health (NIOSH) equation, Key Indicator Method (KIM), and Manual Handling Assessment Charts (MAC). Similarly, Skals et al. (2021) demonstrated the physical burden of MH tasks using motion capture and electromyography, reinforcing the need for ergonomic improvements and organizational training. Another relevant stream of inquiry is seen in

Klingenberg and Boksmas (2010), who critiqued the lack of operational specificity in existing MH outsourcing frameworks within the European automotive industry. Their proposed tactical decision-making model for materials handling outsourcing indicates the need for operational alignment between internal processes and strategic outcomes. Moreover, Marmolejo et al. (2010) found that poor user practices and inadequate source management hindered waste handling and recovery efficiency in Colombia, a finding that parallels materials handling inefficiencies in manufacturing.

Despite the breadth of this scholarship, a critical research gap remains: few studies comprehensively examine how employees across hierarchical and departmental levels perceive MH practices and how these perceptions align with organizational profitability in a Nigerian industrial context. While many studies have either explored performance metrics (Kisioya & Moronge, 2019), technology integration (Chawla et al., 2019; Aron et al., 2023), or safety frameworks (Arezes et al., 2011), there is insufficient empirical work linking materials handling quality, employee perception, and strategic outcomes using robust, integrative models.

This study is motivated by the need to bridge this gap. It aims to evaluate how materials handling practices influence organizational profitability and internal stakeholder perceptions within NBC Owerri. It further seeks to uncover latent patterns among employees using Latent Class Analysis (LCA) and examine structural relationships using Structural Equation Modelling (SEM). Focusing on technical and perceptual dimensions, the study offers a holistic evaluation of the material handling performance nexus. It informs practical interventions in human capital, automation, and strategic logistics planning.

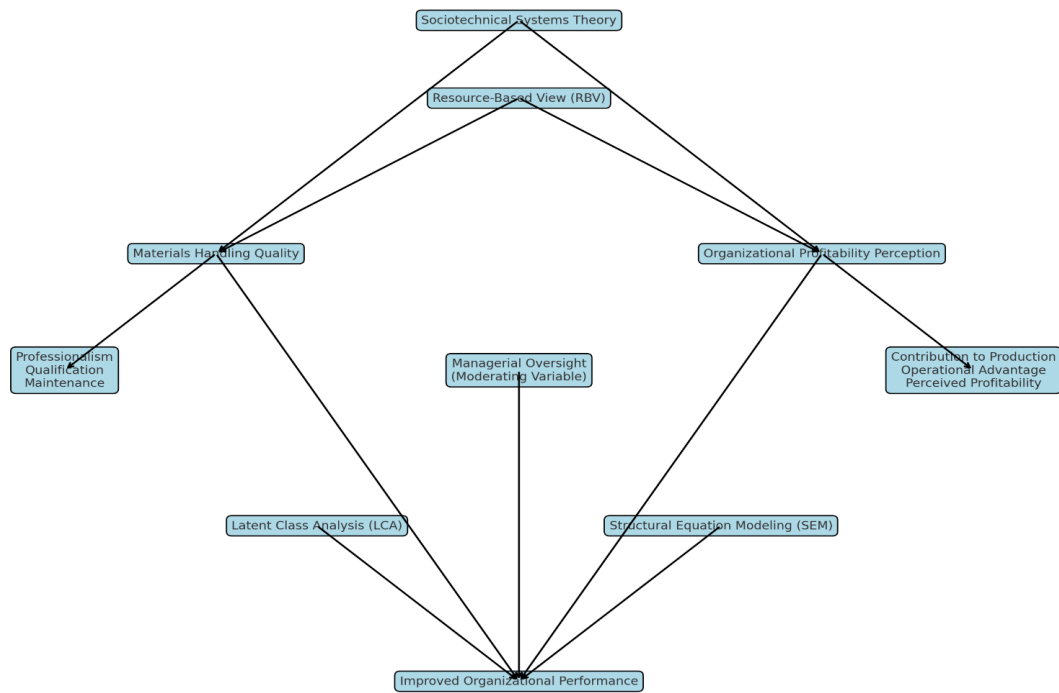
## 2.1. Conceptual/Theoretical Framework

This study is anchored in the Sociotechnical Systems Theory, which emphasizes the interdependence between social components (people, culture, structures) and technical components (tools, procedures, technology) within organizational settings. According to Trist and Bamforth (1951), organizations function optimally when the social and technical subsystems are jointly designed and mutually supportive. Pasmore (1988) further refined this framework by emphasizing the importance of participative design, highlighting that improvements in organizational efficiency must consider both technological systems and human factors.

In this study, materials handling quality is conceptualized as a technical system involving professional handling, qualification of handlers, equipment maintenance, and use of technology. Meanwhile, organizational profitability is treated as a socio-technical outcome, influenced by how well materials handling systems align with employee capabilities, managerial decisions, and strategic goals. The framework supports the view that effective MH systems require more than automation or infrastructure and depend on human competence, perception, and oversight. The firm's Resource-Based View (RBV) (Barney, 1991) provides an economic rationale to complement this. RBV suggests that organizations gain a competitive advantage by leveraging valuable, rare, inimitable, and non-substitutable (VRIN) resources. Under this lens, when strategically developed and efficiently managed, materials handling systems become organizational capabilities that drive performance outcomes such as cost reduction, timely production, and increased profitability. Human capital, such as trained personnel and competent management, also fits into this VRIN framework, making materials handling a key performance driver.

The proposed structural model derived from these theories posits that:

1. Materials Handling Quality (latent variable) is influenced by observed indicators such as professionalism, qualification of handlers, and maintenance status.
2. Organizational Profitability Perception (latent variable) is measured through employee responses on contribution to production, perceived profitability, and operational advantage.
3. Managerial Oversight (observed variable, whether a qualified manager heads materials handling) moderates the relationship between materials handling quality and perceived profitability.



**Fig. 1. Conceptual Framework Linking Materials Handling Practices to Organizational Profitability: A Sociotechnical and Resource-Based Perspective**

The study integrates a systems-thinking perspective with empirically grounded analytical techniques by employing Latent Class Analysis (LCA) to uncover hidden staff subgroup perceptions and Structural Equation Modeling (SEM) to test hypothesized relationships. This framework offers an approach to evaluating the material handling-performance nexus in a real-world industrial setting.

### 2.1.1. Research Methodology

This section outlines the methodological framework adopted to investigate the impact of materials handling within the Nigerian Bottling Company, Owerri. It details the research design, data sources, sample characteristics, instrumentation, and analytical procedures. Each methodological decision was carefully considered to ensure rigour, validity, and alignment with the study objectives, enabling meaningful interpretation of organizational dynamics and perceptions.

### 2.1.2. Research Design

This study adopted a descriptive survey design widely used in social science research for collecting data that describes population characteristics (Creswell & Creswell, 2018). The design was chosen to assess the impact of materials handling in the Nigerian Bottling Company (NBC), Owerri. Considering the contextual and operational nature of materials handling, it was impractical to abstract the subject from its real-world setting into a laboratory or experimental context (Bryman, 2016). Therefore, the deployment of structured questionnaires enabled the researcher to reach a broader employee base and achieve a more representative sample than feasible under experimental conditions.

### 2.1.3. Questionnaire Design

A structured questionnaire was developed as the main instrument for data collection, specifically targeting staff in the production department of NBC Owerri, where materials handling is most operationally visible. The questionnaire employed closed-ended, multiple-choice questions to ensure simplicity and ease of response (Oppenheim, 2000) - the design aimed at eliciting insights on the perceived impact of materials handling activities on operational efficiency. Structured

questionnaires are known for their reliability in gathering uniform data, especially when targeting a large and diverse workforce (De Vaus, 2014).

### 2.1.4. Sources and Methods of Data Collection

The study utilized the primary data source. Primary data were collected through structured questionnaires and face-to-face interviews to clarify responses and capture additional perspectives. According to Kothari (2004), primary data are crucial when direct observations and firsthand accounts are needed. The study covered seven departments directly involved in materials management at NBC Owerri. Secondary data were sourced from relevant literature, including textbooks, journal articles, company reports, and documented operational practices related to NBC and materials handling.

### 2.1.5. Population and Sample Size

The target population comprised 60 staff members from seven departments involved in materials-related functions at NBC Owerri. The department-wise distribution is shown below:

Department	Number of Staff	Percentage (%)
Production	10	16.7
Purchasing	10	16.7
Quality Control	7	11.7
Stores	12	20
Human Resources Development	7	11.7
Finance and Audit	6	10
Physical Distribution	8	13.3
Total	60	100

The sample size was determined using Yamane's (1967) formula:

$$n = \frac{N}{1 + N(e)^2} \quad (1)$$

Where:

n = sample size

N = population size (60)

e = margin of error (5% or 0.05)

$$n = \frac{60}{1 + 60(0.05)^2} \approx 52$$

Thus, a sample of 52 respondents was selected to ensure adequate representation across the departments.

### 2.1.6. Sampling Technique

The study employed a purposive sampling technique, which involves selecting individuals most relevant to the research objectives (Etikan, Musa, & Alkassim, 2016). Structured questionnaires served as the primary instrument, supplemented by observational methods. Questionnaires, often called structured interview schedules, are capable of eliciting independent responses in a standardized format (Groves et al., 2009). Observation helped to triangulate the data collected and enhance the study's credibility.

### 2.1.7. Validity and Reliability of the Measuring Instrument

Validity refers to how well an instrument measures what it is intended to measure. As noted by Cohen, Manion, and Morrison (2011), content validity ensures that the instrument comprehensively covers the subject matter. In this study, content validity was verified through expert review by the research supervisor, a specialist in industrial management.

Reliability reflects the consistency and stability of a measurement instrument (Robson & McCartan, 2016). To confirm reliability, the questionnaire was administered twice to the same group

of respondents, yielding consistent results, a procedure akin to the test-retest method, enhancing the reliability coefficient (Bryman, 2016).

### 2.1.8. Method of Data Analysis

The data collected in this study were analyzed using both descriptive and inferential statistical methods. The descriptive statistics included frequencies, percentages, and cross-tabulations to summarize the demographic characteristics of the respondents and their responses to key questionnaire items (Field, 2018). These statistics provided an initial understanding of the distribution and central tendencies within the dataset.

To examine latent patterns in respondents' perceptions and demographic groupings, Latent Class Analysis (LCA) was employed. LCA is a model-based clustering technique that identifies unobserved subgroups within a population based on observed categorical variables (Collins & Lanza, 2010). This method was appropriate for uncovering hidden heterogeneity in staff perceptions about materials handling (MH), particularly regarding profitability, operational quality, and managerial influence.

Furthermore, the study utilized Structural Equation Modelling (SEM) to assess the relationships between latent constructs such as MH Handling Quality and MH Profitability. SEM was chosen because it allows for the simultaneous examination of multiple dependent relationships and accounts for measurement errors in latent variables (Kline, 2015). Specifically, the Diagonally Weighted Least Squares (DWLS) estimation method was used due to the ordinal nature of the questionnaire data, which violates the normality assumptions required by Maximum Likelihood Estimation (Li, 2016).

Model fit indices, including the Root Mean Square Error of Approximation (RMSEA), Tucker-Lewis Index (TLI), and Comparative Fit Index (CFI), were used to evaluate the adequacy of the SEM model (Hu & Bentler, 1999). A combination of good latent structure and model fit was essential in validating the hypothesized relationships between variables, such as the role of MH management on perceived profitability.

All analyses were conducted using R programming language version 4.4.3, with packages such as poLCA for Latent Class Analysis (Linzer & Lewis, 2011) and lavaan for Structural Equation Modeling (Rosseel, 2012). These tools provided robust frameworks for handling complex models involving both categorical and latent variables.

## 3. Result and Discussion

### 3.1. Latent Class Analysis (LCA)

**Table 1. Conditional Response Probabilities by Latent Class**

Variable	Categories	Class 1 (42.3%)	Class 2 (57.7%)
Gender	Female / Male	1.00 / 0.00	0.00 / 1.00
Marital Status	Married / Single	1.00 / 0.00	0.03 / 0.97
Position	Director / Manager / Senior / Junior	0.00 / 0.00 / 0.00 / 1.00	0.23 / 0.23 / 0.53 / 0.00
Qualification	SSCE / ND / HND / MSC	0.00 / 0.00 / 0.55 / 0.45	0.13 / 0.40 / 0.47 / 0.00
MH Headed by Manager	Yes / No	0.14 / 0.86	1.00 / 0.00
Professionals Used	Yes / No	0.00 / 1.00	0.80 / 0.20
Handlers Qualified	Yes / No	0.00 / 1.00	0.63 / 0.37
MH Maintained	Yes / No	0.00 / 1.00	0.83 / 0.17
MH Advantageous	Yes / No	0.00 / 1.00	0.50 / 0.50

Performance Measure	Test Value
number of observations	52
number of estimated parameters	27
residual degrees of freedom	25
maximum log-likelihood	-192.93

Performance Measure	Test Value
AIC(2)	492.53
BIC(2)	492.53
G <sup>2</sup> (2)	145.81
X <sup>2</sup> (2)	1218.92

The latent class analysis (LCA) in Table 1 identified two distinct groups of respondents based on their demographic profile and perception of material handling (MH) operations. Class 1 (42.3% of the sample) comprises exclusively female, married junior staff with higher qualifications (55% HND/BSC, 45% MSC/PHD), where MH is poorly managed with no report MH being maintained, handled by professionals, or advantageous to production. In contrast, Class 2 (57.7%) consists solely of male, mostly single, managerial or senior staff, predominantly HND/ND holders, with strong agreement that MH is headed by a qualified manager (100%), maintained (83%), and contributes to profit. Model fit statistics include AIC = 439.85, BIC = 492.54, and a G<sup>2</sup> (deviance) = 145.82, indicating a moderately good fit for a two-class solution, revealing polarized latent subgroups in the organization regarding their material handling experience and perceptions.

### 3.1.1. Result of the Structural Equation Model

**Table 2. Parameter Estimates for the SEM Model**

Latent Variable	Estimate	Std.lv	Std.all
MH_Profitability =~ MH_Contributes_to_Profit	1.0	3.953	1.0
MH_Profitability =~ MH_Aids_Production	0.988	3.906	1.0
MH_Profitability =~ MH_Advantageous	0.803	3.172	0.983
MH_Handling_Quality =~ MH_Maintained	1.0	0.775	0.775
MH_Handling_Quality =~ Handlers_Qualified	1.0	0.775	0.775
MH_Handling_Quality =~ Professionals_Used	1.665	1.29	1.29
MH_Profitability ~ MH_Handling_Quality	0.0	0.0	0.0
MH_Profitability ~ Headed_by_MH_Manager	7.861	1.989	0.967
Rmsea	tli	Chisq	Pvalue
5.073	-3.253	17077.443	0.000

The structural equation model in Table 2 was estimated using the Diagonally Weighted Least Squares (DWLS) method with 52 observations, revealing significant factor loadings for most indicators. 'MH\_Profitability' is strongly explained by its components: MH\_Contributes\_to\_Profit (std.all = 1.000), MH\_Aids\_Production (1.000), and MH\_Advantageous (0.983). Similarly, 'MH\_Handling\_Quality' is strongly explained by Professionals\_Used (1.290), while Handlers\_Qualified and MH\_Maintained both loaded at 0.775. However, the direct effect of MH\_Handling\_Quality on MH\_Profitability was not significant (estimate = 0.000), while Headed\_by\_MH\_Manager significantly predicted MH\_Profitability (estimate = 7.861, std.all = 0.967). Fit indices indicate poor model fit (CFI = 0.000, TLI = -3.253, RMSEA = 5.073), suggesting the model may be misspecified or overfit due to sample size or variable selection.

The SEM model can be expressed as, suppose we let:

- $\eta_1$  = MH\_Profitability (Latent variable: perception of MH-related profitability)
- $\eta_2$  = MH\_Handling\_Quality (Latent variable: quality of materials handling processes)
- x = Headed\_by\_MH\_Manager (Observed binary variable: 1 = Yes, 0 = No)

Measurement Equations:

For MH\_Profitability ( $\eta_1$ ):

$$\text{MH\_Contributes\_to\_Profit} = 1.000 * \eta_1 + \varepsilon_1$$

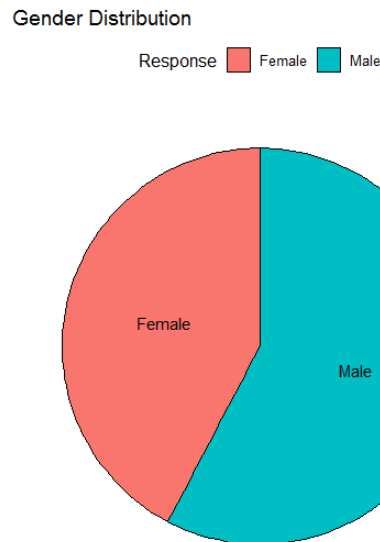
$$\text{MH\_Aids\_Production} = 0.988 * \eta_1 + \varepsilon_2$$

$$\text{MH\_Advantageous} = 0.803 * \eta_1 + \varepsilon_3$$

For MH\_Handling\_Quality ( $\eta_2$ ):

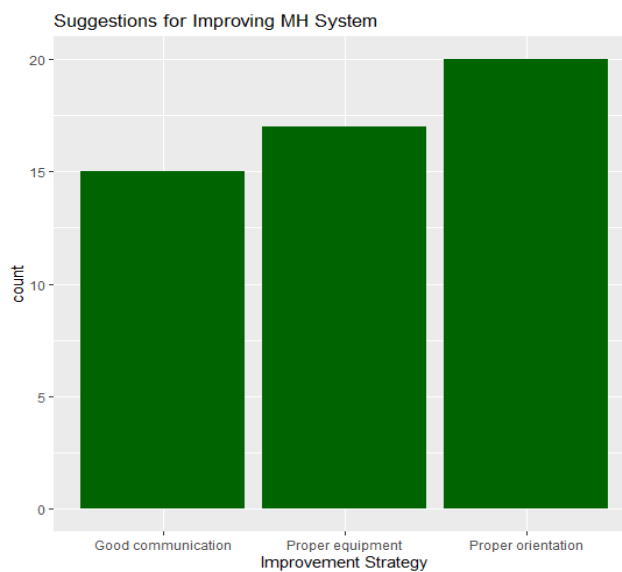
$$\text{MH\_Maintained} = 1.000 * \eta_2 + \varepsilon_4$$





**Fig. 3. Proportion of Male and Female Respondents**

The pie chart in Fig. 3 displays the gender distribution of a sample population. It visually shows that a larger portion of the sample is Male (depicted in cyan), and a smaller portion is Female (depicted in salmon/pink). The distribution appears to be approximately 60% male and 40% female.



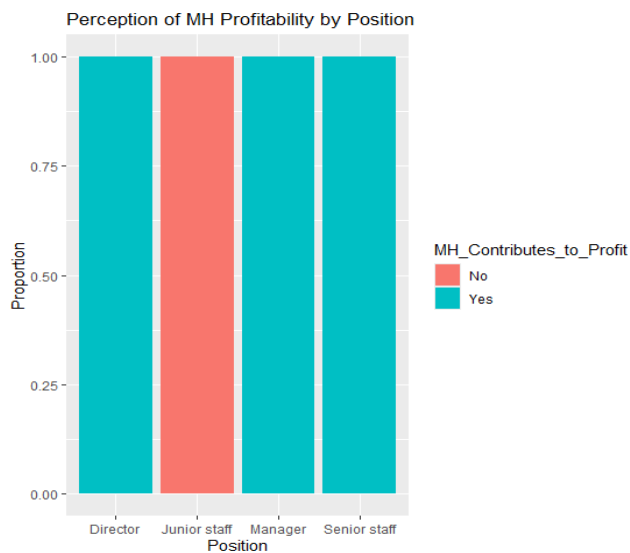
**Fig. 4 Response to the suggestion for Improvement**

Fig. 4 presents participants' suggestions for improving the MH (Material Handling) system. The most frequently suggested strategy was "Proper orientation," with around 20 responses, followed by "Proper equipment" and "Good communication," receiving slightly fewer responses. This distribution implies that while all three areas are considered important, there is a stronger perceived need for better orientation and training for personnel. It suggests that stakeholders view proper onboarding and understanding of procedures as the most critical factor in enhancing the efficiency and safety of the MH system. Addressing this priority could yield immediate improvements in system performance and worker satisfaction.



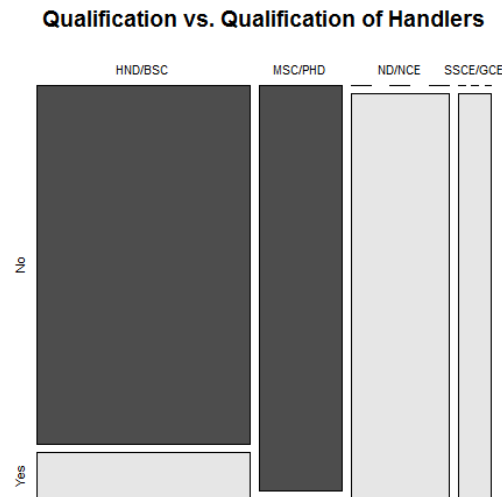
**Fig. 5. Bar Chart of Response to Employee-Management Relationship by Gender**

Fig. 5 illustrates the nature of the employee-management relationship categorized by gender. The chart reveals that male employees described their relationship with management as cordial, while female employees reported a hostile relationship more frequently. This pattern suggests a gender disparity in perceived workplace dynamics, with females possibly experiencing more tension, dissatisfaction, or lack of support from management than their male counterparts. This finding highlights the need for gender-sensitive management practices and interventions aimed at improving communication, trust, and fairness in workplace relations for all employees.



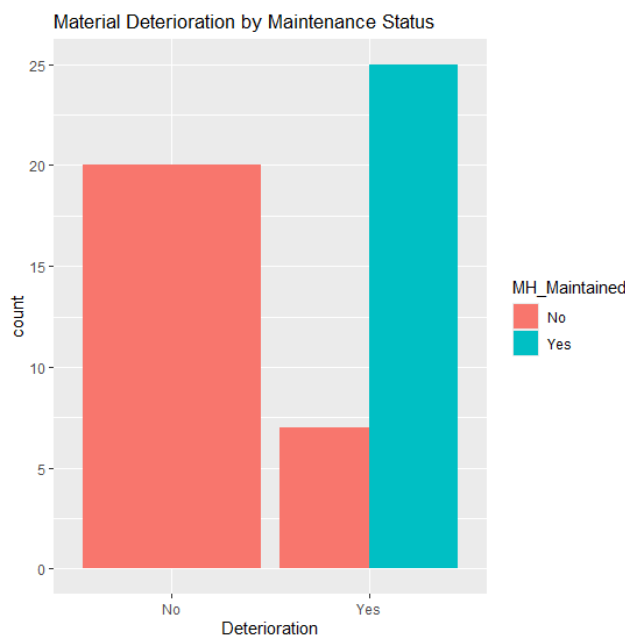
**Fig. 6. Chart of perception of MH Profitability by position**

Fig. 6 illustrates the perception of Materials Handling (MH) profitability across different staff positions within the organization. The chart reveals that all Directors, Managers, and Senior Staff perceive MH as contributing positively to profitability ("Yes"), indicating a unanimous belief among higher-ranking employees. In contrast, only junior staff members have a differing view, with some perceiving MH as not contributing to profit ("No"). This suggests a possible knowledge gap or difference in exposure between junior staff and their senior counterparts, which may reflect varying levels of involvement in strategic or financial decision-making. The implication is that targeted training or communication may be needed to align understanding across all organizational levels.



**Fig. 7 Perceived Qualification of Materials Handlers by Educational Level**

The chart in Fig. 7 presents respondents' perceptions of whether materials handlers are qualified, categorized by the respondents' educational qualifications. A striking pattern emerges that those with higher qualifications (HND/BSc and MSc/PhD) are likelier to perceive handlers as not qualified. In contrast, respondents with lower qualifications (ND/NCE and SSCE/GCE) mostly perceive handlers as qualified. This contrast suggests a possible misalignment in expectations or evaluative criteria; more educated respondents may apply stricter standards or have greater awareness of industry best practices. The implication is that improving communication and setting standardized competency benchmarks could bridge this perception gap and inform recruitment or training policy decisions.



**Fig. 8. Plot of the relationship Between Maintenance and Material Deterioration**

The chart in Fig. 8 shows the relationship between the maintenance status of materials and their deterioration. It reveals that materials that are not maintained have a significantly higher chance of not experiencing deterioration (possibly due to underuse), but a notable number still deteriorate. In contrast, maintained materials are overwhelmingly associated with deterioration, perhaps because they are more frequently used and thus kept in response to wear and tear. This pattern implies that maintenance is more reactive than preventive in the observed context. Therefore, a shift toward a

proactive maintenance culture may be necessary to reduce material deterioration and extend the lifespan of resources.

### 3.2. Discussion of Findings

The findings from this study offer important insights into how materials handling (MH) practices are perceived across different staff levels within the Nigerian Bottling Company (NBC), Owerri, and how these perceptions relate to organizational profitability and MH quality. The Latent Class Analysis (LCA) revealed the existence of two distinct employee subgroups with significantly polarized perceptions of MH practices. Class 1, comprising predominantly junior, female, and highly educated staff, reported negative assessments highlighting poor maintenance, lack of qualified handlers, and a perception that MH does not contribute to productivity. Conversely, Class 2, composed mainly of male, senior, or managerial staff with technical qualifications, expressed positive views, agreeing that MH is managed by qualified personnel and positively contributes to profit. This divergence supports earlier arguments by Arezes et al. (2011) and Skals et al. (2021), who identified knowledge gaps and risk misperceptions among different categories of workers in MH environments. It also suggests that organizational communication and operational transparency may not be uniform across all cadres.

The Structural Equation Modeling (SEM) results further demonstrated that while MH handling quality (measured by maintenance status, handler qualifications, and professional oversight) had strong individual factor loadings, it did not significantly predict MH profitability perception. Rather, the leadership variable, whether a qualified manager headed MH, emerged as a significant predictor of profitability perceptions. This reinforces Klingenberg and Boksmas' (2010) argument that strategic alignment and managerial decision-making are critical in materials handling effectiveness, especially when dealing with operational-level outcomes. The observed disconnect between handling quality and profitability perception may also reflect a broader issue of perceptual asymmetry, where the technical quality of work is not always visible or appreciated by non-operational staff. The perceived lack of benefit of MH among junior staff also mirrors earlier concerns raised by Dza and Kyeremeh (2018) and Aasonaa (2022) in the public and construction sectors, respectively, where limited training, inadequate communication, and deficient tools hinder effective MH engagement. In the present study, responses from junior staff appear to echo similar frustrations despite the private-sector setting, indicating that technological resources alone, as proposed by Chawla et al. (2019) and Aron et al. (2023), may be insufficient without accompanying human capital development and participatory systems management.

Notably, Fig. 6 and Fig. 7 underscore significant perceptual gaps based on educational qualification and maintenance practices. Staff with higher academic qualifications were more critical of MH handler competence, reflecting possibly stricter evaluative benchmarks or deeper awareness of global standards. This aligns with Marmolejo et al. (2010) who found that user-level practices and attitudes directly influence handling efficiency and material recovery in waste management systems. Meanwhile, Fig. 8 showed that materials associated with frequent use—and thus more likely to be maintained—were also more likely to deteriorate, suggesting that maintenance is often reactive. This calls attention to the need for preventive maintenance systems and aligns with Albert et al. (2018), who emphasized early planning and systematic material control as key to performance enhancement. Moreover, findings from Fig. 4 and Fig. 5 suggest that gender and hierarchical position shape employee-management relations and profitability perceptions. Male staff generally reported more cordial management interactions and positive MH views, while female staff indicated less favourable relations and negative profitability implications. These findings call for gender-responsive management practices and more inclusive decision-making to foster alignment across workforce segments.

This study builds on the existing literature by providing empirical evidence from a Nigerian manufacturing context, integrating employee perception with structural modelling techniques. It confirms that while material handling quality is important, managerial leadership, employee communication, and perception alignment are pivotal for translating MH practices into perceived profitability. This supports the theoretical framing of the study, particularly the Sociotechnical Systems Theory, which emphasizes that both human (social) and technical subsystems must be jointly optimized for organizational success (Trist & Bamforth, 1951; Pasmore, 1988).

## 4. Conclusion

The study provides empirical evidence on the relationship between materials handling (MH) practices, employee perception, and organizational profitability within the Nigerian Bottling Company (NBC), Owerri. Latent Class Analysis (LCA) findings reveal significant differences in staff experiences and perceptions, particularly between junior and senior employees regarding MH effectiveness and profitability. Senior and managerial staff view MH as beneficial and well-managed, while junior employees, especially highly educated female staff, express dissatisfaction with handler competence, maintenance routines, and MH's contribution to productivity. Structural Equation Modeling (SEM) results indicate that although MH quality (professionalism, qualifications, and maintenance) has high factor loadings, it does not directly predict perceived profitability. Instead, managerial oversight—specifically the presence of a qualified MH manager—significantly influences profitability. These findings highlight that leadership and employee perception alignment play a more critical role in shaping profit-oriented attitudes than technical adequacy alone, reinforcing Sociotechnical Systems Theory (Trist & Bamforth, 1951; Pasmore, 1988), which argues that optimal organizational outcomes arise from the integrated optimization of human and technical systems. The Resource-Based View (RBV) (Barney, 1991) is also supported, as leadership and employee competence emerge as valuable, rare, and non-substitutable (VRIN) resources that drive strategic outcomes. Based on these findings, several policy recommendations are proposed: organizations should ensure that MH units are led by trained and qualified managers to align operational quality with strategic objectives; management should address perceptual disparities through gender-sensitive engagement, training, and communication strategies that promote inclusion at all staff levels; the existing reactive maintenance culture should be replaced with proactive systems, incorporating scheduled maintenance and digital tracking tools to reduce material deterioration and enhance system efficiency; continuous in-service training should be mandatory for MH staff to support skill enhancement, especially among junior employees, and transparent communication regarding MH strategies and objectives should be prioritized to unify staff perceptions and foster commitment; decision-makers should integrate latent staff perceptions into performance management systems using data-driven tools like LCA to identify perceptual gaps and design targeted interventions; and training content should be tailored to meet the evaluative expectations of highly educated employees while simplifying communication for those with lower academic backgrounds, ensuring standardized competency benchmarks and precise performance evaluations. Effective MH in the manufacturing sector ultimately extends beyond equipment and logistics—it requires competent leadership, ongoing communication, and inclusive decision-making that reflects the perceptions and contributions of all organizational levels. These findings can inform organizational policies and broader industrial practices across Nigeria and similar contexts in sub-Saharan Africa.

## References

- Aasonaa, D. N. (2022). Materials management practices on public projects in the Upper West Region. *Journal of Sustainable Materials Processing and Management*, 2(2). <https://doi.org/10.30880/jsmpm.2022.02.02.007>
- Albert, I., Shakantu, W., & Ibrahim, K. (2018). Impact of materials management practices in the Nigerian building construction industry. *Journals.Co.Za*, (June 2018), 1–10.
- Arezes, P. M., Miguel, A. S., & Colim, A. S. (2011). Manual materials handling: Knowledge and practices among Portuguese health and safety practitioners. *Work*, 39(4), 385–395. <https://doi.org/10.3233/WOR-2011-1189>
- Aron, C., Sgarbossa, F., Ballot, E., & Ivanov, D. (2023). Cloud material handling systems: A cyber-physical system to enable dynamic resource allocation and digital interoperability. *Journal of Intelligent Manufacturing*. <https://doi.org/10.1007/s10845-023-02262-6>
- Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17, 99–120. <https://doi.org/10.1177/014920639101700108>
- Bryman, A. (2016). *Social research methods* (5th ed.). Oxford University Press.
- Chawla, V. K., Chanda, A. K., & Angra, S. (2019). Automatic guided vehicle systems in the flexible manufacturing system - A review. *International Journal of Industrial Engineering: Theory Applications and Practice*, 26(5), 737–765.
- Cohen, L., Manion, L., & Morrison, K. (2011). *Research methods in education* (7th ed.). Routledge.
- Collins, L. M., & Lanza, S. T. (2010). *Latent class and latent transition analysis: With social, behavioral and health sciences applications*. Wiley.
- Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage.
- De Vaus, D. (2013). *Surveys in social research* (6th ed.). Routledge.

- Dza, M., & Kyeremeh, E. (2018). Warehousing and material handling practices in Ghana: A tale of tradition and modernity. *Public Administration Research*, 7(2), 1. <https://doi.org/10.5539/par.v7n2p1>
- Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics*, 5(1), 1-4. <https://doi.org/10.11648/j.ajtas.20160501.11>
- Field, A. P. (2018). *Discovering statistics using IBM SPSS statistics* (5th ed.). Sage.
- Groves, R. M., Fowler, F. J., Couper, M. P., Lepkowski, J. M., & Singer, E. (2009). *Survey methodology* (Vol. 561). Wiley.
- Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6, 1-55. <https://doi.org/10.1080/10705519909540118>
- Kisioya, D. K., & Moronge, M. (2019). Influence of material handling practices on performance of large-scale manufacturing firms in Nairobi County, Kenya. *The Strategic Journal of Business & Change Management*, 6(4), 745-760.
- Kline, R. B. (2015). *Principles and practice of structural equation modeling* (4th ed.). Guilford Press.
- Klingenberg, W., & Boksmas, J. D. (2010). A conceptual framework for outsourcing materials handling activities in automotive: Differentiation and implementation. *International Journal of Production Research*, 48(16), 4877-4899. <https://doi.org/10.1080/00207540903067177>
- Kothari, C. R. (2004). *Research methodology: Methods and techniques* (2nd ed.). New Age International Publishers.
- Li, C. (2016). Confirmatory factor analysis with ordinal data: Comparing robust maximum likelihood and diagonally weighted least squares. *Behavior Research Methods*, 48, 936-949. <https://doi.org/10.3758/s13428-015-0619-7>
- Linzer, D. A., & Lewis, J. B. (2011). poLCA: An R package for polytomous variable latent class analysis. *Journal of Statistical Software*, 42, 1-29.
- Marmolejo, L. F., Diaz, L. F., Torres, P., García, M., Burbano, M. H., Blanco, C., ... Pereira, J. F. (2010). Influence of handling practices on material recovery from residential solid waste. *Sustainability*, 2(7), 2070-2083. <https://doi.org/10.3390/su2072070>
- Oppenheim, A. N. (2000). *Questionnaire design, interviewing and attitude measurement* (2nd ed.). Continuum.
- Pasmore, W. A. (1988). *Designing effective organizations: The sociotechnical systems perspective*. Wiley.
- Robson, C., & McCartan, K. (2016). *Real world research* (4th ed.). Wiley.
- Rosseel, Y. (2012). lavaan: An R package for structural equation modeling. *Journal of Statistical Software*, 48, 1-36.
- Skals, S., Bláfoss, R., Andersen, M. S., de Zee, M., & Andersen, L. L. (2021). Manual material handling in the supermarket sector. Part 1: Joint angles and muscle activity of trapezius descendens and erector spinae longissimus. *Applied Ergonomics*, 92. <https://doi.org/10.1016/j.apergo.2020.10334>
- Trist, E., & Bamforth, K. (1951). Some social and psychological consequences of the longwall method of coal-getting. *Human Relations*, 4, 3-38. <https://doi.org/10.1177/001872675100400101>
- Yamane, T. (1967). *Statistics: An introductory analysis* (2nd ed.). Harper and Row.