Benefits of Material Handling and Management Techniques in Commercial Property Development in Delta State

Olomukoro, Edwin Mitaire,[1] Prof. P.W. Ihuah,[2] & Dr. U. Ogbonda[3]
[1,2,3]Department of Estate Management, Faculty of Environmental Science
Rivers State University, Port Harcourt
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Abstract
This study is designed to investigate the benefits of materials handling and management on commercial property development delivery in Delta State, Nigeria. Based on the objectives developed, concepts on materials handling and management, commercial property development delivery was discussed hinged on the modern portfolio and property life cycle theory were the focus. The study adopted the mix research method of survey design for quantitative data and triangulation research design for qualitative data gathering. A sample size of 400 respondents comprising (project Consultant and Contractors and key informants comprising (Delta State Public Procurement Commission and the General public) was determined using Taro Yamane's Formula. Data was collected using questionnaires and key informants checklist and purposively distributed to the respondents and key informants. Data were analysed using the IBM SPSS v. 23 and presented in frequency, percentages, mean and standard deviation to estimate the mean and standard deviations of variables based on a 5 point Likert point ranging from Strongly Agreed (SA) = 5 to Strongly Disagreed (SD) = 1. The result showed that in the handling and management of concrete, steel, glass, aluminum roofing, timber, paint, and rubber tires, techniques adopted for ensuring durability, weather resistance, and structural integrity includes; proper planning, skilled/professional staff, adequate funding, and just-in-time delivery which aided the development of such sustainable projects. However, challenges such as effective communication and automated inventory control systems were limiting factors in their materials handling and management practices. This challenge is exacerbated by employees growing knowledge in technological application, which can be improved by continuous training in ICT tools and applications, ultimately reducing related onsite meetings of personnel for updates to live feeds from video conferencing applications. The study thus, avers that material handling and management practices were adopted for the selected projects and its fostered sustainable projects, however, computerised systems which encourage online verification of data is proposed. Based on this, the study recommends the continuous use of training of personnel (clients, consultants, and consultants) on materials handling and management skills to ensure improved delivery of commercial property development.

Keywords: *Materials Handling, Management, Techniques, Commercial, Properties, Nigeria*

INTRODUCTION

For the construction industry to contribute to a country's economic growth, cost efficiency and quick quality delivery must be improved in commercial property industry, which will certainly contribute to cost reduction across the country. It is well known that construction project execution

is usually accompanied by inadequate material handling, poor delivery quality, delivery delays, increased costs and even owner dissatisfaction (Abhilin & Vishak, 2015).

Materials are a major cost factor for any industry (Stukhart, 2007). Materials could be classified as wood, rocks, sand, electric cables, heavy duty machines and such as used by major construction firms. In Delta State, Nigeria, known for its vibrant economic activities and strategic importance in the Niger Delta region, the dynamics of materials handling and management present unique challenges and opportunities. One major cause of construction delays and poor project delivery in third world nations has been determined to be strongly caused by poor materials handling and management. Studies have shown that materials management can help in reducing the time and resources required to move materials and products from one location to another, and improve efficiency throughout the supply chain. This improves production cycles, shortens lead times and increases customer satisfaction (Adedeji, Odufuwa & Adebayo, 2012; Abhilin & Vishak (2015), This study aims to tackle challenges in materials handling and management in Warri's commercial property development sector by using case studies and interviews to identify relevant stakeholders, inefficiencies in current practises, causes, and impacts, then develop an implementation framework for improvement. Therefore, this study analysed the benefits of materials handling and management techniques adopted in commercial property development delivery in Delta State, Nigeria. This was achieved by investigating selected public commercial properties in Asaba - Delta Central (North Senatorial District) and Warri- Delta South Senatorial District, Delta State, Nigeria. The following research questions guided this study:

i. What are the types of materials handled and managed in construction of commercial property development delivery in Delta North and South Senatorial Districts of Delta State, Nigeria?
ii. Who are the stakeholders involved in the materials handling and management of commercial property development delivery in the study area?
iii. What are the materials handling and management techniques adopted in the management of commercial property development delivery in the study area?
iv. What are the challenges associated with materials handling and management in the study area?
v. What is the impact inadequate materials handling and management on commercial property development delivery in the study area?

LITERATURE REVIEW

This chapter presents a comprehensive review of the theoretical and empirical foundations of materials handling and management (MHM) in the context of commercial property development. It draws upon relevant regulatory and financial theories to establish a conceptual framework, evaluates the roles of stakeholders, identifies core challenges in materials handling and management (MHM) practices, and discusses the mitigation strategies advanced by scholars. The chapter aims to provide both a scholarly and practical understanding of how materials handling and management contributes to efficient project delivery in commercial real estate development.

Materials Handling and Management

Materials Handling and Management (MHM) is a critical aspect of construction project execution, encompassing the systematic planning, procurement, transportation, storage, and control of materials. According to Madhavi et al. (2013), effective MHM is essential for achieving cost-

efficiency, maintaining quality standards, and ensuring timely delivery of construction projects. The scope of MHM extends across four primary dimensions:

- **Material Planning:** This involves accurate forecasting of material needs and inventory control to avoid shortages or surpluses.
- **Procurement:** It entails sourcing quality materials at optimal costs while maintaining compliance with project specifications.
- **Logistics:** This aspect ensures the efficient transportation and on-site distribution of materials, which is vital for minimizing delays and disruption.
- **Waste Control:** MHM aims to minimize excess material usage and reduce environmental impact, aligning with sustainable construction goals (Bekr, 2014).

Theoretical Frameworks

Two major theoretical frameworks support the analysis and application of materials handling and management (MHM) practices in commercial property development: Regulatory Theories and Modern Portfolio Theory (MPT).

Regulatory Theories

Regulatory theories provide insights into the rationale and objectives of construction material standards and enforcement mechanisms. These theories are often categorized into positive and normative approaches:

1. *Positive Regulatory Theories* attempt to explain why regulations are established, focusing on factors such as market failures, the influence of stakeholder interests, and government interventions driven by opportunism or public interest.
2. *Normative Regulatory Theories*, on the other hand, prescribe what regulatory frameworks should aim to achieve—such as promoting market efficiency, fairness, competition, and transparency (Foundations of Regulation, 2023).

In Nigeria, the practical application of these theories is evident in frameworks such as the National Building Code (2018) and the standards enforced by the Standards Organization of Nigeria (SON), which seek to regulate the quality and safety of construction materials (FGN, 2015).

Modern Portfolio Theory (MPT)

Developed by Markowitz (1952), Modern Portfolio Theory advocates for diversification to optimize the trade-off between risk and return. Although originally designed for financial asset selection, MPT has been adapted to construction material management. Contractors use the principles of MPT to select a diversified mix of materials based on factors such as historical performance, cost, risk exposure, and compatibility with project requirements. This approach reduces the likelihood of material shortages, enhances durability, and minimizes waste (Albert et al., 2018).

Material Classification

Materials used in commercial property development can be broadly categorized based on their composition and handling requirements. In terms of composition, raw materials such as cement and steel form the foundational inputs necessary for structural integrity. These are typically unprocessed and serve as the primary constituents in construction. Purchased parts, which include fixtures and fittings, are essential for functional and aesthetic purposes, often added during the finishing stages of a project. Fabricated components, such as pre-cast beams, are manufactured

off-site and assembled on-site to enhance efficiency and quality control. From a handling perspective, materials are also classified according to the logistical requirements involved in their transportation and storage. Bulk materials like pipes are generally long or large in volume and require specialized handling equipment for movement. Bagged materials, such as cement, are typically packaged for ease of manual transport and storage but still demand careful handling to avoid spillage and degradation. Palletized items—including bricks and tiles—are grouped and transported using pallets, facilitating efficient loading and unloading through mechanized means. These classifications, as outlined by Chandler (2001) and Stukhart (2007), are crucial for ensuring that materials are handled in ways that minimize waste and maximize efficiency throughout the construction process.

Challenges in Materials Handling and Management

Materials often represent 60% to 70% of a construction project's total cost, making MHM a critical factor in budgetary control (Patel & Vyas, 2011). However, several persistent challenges undermine effective materials management in Nigeria and other developing countries; inefficient handling and planning practices contribute significantly to project cost overruns and schedule delays. Furthermore, according to Ameh and Itodo (2013), material wastage can be as high as 30% in some Nigerian construction projects due to poor coordination, theft, and lack of oversight. These challenges emphasize the need for robust systems and frameworks to enhance materials handling and management (MHM) efficiency and sustainability.

Stakeholders in Materials Handling and Management

Effective materials handling and management involve the coordinated efforts of various stakeholders, each playing a vital role throughout the construction process. These stakeholders include professionals, government agencies, and contractors: **Quantity Surveyors -** Responsible for preparing cost estimates, managing budgets, and overseeing procurement activities to ensure cost-effective material acquisition; **Architects and Engineers -** Play crucial roles in specifying material types and ensuring that all materials used align with design and technical standards; **Contractors -** Handle the practical aspects of on-site material logistics, including reception, storage, and usage during construction phases; and **Government Agencies -** Such as the Standards Organization of Nigeria and regulatory bodies overseeing building codes, ensure compliance with safety, environmental, and quality standards. These institutions play a supervisory and enforcement role in guiding material selection and use. The integration of theoretical insights and practical considerations reveals that effective MHM is pivotal to the success of commercial property development. By leveraging regulatory frameworks and decision-making tools such as Modern Portfolio Theory, stakeholders can optimize materials usage, reduce costs, and improve project outcomes. The next sections of this review will examine further dimensions, including stakeholder interactions, policy implications, and recent empirical findings in materials handling and construction management.

Research Methodology

The study adopts a pragmatic philosophy and a mixed research approach, which allows for the triangulation of quantitative and qualitative data, as well as the researcher's bias, collected through questionnaires, oral interviews, and field observations, as explained by Bans-Akutey and Tiimbu (2021). The study population is based on a 3.5% annual projection from the total population of 6,207,444 residents across 25 local government areas and three senatorial districts (Delta North,

Delta Central, and Delta South). This selection was made for easier administrative purposes and accessibility (NBS, 2020; Deinne, 2021), with data generally obtained from the Delta State Civil Service nominal roll and private companies.

In consideration of the ethical requirements of the research, respondents requested to remain anonymous. A purposive sampling technique was employed to reduce bias and ensure that only participants from the target population were selected. The sample size consisted of 400 respondents derived using Taro Yamane's formula, along with 20 purposively selected key informants.

The primary data for the study was collected through questionnaire administration and a key informants' checklist. The questionnaire was designed to allow respondents to provide comprehensive answers easily, while the key informants' checklist was used to verify the results obtained from the questionnaires. The study's instruments were validated for face and content validity by the research supervisor and two other lecturers from the Estate Management department, as recommended by the supervisor, who reviewed the instruments for their relevance to the study.

The Cronbach's Alpha score from an initial 100 respondents yielded a reliability coefficient of 0.82, reflecting an 82% level of significance. Respondents were informed in advance through a letter requesting their participation. The process of administering the questionnaires and conducting oral interviews took eight months to complete, from June 2024 to February 2025.

Out of the distributed questionnaires, 297 were retrieved, and 20 key informants were interviewed, forming the sample used for the analysis. Quantitative data were entered into IBM SPSS version 13, where analysis was conducted using proportions (percentages) and descriptive statistics to estimate frequency, percentages, means, and standard deviations of variables according to a 5-point Likert scale: Strongly Agree (SA) = 5, Agree (A) = 4, Undecided (U) = 3, Disagree (D) = 2, and Strongly Disagree (SD) = 1. Qualitative data were analyzed using literary analysis. All results were presented in tables, charts, and narratives to elucidate the triangulation of findings.

Results

Table 1: Descriptive Statistics for Types of Materials handled and Managed

S/N	Questions	N	Min.	Max.	Mean	Std. Dev.
1	Concrete was used to provide structural strength in foundations, floors, and walls while paints improved aesthetics.	297	1	5	4.12	0.926
2	Steel reinforcement was used to enhance the durability and load-bearing capacity of concrete structures.		1	5	4.47	1.106
3	Glass was incorporated in windows to improve natural lighting and ventilation.		1	5	4.37	1.092
4	Aluminum and wood were used for roofing to protect against weather elements and ensure longevity.		4	5	4.79	0.405
5	Repurposed rubber tires were used as bumpers to prevent waterfront damage.		1	5	4.31	0.874
	Valid N (listwise)	297				
	Average				**4.41**	**0.88**

Source: Researcher Data, (2024), SPSS v.23 Output

The descriptive statistics presented in Table 4.1 provide a comprehensive overview of respondents' perceptions regarding the types of materials handled and managed for the selected commercial properties developed in Delta State, Nigeria. Concrete and Paint Usage (Mean: 4.12, Std. Dev: 0.926): Widely used for structural strength in foundations, floors, and walls. Paint was essential for aesthetics and surface protection. The moderately high mean indicates broad use, with some variation due to alternative materials. Steel Reinforcement (Mean: 4.47, Std. Dev.: 1.106): Extensively used to enhance durability and load-bearing capacity. The high mean reflects strong adoption, though slight disagreement may be due to alternative reinforcements like fiber-reinforced polymers. Glass for Windows (Mean: 4.37, Std. Dev: 1.092): Commonly used for natural lighting and ventilation. The high mean suggests widespread agreement, with minor variation possibly due to alternatives like polycarbonate or tinted glass. Aluminum and Wood for Roofing (Mean: 4.79, Std. Dev: 0.405): Highest mean score and lowest standard deviation, indicating consistent use. Aluminum was valued for weather resistance, and wood served as a common support material. Repurposed Rubber Tires (Mean: 4.31, Std. Dev: 0.874): Used innovatively as bumpers along waterfronts for impact protection. The high mean shows strong acceptance, with minor variation due to site-specific alternatives. The high average mean (4.41) and relatively low standard deviation (0.88) demonstrate broad material adoption, reliability, and strong consensus among stakeholders across projects.

Table 2: Descriptive Statistics of Stakeholders in materials handling and management for Commercial Property Development in Delta State

S/N	Questions	N	Min.	Max.	Mean	Std. Dev.
1	The government of Delta State Government are key stakeholders in the materials handling and management of commercial properties.	297	1	5	4.23	1.128
2	Suppliers significantly influence materials handling and management in commercial property projects.		1	5	4.62	.682
3	Project consultants have a major responsibility in overseeing materials handling and management.		1	5	4.31	.636
4	Contractors are heavily involved in the materials handling and management process.		1	5	4.26	1.031
5	Property developers play a crucial role in materials handling and management for commercial property development.		1	5	4.34	.751
	Valid N (listwise)	297				
	Average				**4.35**	**0.846**

Source: Researcher Data, (2024), SPSS v.23 Output

The descriptive statistics presented in Table 2 provide a comprehensive overview of respondents' perceptions regarding the roles of various stakeholders in materials handling and management for commercial property development in Delta State, Nigeria. Firstly, the question regarding the Delta State Government's role as key stakeholders in materials handling and management yielded a mean score of 4.23 with a standard deviation of 1.128. Secondly, the influence of suppliers on materials handling and management garnered the highest mean score of 4.62, with a standard deviation of 0.682. Thirdly, the responsibility of project consultants in overseeing materials handling and management received a mean score of 4.31, with a standard deviation of 0.636. Fourthly, the involvement of contractors in materials handling and management resulted in a mean score of 4.26, accompanied by a standard deviation of 1.031. Fifth, the role of property developers in materials handling and management yielded a mean score of 4.34 and a standard deviation of 0.751. Furthermore, the average mean across all five questions is 4.35, which suggests that respondents generally agree on the importance of these stakeholders in materials handling and management.

Table 3: Descriptive Statistics of materials handling and management practices in the Study Area

S/N	Questions	N	Min.	Max.	Mean	Std. Dev.
1	Procurement planning is a critical component of materials handling and management in commercial property sector.		1	5	4.12	.926
2	materials handling and management software is widely used to track and manage resources in commercial property projects.		1	5	4.47	1.106
3	Inventory control systems are commonly used in materials handling and management for commercial property development.	297	1	5	4.37	1.092
4	Just-in-time (JIT) delivery is an effective materials handling and management technique adopted in your area.		4	5	4.79	.405
5	Regular supplier evaluations are conducted to ensure quality and efficiency in materials handling and management.		1	5	4.31	.874
	Valid N (listwise)	297				
	Average				**4.41**	**0.881**

Source: Researcher Data, (2024), SPSS v.23 Output

Table 3 illustrates the descriptive results of the survey responses on materials handling and management practices as recorded above, which gave the following results: The mean score of 4.12 indicates that, on average, respondents view procurement planning as an important component of materials handling and management in commercial property projects. Also, with a mean of 4.47, the survey respondents generally believe that materials handling and management software is widely used and valued in managing resources for commercial property projects. The mean score of 4.37 indicates a strong belief in the common use of inventory control systems for materials handling and management in commercial property development. Furthermore, the mean score of 4.79 is notably high, indicating that respondents overwhelmingly view Just-in-Time (JIT) delivery as an effective materials handling and management technique. Also, with a mean of 4.31, respondents generally agree that regular supplier evaluations are an essential practice for ensuring quality and efficiency in materials handling and management. Therefore, the average mean score of 4.41 and standard deviation 0.881 reflects a generally high level of agreement on the importance and effectiveness of various materials handling and management practices.

Table 4: Descriptive Statistics of the materials handling and management Measures Adopted in the Study Area

S/N	Questions	N	Min.	Max.	Mean	Std. Dev.
1	Inadequate training of staff leads to poor materials handling and management practices.		1	5	2.34	1.374
2	Lack of technological adoption hinders effective materials handling and management.		1	5	3.54	1.438
3	Insufficient funding is a major cause of ineffective materials handling and management in your area.	297	1	4	2.26	.880
4	Poor communication among stakeholders contributes to the lack of materials handling and management.		1	5	3.53	1.062
5	Lack of proper inventory control systems results in ineffective materials handling and management.		1	5	3.15	1.348
	Valid N (listwise)	297				
	Average				**2.96**	**1.02**

Source: Researcher Data, (2024), SPSS v.23 Output

Table 4 explained the descriptive statistics on the impact of cause of lack of materials handling and management. The mean score of 2.34 suggests that, on average, respondents disagree with the statement that inadequate staff training led to poor materials handling and management practices in the study area, this may be as a result of the employ of skilled personnel in the projects. Moreso, the mean score of 3.54 indicates an undecided to slightly positive view on the statement, suggesting that respondents are somewhat in agreement that lack of technological adoption affected materials handling and management in the study area. Also, a mean score of 2.26 reflects a general disagreement with the idea that insufficient funding was a major cause of ineffective materials handling and management in the projects understudied. Furthermore, the mean of 3.53, reflects respondents general agreement that poor communication among stakeholders affected materials handling and management in their various projects. Also, the mean score of 3.15 indicates an undecided to slightly positive view that lack of proper inventory control systems led to ineffective materials handling and management. The average mean of 2.96 indicates that respondents generally lean towards a "Undecided" to "Agree" stance regarding the effectiveness of materials handling and management measures, suggesting moderate agreement that factors like training, technology, funding, communication, and inventory control influence materials handling and management practices.

Table 5: Descriptive Statistics on the Effect of Poor materials handling and management on Commercial Projects

S/N	Questions	N	Min.	Max.	Mean	Std. Dev.
1	Delays in project completion are often due to poor materials handling and management.	297	1	5	3.93	.961
2	The cost of commercial property development increases due to inefficient materials handling and management.		1	5	4.15	1.023
3	Poor materials handling and management negatively affects the quality of commercial properties.		1	5	3.52	1.160
4	Ineffective materials handling and management leads to wastage of resources in commercial property projects.		1	5	3.70	1.293
5	Lack of proper materials handling and management impacts the overall profitability of commercial property development.		1	5	3.30	1.220
	Valid N (listwise)	297				
	Average				**3.30**	**1.14**

Source: Researcher Data, (2024), SPSS v.23 Output

The Table 5 provides descriptive statistics for the impact of lack of materials handling and management on commercial property development in Delta State. The mean response is 3.93, indicates that respondents generally agree that poor materials handling and management contributes to delays in project completion. Also, the mean response of 4.15 indicate that respondents generally believe inefficient materials handling and management increases the cost of development. Furthermore, the mean score of 3.52 suggests that respondents moderately agree that poor materials handling and management affects the quality of properties, but the agreement is not as strong as for other statements. Also, the mean of 3.70 is closer to "Agree," indicating that respondents generally believe that ineffective materials handling and management leads to resource wastage. Moreso, the mean response of 3.30 is closer to "Undecided" on the scale, indicating a more balanced view. The overall average mean of 3.30 reflects a moderate agreement that poor materials handling and management have adverse effects on various aspects of commercial projects, such as project delays, increased costs, quality degradation, resource wastage, and profitability.

Summary of Findings

The results show that the successful development and sustainability of several key projects in Delta State, Nigeria, underscore the benefits of materials including (concrete, steel, glass, aluminum, wood, and rubber tires confirms widespread, reliable, and sustainable material usage) handling and management practices in commercial property development. These projects, including:

Figure 1: Delta State Revenue House, Warri

Figure 2: Prof. Chike Edozien Secretariat Complex, Asaba

Figure 3: Ogheye Ultra-modern Floating Market, Koko

Figure 4: Asaba Airport

which was investigated to examine the benefits of materials handling and management on commercial projects in Delta State, showed practices such as proper planning, skilled personnel, and just-in-time delivery are invaluable to commercial property development. This is supported by various scholarly works like Al-Momani (2000), who identifies material wastage as a key issue arising from inadequate management practices and recommends improved materials handling and management strategies to reduce waste. Agyekum *et al.* (2021) determined that poor materials handling and management practices can erode profit margins in construction projects, emphasizing the need for efficient practices to enhance profitability. And Eshofonie (2008), who asserts that regular evaluations of suppliers and an integral material handling and management technique us critical in ensuring that materials meet the required standards and that suppliers adhere to agreed timelines, thereby reducing development cost and time.

Conclusion

This study comprehensively examined the benefits of materials handling and management on the delivery of commercial property development in Delta State, Nigeria. Through an analysis of various types of materials handled, stakeholders, including government entities, suppliers, project consultants, contractors, and property developers, it is evident that effective materials handling and management plays a crucial role in ensuring the timely and cost-effective delivery of commercial property projects. The findings demonstrate that construction materials, planning, skilled personnels, just-in-time delivery, effective communication and automated inventory are significant materials handling and management process, contributing to the successful execution of projects. The study also highlights the importance of technological integration in materials handling and management practices, such as the use of procurement software which have been instrumental in improving efficiency and reducing construction wastage.

Recommendations

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

1. **Strengthening Stakeholder Collaboration:** This collaboration should be aimed at ensuring the timely procurement and delivery of materials, minimizing delays and cost overruns and promote storage of data for effective communication.
2. **Investment in Technology**: These technologies will enhance efficiency, improve accuracy in material estimation, and reduce material wastage, ultimately contributing to the timely delivery of projects.
3. **Capacity Building**: This will ensure trained personnel are equip with the necessary skills and knowledge to effectively manage materials, ensuring that projects are completed on time and within budget.
4. **Enhancing Supplier Networks**: Establishing a robust network of reliable suppliers who can consistently deliver quality materials on time is essential. Efforts should be made to vet and select suppliers based on their track record, capacity, and reliability to prevent supply chain disruptions.

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