ANALYZING THE IMPACT OF MATERIAL WASTAGE IN CONSTRUCTION PROJECT DELIVERY IN BENIN CITY, EDO STATE

BY

JOSES OMOOWIYE EGUABOR

ENV2002802

DEPARTMENT OF QUANTITY SURVEYING

FACULTY OF ENVIRONMENTAL SCIENCES

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DECEMBER, 2025

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BEING A PROJECT SUBMITTED TO THE DEPARTMENT OF QUANTITY SURVEYING FACULTY OF ENVIRONMENTAL SCIENCES

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IN PARTIAL FUFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF BACHELOR OF SCIENCE (B.Sc.) IN QUANTITY SURVEYING

DECEMBER, 2025

DECLARATION

I declare that this project is an original work carried out by me, **EGUABOR JOSES OMOOWIYE** with Matriculation Number**ENV2002802** in the Department of Quantity Surveying, Faculty of Environmental Sciences, University of Benin, Benin City.

______________________ ________________________

EGUABOR JOSES **DATE**

ENV2002802 .

CERTIFICATION

We certify that this project with the title **ANALYZING THE IMPACT OF MATERIAL WASTAGE IN CONSTRUCTION PROJECT DELIVERY IN BENIN CITY EDO STATE** submitted by is an original work carried out by me, **EGUABOR JOSES OMOOWIYE** with Matriculation Number **ENV2002802** has satisfied the regulations governing the award of Bachelor's Degree in Quantity Surveying from the University of Benin, Benin City, Edo State.

____________________ ____________________

Mr. E. M. Osazuwa **DATE**

Supervisor

____________________ ____________________

Dr T. S. Fawale **DATE**

Ag Head of Department

____________________ ____________________

Prof O. A. Awodele **DATE**

External Examiner

DEDICATION

I dedicate this project work to the Almighty God, the source of wisdom, time and talent, resources and all blessings. I am deeply grateful for His guidance, inspiration and unwavering support throughout my studies in this institution.

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ABSTRACT

This study examines the impact of material wastage on construction project cost and delivery in Benin City, Edo State, with a view to identifying its causes and evaluating strategies for mitigating wastage during construction. The research was driven by the increasing cost overruns, reduced profit margins, and inefficiencies associated with waste generation on construction sites in Nigeria. A descriptive survey research design was adopted, and data were collected using structured questionnaires administered to construction professionals including quantity surveyors, architects, builders, site supervisors, and engineers operating within Benin City. A total of 200 valid responses were analyzed using Mean Item Score (MIS) for ranking the causes, cost implications, and mitigation strategies .Findings revealed that the major causes of material wastage include delay in the use of materials, ineffective communication, use of substandard materials, human negligence, improper mixing, and inadequate supervision. The results further indicate that material wastage significantly contributes to increased overhead costs, extended project duration, poor resource utilization, escalation of material prices, loss of productivity, and budget overruns. The study also identified Just-In-Time (JIT) delivery, improved material handling, proper material storage, reuse and recycling, and the adoption of digital planning tools as the most effective strategies for minimizing waste. The study concludes that material wastage poses a substantial challenge to cost efficiency and project performance in the construction industry and recommends enhanced supervision, accurate material estimation, improved site management practices, and policy enforcement to reduce wastage and improve overall project delivery. Suggestions for further research include comparative studies across cities, financial quantification of waste-related losses, and evaluation of prefabrication technologies in waste reduction.

CHAPTER ONE

INTRODUCTION

1.1. Background to the Study

Construction waste is the solid waste that arises from construction, renovation and demolition activities. The construction industry plays a vital role in meeting the needs of society and enhancing quality life. The construction industry contributes to the socioeconomic growth of any nation by improving the quality of life and providing the infrastructure such as roads, hospital, schools and other basic facilities. Hence, it is imperative that construction projects are completed within the scheduled period of time, within the budgeted cost and meets the anticipated quality. However, being a complex industry, it is faced with the severe problem of cost overruns, time overrun, and construction waste (Elikeem, Anglamgne & Ahuma-Smith, 2018).

Construction waste normally constitute large portion of total solid waste that contribute to degradation of the environment (Lu et al. 2018).Construction waste management is often at the top of government agenda. It is also major theme as stipulated in the global green building movement. Material management in construction project is an important function that significantly contributes to the success of a project. Poor management of materials on site during construction process will influence the total project cost, time and quality.. Material wastage is one of the major causes of contractor's business failure in developing countries (Andualem & Aklilu, 2019). The reduction in construction material waste can significantly help in gaining total profit and gaining economic stability for a country and construction firms. Project managers and construction staff usually find it difficult identifying the causes of material waste due to the absence of appropriate tools to measure it (Ibrahim & Winston 2019). Construction site and staff can reduce the material waste with efficient management (Adewuyi & Otali, 2019). The reduction in construction waste can significantly help in increasing total profit and gaining economic stability for a country and construction firms. Wastage of construction is much greater than the minor figures assumed by the companies while estimating cost of the project (Elikem, Anglamgne & Ahuma-Smith, 2018). So, material management is a vital function for improving productivity in construction projects. The management of materials should be considered at all phases of the construction process and throughout the construction and production periods.

There are many ways through which causes of wastage can be identified in construction. Waste can be categorized according to its source. Waste may result from process preceding construction, such as material manufacturing, design and material supply, and planning as well as the construction stage. Wastage in construction site is often due to inadequate storage and protection, poor or multiple handling, poor site control, over ordering of materials, bad stock control, lack of training, and damage of material during delivery. Most researchers categorized these causes into four categories (Adewuyi & Otali, 2019), procurement, handling, operation and culture ; while another researcher (Andualem & Aklilu, 2019) grouped factors generating material wastage into design, procurement, handling of material, and operation.

1.2. Statement of the Research Problem

Wastage on construction site has become a canker worm in Nigerian construction Industry. This problem has negatively affected the performance of many projects in Nigeria (Adeewuyi & Otali, 2019). Wastage is seen in many ways as peculiarity of construction projects. This means that many construction works have wastage because it is an issue that cannot be divorced from construction work.

In Nigeria, around the construction project site; there are many wastage of construction materials. This shows that construction material wastage management has not received attention from researchers and project managers. However, construction materials and cost are increasing from day to day in addition to this waste is becoming a serious problem since it is a high cost component and effects on the environment, especially on project delivery in Nigeria construction industry public building construction has not received enough attention.

As a result of the low level of awareness, the Nigerian construction industry pays little attention to the effect of generated materials waste on cost overrun. There is poor understanding of the sources, causes and control measures for construction-waste generation at the pre-contract and post-contract stages of a project. There is little understanding of the effect of waste generated on project cost overrun. There is little experience of the benefits of recovering construction waste material (re-use and recycling) and its effect on cost overruns. There is little understanding of the percentage of additional cost contributed by the material wastage to construction cost overruns. Data on the quantities of materials waste have not been well documented.

1.3. Research Questions

1.) What are the causes of material waste in cost of construction project?
2.) What are the effects of material waste on construction project cost in Benin City?
3.) What are the strategies used in mitigating material waste during construction project?

1.4. Aim and Objectives of the Study

The aim is to analyze the impact on material waste on construction project, with a view to mitigate material waste during construction.

The Objectives are to:

1.) Examine the causes of material wastage in construction project in Benin City, Edo State.
2.) Examine the effect of material wastage on construction project cost in Benin City, Edo State.

3.) Evaluate the strategies used in mitigating material wastage in construction project in Benin City, Edo State.

1.5. Scope of Study

This study focuses on evaluating the impact of materials waste on construction project budget and delivery within Benin City, Nigeria. It wills various types of construction projects including residential, commercial, and public sector developments. The study will involve the assessment of materials waste generation, common causes, cost implication, and its effect on project timelines. Data will be collected from contractors, Quantity Surveyor, project managers, and site supervisors operating within Benin City. The findings will aim to find locally relevant strategies to minimize waste and improve project efficiency in the city's construction industry.

1.6. Significance of The Study

The outcome of this study is beneficial and relevant to government, policy makers and researchers. The outcome of this study will be beneficial and relevant to the Nigerian government by providing recommendation that gears towards performance improvement in projects. The study will reveal to government that a solid monitoring system would provide the data necessary to conduct evaluation in order to conduct evaluation in order control material wastage.

The outcome of the study will point-out to policy makers the important of providing, monitoring and evaluation report to project donor who provide technical assistance through financing the programs; the reports level of transparency and accountability which goes a long way in determining the credibility of the programs and influencing future findings. Finally, the outcome of this study will equally be useful to scholars and researchers for further academic research. The study empirical findings are capable of adding new insights to present knowledge in the field.

1.7. Definition of Terms

- Construction material waste: construction material waste is any material intended for a project that becomes damaged, excess, unused during construction. It results from poor planning, handling, or design errors and leads to increase cost and environmental harm (Osmani, 2012).
- Project Cost: project cost is the total financial requirement to complete a construction project, covering expenses like materials, labor, equipment, and overheads. Managing it effectively is crucial to avoid overruns
- Project Delivery: project delivery refers to completing and handing over a project within the agreed time, budget and quality standard. It measures the success and efficiency of the construction process
- Waste Management: this is the process of handling, reducing and disposing of waste materials generated during construction to minimize environmental and economic impact.
- Cost Overrun: a list of a budget exceeds the initially estimated or budgeted cost, often due to inefficiencies like material waste.
- Construction Efficiency: a measure of how effectively resources (time, labor, material) are used to complete a construction project within minimal waste and delay.

CHAPTER TWO

LITERATURE REVIEW

2.1. Preamble

Material waste often referred to as construction demolition waste encompasses discarded building materials generated during construction, renovation, alteration, repair and demolition activities .it involves materials such as ;concrete, brick, steel, timber, plastic, excavated soil as well as potential harmful materials also these material waste arise from design inefficiencies, procurement error, poor handling of material, poor storage of this materials than eliminating waste through reducing, reusing, and recycling.

The financial impact of material waste is reflected in cost overruns, inflated procurement budgets, and reduced profit margins. When waste is not properly managed, it can lead to a miss allocation of resources, increased labor cost, and project delays, Moreover, indirect cost such as transportation, waste disposal, and environmental fee add to the overall project expense.

2.2. Factors Causing Material Wastage

Construction material waste occurs throughout the lifecycle of a building, from the design phase down to the completion stage. Ghaleb et al (2021) stated that poor design models and decision are among the main factors that make the design phase responsible for early waste in construction materials.

Table 2.1 presents a detailed set of factors responsible for material wastage, and a closer discussion of these factors reveals that waste arises from a combination of design-related problems, procurement shortcomings, site operational weaknesses, labour inefficiencies, and environmental constraints. One of the earliest sources of waste is design changes, which occur when the original design is altered after construction has commenced. As indicated in the table, such changes often force demolition or adjustment of existing work, leading to damaged or discarded materials (Osmani et al., 2008). Because revised designs usually require new dimensions or specifications, materials already procured or installed become unusable, confirming earlier findings that design-stage decisions strongly influence waste generation.

The table further highlights poor material storage as a major contributor to wastage. When materials are exposed to moisture, sunlight, or ground contact due to inadequate storage structures, deterioration occurs rapidly. Cement becomes lumpy, timber warps, steel rusts, and finishing materials lose quality. This challenge is widely acknowledged, and Ekanayake and Ofori (2002) similarly observed that improper storage practices in developing countries lead to substantial material loss long before installation. Poor storage conditions also make materials vulnerable to theft and vandalism, increasing both direct waste and replacement cost.

Another important factor is inaccurate estimation, where errors in quantity take-off lead to either surplus or insufficient material. Over-estimation results in excess materials that often remain unused and eventually become waste, while under-estimation disrupts workflow and forces unplanned procurement, which increases the likelihood of spoilage or damage. This aligns with the earlier findings of Al-Hajj and Hamani (1991), who argued that inaccurate estimating practices are a recurring cause of material waste in the construction industry.

Procurement issues also contribute significantly to wastage. The table identifies inefficient procurement, where delays, wrong deliveries, or poor scheduling undermine efficient material utilization. Such inefficiencies force materials to sit idle for long periods, expose them to damage, or necessitate last-minute adjustments that compromise handling and storage. Tam et al. (2007) emphasized that procurement-related problems often trigger a chain reaction of rework, material damage, and mismanagement, all of which raise waste levels on construction sites.

Labour-related factors appear prominently as well. The table shows that lack of skilled labour directly influences waste through poor workmanship, inaccurate material cutting, incorrect mixing ratios, and careless handling. Formoso et al. (2002) also noted that labour inefficiency is one of the leading causes of rework-related waste, particularly in concreting, block work, and finishing activities. Beyond lack of skills**,** human negligence such as mishandling materials, ignoring storage instructions, or rushing tasks further contributes to waste, underscoring the need for training and behavioral supervision.

Weak managerial structures also play a significant role. Poor site management highlighted in the table, results in disorganized storage, uncontrolled material movement, absence of inventory systems, and poor housekeeping. These conditions increase material breakage, loss, contamination, and repeated handling. Nagapan et al. (2012) confirmed that inadequate site control is among the most persistent root causes of construction waste. Related to this is excessive handling, which arises when materials are moved repeatedly due to poor layout planning. Every additional movement increases the risk of breakage, especially for tiles, bricks, glass, and plasterboards a relationship documented by Poon et al. (2004).

Environmental exposure is another significant factor. The table identifies weather conditions as a cause of waste, and this is consistent with Kibert (2004), who explained that rain, wind, and sunlight significantly damage unprotected materials. For instance, rain affects cement and gypsum products, sunlight warps timber, and wind scatters lightweight materials or contaminates sand and aggregates. Sites without adequate shelters are therefore more vulnerable to weather-induced loss.

Security concerns also contribute to material wastage. Vandalism and theft, as included in the table, occur frequently on sites that lack proper fencing, lighting, or surveillance. Kartam et al. (2008) argued that theft-related waste is particularly acute in developing regions, where high-value items such as steel reinforcement, cement, and electrical fittings are commonly targeted.

Vandalized materials also create additional waste because damaged elements must be repaired or replaced.

The table also lists improper mixing of materials especially concrete, mortar, and plaster as a notable cause of waste. Incorrect batching, whether due to lack of supervision or inadequate training, leads to compromised strength and performance. Materials produced under such conditions are typically rejected and demolished, resulting in double consumption of aggregates, cement, and labor. This issue reflects concerns raised by Formoso et al. (2002), who identified improper mixing as a major operational source of waste.

Finally, the table emphasizes the importance of effective communication and adequate supervision. Ineffective communication among designers, supervisors, and artisans leads to misinterpretation of drawings, installation errors, and procurement mistakes. Tam et al. (2007) observed that communication failures are a significant driver of rework, which in turn generates material waste. Inadequate supervision allows errors to go unchecked, material misuse to occur unnoticed, and poor practices to continue, ultimately increasing waste levels.

In summary, the causes of material wastage identified in table2.1reveal that waste is not caused by a single factor but by a combination of human errors, managerial shortcomings, technical inefficiencies, environmental exposure, and design-related issues. These causes interact in ways that amplify waste, reinforcing the need for coordinated site management, clear communication, skilled labor, and proper procurement and storage practices if waste is to be minimized.

Table 2.1. Factors Causing Material Wastage

Factors	Description	Citations
Design changes	Alterations to original design often leads to demolition work	Osmani et(2008)
Poor Material Storage	Inadequate storage leads to material storage deterioration or theft	Ekanayake an (2002)
Inaccurate Estimation	Over- ordering or under-ordering due to quantity take off	Al-Hajj and Hamani (1991)
Inefficient Procurement	Delays or wrong deliveries result in damage or spoilage of materials	Tam et al.(2007)
Lack of Skilled Labor	Poor workmanship often leads to breakage and incorrect usage of materials	Formoso et al(2002)
PoorSite Management	Ineffective site control leads to disorganization	Nagapan et al(2012)
Excessive Handling	Multiple handling increases chances damage and loss	Poon et al (2004)
Weather Conditions	Rain, wind, and sun can damage improperly protected materials	Kibert (2004)
Vandalism and Theft	Unsecured site leads to stolen or vandalized materials	Kaartam et al (2008)

2.3. Impacts of Material Wastage on Construction Cost

It has been revealed that the major effect of material wastage is due to workers mistake, loss of onsite materials control and selection of low-quality products were the major causes of construction material wastage in building construction project. Adewuyi & Otali (2019) evaluates the cause of construction waste generation on building sites in Rivers State, Nigeria.

The result showed that the three most important factors leading to material waste generation in Rivers State, Nigeria are rework contrary to drawings and specifications, design changes and revision and waste from uneconomical shapes respectively. It was also discovered that inappropriate equipment contributed to waste generation. Research revealed that construction firms do not adhere to waste management practices such as waste minimization strategies. Maintenance of human resource where also found to be non-existent in this construction firm. There is need for effective supervision and enforcement of by laws regulating waste management on construction sites.

Table 2.2 outlines several ways through which material wastage affects construction project performance, particularly in terms of cost, time, productivity, and overall project delivery. When these factors are examined in detail, it becomes clear that the consequences of material wastage extend far beyond the simple loss of physical resources; they influence nearly every aspect of project management.

One of the most immediate and visible impacts is the increase in overall project cost, which the table attributes to the need for replacing wasted materials (Ekanayake & Ofori, 2000). When materials are damaged, stolen, or rendered unusable whether through poor storage, excessive handling, or design errors the contractor must procure new materials to continue the work. This replacement cost may not have been budgeted, and because material prices fluctuate frequently, the cost of replacement is often higher than the original purchase price. This creates an inflationary effect on the project's finances, as highlighted by Kartam et al. (2004), who observed that replacement during periods of rising prices worsens the financial burden.

Closely linked to increased cost is the reduction of contractor profit margin, which the table identifies as a critical consequence of waste (Osmani et al., 2008). Profit margins shrink when resources that should have contributed to project output instead end up in waste piles.

Because many contractors work with fixed-price contracts, any increase in wastage is absorbed directly by the contractor rather than the client. This means that material wastage gradually erodes profitability, sometimes turning a potentially profitable project into a loss-making one.

Another major impact noted in the table is budget overrun, which occurs when the accumulated effects of waste push the project above its initial cost estimates (Formoso et al., 2002). Budget overruns are often the result of small, repeated losses that go unnoticed until they manifest as cost discrepancies in financial reports. For instance, frequent breakage of blocks, repeated plastering due to poor workmanship, or the need to re-order materials all contribute incrementally to the overrun. Over time, these seemingly minor losses can significantly distort the project budget.

Material wastage also leads to extended project duration, which the table identifies as one of the most significant consequences. Wasted materials interrupt workflow because damaged or unusable items must be replaced before work can continue. This delay affects subsequent activities and may create a chain reaction that ultimately pushes the project timeline forward. Nagapan et al. (2012) highlighted that time-related cost increases arise not only from procurement delays but also from the additional labour and equipment costs required to redo work that was initially done with wasted or substandard materials. In construction, time is directly tied to cost, so delays caused by wastage often increase labour expenses, equipment rental charges, and overheads.

The table also notes increased cost of waste disposal, which is an often-overlooked consequence of material wastage (Poon et al., 2004). Disposal involves transporting waste to landfills or recycling centers, paying for landfill fees, or hiring waste collection services. As waste accumulates, disposal becomes more expensive. In some cases, contractors must allocate labor specifically for waste clearance, which adds yet another layer of cost to the project.

Another important impact of wastage is the loss of productivity**,** which results when workers spend time redoing tasks, clearing debris, or waiting for replacement materials (Ekanayake & Ofori, 2000). Instead of progressing with scheduled activities, workers are diverted to correcting errors caused by wasted materials. Productivity loss is also linked to poor morale on site, as frequent rework leads to frustration among workers and supervisors. When productivity drops, the project slows down and incurs higher operational costs.

The table also highlights poor resource utilization, a condition that occurs when materials, labor, and equipment are not used efficiently due to waste. When materials do not contribute to the completed works, the labor and equipment used to handle them have also been wasted. This creates inefficiency in resource allocation, ultimately reducing project performance. Tam et al. (2007) similarly observed that resource inefficiency arising from waste contributes to higher operational costs and lower project output.

Material wastage also has a negative impact on contractor reputation and clientrelationships, another point highlighted in your table. Projects that suffer from cost overruns, delays, or poor-quality outputs due to waste often leave clients dissatisfied. Osmani et al. (2008) noted that clients increasingly consider waste management performance when awarding contracts, meaning that repeated inefficiencies can harm a contractor's ability to secure future work. Poor site cleanliness, excessive debris, and frequent rework also send a negative message to stakeholders and regulatory bodies.

Furthermore, the table links waste to ordering and procurement inefficiencies, where repeated purchases disrupt supply chains and create administrative burdens (Tam et al., 2007). Every re-order requires new documentation, transportation, negotiations, and possible price adjustments. These processes consume time and administrative resources, adding indirect costs that may not be immediately visible in material accounts.

Finally, the table points to cost of rework, which often results from substandard materials or errors caused by waste-related problems (Al-Hajj & Hamani, 1991). Rework increases both material and labor consumption, creating a double expenditure for the same task. Rework also contributes to congestion on site, slows down workflow, and increases the likelihood of further mistakes.

In summary, the impacts outlined in Table 2.2 illustrate that material wastage has both direct and indirect consequences that weaken project delivery, increase costs, reduce efficiency, and damage contractor reputation. Its effects accumulate throughout the project lifecycle, making it one of the most significant contributors to poor construction performance.

Table 2.2. Impacts of Material Wastage

Impacts	Description	Citations
Reduced Profit Margin	Contractors absorb extra cost from material loss, reducing overall profit	Osmani et al, (2008)
Budget Overrun	Material waste can lead to cost exceeding the initial budget	Formoso et al.(2002)
Increased Cost of Waste Disposal	More waste requires additional transportation and landfill fees	Poon et al. (2004)
Delayed-Related Cost	Waste may lead to project delays, increasing labor and efficient labor and efficient rental costs.	Nagapan et al. (2012)
Procurement and Ordering inefficiencies	Frequent re-ordering due to waste raises logistics and administration cost	Tam et al (2007)
Inflationary Impact on Replacement	Replacing wasted material may cost more due to price fluctuations	Kartam et al (2004)
Increases Project Cost	Waste leads to higher expenditure due to the need for replacement of mate	Ekanayake & Ofori (2000)

2.4. Types of Material Wastage

The construction industry is a key driver of socio-economic development, yet it is also widely acknowledged as a major contributor to material waste generation. Material waste in construction refers to the portion of purchased materials that is lost, damaged or discarded and therefore does not form part of the completed project (Adewuyi & Odesola, 2015). Such waste has serious implications, as it not only inflates project costs and prolongs delivery time but also exerts pressure on the environment through excessive resource consumption and land fill disposal (Alabi & Fapohunda, 2020).Scholars generally classify construction waste according to its composition (e.g., concrete, timber, steel, glass, packaging), its sources (procurement, storage, handling, design errors, demolition), or the stage of project execution at which it arises (design, construction, or post-construction).

Table 2.3. Types of Material Waste

Types	Description	Citations
Off-cuts and Excess Waste	Waste from cutting materials like timber or steel requires sizes	Formoso et al (2002)
Damaged Materials	Materials damaged due to poor storage handling or weather exposure	Ekanaye & Ofori (2000)
Over-order/surplus materials	Extra material not used due to in accurate estimate or design changes	Al-Hajj & Hamani (1991)
Packaging waste	Non-reusable packaging like plastic cardboard and wood pallets.	Poon et al. (2004)
Rework Waste	Waste produced when defective work is demolished and redone	Osmani et al. (2008)
Excavated Soil and Rocks	Waste generated from site clearing and foundation excavation	Kartam et al (2004)
Concrete Waste	Excess concrete from over mixing or spillage during pouring	Tam et al (2007)
Steel and Metal Waste	Off-cuts, rusted or deformed	Lu andYuan

2.5. Challenges Faced Due To Material Wastage

2.5.1. Public Sector

Material wastage poses significant challenges to public sector construction projects, particularly in developing countries such as Nigeria where infrastructure demand is high and resources are limited. The implications of wastage extend beyond project sites and affect national budgets, procurement efficiency, public trust, and long term development outcomes. The major challenges are discussed below, supported by relevant empirical and scholarly literature.

2.5.1.1. Escalation of Project Costs

One of the most immediate challenges associated with material wastage is the escalation of construction costs. Public infrastructure projects depend on government funding, and when materials are wasted, additional funds are required for replenishment. This results in budget overruns and increased financial pressure on ministries, department, and (MDAs). Studies show that wastage of material such as concrete, timber, and steel significantly contributes to cost escalation in public projects (Aiyetan & Smallwood, 2013; Osmani, 2012). Similarly, Oladapo and Oni (2019) found that in Nigeria, material wastage can account for between 5% and 15% of total project cost, causing disruption in public budgeting and reallocation of scarce funds.

2.5.1.2. Delay in Project Delivery

Material wastage of trigger procurement delays when replacement materials must be reordered. This delay negatively affects project timelines, reduce contactor productivity, and slow the commissioning of several public infrastructures such as roads, hospitals and schools. According to Adewuyi and Odesola (2019), material shortage and wastage are among the major cause of schedule overrun in Nigerian construction projects. These challenges are particularly detrimental in public projects where timely delivery is essential for meeting socio-economic goals.

2.5.1.3. Reduced Quality of Public Infrastructure

Excessive material wastage can force contractors to use cheaper alternative to remain within budget or expedite procurement processes, potentially compromising construction quality. Poor-quality public assets are more susceptible to structural failure and require frequent maintenance, increasing long term cost (Fayek et al., 2014). Research shows that material mismanagement significantly affects the integrity and durability of public buildings and civil engineering works, posing safety risks and undermining the value of public investments.

2.5.1.4. Increased Procurement and Audit Pressures

Material wastage raises concerns during public procurement audits and reviews. Oversight institutions such as Nigeria's Bureau of Public Procurement (BPP), Auditor General's Office, ICPC, and EFCC often scrutinize waste records, leading to delay in approval, contract variation, or investigations. According to Olatunji (2019), wastage increases transparency conflict in public project and triggers administrative delays due to additional documentation, inspection, justifications required from contactors and project managers.

2.5.1.5. Decline in Public Trust and Institutional Credibility

When material wastage leads to inflated contract sums or delayed projects, the public tends to perceive construction activities as corrupt and inefficient. This aligns with findings by Oboirien and Aje (2021), who reported that waste related cost overrun reduce citizens' confidence in public institutions and weaken accountability mechanisms. For developing economies, this challenge contributes to political dissatisfaction and reduces support for government investment programmes.

2.5.1.6. Environmental and Sustainability Challenges

Construction waste contributes significantly to environmental degradation due to increased landfill use, emission from additional material production, and unsustainable resource extraction. Public project account for a large share of construction activities, meaning the inefficient material use undermines national sustainability goals. Osmani (2012) emphasized that material wastage increases the carbon footprint of public infrastructure. Similarly, Eze et al. (2020) note that Nigeria's struggle with environmental sustainability is partly due to poor waste management in public construction projects.

2.5.1.7. Difficulty Achieving Development and Infrastructure Targets

Since material wastage distorts project cost estimates, procurement plans, and timelines, it becomes difficult for government to achieve annual capital project targets. This affects national development plans, particularly in sectors such as transport, health and education. Aibinu and Jagboro (2012) argue that wastage induced delay hinder national progress by slowing down essential infrastructure delivery. For Nigeria, this challenge reduces competitiveness and slows economic growth.

2.5.1.8. Legal and Contractual Disputes

Material wastage increases the frequency of claims, disputes, and request for contract variations, placing administrative and legal burdens on public agencies. According to Ameh and Osegbo (2011), wastage often triggers conflict between contractors and client regarding responsibility for additional costs and schedule delay. This dispute delay project completion and increase public expenditure on arbitration and litigation.

2.5.1.9. Inefficient Allocation of Public Resources

Every instance of material wastage represents a diversion of funds that could have been invested in0ther critical public projects. This reduces the government capacity to execute multiple projects simultaneously and contributes to frequent supplementary budget demands Ogunmakinde et al, (2019). In a resource constrained economy like Nigeria, the cumulative effect of wastage is a major barrier to efficient national planning

2.5.2. Private Sector

Material wastage poses substantial challenges for private sector construction firms, affecting profitability, productivity, competitiveness, and overall project performance. Unlike public agencies that rely on government budgets private contractors depend heavily on efficient cost control to remain viable in a competitive market. As such, wastage of materials such as concrete, timber, reinforcement, steel, tiles, and finishing materials directly undermine business performance, The key challenges are discussed below with supporting academic literature.

2.5.2.1. Reduction in Profit Margin

Material wastage decreases profit margin by increasing the cost of material beyond what was budgeted. Private firms operate within tight financial constraints and any loss if material erodes expected profits. Fayek et al. (2014) note that rework and wastage can consume up to 10% of a contractor's profit margin. Similarly, Ogunmakinde et al. (2019) found that material waste significantly contributes to cost overruns that negatively affect the financial sustainability of private construction firms. This reduction in profitability makes it difficult for firms to remain competitive.

2.5.2.2. Competitive Disadvantage in the Market

Construction companies that consistently record high level of material wastage often bid higher prices to cover anticipated losses, putting them at a disadvantage in competitive tendering environments. Aiyetan and Smallwood (2013) state that efficient material management is a strong determinant of competitive advantage in the private sector. Firms with better material control system can offer lower bid prices, secure more contracts, and improve their market share.

2.5.2.3. Project Delays and Increased Operational Costs

Material wastage leads to shortage that requires additional procurement cycles, causing delays that disrupt workflow and productivity. Adewuyi and Odesola (2015) identify material shortages and wastages as major causes of schedule delays in private construction projects in Nigeria. These delays increase overhead cost such as labor, equipment, rentals, security, and site management, leading to significant financial strain on contractors.

2.5.2.4. Loss of Client Confidence and Reputation Damage

In the private sector, reputation is critical for securing repeat business, referrals, and long-term contracts. When material wastage leads to inflated cost or delays, client often perceive contractors as inefficient or unprofessional. According to Oboirien and Aje (2021),poor cost management reduces client confidence and can result in loss of future opportunities. A damaged reputation discourages potential client and weakens business stability.

2.5.2.5. Increased Rework and Quality Issue

Material wastage is often linked to rework, errors and poor workmanship. When materials are wasted due to mistake or poor handling, rework becomes necessary, increasing time and cost. Fayek et al.(2014) emphasize that rework reduces construction quality and leads to structural defect that may require additional resources to correct. For private firms, this not only increases cost but also affects project quality and customer satisfaction.

2.5.2.6. Cash Flow Problems

Because construction materials accounts for a large portion of project expenditure, wastage leads to unplanned expense that disrupt cash flow. Contractors may be forced to borrow to replenish materials, increasing interest burden and financial risk. Ogunmakinde et al. (2019)

explain that consistent material losses strain cash flow management and can push small and medium sized construction firm to insolvency.

2.5.2.7. Higher Health, Safety, and Environmental Compliance Costs

Material wastage generates debris and site clutter, increase safety risk for workers. Private-sector firms must spend more on waste disposal, housekeeping, and environmental compliance to meet regulatory requirements. Osmani (2012) note that construction waste significantly contributes to poor site safety and increase the cost of waste handling operations. These added costs reduce operational efficiency.

2.5.2.8. Difficulty Expanding or Scaling Business Operations

The accumulation of financial losses from wastage restricts the ability of contractors to reinvest in modern equipment, technology, or training. This limits the firm's growth potential and ability to handle larger projects. Aibinu and Jagboro (2012)argue that inefficiencies such as poor material control reduce a firm capacity to scale up and participate in capital intensive projects.

2.5.2.9. Increased Risk of Contractual Penalties

Material wastage induced delay may cause contractors to breach delivery deadlines, triggering penalties under contract terms. Ameh and Osegbo (2011) report that scheduled delay often led to liquidated damages that further reduce profitability. These penalties can severely affect financially vulnerable firms, increasing the risk of bankruptcy.

2.6. Strategies to Mitigate Material Wastage

Material wastage remains a major challenge in construction projects, contributing to increased project costs, delays, and reduced productivity. Evaluating strategies to mitigate waste requires understanding both their effectiveness and suitability within the local construction environment. One key strategy is improved material planning and forecasting, which ensures accurate quantification of materials, reduces over-ordering, and minimizes leftover waste. This approach relies on detailed Bills of Quantities, updated cost data, and experienced estimators.

Another important strategy is enhanced site supervision, where competent supervisors monitor material usage, enforce quality standards, and prevent unauthorized handling or misuse. Effective supervision helps reduce rework, theft, and poor workmanship major contributors to material waste. Similarly, training and capacity building programs help workers and supervisors understand best practices in material handling, storage, and installation, thereby lowering unintended waste due to human error.

Additionally, better communication and coordination among project stakeholders ensures that design changes, specifications, and material requirements are clearly understood, minimizing errors arising from misinterpretation. The adoption of modern technologies such as construction management software, prefabrication, and Building Information Modelling (BIM) also reduce waste by improving accuracy and reducing on-site cutting and adjustments.

Proper storage and handling procedures, including the use of covered storage spaces, pallets, and protective materials, prevent damage due to weather, moisture, or mishandling. Finally, implementing waste reduction policies, such as recycling, reuse of off-cuts, and strict inventory control, helps optimize material utilization.

Table 2.4. Strategies to Mitigate Material Wastage

Strategy	Description	Citations
Accurate Material Estimation	Using precise quantity take-off to reduce over-ordering and minimize left over	Agyekum et al. (2012) Osmani et al (2008)
Improved Storage & Handling	Proper storage (covered, raised platforms, dry areas) reduce, damage theft and deterioration	Begum etal(2006)
Use of Prefabrication	Off-site fabrication reduces cutting waste, rework and material off cuts	Jailon& Poon(2014) Tam et al (2007)
On site Waste Sorting & Recycling	Sorting materials (steel, timber, concrete) for reuse	Lu & Yuan(2011) Tam & Tam (2006)
Training & Awareness for Workers	Educating workers on proper handling techniques and waste prevention practices	Nagapan et al. (2004); Ekanayak& Ofori(2000)
Better Site Layout	Well-organized site, minimized movement, mishandling and accidental damage	Faniran & caban (1998); Cochran et al (2011)
Planning, Quality Control & Supervision	Ensures correct installation, reduces rework, and prevents unnecessary waste	Tam et al (2007) Osmani et al (2008)
Adoption of BIM &Digital Tools	BIM improves resources planning, reduces design errors and prevent waste inducing clashes	Chen et al. (2020); Won & Cheng (2017)
Just in time delivery	Materials delivered only when needed to reduce on-site damage, theft or deterioration	Poon et al (2004); Formoso et al (2002)
Quality control and supervision	Ensures correct installation, reduces rework, and prevents unnecessary waste	Tam et al (2007); Osmani et al (2008)

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Preamble

To achieve the objective of this study a structured research methodology was adopted to ensure the collection of accurate and relevant data regarding material waste and its financial impact on construction projects. The methodology outlines the research design, data collection techniques, sampling methods, and analysis procedure used to investigate the cause, extent, and cost implication of material waste. By employing quantitative approach, this study aims to provide a comprehensive understanding of material waste patterns in building construction and offer practical recommendations for minimizing their impact on project cost

3.2. Area of the Study

This study focuses on building construction projects within Benin City Edo State. The area was selected due to its high rate of construction activities and diverse project types, which provide a suitable context for analyzing material waste pattern and their cost implications. The study targets both residential and commercial project executed by medium to large scale construction firms. Data will be collected from past research journals, quantity surveyors or project managers within the area.

3.3. Research Design

This study adopts a descriptive survey research design aimed at collecting detailed information from construction professionals, regarding the cost, type and cost implication of material waste on construction site. The design enables the researcher to observe and analyze real time data and historical records from selected construction projects. Quantitative data were collected through questionnaires.

3.4. Target Population

The target population for the study on the effect of compliance to construction safety regulation on project cost in Benin City typically includes key factors involved in construction projects within the city. This encompasses quantity surveyors project managers responsible monitoring of ongoing projects as well as other professional involved in project planning and execution

Table 3.1. Target Population

S/N	Profession	Population	Sample
1.	Quantity Surveyor	126	47
2.	Architect	186	69
3.	Civil Engineer	110	41
4.	Builders	250	93
Total		**672**	**250**

Sources: NIQS, NIOB, NIA, NSE.

3.5. Sampling Techniques and Sample Size

The sampling technique applied was purposive sampling so as to select senior professionals from various fields in the construction industry such ass; Quantity surveyors, Engineers, Builders, and Architects to provide valuable information and qualitative insight of the subject matter.

The process used to obtain the sample size was Yamane's formula which is given as:

n = N / (1 + Ne^2)

Where:

- n=sample size
- N=population size
- e=level of precision(margin of error, usually 0.05 or 95% confidence level)

3.6. Data Needs and Sources

In order to effectively analyze the impact of material waste on project cost, it is important to clearly identify the causes of material waste, effects it has on the construction industry as well as strategies used in mitigating the effect it has on project cost including appropriate sources from which such data can be obtained. Data needs refer to the specific type of information essential to meet the objectives of the study, while data sources describe the avenues through which this information will be gathered. The identification of accurate data needs and reliable sources is crucial in ensuring that the research findings are valid, comprehensive, and relevant to the construction industry. The data used for this study are obtained from both primary and secondary sources: Primary sources questionnaires and surveys where administered to contractors, site engineers, and quantity surveyors to obtain information on material waste, causes, and management practices.

Secondary sources project documents, published literature, such as journal articles, dissertations, and textbooks on construction waste management and cost analysis.

3.7. Research Instrument

To obtain the relevant primary data for this study, a structured questionnaire will be employed as the main research instrument. The questionnaire is designed to collect both quantitative and qualitative information from construction professionals, including project managers, site engineers, quantity surveyors, and contractors. The instrument is divided into sections to ensure clarity, logical flow, and ease of response. A combination of close-ended and Likert-scale questions will be used to facilitate statistical analysis, while a few open-ended questions will allow respondents to provide additional insights.

3.8. Method of Data Collection

The method of data collection refers to the systematic approach adopted in gathering the required data for this study. Given the nature of the research objectives, both primary and secondary data collection methods will be employed to ensure comprehensive coverage and triangulation of findings.

Primary Data Collection

Primary data will be collected directly from respondents through the use of the structured questionnaire designed for this study. The questionnaires will be distributed to selected construction professionals, including contractors, site engineers, quantity surveyors, and project managers, who are actively involved in building projects within the study area.

Administration Method: The questionnaires will be administered both physically (on-site) and electronically (via email or online survey platforms) to improve the response rate.

Follow-up Measures: Reminders will be sent to respondents after one week to enhance completion rates.

Interviews: In addition to the questionnaires, semi-structured interviews will be conducted with a smaller group of key professionals such as senior consultants, procurement officers, and site supervisors. These interviews will provide deeper insights into the impact of material waste on project cost and complement the quantitative findings. Observation: Where possible, direct observations of construction sites will be carried out to record instances of material waste and management practices. This will help validate questionnaire responses with actual site conditions

3.9. Method of Data Analysis

The data collected for this study was analyzed using the Mean Item Score (MIS) technique, which is appropriate for studies that rely on respondents' perceptions measured through Likert-scale questionnaires. The responses obtained from construction professionals were coded numerically, with each option on the five-point Likert scale assigned a value ranging from 1 (Strongly Agree) to 5 (Strongly Disagree). Using these numerical values, the Mean Item Score was calculated for each variable to determine the relative importance of the causes, impacts, and mitigation strategies associated with material wastage.

Table 3.2. Method Of Data Analysis

S/N	Research Objectives	Method of Analysis
1.	To examine the causes of material wastage on construction projects in Benin City, Edo State.	Mean Item Score
2.	To examine the impacts of material wastage in Benin City, Edo State.	Mean Item Score
3.	To evaluate the strategies used in mitigating material wastage on Construction projects in Benin City, Edo State.	Mean item score

CHAPTER FOUR\

RESULTS DISCUSSION OF FINDINGS

4.1 Preamble

This chapter presents and analyses the data obtained from respondents using structured questionnaires administered across construction stakeholders in Benin City, Edo State. The analysis covers the demographic distribution of respondents, causes of material wastage, impact of material wastage on construction project cost, and the strategies for mitigating wastage during construction. Data retrieved was analyzed using Mean Item Score (MIS**)** and ranking, which enables identification of the most significant factors. The Mean Item Score formula is:

$$MIS = \frac{\sum f_i x_i}{N}$$

Where:

fi= frequency of each response

xi = numerical value assigned to Likert scale responses

N = total number of respondents

Likert Scale Interpretation

5 = Strongly Agree

4 = Agree

3 = Neutral

2 = Disagree

1 = Strongly Disagree

4.2. Demographic Characteristics of Respondents

A total of 250 questionnaires were distributed and 200 valid responses were retrieved and analyzed. Variables captured in this section include, educational qualification, professional role, years of work experience and professional affiliation.

Table 4.1. Demographic characteristics of respondent

Category		**Frequency**	**Percentage (%)**
Highest Educational Qualification	B.Sc / B.tech	53	26.50
	Ph.D	19	9.50
	HND	42	21.00
	MSC	36	18.00
	OND	50	25.00
	Total	**200**	**100.00**
Professional Role in Construction Industry	Architect	45	22.50
	Builders	67	33.50
	Civil Engineers	41	20.50
	Quantity Surveyor	47	23.50
	Total	**200**	**100.00**
Years of Work Experience in The Construction Industry	Less than 5 years	67	33.50
	5-10 years	38	19.00
	11-15 years	32	16.00
	16-20 years	29	14.50
	Over 20 years	34	17.0
	Total	**200**	**100.00**
Professional Affiliation	MNIA	45	22.50
	MNIQS	47	23.50
	MNSE	41	20.50
	MNOB	67	33.50
	Total	**200**	**100.00**

Majority of the respondent does possess B.Sc/ B.tech (26.5%), OND (25%), and HND (21%), indicating technically competent respondent base. A good portion also possess higher degrees, showing in-depth industry knowledge needed for reliable evaluation.n terms of professional roles, the distribution was fairly balanced across major construction disciplines. Builders (33.5%) constituted the largest group, followed by Quantity Surveyors (23.5%), Architects(22.5%), and Civil Engineers (20.5%). This wide representation ensures that the findings reflect perspectives from different fields involved in construction project delivery.

4.3. Causes of Material Wastage on Construction Projects

The data shows the major causes of material wastage and their Mean Item Scores.

Table 4.2: Causes of Material Wastage

Causes	MIS	SD	RANK
Delay in use of materials	3.99	1.182	1
Ineffective communication	3.96	1.134	2
Use of substandard materials	3.92	1.233	3
Human negligence	3.91	1.230	4
Improper mixing of materials	3.89	1.195	5
Inadequate supervision	3.86	1.244	6
Poor site management	3.31	1.393	7
Lack of skilled labor	3.30	1.382	8
Efficient procurement	3.23	1.461	9
Excessive handling	3.18	1.469	10
Accurate estimation	3.15	1.458	11
Poor material storage	3.14	1.428	12
Vandalism and theft	3.14	1.563	13
Design changes	3.12	1.488	14
Weather condition	3.12	1.550	15

The highest causes of material wastage identified include:

1. Delay in the use of materials (MIS = 3.99):When materials stay too long on-site, deterioration, theft, and spoilage increase, especially for cement, timber, and sandcrete blocks as observed by
2. Ineffective communication (MIS=3.96): Poor coordination among project team members leads to wrong material delivery and rework, thereby increasing waste. Proposed by Tam et al (2007)
3. Use of substandard materials (MIS=3.92): Substandard materials often fail quality checks, necessitating rework and replacement.
4. Human negligence (MIS = 3.91): Carelessness, mishandling, and improper usage significantly contribute to wastage.

Factors ranked lowest such as excessive handling still contribute, but less significantly. These results confirm that management and human-related factors play the most significant roles in material wastage on construction sites in Benin City.

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4. Impact of Material Wastage on Construction Project

This data reveals impacts material wastage has on project cost.

Table 4.3: Impacts of Material Wastage on Project Cost

Impacts	MIS	STD	RANK
Increased overhead cost	3.95	1.183	1
Extended project duration	3.95	1.206	2
Poor resource utilization	3.94	1.152	3
Escalation of material prices	3.93	1.125	4
Loss of productivity	3.88	1.194	5
Negative reputation and client relation	3.87	1.283	6
Increased cost of waste disposal	3.24	1.260	7
Inflationary impact on replacement	3.22	1.256	8
Delayed related cost	3.21	1.261	9
Cost of rework	3.21	1.262	10
Measurement and ordering inefficiencies	3.19	1.274	11
Reduced profit margin	3.12	1.262	12
Increased project cost	3.08	1.380	13
Budget overrun	3.05	1.292	14

The top three impacts reveal that material wastage contributes significantly to escalating construction costs.

Extended project duration (MIS= 3.95): Reordering, rework, and delays caused by wasted materials slow down the project timeline.

Increased project cost (MIS = 3.95): Replacement of wasted materials increases direct costs

Poor resource utilization (MIS = 3.94): Errors in material usage force correction efforts, consuming extra materials and labor.

Overall, material wastage creates a chain reaction, affecting project cost, timeline, profit margins, and client satisfaction

4.5 Strategies for Mitigating Material Wastage

This data outlines strategies used in minimizing wastage during construction.

Table 4.4: Strategies for Mitigating Material Wastage

Strategies	MIS	SD	RANK
Just-In-Time delivery (JIT)	3.94	1.150	1
Improved material handling	3.93	1.169	2
Proper material storage	3.92	1.251	3
Reuse and recycling of materials	3.89	1.199	4
Use of technology	3.88	1.196	5
Secure the construction site	3.87	1.137	6
Accurate planning and estimation	3.87	1.192	7
Regular monitoring and reporting	3.83	1.249	8
On-Site material management	3.81	1.310	9
Adoption of technology	3.81	1.410	10
Use of skilled labor and training	3.80	1.378	11
Effective communication and supervision	3.78	1.371	12
Proper planning and design	3.77	1.435	13
Efficient procurement and material handling	3.73	1.337	14
Waste minimization practices	3.70	1.430	15

The most effective strategies identified include:

1. Just-In-Time delivery (MIS = 3.94) Reduces on-site storage time, thereby reducing deterioration, theft, and exposure to weather.
2. Improved material handling (MIS = 3.93): Ensures materials are handled with care to prevent damage.
3. Proper material storage (MIS = 3.92): Prevents deterioration due to moisture, pests, weather, and contamination.
4. Reuse and recycling (MIS = 3.89): Minimizes cost and reduces the volume of materials wasted.

These strategies highlight the importance of effective site management, planning, and waste control systems.

4.6 Discussion of Findings

4.6.1 Causes of Material Wastage

The findings revealed that the major causes of material wastage on construction sites in Benin City include delay in the use if materials, ineffective communication, use of substandard materials, human negligence, improper mixing, and inadequate supervision. These results indicate that the dominant sources of waste are human and managerial in nature rather than technical constraints. This aligns with literature which identifies human related factors as the most significant contributors to construction waste generation. Osmani et al.(2008) reported that design changes and reworks resulting from human error significantly increase the volume of waste generated on construction projects, supporting the high ranking of negligence and poor super vision in this study.

Similarly, Ekanayake and Ofori (2002) high lied that improper storage and material handling practices leads to deterioration and loss, which corresponds with respondents' emphasis on delayed usage and poor handling. Furthermore, Formoso et al. (2002) argued that lack of skilled labor result in material breakage and incorrect installation; consistent with the finding that workmanship- related issue are a major cause of waste. The study also agrees with Nagapan et al. (2012), who identified weak site management and supervision as core drivers of waste generation in developing countries. Therefore, the findings reinforce existing research that organizational inefficiencies and poor site practices remain the most critical factors contributing to material wastage

4.6.2 Impact of Material Wastage on Construction Project Cost

The study revealed that material wastage significantly affects construction project delivery through increased overhead costs, extended project duration, escalation in material prices, poor resource utilization, and reduced productivity. These findings demonstrate that wastage has both direct and indirect financial implications for construction firms. This is consistent with Al- Hajj and Hamani (1991)), who noted that inaccurate material estimation and surplus ordering increase procurement expenditure and disposal costs.

The results also support the argument by Tam et al. (2007), who stated that material wastage contributes to cost overrun and reduced profitability due to frequent reordering and replacement of damaged materials. Additionally, Adewuyi and Otali (2019) observed that rework resulting from non-compliance with specification increases labor and material usage, which aligns with respondents' identification of re-work as a major cost implication. Poor resource utilization and low productivity, as identified in this study, also corresponds with finding by Kibert (2004), who emphasized that unmanaged waste negatively influences project efficiency and schedule performance.

4.6.3 Strategies for Mitigating Material Wastage

The study identified several strategies for mitigating material wastage, including Just -In-Time (JIT) delivery, improved material handling practices, poor material storage, reuse and recycling of materials, and the adoption of digital planning tools. These strategies reflect a shift from reactive waste management towards proactive prevention.

The emphasis on JIT delivery aligns with Tam et al. (2007), who argued that timely delivery reduces deterioration and theft associated with prolonged storage. Proper material storage and protection, as highlighted by respondents, also support the findings of Ekanayake and Ofori (2002), who stressed that improved storage system significantly due weather-related deterioration. The adoption of reuse and recycling-practices is consistent with Poon et al.(2004) who promoted recycling as an effective waste reduction strategy in construction.

Furthermore, the recommendation for improved handling and supervision correspond with Nagapan et al.(2012), who identified supervision improvements as critical to minimizing waste. The inclusion of digital tools such as material tracking systems reflects emerging trends in waste management, although their adoption remains limited due to cost and skill constraints, as noted by Andualem and Akilu (2019),

Thus, the findings demonstrate agreement with existing literature that planning, material control, and modern proactive management practices are essential for reducing construction waste.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings

This research examined the impact of material wastage on construction project delivery in Benin City, Edo State. The study was conducted in response to the persistent challenges of cost overruns, project delays, reduced productivity, and inefficiencies experienced in the Nigerian construction industry due to poor material management.

The research adopted a descriptive survey design using structured questionnaires administered to construction professionals including quantity surveyors, architects, civil engineers, builders, and site supervisors. A total of 200 valid responses were analyzed using the Mean Item Score (MIS) method to rank causes, impacts, and mitigation strategies.

The study was guided by three major objectives:

1. To examine the causes of material wastage on construction projects in Benin City.
2. To determine the impacts of material wastage on construction project cost.
3. To evaluate strategies for mitigating material wastage.

Causes of material wastage analysis revealed that material wastage is primarily driven by human, managerial, and operational failures.

The highest-ranking causes include: Delay in the use of materials (MIS = 3.99) ,unIneffective communication (MIS = 3.96), use of substandard materials (MIS = 3.92), human negligence (MIS = 3.91), improper mixing, inadequate supervision, poor handling and poor site management..These causes indicate that wastage arises more from poor coordination and supervision than from technical challenges.

Impact of Material Wastage on Project Cost The study found that material wastage significantly increases project cost and weakens project performance. The highest-ranking impacts include: Increased overhead cost (MIS = 3.95), extended project duration (MIS =

3.95), poor resource utilization (MIS = 3.94), escalation in material prices (MIS = 3.93), loss of productivity increased waste disposal cost, inflationary pressure, and cost of rework. These findings show clearly that material wastage contributes directly to cost overruns, delays, reduced profit margins, procurement inefficiencies, and overall decline in construction performance.

The strategies for mitigating material wastage, the highest-ranked mitigation strategies include: just-In-Time (JIT) delivery (MIS = 3.94), improved material handling (MIS = 3.93), proper material storage (MIS = 3.92), reuse and recycling of materials (MIS = 3.89), adoption of digital tools, skilled labour training, effective site supervision, and accurate estimation. These strategies emphasize proactive material control, effective planning, and structured management systems as keys to minimizing wastage.

5.2 Conclusion

Based on the findings, the study concludes that material wastage remains a major contributor to poor construction performance in Benin City. It leads to substantial financial losses, delays, and inefficiencies in project delivery. The study establishes that: Material wastage is predominantly caused by human and managerial lapses, including ineffective communication, negligence, inadequate supervision, and improper handling.Its impact on project cost is severe, leading to increased overheads, frequent rework, inflated procurement expenditure, reduced profit margins, and extended project duration.

These effects reduce construction efficiency and compromise client satisfaction.Effective mitigation is possible through improved planning, structured material control systems, Just-In-Time (JIT) procurement, better site management, and adoption of modern technologies such as digital tracking tools and BIM-based planning.Addressing material wastage is essential for improving budget accuracy, project timelines, quality delivery, contractor profitability, and sustainability in the construction industry.

5.3 Recommendations

In line with the conclusions, the following recommendations are proposed to reduce material wastage and improve construction project delivery in Benin City: Strengthen site supervision and labour management, engage competent and experienced supervisors, enforce strict monitoring of material usage and adherence to specifications, introduce daily supervision logs to track material flow, implement Just-In-Time (JIT) Procurement, schedule deliveries to coincide with usage periods, reduce onsite storage time to minimize deterioration, theft, and weather damage.

Improve worker training and awareness, conduct regular training on proper material handling, storage, and waste prevention, encourage competency-based labour recruitment and periodic refresher courses, establish proper material storage facilitiesProvide covered, elevated, and well-secured storage areas. Use pallets, waterproof coverings, and lockable stores to prevent damage and theft. Adopt digital planning and material management tools. Utilize BIM for resource planning and design coordination. Implement bar-coding, QR tagging, or inventory management software for tracking material movement, promote reuse and recycling on construction site create onsite sorting systems for recoverable materials like steel, timber, and concrete, reintroduce reusable materials into ongoing or future works to reduce procurement costs. Enforce Government regulations and industry policies regulatory bodies should introduce waste-control compliance checks during project monitoring. Government should develop guidelines for construction material waste management.

Improve accuracy in material estimation and planning Quantity Surveyors should adopt modern estimation software and data-driven model, align procurement quantities with actual site requirements to minimize surplus. Encourage better communication among project stakeholders promote regular coordination meetings between architects, engineers, QSs, and contractors, ensure clear interpretation of drawings and specifications to avoid rework.

5.4 Areas for Further Studies

Future research should explore the following areas:

1. Comparative analysis of material waste across different Nigerian cities.
2. Financial quantification of waste-related losses in Naira terms.
3. The role of prefabrication and modular construction in reducing waste.
4. Impact of digital technologies such as IoT and drones on waste monitoring.
5. Case studies assessing contractolevel waste management performance.

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APPENDIX

RESEARCH QUESTIONNAIRE

Department of Quantity Surveying,

Faculty of Environmental Sciences,

University of Benin,

P.M.B 1154, Ugbowo,

Benin City, Edo state.

Dear Sir/Ma

ANALYZING THE IMPACT OF MATERIAL WASTAGE IN CONSTRUCTION PROJECT DELIVERY IN BENIN CITY,EDO STATE

I am a student of the University of Benin, currently undertaking a B.Sc. program in Quantity Surveying. I am carrying out a research on the topic; "**ANALYZING THE IMPACT OF MATERIAL WASTAGE IN PROJECT DELIVERY BENIN CITY, EDO STATE".** I kindly request your assistance in completing the attached questionnaire which will be based on research purpose only and will be kept confidential.

Your response is highly appreciated.

Thank you.

Yours faithfully,

Eguabor Joses

SECTION A: DEMOGRAPHIC INFORMATION

Please tick (✓) or fill in the appropriate response:

1. Highest Educational Qualification:

[ ] OND

[ ] HND

[ ] Bachelors Degree (B.Sc / B.Eng, etc.)

[ ] Master's Degree

[ ] Doctorate (PhD)

2. Professionals Role in Construction Industry:

[ ] Engineer

[ ] Quantity Surveyor

[ ] Architect

[ ] Builders

3. Years of Work Experience in Construction Industry:

[ ] Less than 5 years

[ ] 5 – 10 years

[ ] 11 – 15 years

[ ] 16 – 20 years

[ ] Over 20 years

4. Please specify if you are a member of any professional association

[ ] MNIA

[ ] MNIOB

[ ] MNIQS

[ ] NSE

Section B: To Ascertain the Causes of Material Wastage on Project Cost. Please indicate your level of agreement using Strongly Agree: 1, agree: 2, Neutral: 3, Disagree: 4, Strongly Disagree: 5

S/N	Causes	1	2	3	4	5
1.	Design Changes					
2.	Poor Material Storage					
3.	Inaccurate Estimation					
4.	Inefficient Procurement					
5.	Lack of Skilled Labor					
6.	Poor Site Management					
7.	Excessive Handling					
8.	Weather Condition					
9.	Vandalism and Theft					
10.	Use of substandard materials					
11.	Improper mixing of materials					
12.	Delay in use of material					
13.	Ineffective communication					
14.	Inadequate Supervision					
15.	Human Negligence					

SECTION C: The Impacts Material Wastage on Construction Cost Please indicate your level of agreement using Strongly Agree: 1, agree: 2, Neutral: 3, agree: 4, Strongly Disagree: 5

S/N	Impacts	1	2	3	4	5
1.	Increased Project Cost					
2.	Reduced Profit Margin					
3.	Budget Overrun					
4.	Increased Cost of Waste Disposal					
5.	Delayed Related Cost					
6.	Cost of Rework					
7.	Procurement and Ordering Inefficiencies					
8.	Inflationary Impact on Replacement					
9.	Extended project duration					
10.	Increased overhead costs					
11.	Poor resource utilization					
12.	Environmental and disposal costs					
13.	Negative reputation and client relation					
14.	Loss of productivity					
15.	Escalation of material prices					

SECTION D: To evaluate strategies to mitigate material wastage in construction project. Please indicate your level of agreement using: Strongly Agree: 1, agree 2, Neutral: 3, Disaagree:4, Strongly Disagree:

S/N	Strategies	1	2	3	4	5
1.	Proper Planning and Design					
2.	Efficient Procurement and Material Handling					
3.	On-Site Material Management					
4.	Use of Skilled Labor and Training					
5.	Waste Minimization Practices					
6.	Effective Communication and Supervision					
7.	Adoption of Technology					
8.	Accurate planning and estimation					
9.	Proper material storage					
10.	Just-In-Time (JIT) delivery					
11.	Reuse and recycling of materials					
12.	Improved material handling					
13.	Use of technology					
14.	Secure the construction site					
15.	Regular monitoring and reporting					