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# Integrating AI for Material Management in Building Construction: A Study of Stakeholders in Lagos State, Nigeria.

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**Abstract**

*Construction materials constituent major components of construction project and are factors that significantly affects project performance. Managing materials on building construction sites is challenging and often leads to material wastage, poor workmanship, project delays, and inadequate material flow. Material management in construction project was largely manual prior to recent advances in digital technologies and Artificial Intelligence (AI). This study assessed the use of AI for material management by construction stakeholders in Lagos State, Nigeria and its implications for project performance. A structured questionnaire was distributed to 372 construction professionals; 258 response were received (69.35% response rate). The data were analysed using mean scores (MS), standard deviation (SD), t-test. Areas were AI was used for material management are for inventory management (MS = 3.89, SD = 0.70, t = 84.65), purchase order management (MS= 3.85, SD = 0.59, t = 100.18), and demand forecasting and planning (MS = 3.83, SD = 0.81, t = 72.72). The software most used by construction professional for material management in Lagos State are Zoho inventory (MS = 4.43, t = 20.17), Intuit QuickBooks (MS = 4.27, t = 94.38), and Inflow Inventory (MS= 3.92; t = 89.04). AI material management techniques employed included supply-chain and logistics optimisation (MS = 2.61, SD = 0.422, t = 113.23), and machine learning algorithms for demand prediction (MS = 2.50, SD = 0.790, t = 117.66). Key barriers included high installation cost, unreliable power supply, and limited visibility for remote sensing and monitoring. The study recommended integrating AI into building projects in Nigeria and strengthening professional training and capacity building to support adoption.*

**Keywords:** Artificial intelligence; material management; Construction industry; Lagos State; project performance.

## 1.0 Introduction

### 1.1 Background to the Study

The construction subsector drives industrialisation, creates employment, and contributes to technological and socioeconomic development; it is strategically important to national growth (Luo *et al*., 2022; Zabidin *et al*., 2022; Korke *et al*., 2023). According to Luo *et al*. (2022), the construction industry currently contributes 13% of the world's Gross Domestic Product (GDP), and it is anticipated that by the year 2030 the value of Artificial Intelligence (AI) in construction project management will have increased by 85%, reaching $15.5 billion globally (Korke *et al*., 2023). Construction activities increased with increases in population growth, urbanisation, technological advancement, and environmental development (Liang & Yang, 2019). As

construction activities increase, the use of construction materials also increases (Mehra *et al*., 2022). Construction materials are a major component of construction projects and are a factor that largely affects project performance (Sila & Gakobo, 2021).

Material management of construction projects was mostly carried out manually before the introduction of digital technologies (Pitkänen, 2024). Digitalisation in the construction industry provides opportunities to realise large construction projects within their time frame and budget limits (Patil, 2018). One of the products of digitalisation and advancement in information and communication technology was the introduction of AI (Zhang & Lu, 2021). 'AI' is a general term that implies the use of a computer to model intelligent behaviour with minimal human intervention (Pavel, 2017). AI is the study of how to make computers perform intelligent tasks that in the past were performed by human beings (Zhang & Lu, 2021). AI is a compilation of computer science, logic, biology, psychology, philosophy, and many other disciplines (Konar, 2018; Haugeland *et al*., 2023).

AI has achieved remarkable results in applications such as speech recognition, image processing, natural language processing, and proving of automatic theorems. Intelligent robots have played an indispensable role in social development, and they have brought revolutionary results in improving labour efficiency, reducing labour costs, optimising the structure of human resources, and creating new job demands (Konar, 2018). It was noted that artificial robots (machines) could do more than just labour-intensive work; they can develop human-like intelligence. On these notes, AI has penetrated into our daily lives, playing novel roles in industries, healthcare, transportation, education and most especially in construction (Ugwu et al., 2024; Kohli, 2025). Construction materials account for 60% of the construction cost component (Akanni *et al*., 2014; Ijigah *et al*., 2024). But inefficient material management throughout the construction projects' value chain has resulted in poor performance, especially in terms of time, cost, quality, and productivity (Eze *et al*. (2020). Managing materials on construction projects is challenging, and this results in material waste generation, poor quality of work, project delays, and poor material flow (Albert *et al*., 2025).

According to Akanni et al. (2014); Setiawan *et al. (2021);* Rao *et al*. (2022); and Ijigah et al. (2024), special attention should be given to material management of construction projects to enhance project performance. Enhancing construction project material

management processes will reduce the percentage of abandoned projects, enhance cost-effectiveness and bridge the gaps in project delivery.The challenge above calls for the integration of AI for material management of building construction projects in Lagos State. Integrating AI for material management of building construction projects will provide contractors, consultants, policymakers, and academia with in-depth understanding of the relationships among the variable constructs.

### 1.2 Statement of the Problem

Despite the potential of AI to optimise material management, construction projects in Lagos State continue to experience high levels of material waste, cost overruns, and schedule delays. The uptake of AI by industry stakeholders remains limited due to infrastructural, cost and capacity constraints; empirical evidence quantifying software adoption, techniques in use and barriers in the Lagos context is limited. This study addresses these gaps

### 1.3 Aim and Objectives

The aim of the study is to assess the adoption and application of AI for material management in building construction projects in Lagos State, Nigeria, and to identify barriers and opportunities for improved project performance. The objective of the study are to:

i. map AI software/techniques used;
ii. assess levels of awareness and adoption;
iii. examine AI applications across material management areas (inventory, procurement, forecasting);
iv. identify barriers to AI adoption;
v. recommend strategies for integration and capacity building.

## 2.0 Literature Review

### Empirical Studies

Using a structural equation model, Kar and Jha (2020) investigated how material management concerns affected building projects' cost and schedule performance. Their study also explored the critical barriers to material management and enablers of sustainable material management practices in the construction industry. Ammar *et al.* (2021) examined how material quality management and manufacturing organisation systems can be improved in the construction industry. In Nigeria Edike (2023) investigated material management practices and factors influencing material conservation on construction sites in Nigeria. Also Eze et al. (2020) assessed the triggers of inefficient materials management practices by small

and medium-sized construction enterprises in Nigeria. These studies do not empirically establish the relationship between AI use and material management outcomes in Nigerian construction projects.

Many studies where carried on material management and artificial intelligence but none of the studies produced and empirical information to establish a relationship between the variable constructs. Pereira et al. (2023) carried out a systematic literature review on the impact of artificial intelligence on workplace outcomes. Helo & Hao (2022), assess the use of AI in operations and supply chain management. Saad *et al*. (2021) examined the use of smart production planning and control technology in the construction industry. Zhao et al. (2021), examined the use of AI aided data-driven infrastructure to compute materials information in the construction industry. Xing et al (2010) examined the use of Artificial intelligence in reverse supply chain management. Noraas *et al*. (2019) examined the use of deep neural networks for structural material properties of construction projects. While Ugwu *et al.* examined the use of AI in health care industries to enhance resilience and reduce waste. Kohli (2025) assessed the impact of using AI on fashion Education to create employments.

## 2.0 Theoretical framework

### 1. Material Management Practices in the Construction Industry

Material management in the construction industries are classified into inventory management, purchase order management, demand forecasting and planning, supplier management, receiving and inspection, warehouse management, reporting and analytics, and integration of al with enterprise resource planning systems (Martinez-Ruedas et al 2024; Grützner et al., 2025)

### 2. AI Material Management Techniques

Table I shows the list of AI material management techniques used in the construction industry. The identified techniques are supply chain and logistics, machine learning algorithms for demand prediction, machine learning and optical character recognition, statistical analysis for identifying trends, natural language processing for data extraction from document, computer vision for automated invention tracking, Simple Moving Average, Autoregressive integrated moving average, multiple aggregation algorithm, life cycle modelling, and adaptive smoothing. Others are market research, panel consensus, historical method, Delphi method, inventory optimization, and supplier management, inventory analytics and reporting, batch tracking, barcode scanning, and

multichannel order management. AI material management techniques was further assessed in the study.

**Table 1. List of (AI) Material Management Techniques**

| List of (AI) material management Techniques | Reference |
|---|---|
| Supply Chain and Logistics. | Akbari & Do 2021 |
| Machine learning algorithms for demand prediction | Aktepe et al.,2021; Mediavilla et al., 2022 |
| Machine learning (ML) and optical character recognition (OCR) | Tang *et al.,*2024 |
| Statistical analysis for identifying trends | Okeleke *et al.,*2024 |
| Natural language processing for data extraction from document | *Wu et al.,*2024 |
| Computer vision for automated invention tracking | Wang *et al.,*2021 |
| Simple moving average (SMA), | Sathish *et al.,*2021 |
| Autoregressive integrated moving average (ARIMA), | Sathish *et al.,*2021 |
| Multiple aggregation algorithm (MAPA), | Abdelaziz *et al.,*2024 |
| Life cycle modelling (LCM) | Baduge *et al.,*2022 |
| Adaptive smoothing (AS) | Sathish *et al.,*2021, Belmouadden *et al.,*2025 |
| Market research, | Nascimento *et al.,*2025 |
| Panel consensus, | Kermansaravi *et al.,*2025 |
| Historical method, | Shahkarami *et al.,*2014 |
| Delphi method | Wang *et al.,*2023 |
| Inventory optimization | Wang *et al.,*2023 |
| Supplier management | Liu & lin 2021; Wang *et al.,*2023 |
| inventory analytics and reporting | Islam *et al.,*2024 |
| Batch tracking | Tu *et al.,*2024 |
| Barcode scanning, | Ahn, et al., 2018; Farhaoui et al., 2024 |
| Multichannel order management | Martinez-Ruedas et al 2024 |

**AI management Software's and Areas of Application**

Table shows the area AI management software was applied for material management in the construction industry. The identified software are Zoho inventory, Intuit quickbooks, Inflow inventory, Barcode, Siemens teamcenter integrated material management (IMM), IoT (Internet of Things ), GPS/BeiDou Navigation Satellite System, Netsuite, Cin7, and Big data.

**Table 2: AI management software's and areas of application**

| Soft wares for material management | Reference | Material management practice Area |
|---|---|---|
| Zoho inventory | Castillo et al., 2022; Kamalruzaman & Omar (2023); | Inventory management |
| Intuit quickbooks | Shelton, C. (2023) | Purchase Order Management |
| Inflow inventory | Luo et al., 2022 | Supplier Management, Warehouse Management. Purchase Order Management |
| Barcode, | Ahn, et al., 2018 | Warehouse Management, Purchase Order Management |
| Siemens teamcenter integrated material management (IMM) | Martinez-Ruedas et al 2024 | Integration of AL with enterprise resource planning systems |
| Cloud Computing , | Mwangi, L. K. (2021) | Supplier Management |
| IoT (Internet of Things ), | Zhong et al., 2017; Oke et al., 2022; Althoey et al., 2024 | Reporting and Analytics |
| RFID, | Sardroud, J. M. (2012) | Supplier Management |
| GPS/BeiDou Navigation Satellite System, | Xu et al 2021 | Receiving and Inspection |
| Netsuite | Ries, P. (2023). | Supplier Management and cost control in photo type projects |
| Cin7 | Hammad et al., 2023; Grützner et al., 2025 | Inventory |
| Big data , | Huang et al 2021; Agostinelli et al 2022 | Resource management Asset management |

## 3.0 Research Methodology

The study was carried out in Lagos State, Nigeria. Lagos city lies approximately at latitude 6.5244° N and longitude 3.3792° E. Lagos State is bounded to the south by the Atlantic Ocean and to the west by the Republic of Benin. The state has a high population density and a large number of construction projects, which motivated its selection (Obayelu *et al*., 2022). The population for this study was drawn from the stakeholders within the construction industry in Lagos Nigeria. Construction industries stakeholders in Lagos State is made up of architects, builders, engineers, and quantity surveyors who are either contractors, consultants or clients practicing in Lagos State. Details of the sample size is presented in Table 3.

**Table 3: Sample Frame of the Project Stakeholders**

| S/No | Professionals | Lagos State | Sample Size |
|---|---|---|---|
| 1 | Builders | 2,805 | 197 |
| 2 | Quantity surveyors | 860 | 60 |
| 3 | Architects | 902 | 64 |
| 4 | Engineers | 720 | 51 |
| | TOTAL | 5287 | 372 |

Source: From the Professional Bodies Platform in Lagos State, Nigeria. 2024

The sample size was caculated using the Yamane (1973)

$n = N / [1 + N(e^2)] \rightarrow n = 5287 / [1 + 5287(0.05^2)] = 5287 / 14.2175 = 371.86 \approx 372.$

Where, n = sample size

N= Total population

e= Level of precision which is 0.05 (5% level of precision)

372 questionnaires were distributed to construction professionals in Lagos state. The research makes use of a non-probability sampling method to obtain the necessary data. This implies a simple random selection of the different members of the population in the study area. The preliminary instrument for collecting the data is the use of research questionnaire. The questionnaires was distributed via email and messages, with participants instructed to complete them within a specified timeframe

The questionnaire underwent a pilot test with a small group (25) to assess its reliability and validity, and necessary adjustments were made based on feedback. Subsequently, the questionnaire was distributed to a diverse array of stakeholders in the construction industry, encompassing various roles and organizations, to ensure a representative dataset. The questionnaire featured a blend of open-ended questions, strategically crafted to assess the Artificial Intelligent (AI) for material management of building construction projects in Lagos state. Descriptive and inferential statistics tools were used in the study. Statistical software for social sinecces (SPSS) was used to analyse the one-sample t- test, Independent T-Test, mean score , standard deviation at ($\alpha$ = 0.05) significance level. Accepted significance level $\leq$ Sig. (2-tailed 0.05) $\geq$ or rejected.

## 4.0 Result, Analysis and Discussion

### Number of Questionnaire Administered and Retrieved in the Study Area

Table 4 shows the number of questionnaires administered with the response rate. Three hundred and seventy two (372) questionnaire were administered based. Two hundred and fifty eight questionnaires was retrieved from the respondent (69.35%). The remaining one hundred and fourteen (114) representing (30.65%) was not recovered from the respondent because of the period

given for the research study. Lindemann (2021) suggests that an acceptable response rate for academic research is a minimum of 33%, meeting a reasonable level of representativeness, and American association of public opinion research (AAPOR) recommends a 60% acceptable response rate.

**Table 4: Number of Questionnaire Administered and Retrieved in the Study Area.**

| Administered | Retrieved | Percentage (%) |
|---|---|---|
| 372 | 258 | 69.35 |

### 4.1 Background Information of the Respondents

Table 5 shows the background information of the respondents. The information's are academic qualification, years of work experience and professional qualification of respondents. As regards the academic qualifications category, the largest group (54.26%) holds a Bachelor's degree (B.Sc/B.Tech/B.Eng). Master's degrees (M.Sc) holders represented (15.12) % of the respondents. These was followed by PhDs (7.75%) and lower proportions hold ND/NCE (8.14 %), HNDs (9.69 %), and PGDs (5.04%). From the study, it is evident that the most common experience range is 1 to 5 years (36.43%) and the next group are those with experience ranging from 6 to 10 years (30.23%) and 11 to 15 years (20.93%). A smaller proportion have 16 to 20 years (4.26%) or 21+ years (8.14%) of experience. Table 4.3, also shows a diverse range of professional qualifications, with builders (42.25%) forming the largest group and was followed by engineers (22.09%) and quantity surveyors (18.60%), smaller groups hold qualifications in architecture (7.75%), and project management (9.30%).

Also (88.37%) of the respondents have been involved in Inventory optimization, quality management systems, while (4.65%) of the respondents have been involved in Supply management and (6.98) % of the respondents have been involved in Warehouse quality management standards while (5.43%) of the respondents have been involved in Demand forecasting quality management. Based on the forgoing information outlining the demographics, project involvement, and professional backgrounds of respondents the data acquired was considered adequate and reliable for the analysis upon which inferences were made.

**Table 5 Background Information of the Respondents**

| S/N | Categories | Background Information | Freq. | Per cent | Cum. Freq. |
|---|---|---|---|---|---|
| 1 | **Years of experience in the building Industry** | Less than 5 years | 94 | 36.43% | 36.43% |
| | | 6 to 10 | 78 | 30.23% | 66.66% |
| | | 11 to 15 | 54 | 20.93% | 87.59% |
| | | 16 to 20 years | 11 | 4.26% | 91.85% |
| | | 21 and above | 21 | 8.14% | **100.00%** |
| | | | **258** | **100.00%** | |
| 2 | **Professional qualification of respondents** | Architect | 20 | 7.75% | 7.75% |
| | | Builder | 109 | 42.25% | 50.00% |
| | | Project Manager | 24 | 9.30% | 59.30% |
| | | Quantity Surveyor | 48 | 18.60% | 77.90% |
| | | Engineers | 52 | 22.09% | **100. 0%** |
| | | | **258** | **100.00%** | |
| 3 | **Material Management approach** | Inventory optimization | 214 | 82.95% | 82.95% |
| | | Supplier | 12 | 4.65% | 87.60% |
| | | Warehouse | 18 | 6.98% | 94.58% |
| | | Demand forecasting | 14 | 5.43% | **100.00%** |
| | | | **258** | **100.00%** | |
| 4 | **Academic Qualification** | ND/NCE | 21 | 8.14% | 18.14% |
| | | HND | 25 | 9.69% | 17.83% |
| | | PGD | 13 | 5.04% | 22.87% |
| | | B.Sc/B.Tech/B.Eng | 140 | 54.26% | 77.13% |
| | | M.Sc | 39 | 15.12% | 92.25% |
| | | Ph.D | 20 | 7.75% | 100.00% |
| | | | **258** | **100%** | |

### 4.2 Areas were AI was used for Material Management in Lagos State

Table 6 assessed the areas were AI was used for material management in Lagos State using pair t - test. From the result in Table 7, inventory management was significant at Sig. (2-tailed) with Mean Score (MS= 3.89), Standard Deviation (S.D. =0.70), and calculated t vales of (t = 84.65) and p > 0.001 was ranked 1st. The study is in agreement with findings by Wang *et al.* (2023) that AI are mostly used for inventory management. Purchase order management was also significant (MS = 3.85; SD =0.59; t = 100.18; p > 0.001) was ranked 2nd. Demand forecasting and planning (MS= 3.83; S.D. =0.81; t = 72.72) was ranked 3rd. Integration of AI with enterprise resource planning systems (MS= 3.64; S.D. =0.82; t = 68.26; p > 0.001) was ranked least among the eight areas were AI was used for material management in Lagos state. All the

listed areas were AI was used for material management in Lagos state are significant p > 0.001 at Sig. (2-tailed) and the calculated table value (t)values ranges from (t= 68.98) been the lowest to (t= 90.77) been the highest.

**Table 6 Areas were AI was used for Material Management in Lagos State**

| Areas were Artificial Intelligence (AI) was used for Material Management | *Df* | M.S. | S.D. | t | Sig. (2-tailed) | Rank |
|---|---|---|---|---|---|---|
| Inventory Management | 257 | 3.78 | 0.77 | 75.71 | 0.000 | 1 |
| Purchase Order Management | 257 | 3.75 | 0.67 | 86.56 | 0.000 | 2 |
| Demand Forecasting and Planning | 257 | 3.74 | 0.76 | 75.32 | 0.000 | 3 |
| Supplier Management | 257 | 3.73 | 0.78 | 73.13 | 0.000 | 4 |
| Receiving and Inspection | 257 | 3.71 | 0.76 | 75.17 | 0.000 | 5 |
| Warehouse Management | 257 | 3.70 | 0.83 | 68.98 | 0.000 | 6 |
| Reporting and Analytics | 257 | 3.67 | 0.72 | 78.49 | 0.000 | 7 |
| Integration of AL with enterprise resource planning systems | 257 | 3.65 | 0.62 | 90.77 | 0.000 | 8 |

**Note:** *Df* = Degree of freedom; M= Mean Score; S.D = Standard Deviation; t= calculated t value

### 4.3 Assessment of Al Software Used by Construction Company for Material Management in Lagos State.

Table 9 assessed the Al software used by Construction Company for material management in Lagos state. From the result in Table 9, Zoho inventory with Mean Score (MS= 4.43), and calculated t vales of (t = 20.17) was ranked 1st, while Intuit quickbooks (MS= 4.27; t = 94.38) was ranked 2nd while Inflow inventory (MS= 3.92; t = 89.04) was ranked 3rd. Big data **(**MS= 3.41; t = 53.29**)** was ranked least among the fifteen (Al) software used by Construction Company for material management in Lagos state. Only four of the listed level of usage of (Al) software by Construction Company for material management in Lagos state were significant (p > 0.05) at Sig. (2-tailed). Eleven (11) of the listed software's are not significantly used by Construction Company for material management in Lagos state. Calculated table value (t) ranges from (t= -1.872) been the lowest to (t= 1.752) been the highest.

**Table 7: Independent T-Test for (AI) Software's used for Material Management in Lagos State**

| **Software's Used For Material Management** | | **Awareness** | | | **Adoption** | | | **Overall mean** | | **t** | **sig** | **Remark** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Software's** | **N** | **SD** | **MS** | **RK** | **SD** | **MS** | **RK** | **MS** | **RK** | | | |
| Zoho inventory | 258 | 0.47 | 2.70 | 10 | 0.61 | 2.45 | 21 | 2.56 | 1 | 1.496 | .045 | S |
| Intuit quickbooks | 258 | 0.47 | 2.30 | 21 | 0.72 | 2.25 | 21 | 2.28 | 2 | .298 | .048 | S |
| Inflow inventory | 258 | 0.90 | 2.09 | 2 | 1.12 | 2.25 | 8 | 2.17 | 3 | -.530 | .224 | NS |
| Barcode, | 258 | 0.70 | 2.30 | 4 | 0.61 | 1.95 | 6 | 2.13 | 4 | 1.758 | .234 | NS |
| Siemens teamcenter integrated material management (IMM) | 258 | 0.85 | 2.22 | 6 | 0.65 | 2.00 | 8 | 2.11 | 5 | .931 | .004 | S |
| Cloud Computing , | 258 | 0.63 | 2.13 | 7 | 1.00 | 1.95 | 2 | 2.04 | 6 | .720 | .052 | NS |
| IoT (Internet of Things ), | 258 | 0.63 | 2.14 | 19 | 0.91 | 1.90 | 21 | 2.02 | 7 | .977 | .329 | NS |
| RFID, | 258 | 1.01 | 1.87 | 22 | 0.85 | 2.10 | 17 | 1.99 | 8 | -.800 | .922 | NS |
| GPS/BeiDou Navigation Satellite System, | 258 | 0.79 | 1.91 | 23 | 0.61 | 2.05 | 15 | 1.98 | 9 | -.629 | .510 | NS |
| Sortly | 258 | 0.73 | 1.57 | 20 | 0.80 | 2.00 | 17 | 1.79 | 10 | -1.872 | .444 | NS |
| Ike | 258 | 0.78 | 1.65 | 15 | 0.62 | 1.80 | 17 | 1.73 | 11 | -.685 | .128 | NS |
| Netsuite | 258 | 0.78 | 1.65 | 2 | 1.01 | 1.80 | 2 | 1.73 | 12 | -.544 | .285 | NS |
| Fishbowl | 258 | 0.86 | 1.74 | 5 | 0.98 | 1.70 | 10 | 1.72 | 13 | .139 | .690 | NS |
| Cin7 | 258 | 1.00 | 1.78 | 8 | 1.04 | 1.65 | 5 | 1.72 | 14 | .426 | .672 | NS |
| Big data , | 258 | 1.12 | 1.57 | 10 | 0.67 | 1.85 | 15 | 1.71 | 15 | -.991 | .018 | S |

Note: p is significant at p≤ 0.05. t=t-value, N= Number of respondents, SD= standard deviation S= significant difference, NS= no significant difference

### 4.4 Assessment of AI Material Management Techniques Used By Companies in Lagos State

Table 8 assessed the level of following AI material management Techniques used by companies in Lagos state. . From the result in Table 4.5, Parallel control and management, to

Realization of transformation and upgrade co-ordinately with its Supply Chain and Logistics with Mean Score (MS= 2.61), Standard Deviation (S.D. =0.422), and calculated t vales of (t = 113.23) was ranked 1st, while Machine learning algorithms for demand prediction (MS= 2.50; S.D. =0.790; t = 117.66) was ranked 2nd. Machine Learning (ML) and optical character recognition (OCR) (MS= 2.49; S.D. =0.765; t = 100.49) was ranked 3rd. Multichannel order management **(**MS= 2.00; S.D. =0.596; t = 61.63**)** was ranked least among the seven (AI) material management Techniques used by your company in Lagos state All the listed (AI) material management Techniques used by your company in Lagos state are significant (0.000) at Sig. (2-tailed). Calculated table value (t) ranges from (t= 61.63) been the lowest to (t= 117.66) been the highest.

**Table 8: AI Material Management Techniques in Lagos state**

| Variables | Mean | Df | S. D | T | Sig. (2-tailed) | Rank |
|---|---|---|---|---|---|---|
| Supply Chain and Logistics. | 2.61 | 257 | 0.42 | 87.23 | 0.000 | 1 |
| Machine learning algorithms for demand prediction | 2.50 | 257 | 0.79 | 92.66 | 0.000 | 2 |
| Machine learning (ML) and optical character recognition (OCR) | 2.49 | 257 | 0.76 | 18.49 | 0.000 | 3 |
| Statistical analysis for identifying trends | 2.47 | 257 | 0.69 | 76.61 | 0.000 | 4 |
| Natural language processing for data extraction from document | 2.45 | 257 | 0.92 | 17.89 | 0.000 | 5 |
| Computer vision for automated invention tracking | 2.44 | 257 | 0.56 | 92.89 | 0.000 | 6 |
| Simple moving average (SMA), | 2.42 | 257 | 1.13 | 80.58 | 0.000 | 7 |
| Autoregressive integrated moving average (ARIMA), | 2.40 | 257 | 0.95 | 84.61 | 0.000 | 8 |
| Multiple aggregation algorithm (MAPA), | 2.38 | 257 | 0.67 | 93.93 | 0.000 | 9 |
| Life cycle modelling (LCM) | 2.33 | 257 | 0.51 | 80.23 | 0.000 | 10 |
| Adaptive smoothing (AS) | 2.31 | 257 | 0.86 | 95.35 | 0.000 | 11 |
| Market research, | 2.32 | 257 | 1.24 | 89.74 | 0.000 | 12 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Panel consensus, | 2.30 | 257 | 0.72 | 84.18 | 0.000 | 13 |
| Historical method, | 2.22 | 257 | 0.55 | 89.78 | 0.000 | 14 |
| Delphi method | 2.22 | 257 | 1.10 | 73.94 | 0.000 | 15 |
| Inventory optimization | 2.15 | 257 | 0.73 | 71.55 | 0.000 | 16 |
| Supplier management | 2.13 | 257 | 0.67 | 76.15 | 0.000 | 17 |
| inventory analytics and reporting | 2.09 | 257 | 0.73 | 84.18 | 0.000 | 18 |
| Batch tracking | 2.04 | 257 | 0.42 | 62.81 | 0.000 | 19 |
| Barcode scanning, | 2.02 | 257 | 0.60 | 71.73 | 0.000 | 20 |
| Multichannel order management | 2.00 | 257 | 0.60 | 61.63 | 0.000 | 21 |

**Note***:* *Df* = Degree of freedom; M= Mean Score; S.D = Standard Deviation; t= calculated t value

### 4.5 Factors Affecting the Use of AI for material Management

Table 9 assessed the factors affecting the use of AI for material Management of Construction Projects in Lagos State. From the result in Table 10, Secure platforms to protect data privacy with a Mean Score (MS= 4.13) and Standard Deviation (S.D. =0.76) and calculated t vales of (t = 18.61) was ranked 1st, while aligning existing systems with AI tools (MS= 4.05; S.D. =0.76; t = 82.14) was ranked second and Strong implementation methodology from an experienced vendor (MS= 4.03; S.D. =0.79; t = 78.83) was ranked 3rd. Inadequate training centers (MS= 3.66; S.D. =0.78; t = 72.27) was ranked least among the eighteen (18) factors affecting the use of AI for material Management of Construction Projects in Lagos State. All the listed factors affecting the use of AI for material Management of Construction Projects in Lagos State were significant.

**Table 9: Factors Affecting the Use of AI for material Management**

| Factors | N | 1 | 2 | 3 | 4 | 5 | S | M | Rk |
|---|---|---|---|---|---|---|---|---|---|
| Secure platforms to protect data privacy. | 258 | 0 | 0 | 18 | 102 | 138 | 1152 | 4.465 | 1 |
| Aligning existing systems with AI tools | 258 | 0 | 6 | 24 | 102 | 126 | 1122 | 4.349 | 2 |
| Strong implementation methodology from an experienced vendor | 258 | 0 | 6 | 18 | 120 | 114 | 1116 | 4.326 | 3 |
| human nature to resist change | 258 | 6 | 6 | 36 | 72 | 138 | 1104 | 4.279 | 4 |
| Time-consuming staff training and temporary impact on productivity. | 258 | 6 | 6 | 30 | 114 | 102 | 1074 | 4.163 | 5 |
| Low Technological advancement | 258 | 0 | 6 | 36 | 132 | 84 | 1068 | 4.140 | 6 |
| transitioning to advanced technologies requires successful change management | 258 | 6 | 0 | 30 | 138 | 84 | 1064 | 4.124 | 7 |
| Lack of physical facilities | 258 | 2 | 12 | 6 | 180 | 60 | 1062 | 4.116 | 8 |
| Lack of support from the stakeholders | 258 | 6 | 12 | 54 | 66 | 120 | 1056 | 4.093 | 9 |
| Lack of expatriate | 258 | 0 | 12 | 12 | 180 | 54 | 1050 | 4.070 | 10 |
| Higher implementation costs, including the need for external IT consultants | 258 | 18 | 6 | 36 | 84 | 114 | 1048 | 4.062 | 11 |
| Technical complexity of implementation | 258 | 12 | 0 | 30 | 138 | 78 | 1044 | 4.047 | 12 |
| Commitment of the stakeholders | 258 | 6 | 6 | 18 | 168 | 60 | 1030 | 3.992 | 13 |
| Financial issues | 258 | 6 | 12 | 36 | 132 | 72 | 1026 | 3.977 | 14 |
| Maintenance issues | 258 | 6 | 0 | 54 | 138 | 60 | 1020 | 3.953 | 15 |
| Government policies | 258 | 6 | 12 | 18 | 180 | 42 | 1014 | 3.930 | 16 |
| Economy instability | 258 | 6 | 12 | 24 | 180 | 36 | 1002 | 3.884 | 17 |
| Inadequate training centers | 258 | 0 | 6 | 96 | 96 | 60 | 984 | 3.814 | 18 |

*MS=mean score; EI = extremely influential, 5; MI = moderately influential, 4; SI = somewhat influential, 3; SI = slightly influential, 2; NI = not at all influential, 1*

## 5.0 Conclusions and Recommendations

### 5.1 Conclusions

This study found that AI is primarily applied in inventory management, purchase order management, and demand forecasting among Lagos construction stakeholders. The most frequently used software were Zoho Inventory, Intuit QuickBooks, and Inflow Inventory. Several AI techniques (supply-chain optimisation, ML demand forecasting, OCR) are in use, though overall adoption levels remain low. Key barriers include data security concerns, system integration challenges, and infrastructure constraints. These findings indicate opportunities for targeted capacity building, improved ICT infrastructure, and vendor-supported implementations to increase AI uptake in material management.

### 5.2 Recommendations

In view of the conclusions that enumerated from this research, the following recommendations is proposed to encourage the use of AI for material management of construction projects in Lagos state.

i. Encourage adoption of proven AI software (e.g., Zoho Inventory, QuickBooks) through pilot projects.
ii. Develop targeted training programmes for construction professionals on AI tools and data analytics.
iii. Improve site power and connectivity to support real-time monitoring and IoT applications.
iv. Promote vendor partnerships and implementation roadmaps to reduce cost and technical risk.
**v.** Government and professional bodies should issue guidelines for data privacy and standardise material management metadata.

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