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Editorial

This edition of NIU *Journal of Management Sciences* touches on as Investment Behavior, Supply Chain Disruption, Credit Risk Management, Portfolio Management and Financial Performance as well as Blockchain Technology and Curbing Fraudulent Activities in Deposit Money Banks.

One of the papers, in this issue, clarify how rational, behavioural, cognitive, and social factors shape young people's investment intentions as well as choices, while identifying gaps in research conducted so far that can inform future research agenda. It therefore, recommends greater theoretical integration, the adoption of mixed-method and longitudinal approaches, and increased attention to digital investment platforms.

Another paper also reveals that trade unionism enhances employee engagement and ensure production-stimulated work environment because labour organization always pressured organization to do the right thing; but collective bargaining is losing its potency as employers of labour always most time have reasons to renege on their promise for better welfare package mostly in developing world due to weak contract enforcement mechanism. The paper therefore, recommends that the management must do everything within its power to manage labour movement in the organization through employee engagement, ensuring employee welfare, working conditions and timely compensation and other benefits so that trade unionism does not turn to be a menace to organizational stability.

On the whole, this edition of *NIU Management Sciences* features many empirical and theoretical based articles which can be of great benefit to every reader.

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Curbing Fraudulent Activities in Deposit Money Banks: The role of Blockchain Technology in Nigeria

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Abstract. As digital intermediation accelerates, Nigerian deposit money banks (DMBs) confront rising cyber-enabled fraud since the launch of Bitcoin in 2009, despite ongoing reforms. Most blockchain research still centres on cryptocurrencies, with relatively few studies examining their applications in other industries. This study investigates whether blockchain technology (smart contracts, permissioned distributed ledgers, and secure digital wallets) is associated with lower fraud in Nigerian DMBs.Using survey data from 120 bankers across five institutions spanning international, national, and regional licenses, we estimate Ordinary Least Squares (OLS) models relating each BCT dimension, and a composite index, to two outcomes: spread of fraud (SOF) and internet fraud activities (IFA). Reliability analysis shows strong internal consistency (α = 0.75–0.91). Models include robustness checks for multicollinearity and specification. Results indicate that higher perceived deployment of smart contracts, distributed ledger, and digital wallet capabilities is negatively and significantly associated with SOF and IFA; a composite BCT index positively predicts overall fraud-reduction assessments. These findings align with recent sectoral evidence that blockchain adoption lowers fraud-related costs and enhances transaction integrity in banking. Given Nigeria's elevated incidence of electronic fraud in retail payments, the practical implication is that embedding programmable controls, tamper-evident shared records, and cryptographic authentication can harden high-risk processes. We recommend that regulators and DMBs advance permissioned BCT pilots integrated with Anti-Money Laundering (AML) and Know Your Customer (KYC) workflows, strengthen reporting standards, and build human-capital readiness. Beyond cryptocurrency, enterprise-grade BCT offers credible pathways to reduce fraud externalities and improve operational resilience in Nigeria's banking sector.

Keywords: Blockchain; Smart contracts; Distributed ledger; Digital wallet; Bank fraud; Nigeria.

1. Introduction

Information and communication technologies have transformed financial intermediation, compressing time and distance in payments, credit, and market access. Yet the same digitization has widened the attack surface for criminal exploitation. Nigerian deposit money banks (DMBs) which are central to savings mobilisation and the payments backbone, are particularly exposed as retail transactions migrate to mobile and card rails. In 2023 alone, Nigeria Inter-Bank Settlement System (NIBSS) recorded tens of thousands of successful fraud cases, with electronic channels dominating the modus operandi, underscoring the urgency of control innovations (NIBSS, 2024; CBN, 2024). Against this backdrop, blockchain technology (BCT) has evolved from its cryptocurrency origins into an enterprise toolset offering append-only, consensus-verified records and programmable business logic (Cong & He, 2019; Pilkington, 2016). Recent empirical work in banking links BCT adoption with reductions in fraud-related costs and enhanced transaction security (Ahmed, 2025; Almadadha, 2025; Al-Dmour et al., 2024).

Conceptually, three BCT capabilities map tightly onto fraud-control pain points in Nigerian banking. First,

smart contracts encode preventive controls via multi-party approvals, time locks, exposure thresholds, so that exceptions and entitlements are enforced automatically, shrinking windows for human manipulation (Bassan, 2024; Cong & He, 2019). Second, permissioned distributed ledgers synchronize a single source of truth across authorized nodes, making post-hoc alteration conspicuous and raising the coalition size required for insider collusion (Tschorsch & Scheuermann, 2016). Third, secure digital wallets extend cryptographic identity and authentication to end-users and devices, mitigating credential replay and SIM-swap fraud vectors prevalent in the Nigerian retail context (NIBSS, 2024). These properties jointly target the "opportunity" and "capability" legs of the fraud diamond by reducing editability, discretion, and information asymmetry at control points.

The policy environment is also shifting. Nigerian authorities emphasize stronger reporting and collaborative defenses in e-payments (CBN, 2024). Internationally, tier-one banks are piloting blockchain-based payment and settlement rails with automated settlement and auditable histories, which show evidence that BCT's operational claims are becoming production-relevant (Reuters, 2025). In parallel, research synthesizing over a hundred studies finds a maturing consensus that BCT improves data integrity and compliance automation, while noting integration and governance challenges (Shi *et al.,* 2025). This external validation supports examining whether similar benefits are detectable, at least perceptually, in Nigerian DMBs.

Despite growing global evidence, rigorous bank-level analyses within Nigeria remain scarce, often focusing on cryptocurrencies rather than enterprise BCT. The majority of current blockchain research is focused on its application to cryptocurrencies such as Bitcoin, with only a small number of researchers investigating the use of Blockchain Innovation in other situations or segments. Blockchain innovation is more than just fair cryptocurrency; it has numerous applications in government, finance, banking, accounting, and business administration. Therefore, to fill the gap, this study explored and investigates its openings and challenges by examining the effect of blockchain technology on curbing fraudulent activities in Deposit Money Banks in Nigeria. The present study addresses this gap by: (i) operationalising BCT through three constructs (smart contracts, distributed ledger, and digital wallets) reflecting capabilities most plausibly connected to control enhancement; (ii) defining two outcome measures aligned to Nigeria's threat landscape, including spread of fraud (SOF) and internet fraud activities (IFA); and (iii) estimating interpretable models with reliability diagnostics and specification checks. By anchoring the measurement strategy in control-relevant mechanisms rather than generalised "blockchain awareness," the analysis better aligns with how DMBs actually deploy technology to mitigate fraud.

The contribution is threefold. First, the paper provides up-to-date sectoral context by situating Nigerian fraud exposure within documented trends in retail electronic channels (NIBSS, 2024) and supervisory expectations (CBN, 2024). Second, it ties micro-level BCT mechanisms to canonical economic and criminological theories: immutability and consensus reduce post-transaction opportunism; programmability turns policy into executable rules, thereby constraining agency problems (Cong & He, 2019). Third, it connects local findings to emerging international evidence that BCT adoption correlates with lower fraud and security costs in banking (Ahmed, 2025; Almadadha, 2025; Al-Dmour et al., 2024) and to compliance automation prospects around AML/KYC (Ogunrinde, 2025).

The main objective of the study is to examine the effect of blockchain technology on curbing fraudulent activities in deposit money bank in Nigeria. The specific objectives are to:

- evaluate blockchain technology effect on curbing spread of fraud in deposit money banks in Nigeria.
- assess blockchain technology effect on curbing internet fraud activities in deposit money banks in Nigeria

To achieve the specific objectives, the study hypothesized that:

$H_0$1: Blockchain technology plays no significant role in curbing spread of fraud in deposit money banks in Nigeria

$H_0$2: Blockchain technology plays no significant role in curbing internet fraud activities in deposit money banks in Nigeria.

We proceed as follows. Section 2 reviews the state of BCT, smart contracts, permissioned ledgers, and digital wallets, highlighting applications, risks, and Nigerian-specific considerations, and augments the empirical literature with recent banking studies. Section 3 details the research design, sampling across license categories, validity and reliability procedures, and model specifications. Section 4 presents result with robust checks and diagnostic tests. Section 5 interprets the findings in light of Nigeria's fraud

landscape and international pilots, and Section 6 outlines actionable recommendations for DMBs and policymakers, including permissioned-ledger pilots for high-risk workflows (dispute management, chargeback resolution, high-value transfers), wallet-level cryptographic controls, and smart-contract guardrails for entitlements and reconciliation. By evidencing significant negative associations between perceived BCT deployment and fraud outcomes, this study contributes Nigeria-specific, practitioner-relevant evidence to a fast-moving global conversation on hardening banking operations with blockchain.

2. Literature Review

2.1 Blockchain Technology: Overview, Applications, and Risks

Blockchain technology refers to append-only, consensus-validated ledgers that distribute verification across multiple nodes, reducing single points of failure and aligning incentives around a shared, tamper-evident record (Cong & He, 2019). In banking, permissioned implementations, rather than open, permissionless networks, dominate production pilots because they can enforce access control, privacy layers, and throughput guarantees needed for regulated financial intermediation. Beyond payments and settlements, banks increasingly explore blockchain for KYC/AML data-sharing, trade finance, collateral registries, and audit trails that support internal control testing (Ma, 2024; Al-Dmour et al., 2024). By enabling deterministic execution of rules and synchronized books-of-record, blockchain reduces reconciliation frictions and narrows windows in which fraudsters or insiders can manipulate states ex post. Empirical and review evidence in 2024–2025 reports associations between blockchain adoption and lower fraud risk or compliance costs through improved traceability, automated controls, and auditability (Al-Dmour et al., 2024; Ogunrinde, 2025; Guo, 2025).

Governance failures can re-centralize power (e.g., validator cartels) or weaken change-control; interoperability constraints can strand data; and legal enforceability of "smart legal contracts" is jurisdiction-dependent (Bassan, 2024). Privacy-preserving designs (e.g., proof systems that selectively reveal compliance-relevant properties) aim to balance transparency with data-protection mandates (Buterin et al., 2024). Operationally, throughput/latency trade-offs persist, though permissioned architectures mitigate many performance bottlenecks. For Nigerian DMBs, risks are as much organizational as technical: talent scarcity, vendor lock-in, and process misfit can blunt benefits even when pilots succeed technologically. Still, the direction of travel is clear: where processes require shared truth and automated exception-handling, permissioned BCT can credibly harden controls and lower the expected value of fraud. This framing extends your manuscript's baseline account of BCT while updating applications/risks with current banking evidence.

2.1.1 Smart Contracts: A Revolutionary Application

Smart contracts encode business logic that executes when pre-specified states or events are verified on-chain, eliminating manual handoffs and lowering discretion at control points (Cong & He, 2019). In retail and corporate banking, such logic can enforce multi-factor approvals for high-risk actions (e.g., beneficiary changes, bulk-payment releases), implement time-locks and exposure caps, and trigger enhanced due-diligence workflows before settlement, controls that are otherwise vulnerable to social engineering or insider override. Recent empirical studies underscore both promise and limits. On the upside, studies report improved control effectiveness and auditability when BCT underpins process execution, with observable reductions in exception rates and reconciliation breaks (Ma, 2024; Ogunrinde, 2025). On the downside, oracles and off-chain dependencies introduce new attack surfaces, and contract immutability can ossify defects without robust upgrade paths (Bassan, 2024). Privacy-enhancing designs such as "Privacy Pools" propose selective disclosure to satisfy AML/CFT requirements while preserving user confidentiality (Buterin et al., 2024).

For Nigerian DMBs, the relevance is practical: encode exception-handling for disputed transfers; implement rule-based disbursement for loan proceeds contingent on verified milestones; and automate sanctions/KYC screens prior to value movement. In principle, these features counteract two legs of the fraud diamond (opportunity and capability) by constraining editability and shrinking windows for collusion. This subsection refines the discussion already present in your manuscript by tying smart-contract mechanisms to specific fraud-control scenarios common to Nigerian channels.

2.1.2 Distributed Ledger Technology (DLT): Decentralization and Security

Distributed ledgers maintain synchronised records across authorized nodes, making unilateral alteration conspicuous and raising the coalition size required for insider fraud. In permissioned banking deployments,

consensus mechanisms are calibrated for finality and throughput (e.g., PBFT-style variants), while access layers segment read/write privileges to align with bank secrecy laws. Empirical banking research indicates that DLT can reduce settlement times, lower reconciliation effort, and produce auditable histories that deter post-hoc manipulation, mechanisms tightly linked to fraud-loss reduction (Al-Dmour et al., 2024). Complementary evidence from internal-control studies shows BaaS architectures improving logging integrity and control-testing efficiency (Ma, 2024). Where DLT undergoes interbank workflows (e.g., trade finance), programmable checks and shared state reduce duplicate financing and document fraud.

Nevertheless, decentralisation is not a panacea. Poor key management, weak node governance, or misaligned incentives can reintroduce central points of failure. Interoperability with core banking systems and payment gateways remains a major integration cost. For Nigerian DMBs, consortium governance and regulator-observer nodes can mitigate coordination risks while preserving auditability. The balance of current evidence suggests that well-governed permissioned DLTs, rather than public chains, are the pragmatic route for regulated institutions seeking fraud-resilient operations. This expands and updates your manuscript's foundation on DLT's role in decentralization and security.

2.1.3 Digital Wallets: Enhancing Blockchain Usability

Digital wallets operationalize cryptographic identity and authorization. Properly implemented, they embed strong credential protection (e.g., hardware-backed keys, secure enclaves), multi-factor prompts, and transaction-signing that binds intent to device and user. In the Nigerian retail context, wallet security directly intersects with high-incidence fraud vectors such as SIM-swap and social-engineering attacks. Regional and continental threat assessments from 2024–2025 document rising SIM-swap prevalence and its role in account takeovers; risk is amplified where USSD-based journeys and weak KYC controls persist (INTERPOL, 2025; Regulation Innovation, 2024). Wallet hardening, FIDO-class authenticators, number-binding, and biometric re-verification for sensitive actions, reduces the expected payoff of credential-theft attacks by making step-up friction unavoidable at high-risk moments.

Empirically, digital-identity enhancements combined with behavioral analytics have been associated with significant drops in mobile-channel fraud in African pilots, though equity risks (e.g., biometric failure rates) must be managed (GSMA/SSRN syntheses, 2024–2025). For banks piloting blockchain rails, wallets provide the user-facing boundary where private keys authorize rule-bound transfers; thus, wallet design is inseparable from control design. This subsection anchors your original emphasis on wallets while integrating up-to-date regional fraud patterns and mitigation evidence salient for Nigerian DMBs.

2.1.4 Blockchain's Potential in Nigeria

In Nigeria, blockchain technology, especially in cryptocurrencies, has sparked debates about its economic implications. Bitcoin and other digital currencies are seen as tools for financial recovery and investment opportunities. Blockchain's transparent and secure systems also hold promise for addressing fraud and inefficiencies in financial transactions (Mehedi, 2021). Blockchain technology can transform various sectors by enabling decentralized, secure, and efficient systems. For example, digital wallets and smart contracts can streamline financial services, enhance contract management, and improve overall trust in digital transactions (Hodge, 2020; Kshetri, 2018). However, the adoption of blockchain in Nigeria requires addressing regulatory challenges, technological barriers, and public awareness to realize its full potential.

Nigeria's accelerating digitization has expanded the payments surface and, with it, fraud externalities. The NIBSS 2023 fraud landscape shows sharp rises in losses through certain e-channels and highlights organized social-engineering schemes; ATM fraud fell, but internet-banking losses spiked, underscoring that risk migrates across rails as controls harden unevenly (NIBSS, 2024). Supervisory messaging in 2024 emphasised collaborative defences and continuous innovation in the payment system (CBN, 2024). Within this environment, blockchain's most credible near-term value is not speculative crypto exposure but permissioned, bank-regulated deployments that: (i) encode entitlements and exception rules, (ii) synchronize tamper-evident records across counterparties, and (iii) strengthen identity-to-transaction binding via hardened wallets.

Barriers such as skill gaps, integration cost, absence of shared utilities (e.g., KYC registries), and questions of legal enforceability for code-as-contract. Yet international pilots demonstrate feasibility for payment, settlement, and trade-finance use cases with reported reductions in reconciliation effort and fraud risk, evidence that can inform Nigerian pilots under regulatory sandboxes. Strategically, DMBs can target high-loss workflows first (internet-banking dispute management, card-not-present chargebacks, corporate

bulk transfers) and measure marginal fraud-loss reductions against deployment costs. This subsection faithfully extends your Nigeria-specific framing while grounding it in current statistics and policy signals.

Nigeria's rapid adoption of digital payments coincides with high cyber fraud exposure (Ololade et al., 2020). BCT's transparency and programmability offer credible pathways to mitigate SIM swap misuse, mule networks, and credential stuffing by hardening identity and enforcing rule-based controls. Yet uptake hinges on regulatory clarity, interoperability with core banking, and human capital readiness. Conclusively, blockchain technology, with its transformative applications like cryptocurrencies, smart contracts, and digital wallets, is reshaping industries by providing decentralized, secure, and transparent solutions. While its potential to revolutionize sectors is undeniable, challenges such as scaling, regulatory oversight, and technical risks must be addressed. In Nigeria and beyond, leveraging blockchain's benefits requires strategic adoption and a commitment to overcoming its limitations.

2.2 Curbing Fraudulent Activities

Classic frameworks, the fraud triangle and its "fraud diamond" extension, locate misconduct at the intersection of pressure/incentive, opportunity, rationalization, and capability. Digital banking in Nigeria intensifies pressure (economic stressors), lowers discovery costs for capable actors (phishing kits, SIM-swap facilitation), and, when controls lag, expands opportunity. Effective counter-fraud therefore prioritizes shrinking opportunities and limiting capabilities without unduly degrading user experience. Blockchain capabilities map directly onto these levers.

Opportunity reduction through immutability and shared state. Permissioned ledgers create an append-only, time-stamped event history visible to authorized parties. For internal fraud, this increases the coalition size required for tampering and makes unauthorized post-hoc edits conspicuous. For external fraud, immutable trails facilitate faster dispute adjudication and recovery by clarifying provenance (who authorized what, when, under which rules). Empirical banking studies in 2024–2025 report that DLT adoption reduces reconciliation breaks and supports stronger control-testing, mechanisms linked to lower fraud-related costs (Al-Dmour et al., 2024; Ma, 2024).

Capability constraints via programmable controls. Smart contracts translate policy into executable code, multi-party approvals, velocity limits, geofenced authorizations, so that high-risk actions require cryptographic concurrence. This compresses the "window of malfeasance" and limits insider override. Reviews and empirical work highlight reductions in manual exception handling and improved auditability when rules are encoded rather than merely documented (Ogunrinde, 2025; Guo, 2025). Legal-tech analyses caution that contract upgradability and oracle design are critical to avoid freezing defects into production (Bassan, 2024).

Identity hardening at the wallet edge. Since most Nigerian fraud losses manifest through retail channels with identity takeovers, wallet controls, including secure key storage, device binding, and step-up authentication, are decisive. Regional assessments show SIM-swap and social-engineering as dominant tactics, implying that controls must bind authorization to verified user-device pairs and trigger adaptive challenges for unusual behavior (INTERPOL, 2025; Regulation Innovation, 2024). Wallets can also embed consent receipts and transaction-purpose attestations that improve dispute resolution. Data-sharing and AML/KYC compliance. Fraud and AML risks overlap; proceeds of fraud flow through mule accounts, and weak KYC allows account proliferation. Blockchain-based KYC utilities and privacy-preserving disclosure protocols enable cross-institution verification without centralized honeypots. Recent work argues that shared ledgers and selective disclosure can streamline monitoring and raise detection precision, though they do not obviate regulatory obligations (Hafe & colleagues, 2025; AML/CFT analyses, 2024–2025).

Implications for Nigerian DMBs. Given NIBSS-documented spikes in internet-banking losses in 2023, banks should prioritize internet-channel entitlements and onboarding flows for BCT augmentation (NIBSS, 2024). Pilot roadmaps can adopt three horizons: (1) Control-layer pilots, encode approval chains and velocity limits for high-risk payments; (2) Data-layer pilots, permissioned ledgers for dispute management and chargeback evidence, integrating with existing core systems; (3) Identity-layer pilots—wallet hardening and number-binding to counter SIM-swap. Across horizons, independent model validation and adversarial testing (red-team simulations) should precede scale-up. These recommendations extend your manuscript's fraud-mitigation logic while anchoring it in current empirical and supervisory signals.

2.2.1 Spread of Fraud

"Spread of fraud" captures diffusion across channels, products, and customer segments. Nigerian data show

risk migration: as ATM and some web modalities harden, losses concentrate in internet-banking incidents and social-engineering-enabled takeovers (NIBSS, 2024). Containment therefore requires both lateral barriers (so compromises in one channel cannot be replayed in others) and vertical barriers (so a single compromise cannot escalate from low- to high-privilege actions). Lateral barriers with shared ledgers. Permissioned DLTs can synchronize interdiction states (e.g., device ban-lists, mule-account indicators) across channels and counterparties with strong proof. When a bank flags a beneficiary as associated with fraud, a consortium ledger can propagate this state, subject to due-process guardrails, so other participants adjust risk scoring. Studies in 2024–2025 emphasize the compliance and fraud-prevention benefits of shared, verifiable provenance that reduces duplicate financing and cross-institution exploits (Al-Dmour et al., 2024; Ma, 2024).

Vertical barriers with smart-contract entitlements, including encoding entitlements, prevent privilege escalation: new device registrations, profile changes, or high-value transfers require threshold signatures or time-locks. For corporate bulk payments, a Nigerian hotspot given large ticket sizes, contracts can enforce per-beneficiary and per-batch limits and require co-signers from separate departments. Reviews and empirical syntheses indicate that such rule-binding reduces error/fraud incidence and improves ex-post traceability for audit (Ogunrinde, 2025; Guo, 2025). Wallet-centric identity controls to slow diffusion through SIM-swap and phishing expand fraud's "spread" by enabling credential portability. Evidence from African pilots shows large fraud reductions when biometric re-verification is required for sensitive actions and when behavioral analytics gate anomalous sessions (SSRN/GSMA syntheses, 2024–2025). For Nigeria, where USSD remains salient, number-binding and transaction-signing, so authorization is cryptographically tied to a specific device key, reduce replay risk even after phone-number compromise (INTERPOL, 2025; Regulation Innovation, 2024).

Measurement and expected effects. Your study's SOF construct (and composite CFA index) can be interpreted as capturing these containment mechanisms: if BCT deployment compresses successful replay across channels and raises the coalition size for inside jobs, perceived SOF should fall. This interpretation is consistent with your empirical results showing significant negative associations between BCT dimensions and fraud outcomes.

2.2.2 Internet Fraud Activities (IFA)

Nigeria's internet-banking fraud losses rose sharply in 2023, driven by credential theft, session hijacking, and insider-enabled exploits; a single large internal incident amplified the aggregate loss picture (NIBSS, 2024). In this domain, blockchain's most actionable levers are (i) programmable pre-settlement checks (smart-contract-enforced sanctions/KYC screens and velocity limits), (ii) immutable evidence (tamper-evident event chains for rapid dispute resolution), and (iii) wallet hardening (private-key protection, device binding, and adaptive authentication). AML-aligned designs enable selective disclosure to satisfy monitoring mandates without over-exposing personal data (Hafe et al., 2025). Empirical finance and information-systems studies report that banks adopting DLT-backed settlement or control layers experience lower exception rates and fewer fraud opportunities due to synchronized state and automated entitlements (Al-Dmour et al., 2024; Ma, 2024). While causality is hard to prove outside controlled pilots, converging evidence and mechanism plausibility support your study's findings that higher perceived deployment of smart contracts, distributed ledgers, and hardened wallets is associated with lower IFA.

2.3 Theoretical Framework

The researcher based the work on the new growth theory and fraud diamond. The new growth theory is concerned with the relationship between the growth of the economy and the growth of information and knowledge. The essential point of new growth theory is that knowledge drives growth. The major assumptions of new growth theory are that technological progress is a product of economic activity whereas previous theories treated technology as a product of non-market forces. While the fraud diamond, is an extension of the fraud triangle theory to include the capability element of the fraudster. Fraud diamond states that if all four components are present, unshakable capacity, perceived opportunity, incentive and rationalization, a person is highly likely to pursue fraudulent activities.

To deepen the theoretical grounding, we juxtapose blockchain's core properties with canonical fraud theories. Immutability constrains post transaction opportunism by making alterations conspicuous in the shared history, thereby heightening perceived detection and diminishing rationalisation (Taylor et al., 2014). Consensus protocols distribute verification across nodes, approximating separation of duties; no single insider can unilaterally rewrite history without collusion, which raises the minimum coalition size and

coordination costs for fraud (Mainelli & Smith, 2015; Tschorsch & Scheuermann, 2016). Programmability via smart contracts codifies preventive controls—authorization limits, time locks, or multi factor conditions, transforming informal policies into executable rules (Cong & He, 2019). Empirical literature, albeit heterogeneous, increasingly reports integrity gains: supply chain trials show fewer discrepancies and faster exception resolution (Saberi et al., 2019; Kamilaris et al., 2019), trade finance pilots reduce document fraud via shared state and digitised guarantees (Bogucharskov, 2018; Eyers, 2020), and cybersecurity studies leverage blockchain anchored logs for forensic assurance (Chikelue, 2020).

We note implementation risks, a key mismanagement, privacy leakage, and vendor lock in that, if unaddressed, can reintroduce vulnerabilities (Zheng et al., 2017; Chauhan, 2018). For financial institutions, permissioned DLT with granular roles and privacy overlays (e.g., channels, zero knowledge proofs) is often preferable to permissionless designs because it satisfies confidentiality mandates while preserving shared provenance (Risius & Spohrer, 2017). Nigerian banking presents a high value laboratory: pervasive mobile payments, elevated phishing and SIM swap attacks, and growing regulator interest in digital identity. Yet rigorous bank level studies remain scarce. This lacuna motivates the operationalised constructs, such as smart contracts, DLT, and digital wallets and outcome measures, including SOF and IFA, selected to reflect control points where blockchain's marginal impact is most plausible.

This study is anchored in three complementary lenses vis-a-vis fraud triangle/diamond, principal–agent theory, and information asymmetry, that jointly explain why digital banking is vulnerable to misconduct and how enterprise blockchain capabilities could suppress that vulnerability. According to fraud triangle/diamond theories, Cressey's classic formulation posits that fraud emerges when pressure and opportunity coincide and offenders rationalize their actions; the "fraud diamond" adds capability as a fourth condition (Cressey, 1953; Wolfe & Hermanson, 2004; Mainelli & Smith, 2015). In Nigerian retail and internet banking, macroeconomic stressors elevate pressure, while credential replay, weak device binding, and manual entitlements present opportunity and require modest technical capability. The three blockchain capabilities map tightly onto the opportunity–capability axis. Permissioned distributed ledgers harden records ex post by making alteration conspicuous and multi-party, thus raising the coalition size for successful manipulation (Tschorsch & Scheuermann, 2016). Smart contracts shrink discretionary windows and human overrides by turning policy into executable rules (e.g., velocity limits, time locks, co-signing thresholds). Secure digital wallets constrain capability at the edge by binding authorization to devices and private keys and forcing step-up authentication for high-risk actions. If these mechanisms work as intended, the expected utility of fraud falls because both the probability of success and the probability of escaping detection decline (Cressey, 1953; Wolfe & Hermanson, 2004).

Agency theory formalises how misaligned incentives and imperfect monitoring generate agency costs (Jensen & Meckling, 1976). In banking, clients (principals) rely on banks (agents) to process payments truthfully; within banks, managers (principals) rely on staff (agents) to administer entitlements and resolve disputes. Two agency frictions are salient: (i) moral hazard—agents may exploit private discretion in low-visibility steps; and (ii) monitoring and bonding costs—principals must invest in controls and audits (Saberi et al., 2019; Kamilaris et al., 2019). Permissioned ledgers reduce the scope for hidden action by synchronizing an append-only "book of record" across authorized nodes, and smart contracts curtail opportunistic deviations by executing rule-bound steps deterministically (Jensen & Meckling, 1976; Cong & He, 2019). Wallet-level cryptographic identity is a bonding device: transactions require the customer (or authorized staff device) to present verifiable proof of intent. Taken together, blockchain capabilities are predicted to reduce agency costs by compressing informational slack and converting discretionary checkpoints into verifiable, auditable events.

In addition, Akerlof (1970) shows that when one side holds private information, adverse selection and moral hazard can unravel market quality. In digital payments, counterparties and intermediaries observe different slices of truth (device state, KYC quality, sanctions status), creating room for both *ex-ante* selection of risky relationships and ex post manipulation of logs. Permissioned DLT and standardized event schemas reduce asymmetry by producing a tamper-evident, time-stamped trail that multiple parties can verify, while privacy-preserving proofs enable selective disclosure of compliance properties (Akerlof, 1970; Buterin et al., 2024). In principle, this shifts the environment from "hidden" to "constrained" information, improving screening and reducing disputes.

Combining these lenses yields testable predictions aligned with the constructs and outcomes: Higher perceived deployment of smart contracts will be associated with lower SOF and IFA, because

programmable approvals, velocity limits, and pre-settlement checks reduce exploitable discretion (Cong & He, 2019). Also, higher perceived deployment of permissioned ledgers will be associated with lower SOF and IFA, as shared, immutable state improves monitoring and deters post-hoc edits (Al-Dmour et al., 2024), while higher perceived deployment of secure digital wallets will be associated with lower SOF and IFA, as device binding, private-key control, and adaptive authentication suppress account-takeover vectors common in Nigeria. Lastly, a composite BCT index will negatively relate to fraud outcomes because simultaneous improvements in process integrity, record immutability, and identity assurance are complementary, not additive (Ahmed, 2025; Almadadha, 2025). These propositions connect criminological and micro-contracting theory to concrete control technologies that Nigerian DMBs can pilot under existing regulation. They also rationalize why perceptual measures of BCT deployment (as used in your instrument) should correlate with bankers' assessments of fraud exposure: the mechanisms are salient to day-to-day workflows in internet banking, dispute management, and high-value transfers.

2.4 Empirical Review of Literature

2.4.1 Blockchain Technology and Spread of Fraud

Vivekanadam, (2020) examined blockchain as a computerized record in which each record known as squares are combined in a single list known as a chain. It is respected as Bitcoin's spine innovation. It is additionally respected as cohesive collections of digital wallets. Blockchains are basically utilized by cryptocurrencies such as Bitcoin and other applications to record these exchanges. A blockchain is commonly alluded to as a collection of dispersed databases that comprises of all open exchanges, records and advanced occasions at that point that data is shared among the members. Each exchange is confirmed and it cannot be evacuated. The blockchain can be utilized for trading the exchange safely without a middleman. It empowers client relationships and supply chain values and, subsequently, coordination with IoT and Cloud innovation. The usefulness of disseminated record is combined with blockchain security to illuminate the money related and non-financial industry issues. The paper proposes blockchain technology with gadgets and creates a common stage for secure information communication.

Chikelue*et al*. (2020) sought to investigate the appropriation of Blockchain technology for the cyber security of developing market multinational organizations (EMNCs) with a diagram of Nigerian internationalized banks. Auxiliary information from the Web Crime Complaint Center, Proshare, and Africa's cybersecurity report were examined and talked about. Based on the information obtained, it was concluded that Blockchain technology will make cybercrime prohibitively expensive for perpetrators, thereby immobilizing cyber hoodlums. The study becomes instrumental for rising market multinational organizations (EMNCs) by recommending arrangements for cybercrime challenges. The suggestion of the consider is that execution will move forward for Nigerian banks ought to they embrace Blockchain technology for cyber security. It'll drive development through the minimization of cybercrime misfortunes and reposition the banks to be deliberately competitive with developed banks within the industry. This encourages the modern development hypothesis.

Mehedi, (2021) investigated the effects of blockchain technology on universal exchange and discovered how blockchain technology can progress the different area s of universal exchange. The research also aims to discover the challenges with respect to the execution of blockchain technology in worldwide exchange to assist companies accomplish effective collaboration and understand what prerequisites must be met to make progress. The study's findings secured the fundamentals of blockchain technology; blockchain's role in encouraging supply chain and exchange funds; the impact and selection of blockchain technology; and the key challenges of blockchain implementation. A subjective approach was utilized based on 12 semi-structured in-depth interviews with ten companies working in completely different commerce areas and two blockchain master's to get experimental information.

Moreover, a few proposals with respect to the large-scale usage of blockchain in exchange funds were displayed. The discoveries of the research have upgraded the current level of inquire about the connection between blockchain technology and universal exchange, and the investigation of different application regions perm its analysts to conduct an in-depth investigation of blockchain pertinence in numerous trade environment s. The experimental discoveries will aid companies in

creating their selection procedures and planning to ex ecute the innovation within the exchange handle.

In their research, Kiu *et al.* (2019) expressed that Blockchain Technology has been broadly investigated and ceaselessly revolutioni zing numerous divisions around the world, counting the development industry. The development industry requires blockchain technology to make strides against the current restriction of centralized technology in its different venture life cycles. Within the paper, we displayed a writing audit, pointing to the possibilities of Blockchain applications in the development industry. The paper also surveyed the special highlights of the blockchain technology, which trigger its capabilities in the development industry. The paper advanced investigated the blockchain application suggestions if they were received in the development industry. In brief, blockchain innovation is still moderately modern in the development industry and requires profound research to create a genuine life-on-hand application for the development industry soon.

Gul (2021) considered the impacts of blockchain technology on the environment, economy, and society, which are the three fundamental zones of maintainable advancement. It can be said that blockchain technology has both positive and negative impacts on these three fundamental ranges. Giving the opportunity to build collective esteem and support social impact ventures with a focus on sustainable society, innovation also empowers majority rule information administration. Blockchain technology has the potential to expand budgetary consideration by allowing the improvement of unused commerce models with a focus on sustainable economy. Whereas blockchains working with a proof-of-work strategy have the potential to hurt the environment with their high vitality utilization, blockchains working with distinctive strategies can decrease vitality utiliza tion. Simultaneously, it is anticipated that the negative impacts of this innovation on the feasible environment can be eliminated with the use of renewable vitality assets in mining.

2.4.2 Blockchain Technology and Internet fraud Activities

Together with the mindfulness of the 51% assault, investigated by Eyal and Sirer (2014), it appears that it is conceivable for miners to pick up income by having as if it were 25% computing control. Usually what they call "selfish mining attacks." The thought behind it is that rather than broadcasting to the organization after mining the squares, the "selfish miners" keep the found squares private with the expectation of inevitably forking the chain. Whereas the genuine hubs keep mining on the open chain, the childish diggers keep working on mining modern squares and keeping the pieces to themselves. Reyna et al. (2018) state that blockchain seems to enhance the IoT with its transparent feature, which makes it simpler to follow back exercises, in this way improving security. Furthermore, a decentralized peer-to-peer IoT framework is expected to enable better control of IoT administrations to keep track of the data stream, comprehend the issue related to high support costs caused by centralized frameworks, and enable the robotized handling of merchandise and administrations (Casino, 2019).

Blockchain can also move forward a few segments of the IoT, such as a modern IoT E-business show proposed by Zhang et al. (2015) in which commerce forms can be moved to the blockchain, coming about in conveyed independent organizations where trade capacities are robotized and supplant human performing artists (Zhang et al., 2015; Zheng et al., 2018). IBM and Samsung also employ its verification of concept for Independent Decentralized Peer-to-Peer Telemetry, which permits smart-home proprietors to distinguish operational issues and upgrade the computer program by themselves (Zheng et al., 2017; IBM & Samsung, 2015). Iansiti and Lakhani (2017) compare blockchain to TCP/IP, proposing that blockchain has the potential to be the spine of the IoT.

Recently, empirical evidence on enterprise blockchain in banking has shifted from conceptual to measurement-based studies, with several findings relevant to fraud exposure and control effectiveness. In multi-bank samples, Al-Dmour et al. (2024) report positive associations between blockchain applications and commercial bank performance, attributing part of the effect to improved data integrity, traceability, and control automation that lower exception handling and dispute costs. Ahmed (2025) quantifies cost channels in banking transactions and finds that blockchain adoption significantly reduces processing, transfer, and fraud costs, evidence consistent with opportunity-reducing mechanisms. Almadadha (2025) shows that Australian banks adopting blockchain post higher ROA/ROE, consistent with operational efficiencies; although profitability is a broad outcome, authors trace

gains to reconciliation and error-reduction effects that also underpin fraud mitigation. Ma et al. (2024) (accounting/control setting) find that BaaS-enabled internal controls improve logging integrity and control-testing efficiency, again pointing to the same channels, immutability and synchronized state, that your study investigates.

In process-specific studies, for instance trade finance, where duplicate invoicing and document forgery are endemic, recent reviews and pilots indicate that DLT reduces processing times and fraud risk by anchoring documents and events on a shared ledger with programmable checks (Mazumder, 2025). Supervisory and standard-setting bodies similarly emphasize that tokenization and DLT can increase transparency and auditability across clearing and settlement, while cautioning that benefits need careful validation (FSB, 2024; BIS, 2025). These findings speak to your SOF construct: as provenance is standardized and shared, fraud has fewer paths to spread across products and counterparties. On the edge of the system, wallet design determines whether authorization can be replayed or hijacked. Regional cyber-threat assessments and policy reports for Africa (2024–2025) document SIM-swap and social-engineering as dominant takeover paths; strengthened device binding, biometric step-ups for sensitive actions, and number binding materially reduce successful attacks, precisely the elements embodied in secure wallet deployments (e.g., FIDO-class authenticators) (INTERPOL, 2025). Although not solely blockchain-dependent, wallets are the user-facing boundary of permissioned blockchain rails; thus, cryptographic keys and intent proofs provide a stronger evidentiary basis in disputes, which matters directly for IFA (internet banking fraud) and chargebacks.

In Nigeria-specific context,sectoral statistics for 2023 compiled by the Nigerian Inter-Bank Settlement System (NIBSS) show pronounced shifts of fraud losses toward internet-banking channels, underscoring that hardening card/ATM rails displaces rather than eliminates risk (NIBSS, 2024). Consumer-side survey evidence in 2024 (IPA Nigeria) indicates high exposure to scam attempts but lower self-reported realized losses, consistent with partial control improvements yet persistent social-engineering pressure (IPA, 2024). These patterns motivate a focus on internet-banking entitlements and dispute-resolution processes where permissioned ledgers, and smart contracts can change the payoff calculus by (i) encoding approvals and pre-settlement checks; and (ii) creating tamper-evident evidentiary trails for rapid adjudication.

However, international policy reviews emphasize that while DLT promises better transparency and integrity, net benefits are context-dependent: governance quality, interoperability with core systems, and privacy-preserving compliance determine whether fraud falls (FSB, 2024; Buterin et al., 2024). Legal enforceability of smart-contract outcomes, upgradability patterns, and oracle design remain critical to avoid ossifying defects (Bassan, 2024). These conditions explain heterogeneous effects across banks and countries and reinforce the value of Nigeria-specific measurement, as undertaken in your study.

Across settings, results converge on a mechanism narrative: where blockchain functions as (i) a shared, tamper-evident record, (ii) a rule-execution layer for high-risk entitlements, and (iii) a cryptographic identity boundary at the wallet/device, banks report fewer reconciliation breaks, faster dispute resolution, and lower fraud-related costs. The finding that perceived deployment of smart contracts, permissioned ledgers, and secure wallets correlates negatively with SOF and IFA aligns with those mechanisms. It also fits agency and asymmetry predictions: less discretionary slack and more verifiable information imply fewer profitable fraud opportunities.

3. Research Methods and Procedure

3.1 Research design and setting

This study employs a cross-sectional, explanatory design to examine whether the perceived deployment of three blockchain technology (BCT) capabilities, smart contracts, permissioned distributed ledgers, and secure digital wallets, is associated with two fraud outcomes in Nigerian deposit money banks (DMBs): spread of fraud (SOF) and internet fraud activities (IFA). The design is appropriate because the objective is to test directional propositions derived from the fraud triangle/diamond, principal–agent theory, and information-asymmetry arguments, using bank-level perceptions as proximal measures of control intensity and fraud exposure. Cross-sectional surveys are widely used in internal control, information systems, and financial-intermediation research when construction (deployment breadth, perceived exposure) is latent, context-dependent, and difficult to observe directly (Hair et al., 2019; Kline, 2016). To discipline inference, the analysis incorporates comprehensive measurement validity checks, econometric diagnostics, and robustness analyses recommended for survey-based models (Podsakoff et al., 2003; Wooldridge, 2010).

On ethical grounds, the study adhered to ethical research norms, including voluntary participation, informed consent, anonymisation, and secure storage of de-identified data accessible only to the research team. No operational secrets, customer data, or personal identifiable information were collected. Reporting aggregates results to avoid re-identification risk. These safeguards align with professional standards for research in financial institutions.

3.2 Population, sampling, and data collection

The target population consists of employees of licensed Nigerian DMBs across international, national, and regional authorization categories. Consistent with sectoral heterogeneity, we sampled across core control-relevant functions, operations, e-channels, internal audit, risk/compliance, information security, and retail/corporate banking, so that responses reflect diverse vantage points in the fraud-control workflow. Stratification by license class and function improved coverage and mitigated single-bank or single-unit idiosyncrasies (Hair et al., 2019). Eligible respondents were mid- to senior-level staff with role responsibility or line-of-sight over payments, controls, or fraud case management. Data collection used a self-administered questionnaire with informed consent, anonymity assurances, and no personally identifiable information. Procedural remedies against common method bias (CMB) included: separating predictors and outcomes in the instrument; varying response formats; assuring respondents of no right/wrong answers; and positioning sensitive fraud-outcome items after less sensitive BCT items to reduce evaluation apprehension (Podsakoff *et al.,* 2003).

3.3 Validity and Reliability Tests

The reliability of the instrument was done through the test-retest method. That is to say, the instrument was pre-tested twice before proceeding to administer the instrument to the respondents.Construct validity was assessed via a two-stage approach. First, exploratory factor analysis (EFA) verified expected dimensionality. Second, confirmatory factor analysis (CFA) tested a three-factor BCT model and a two-factor outcomes model. Convergent validity requires standardized loadings ≥ .50 and average variance extracted (AVE) ≥ .50; reliability requires Cronbach's α and composite reliability (CR) ≥ .70 (Hair et al., 2019; Kline, 2016). Discriminant validity was evaluated via HTMT (threshold < .85–.90) and Fornell–Larcker criteria (AVE greater than squared inter-construct correlations). Model fit was judged using χ^2/df, CFI/TLI ≥ .90, RMSEA ≤ .08, and SRMR ≤ .08 (Kline, 2016). Item deletion was conservative, and theory guided.

On reliability regression testing using SPSS, the Cronbach's alpha value wasobtained. Table1 shows that the variables have high internal consistency which shows that the responses attached to each variable of interest are good for analyses.

Table 1: Reliability of the Blockchain Technology Questionnaires

Variable	Cronbach Alpha	Internal Consistency
Smart Contract	0.86	Excellent
Distributed Ledger	0.82	Excellent
Digital Wallet	0.91	Excellent
Spread of Fraud	0.73	Excellent
Internet Fraud	0.80	Excellent

Source: *Authors' Compilation*

Researcher's Conceptual Model

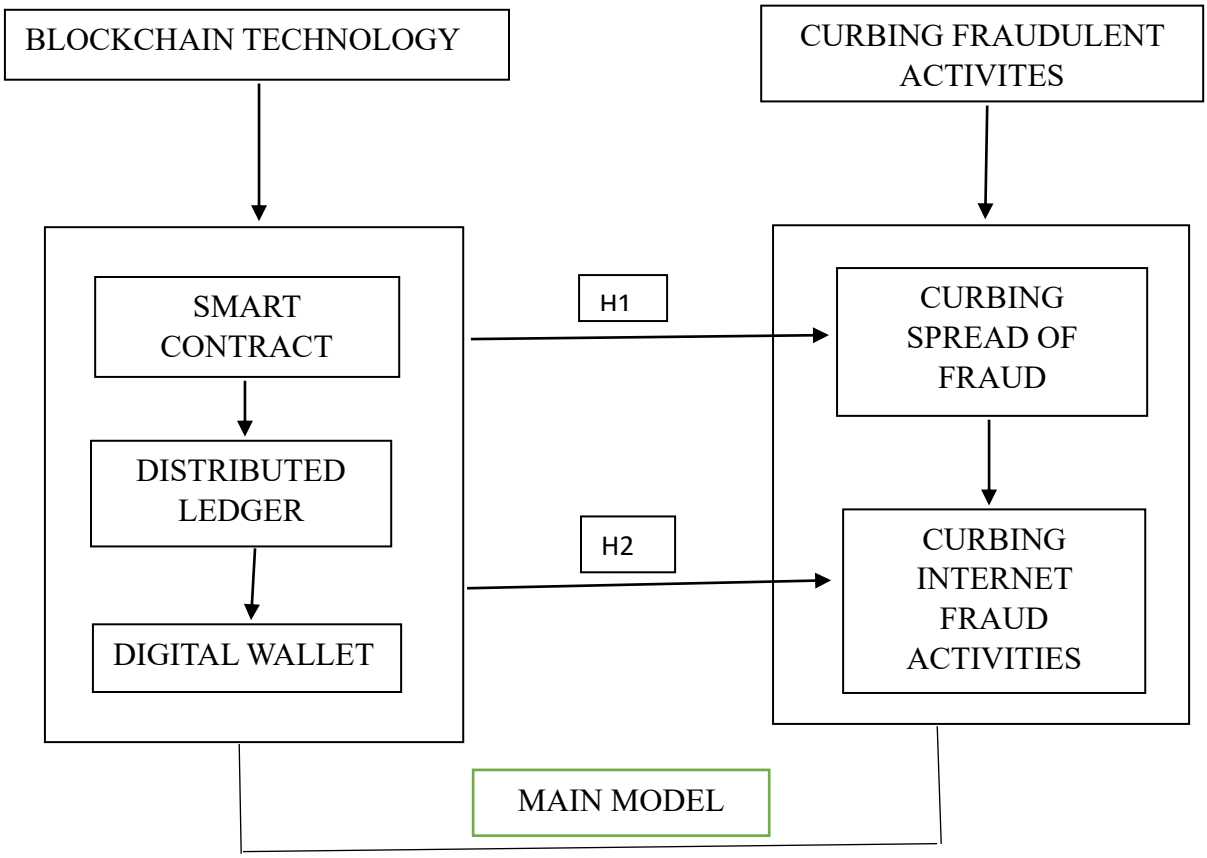

Figure 1: Conceptual Model, 2023

3.3 Model Specifications and Data Issues

Following the fraud triangle hypothesis, the baseline models to achieve the stated objectives are specified below:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \varepsilon_i \quad 1$$

Where Y, the Dependent Variable (Curbing Fraudulent Activities) is a 3*1 vector of dependent variable such as Curbing Fraudulent Activities (CFA), which is also proxied with Spread of Fraud (SOF) and Activities of Internet Fraud (IFA). The models are written explicitly in Equation 2-4:

$$SOF_i = \beta_0 + \beta_1 SMC_i + \beta_2 DIL_i + \beta_3 DIW_i + \varepsilon_i \quad 2$$

$$IFA_i = \beta_0 + \beta_1 SMC_i + \beta_2 DIL_i + \beta_3 DIW_i + \varepsilon_i \quad 3$$

$$CFA_i = \beta_0 + \beta_1 SMC_i + \beta_2 DIL_i + \beta_3 DIW_i + \varepsilon_i \quad 4$$

Where X is the Independent Variable (Blockchain Technology); β_0= Value of the Intercept; $\beta_1, \beta_2, \beta_3$= Coefficient of explanatory variables; and ε = Error Term. $i$is the Number of Sampled DMBs. The independent variable is Blockchain Technology (BTC) represented with Smart Contract (SMC), Distributed Ledger (DIL) and Digital Wallet (DIW). We expect the coefficients to be positive in Equation 1 to 4 ($\beta_{1\text{-}3} > 0$) as the *a priori* expectations.The study estimated Equation 2-4 via OLS because outcomes are measured on quasi-continuous Likert scales (averaged across multiple items), for which OLS yields unbiased and efficient estimates under standard conditions; coefficient interpretation is transparent and comparable across specifications (Wooldridge, 2010). To guard against assumption violations, we compute heteroskedasticity-robust (Huber–White) standard errors (White, 1980). Because multicollinearity can inflate variance when technology dimensions co-move, we examine variance inflation factors (VIF) and tolerances, and center predictors.

4. Results and Discussion

For estimation, we standardised predictors to facilitate coefficient comparability. OLS models were chosen

for interpretability given the continuous Likert type indices aggregated at scale level; as a sensitivity check we replicated results using robust standard errors and median regressions, yielding consistent signs and significance. Multicollinearity diagnostics (VIF < 5) indicated acceptable independence. We addressed common method variance via procedural remedies (assured anonymity, separated predictor/outcome sections) and the Harman single factor test, which did not indicate dominance by a single factor. Although causal identification is beyond scope, we discuss threats, omitted variable bias (e.g., broader digital maturity), reverse causality (banks with less fraud invest more/less in BCT), and measurement error, and interpret estimates accordingly. Ethical approval was obtained from the relevant institutional review committee; participation was voluntary and non-remunerated.

The descriptive statistics of the study variables are presented in Table 2. It showed that the minimum of 1, maximum value of 5, Mean of 4.08 and Standard Deviation of 1.13 for Smart Contract. Minimum of 1, mean of 5, maximum of 4.16 and Standard Deviation of 1.04 for Distributed Ledger. While Digital Wallet ranges from minimum of 1 to maximum of 5, mean of 4.28 and standard deviation of 0.98. Spread of fraud range from minimum of 1, mean of 4.13, maximum of 5 and standard deviation of 0.99. Internet fraud activities range from minimum of 1 to maximum of 5, mean of 4.30 and standards deviation of 0.98. All the results revealed that all the variables follow a normal distribution.

Table 2: Descriptive Statistics of Variable of Interest.

Variables	Num	Minimum	Maximum	Mean	Standard Deviation
Smart Contract	120	1	5	4.08	1.13
Distributed Ledger	120	1	5	4.16	1.04
Digital Wallet	120	1	5	4.28	0.98
Spread of fraud	120	1	5	4.13	0.99
Internet fraud Activities	120	1	5	4.30	0.98

Source: *Author Compilation*

Test of Hypotheses

H_{01}: Blockchain technology does not play significant role in curbing spread of fraud in deposit money banks in Nigeria. (300 words)

Table 3 shows that the coefficient of determination of the model is 0.43. This implies that 43 percent changes in spread of fraud are explained by Blockchain technology. Also, Table 3 indicates that there is a negative relationship between Smart contract and spread of fraud in deposit money bank. 1 unit increase in smart contract leads to 1.923 unit decrease in spread of fraud in deposit money bank, and it is statistically significant at 5 percent with T-stat of 5.270 and p-value of 0.008 which is less than 0.05. Also,1 unit increase in Distributed ledger leads to 1.259 unit decrease in spread of fraud in deposit money bank, and it is statistically significant at 5 percent with T-stat of 4.287 and p-value of 0.047 which is less than 0.05.One unit increase in Digital wallet leads to 1.781 unit decrease in spread of fraud in deposit money bank and it is statistically significant at 5 percent with T-stat of 3.247 and p-value of 0.032 which is less than 0.05.Hence, we reject the null hypothesis and conclude that Blockchain technology has significant effect on spread of fraud in deposit money banks.

Table 3: Regression Analysis for the effect of Blockchain technology on curbing spread of fraud in deposit money banks in Nigeria. Dependent Variable: Spread of fraud

Variable	Coefficient	Standard Error	t-stat	Prob.
(Constant)	15.238	1.302	11.707	0.000
Smart Contract	-1.923	0.075	5.270	0.008
Distributed Ledger	-1.259	0.072	4.287	0.047
Digital Wallet	-1.781	0.057	3.247	0.032
R-Square	0.47			
Adjusted R-Square	0.43			
F-Statistic	F(1, 80) = 5.709**			
Prob. (F-Stat)	Prob >F = 0.0495			

'**' and '*' indicate significant at 5% and 10% respectively. Source: Researcher's Computation (2024)

Hypothesis 2

H_{02}: Blockchain technology does not have significant effect on curbing internet fraud activities in deposit money banks in Nigeria.

Table 4indicates that the coefficient of determination of the model is 0. 241.This indicates that roughly 24.1% of variation in IFA is explained by the three BCT levers plus the constant, an economically meaningful share for organizational controls in a complex fraud environment. Table 4 estimates the association between the three BCT capabilities and activities of internet fraudsters (IFA outcome). The fitted model reports $R^2 = 0.271$ (Adjusted $R^2 = 0.241$) and an omnibus F-statistic reported as $F(1, 80) = 5.9338$, with Prob > F = 0.000; coefficients for each capability are negative and statistically significant at 5%. Specifically: Smart contracts $\beta = -1.133$ (SE = 0.043; t = 5.124; p = 0.017); Distributed ledger $\beta = -1.939$ (SE = 0.082; t = 4.347; p = 0.034); and Digital wallet $\beta = -1.781$ (SE = 0.047; t = 3.173; p = 0.014). The constant is 15.248 (SE = 1.475; t = 11.707; p = 0.000). The relatively larger magnitude on distributed ledger (−1.939) suggests that tamper-evident, shared records and synchronized books of record may be particularly salient for deterring or containing internet-channel attack paths such as dispute manipulation, and ex-post edits.One unit increase in smart contracts leads to 1.133 unit decrease in activities of fraudsters in deposit money bank, and it is statistically significant at 5 percent with T-stat of 5.124 and p-value of 0.017 which is less than 5 per cent. Also, one unit increase in Distributed ledger leads to 1.939 unit decrease in activities of fraudsters in deposit money bank, and it is statistically significant at 5 percent with T-stat of 4.347and p-value of 0.034 which is less than 0.05. One unit increase in Digital wallet leads to 1.237 unit decrease in activities of fraudsters in money bank deposit, and it is statistically significant at 5 percent with T-stat of 3.173 and p-value of 0.014 which is less than 0.05. Hence, we reject the null hypothesis and conclude that Blockchain technology has significant effect on activities of fraudsters in deposit money banks in Nigeria.

Table 4: Regression Analysis for the effect of Blockchain technology on curbing internet fraud activities in deposit money banks in Nigeria. Dependent Variable: Activities of Internet fraudsters

Variable	Coefficient	Standard Error	t-stat	Prob.
(Constant)	15.248	1.475	11.707	0.000
Smart Contract	-1.133	0.043	5.124	0.017
Distributed Ledger	-1.939	0.082	4.347	0.034
Digital Wallet	-1.781	0.047	3.173	0.014
R-Square	0.271			
Adjusted R-Square	0.241			
F-Statistic	F(1, 80) = 5.9338**			
Prob. (F-Stat)	Prob >F = 0.000			

'**' and '*' indicate significant at 5% and 10% respectively. Source: Researcher's Computation (2024)

Main Model Hypothesis

H_0: Blockchain technology does not have significant effect in curbing Fraud Activities in Deposit money bank

The study reports a main-model specification using a composite blockchain index (BCT) to explain fraud reduction (an overall outcome complementary to SOF/IFA). Table 5 shows $R^2 = 0.242$ (Adjusted $R^2 = 0.230$) with $F(1, 80) = 3.508$ and Prob > F = 0.005. The BCT index carries a positive, statistically significant coefficient: $\beta = 2.080$ (SE = 0.043; t = 1.873; p = 0.005). The constant is 44.688 (SE = 1.858; t = 24.054; p = .000). There is a positive significant effect of blockchain technology in curbing fraud activities in deposit money banks. The index-based result complements the granular IFA model: when banks report broader deployment across smart contracts, permissioned ledgers, and secure wallets, they also report higher levels of overall fraud reduction. Table 5indicates that the coefficient of determination of the model is 0.24. This implies that 24 percent changes in fraud reduction are explained by blockchain technology. Table 5 shows that there is a positive significant effect of block chain technology in curbing fraud activities in deposit money bank. 1 unit increase in block chain technology leads to 2.080 unit increase in fraud reduction in deposit money bank, and it is statistically significant at 5 percent with T-stat of 1.873 and p-value of 0.005; F-Stat of 3.508 and p-value of 0.005 which is less than 0.05. Hence, we conclude that block chain technology has significant effect on curbing fraud activities in deposit money banks in Nigeria

Table 5: Regression Analysis for the effect of Blockchain technology in curbing Fraud Activities in deposit money banks in Nigeria. Dependent Variable: Fraud reduction

Variable	Coefficient	Standard Error	t-stat	Prob.
(Constant)	44.688	1.858	24.054	.000
Blockchain	2.080	0.043	1.873	.005
R-Square	0.242			
Adjusted R-Square	0.230			
F-Statistic	F(1, 80) = 3.508**			
Prob. (F-Stat)	Prob >F =0.005			

5. Discussion of Findings

The study shows that higher perceived deployment of smart contracts, permissioned distributed ledgers, and secure digital wallets is associated with lower internet fraud activities (IFA), and that a composite BCT index positively predicts overall fraud reduction. Interpreted through the fraud diamond, these results imply that blockchain capabilities compress the opportunity and capability dimensions of fraud. Smart contracts translate policy into executable rules (velocity limits, co-signing thresholds, pre-settlement KYC/sanctions check), thereby shrinking the discretionary windows where social engineering and insider override usually operate. Permissioned ledgers raise the coalition size required for tampering and render ex-post edits conspicuous via append-only, time-stamped trails. Wallet hardening constrains capability at the edge by binding authorization to cryptographic keys, devices, and step-up authentication (Cressey, 1953; Wolfe & Hermanson, 2004; Cong & He, 2019).

From agency theory perspective, the negative coefficients on all three BCT dimensions point to lower agency costs. Programmable controls reduce moral hazard in high-risk steps (e.g., beneficiary changes, bulk-payment releases), while shared state improves monitoring and reduces reconciliation disputes that otherwise depend on unverifiable logs. While wallets act as bonding mechanisms, authorisation requires device-tied keys and user intent proofs, dampening opportunistic behaviour in retail channels (Jensen & Meckling, 1976; Cong & He, 2019). The composite BCT effect suggests complementarities when rule-execution (smart contracts), shared truth (DLT), and strong identity (wallets) move together, monitoring and bonding reinforcing each other rather than simply add up.

The findings also align with information asymmetric arguments. Internet banking fraud thrives when counterparties and internal units observe different "slices of truth." By standardizing event provenance and making records tamper-evident, permissioned DLT reduces hidden action and supports quicker, evidence-based dispute resolution. Privacy-preserving proofs can expose compliance-relevant properties (e.g., sanction-screened/PEP-screened) without revealing full personal data, striking a workable balance between control and confidentiality (Akerlof, 1970; Buterin, Gafni, & Roughgarden, 2024).The relative magnitudes, particularly the strong association for distributed ledgers, are intuitively consistent with Nigeria's 2023–2024 fraud profile, where internet-channel losses and dispute complexity have grown: when the "book of record" becomes shared, tamper-evident, and quarriable, both opportunism and ex-post narrative manipulation become harder. Meanwhile, smart contracts and wallets attack the two flanks of typical incidents: entry (credential takeover, SIM-swap) and execution (authorization of high-risk transfers). The pattern of results, negative signs across all BCT levers and a positive composite effect, mirrors recent multi-bank evidence linking blockchain adoption to better control outcomes and lower exception/fraud-related costs (Al-Dmour, Alshurideh, Al-Kurdi, &Masa'deh, 2024; Ahmed, 2025; Almadadha, 2025; Ma, Sun, & Chen, 2024).

6. Conclusion and Recommendations

This study provides Nigeria-specific, bank-level evidence that stronger perceived deployment of enterprise-grade blockchain capabilities (smart contracts, permissioned ledgers, and secure digital wallets) coincides with lower fraud exposure in internet channels and higher overall fraud-reduction assessments. The pattern is theory-consistent (fraud diamond, principal–agent, information asymmetry) and practice-consistent with emerging international evidence in banking. While causality awaits pilot-based designs, the results justify targeted, near-term adoption in high-loss workflows.

Based on the objectives of the study which sought to examine the effect of blockchain technology in curbing fraudulent activities in DMBs in Nigeria, the study concluded that blockchain technology plays a significant role in curbing spread of fraud and internet fraud activities in Deposit Money Banks in Nigeria.

The empirical results indicate that higher deployment of smart contracts, permissioned distributed ledgers, and secure digital wallets coincides with lower fraud exposure, especially on internet channels. The appropriate managerial response is not to "adopt blockchain" generically but to embed specific BCT capabilities into high-loss processes where they change incentives and evidence. Practically, that means (i) converting policy into enforceable code at critical entitlements; (ii) anchoring dispute-relevant events on a shared, tamper-evident ledger; and (iii) binding authorization to cryptographic identity at the wallet/device boundary. Policy action should, in turn, enable and standardize these moves. In line with these findings, the study recommended that government, Central Bank and Deposit Money Banks should conduct a comprehensive review on block chain technology and explore the usage and benefits of Smart contracts, Distributed ledgers and Digital wallet. They should go beyond crypto currencies and exhaust the capabilities of blockchain technology to curb spread of fraud and elimination or minimization of Internet fraud activities. The study also recommend that the Nigerian government should avoid banning such good technology but study and utilize the use of blockchain technology in public and private sectors of the economy. The researcher believes that this technology has great potentials, not just in relation to cryptocurrency or curbing fraudulent activities because the technology is so robust and if utilized well can make a huge difference in Nigerian economy.

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Exploring Investment Behavior among Young Consumers: A Review and Research Agenda

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Abstract. This paper provides a comprehensive theoretical and methodological review of conceptual and empirical research on investment behaviour among young consumers, particularly undergraduates, who have increasingly become active in the financial market. The main objective of the paper is to clarify how rational, behavioural, cognitive, and social factors shape young people's investment intentions as well as choices, while identifying gaps in research conducted so far that can inform future research agenda. The study achieved its aim by systematically reviewing dominant theoretical frameworks that have been used in studying investment behaviour among young consumers, including the Theory of Planned Behaviour, Behavioural Finance Theory, Prospect Theory, Dual Process Theory, and Rational Choice Theory. It also synthesized empirical studies that have employed quantitative methods such as regression analysis, ANOVA, and structural equation modelling in exploring the phenomenon of investment among young consumers. Result from the review, suggest that existing studies rely heavily on cross-sectional survey data and quantitative techniques, with limited use of qualitative, longitudinal, or experimental designs. Findings from the reviewed studies consistently show that investment behaviour among young consumers is multidimensional, shaped by financial literacy, perceived behavioural control, emotional biases (such as overconfidence and loss aversion), parental influence, peer dynamics, and digital financial environments. Furthermore, the review showed that while rational evaluation plays a role in investment decisions, behavioural and contextual factors frequently drive decision-making. The paper therefore recommends greater theoretical integration, the adoption of mixed-method and longitudinal approaches, and increased attention to digital investment platforms. It further encourages the development of hybrid models that combine rational and behavioural perspectives in explaining investment behaviour among young investors.

Keywords: Behavioral finance, financial literacy, Investment behavior, Responsible marketing, Undergraduate students, young consumers.

1. Introduction

Investment refers to the allocation of funds or other resources to a specific asset or project with the expectation of generating future financial returns (Gitman & Zutter, 2008). In essence, it entails deploying present capital in ways intended to yield profits over time (Ansari & Moid, 2013). Examining investment behaviour among undergraduate students is therefore a significant line of inquiry, given its implications for their long-term financial stability as well as its broader contribution to economic development. As observed by Evbayiro-Osagie, Isibor, and Ihemefor (2017), university students frequently represent first-time account holders, positioning them at an early and formative stage in terms of financial engagement. For financial institutions seeking to cultivate enduring client relationships, insight into this group's investment behaviour becomes especially valuable. Moreover, careful attention to the factors shaping investment decisions, particularly among young adults, is essential for the design of effective financial education programmes and policies (Kolade, Adewale, & Owonibi, 2022). Such efforts are critical because financial education not only strengthens individual confidence but also mitigates vulnerability to cognitive biases that encourages poor financial behaviour (Lusardi & Mitchell,
2014).

Recent research has increasingly emphasized the central role of financial education in shaping the investment behaviour of undergraduates. Owusu, Ansong, Koomson, and Addo-Yobo (2020), for example, reported that higher levels of financial literacy among Ghanaian university students were

positively associated with more prudent savings and investment decisions. In a similar vein, Kolade et al. (2022) found that financial literacy exerted a significant influence on Nigerian undergraduates' attitudes toward financial investments, thereby reinforcing the argument for targeted financial education initiatives. Beyond financial education, parental financial behaviour has also been shown to play a pivotal role in shaping students' investment habits, suggesting that the family functions as a primary agent of financial socialization. At the macroeconomic level, factors such as interest rates and inflation further condition the investment behaviour of young people. David (2023), in an empirical assessment of interest rate variations and investment behaviour in Nigeria, found that macroeconomic variables significantly influence the investment decisions of young people.

Despite these contributions, the existing studies remain limited in scope, as the drivers, antecedents, and challenges associated with investment among young consumers, particularly undergraduates, have not been examined in a comprehensive manner. A more thorough exploration of these dimensions is therefore warranted, especially given that undergraduates constitute a substantial proportion of the youth population expected to shape the future trajectory of Nigeria's economy. This paper therefore presents a comprehensive theoretical and methodological review of existing research on investment behaviour among undergraduates. In doing so, it critically examines the principal theories that have informed prior investigations, alongside the research methods employed, while drawing attention to the key factors identified as influencing the behaviour of these young investors. The paper further identifies existing knowledge gap and outlines areas that remain open for further scholarly inquiry.

2. Investment Behaviour: Theoretical Review

Understanding how young consumers make investment decisions requires a coherent theoretical foundation that integrates both rational and behavioural perspectives. Hence, this study engages Rational Choice Theory, the Theory of Planned Behaviour (TPB), Behavioural Finance, Dual-Process models, and Prospect Theory, as together they provide a comprehensive framework for explaining investment behaviour. Rational Choice Theory provides the foundational assumptions for information processing and utility maximisation in financial decision-making (Becker, 1976). Complementing this view, TPB accounts for the attitudinal, normative, and perceived behavioural control factors that shape intentions, particularly among undergraduates whose decisions are influenced by peer dynamics and self-efficacy considerations (Ajzen, 1991).

The behavioural finance and prospect theory extends explanation for financial behaviour beyond the rational model. It explains systematic deviations from rationality by incorporating factors such as loss aversion, framing effects, and heuristic bias: that are frequently observed among novice investors (Kahneman & Tversky, 2013; Barber & Odean, 2001). Dual process models, distinguishing between System 1 and System 2 processing, further clarify the conditions under which intuitive judgments supersede reflective reasoning, thereby informing interventions aimed at strengthening cognitive reflection (Kahneman, 2011; Frederick, 2005; Stanovich & West, 2002). Taken together, these widely cited theoretical perspectives provide an interdisciplinary, empirically grounded, and conceptually coherent basis for understanding young investors' financial behaviour. They also offer a policy-relevant foundation for the development of marketing strategies that align with the cognitive and behavioural realities characterizing young consumers (Lusardi & Mitchell, 2014).

2.1 Theory of Planned Behavior

The theory of planned behaviour (TPB) remains one of the most extensively utilized frameworks for explaining human decision-making (Ajzen, 1991). Central to the theory is the proposition that behavioural intention serves as the most immediate antecedent of action, shaped by three interrelated determinants: attitude, subjective norms, and perceived behavioral control. Within investment settings, these components operate jointly to explain how young consumers develop both the intention and the confidence to engage in investing. Attitude captures an individual's evaluative judgment of investing, whether it is perceived as advantageous or fraught with risk. When investment is construed as a pathway to financial independence or social mobility, intention is strengthened and, conversely, may weaken when such positive evaluations are absent (Ajzen, 2020). Subjective norms denote perceived social pressures, including peer influence, family expectations, and participation in online financial communities, that frequently guide the behaviour of young adults (Kobylińska, 2022). Perceived behavioral control, by contrast, reflects an individual's sense of capability and access to the requisite financial resources, a perception often shaped by levels of financial literacy and digital familiarity (Xiao & Porto,

2017). Empirical findings provide considerable support to the relevance of TPB in explaining youth investment behaviour. Baihui, Bahador and Saat (2024) reported that all three TPB components significantly predicted students' intentions to invest in Internet Money Market Funds, whereas Paramita, Rahayu and Widjaja (2018) identified attitude and perceived behavioral control as the most influential predictors. Additional studies have also demonstrated that TPB constructs consistently account for financial intentions, although their relative influence appears to vary across cultural settings, gender, and contextual factors (Rosavina et al., 2019; Aren & Zengin, 2017). Despite its explanatory strength, TPB does not fully encompass the emotional, impulsive, and social media–driven financial choices that frequently characterise young investors (Hoffmann & Post, 2017). Investment behaviour, for instance, may be shaped by prevailing trends or the fear of missing out, which often unfolds with minimal deliberation. Furthermore, perceived behavioural control may insufficiently account for structural and technological constraints that condition actual efficacy (Xiao & O'Neill, 2018). Regardless of this, TPB continues to offer a robust framework for modelling investment intentions and informing behavioural interventions. In this regard, the theory suggests that favourable attitudes toward investment behaviour can be strengthened through literacy programmes, the reinforcement of supportive peer norms, and the enhancement of perceived control via digital education. Future research may therefore refine TPB by incorporating emotional, cultural, and digital dimensions, thereby aligning the framework more closely with the contemporary realities of investment decision-making among young adults.

2.2 Behavioral Finance Theory

Behavioural Finance emerged in the late twentieth century in response to the limitations of classical financial theories, which assume that investors behave rationally and that markets are efficient. Drawing on Kahneman and Tversky's (2013) Prospect Theory and Thaler's (1985) concepts of bounded rationality and mental accounting, it incorporates psychological, cognitive, and emotional dimensions into financial decision-making. In doing so, it challenges the rational agent model by demonstrating that investor choices are systematically shaped by biases, heuristics, and affective states (Barberis & Thaler, 2003). For young and inexperienced investors in particular, behavioral finance offers a useful explanatory lens, as their financial behaviour often reflects emotional responses, social influence, and limited experience rather than purely objective analysis. Within this framework, four behavioural dimensions (loss aversion, overconfidence, herding, and risk perception) are especially pertinent to explaining their departures from rationality.

Loss aversion refers to the tendency to assign greater weight to potential losses than to equivalent gains. Such emotional asymmetry fosters excessive risk aversion, even when expected returns are favourable (Kahneman & Tversky, 2013). Empirical evidence continues to confirm its persistence, indicating that loss-averse investors frequently avoid equities or long-term investments despite positive expected outcomes (Tetteh, Adu-Darko, & Agyirey-Kwakye, 2024). Among young consumers, this bias may appear as heightened financial caution or withdrawal during periods of market volatility. Nevertheless, financial education and digital investment tools can temper these tendencies by reframing risk as opportunity (Agyemang-Mintah, Awuah, & Asamoah, 2021). Overconfidence bias arises when investors overestimate their knowledge, analytical competence, or informational advantage. It is associated with excessive trading, inadequate portfolio diversification, and weak long-term returns (Chaudhary, 2025; Barber & Odean, 2001). For young investors, digital trading platforms and social media environments often amplify this bias, as gamified interfaces and rapid feedback cultivate an inflated sense of expertise. While overconfidence may initially stimulate financial participation, it frequently erodes stability and sustained investment discipline. Evidence suggests that targeted financial education and reflective decision-training can curb overconfidence by increasing awareness of cognitive limitations (Aren, & Aydemir, 2014).

Herding denotes the tendency of investors to follow others' actions rather than exercise independent judgment. Although it can function as a rational heuristic under conditions of uncertainty, herding may also contribute to speculative bubbles and collective misjudgments (Spyrou, 2013). Among undergraduates and novice investors, such behaviour is often shaped by online trends, influencers, and investment communities, where popularity is frequently equated with credibility (Hong, Kubik & Stein, 2004; Bikhchandani, Hirshleifer & Welch, 1992). At the same time, herding is not invariably irrational; it may reflect social conformity or a desire for belonging, both of which are integral to youth identity and culture. This duality underscores the importance of examining herding not solely as a cognitive bias but also as a socio-psychological phenomenon. Risk perception concerns the subjective assessment of uncertainty and potential loss, which often diverges from objective

measures of risk. It is shaped by emotional states, prior experiences, and external cues (Ricciardi & Simon, 2000). For young investors, limited experience and exposure to negative financial narratives tend to heighten perceived risk. Recent findings suggest that perceived risk, rather than actual financial literacy, frequently determines willingness to invest (Agyemang-Mintah et al., 2021). Accordingly, understanding the dynamics of risk perception is critical for designing interventions that build confidence without promoting recklessness.

Taken together, these behavioural dimensions indicate that young investors' financial behaviour emerges from the interplay of emotion, cognition, and social context, rather than from purely rational analysis. Yet much of the empirical literature examines these biases in isolation, overlooking their interaction. Overconfidence, for instance, may dampen loss aversion, while herding can lower perceived risk by providing social reassurance (Hong, Kubik & Stein, 2004; Barber & Odean, 2001; Gervais & Odean, 2001;). Future research would benefit from integrative behavioural models that account for such interdependencies, particularly within digital investment environments characterised by information overload and social validation. Practically, recognising these biases enables the development of interventions that accommodate behavioural tendencies instead of presuming perfect rationality. Educational programmes, for example, can frame risk-taking as strategic learning, while marketing communications may nudge investors toward diversification and long-term orientation. In this way, behavioural finance deepens theoretical insight into youth investment behaviour while offering actionable guidance for promoting informed and sustainable financial participation.

2.3 Dual Process Theory

The Dual Process Theory (DPT) offers a cognitive-psychological explanation of decision-making by proposing that individuals draw on two interacting systems of thought: System 1, characterised as fast, intuitive, and emotion-driven, and System 2, which is slower, reflective, and analytical (Kahneman, 2011). Within financial settings, the interplay between these systems shapes how investors interpret information, evaluate risk, and navigate uncertainty. System 1 facilitates rapid heuristic judgments that may prove adaptive under time constraints, whereas System 2 underpins more deliberate reasoning, however at a greater cognitive cost (Evans & Stanovich, 2013).

Among young investors, the predominance of System 1 is reflected in impulsive or emotionally driven investment behaviour shaped by digital stimuli, peer trends, and gamified trading environments. Immediate feedback and social validation on investment platforms tend to activate intuitive, rather than reflective, decision-making processes (Othman, 2024). By contrast, engagement of System 2 becomes more apparent when individuals assess long-term outcomes, diversify portfolios, or consult professional advice. While DPT accounts for numerous departures from rational behaviour, its rigid distinction between Systems 1 and 2 has been criticised as overly simplistic. Empirical research indicates that emotion and cognition often operate in tandem, functioning along a continuum rather than as discrete mechanisms (Evans & Stanovich, 2013; Harmon-Jones, Harmon-Jones, & Summerell, 2017). For young investors, this interaction suggests that affective impulses and reflective reasoning frequently co-determine financial judgements.

Recognizing this cognitive duality carries important implications for education, research, and responsible marketing. Evidence indicates that reflective decision-training, structured financial literacy programmes, and "choice architecture" mechanisms (such as delayed confirmation prompts or visualised risk feedback) can stimulate System 2 processing and moderate impulsive responses (Kahneman, 2011; Frederick, 2005; Othman, 2024). By encouraging greater deliberation, these interventions support more considered and sustainable financial behaviour among young consumers.

2.4 Prospect Theory

Prospect Theory (PT), advanced by Kahneman and Tversky (2013), stands as one of the most influential frameworks in behavioural economics for understanding decision-making under conditions of risk. It advances two central principles: loss aversion, whereby losses are weighted more heavily than equivalent gains, and diminishing sensitivity, which posits that the psychological impact of gains or losses declines as their magnitude increases. Within investment contexts, prospect theory clarifies why investors (particularly young or inexperienced ones) often behave inconsistently. Many retain losing stocks for extended periods (the disposition effect) or dispose of winning assets prematurely out of concern over potential future losses (Barberis & Xiong, 2012). Among young investors, such tendencies are amplified by emotional reactivity and social comparison, especially on digital platforms that deliver immediate feedback. Continuous real-time visibility can intensify sensitivity to losses (Kaur and Badola, 2026). Cross-cultural research, however, show that the degree of

loss aversion varies according to financial literacy levels and cultural attitudes toward risk (Wang, Rieger, & Hens, 2017).

Although prospect theory has substantially advanced behavioural finance, critics argue that it remains primarily descriptive and pays limited attention to social and contextual influences, including peer dynamics within online investment communities. Integrating it with dual process theory helps address this gap, as intuitive, emotion-driven System 1 processes may heighten loss aversion, whereas reflective System 2 reasoning can temper it. Recent evidence (Chaudhary, 2025; Marcu, Rad & Rad, 2024) indicates that loss aversion diminishes with greater experience and education, suggesting that behavioural interventions can mitigate emotional bias. Overall, prospect theory continues to provide a foundational lens for understanding youth investment behaviour. Future research might examine how digital technologies and peer interactions reshape reference points and perceptions of loss. Extending PT to online investment environments would further strengthen both theoretical insight and practical approaches to fostering balanced and informed financial behaviour among young consumers.

2.5 Rational Choice Theory

Rational Choice Theory (RCT) occupies a central position in classical economics, proposing that individuals make decisions through logical evaluation of alternatives in order to maximise expected utility (Simon, 1986; Becker, 1976). The theory assumes that investors behave rationally, maintain stable preferences, and possess complete information, enabling selection of options with the most favourable risk-return trade-off. Applied to young or student investors, RCT suggests that investment decisions stem from deliberate assessments of opportunity cost, financial literacy, and expected returns. Empirical findings, however, frequently challenge these assumptions. Evidence indicates that young investors often rely on emotions, peer dynamics, and online trends rather than systematic analysis (Baihui, Bahador & Saat, 2024; Agyemang-Mintah et al., 2021). Such patterns underscore the limits of strict rationality, particularly when decisions are made under uncertainty or cognitive strain. Simon (1986) introduced bounded rationality to refine RCT, arguing that individuals "satisfice" instead of optimise due to constraints of time, information, and cognitive capacity. Among novice investors, bounded rationality is especially apparent, as limited financial experience, exposure to digital trading stimuli, and social media hype restrict the capacity to process complex financial information (Wardana & Tandiawan, 2025).

Nevertheless, rational elements remain observable; many students continue to compare alternatives, consult expert advice, or estimate expected returns. RCT therefore retains partial explanatory relevance when positioned alongside behavioural frameworks such as behavioural finance and dual process theory, which account for the cognitive and affective biases shaping youth investment behaviour (Kahneman, 2011; Barberis & Thaler, 2003). For researchers, RCT serves as a normative benchmark against which deviations from logical standards can be evaluated. For educators and marketers, recognition of bounded rationality highlights the need to simplify complex financial products, encourage reflective decision-making, and promote responsible investment participation among young consumers.

3. Theoretical Synthesis and Evaluation

The synthesis in Table 1 indicates that although each theory contributes valuable insight, none independently captures the full complexity of undergraduate or young consumer investment behaviour. The theory of planned behaviour (Ajzen, 1991) provides a structured account of how attitudes, subjective norms, and perceived behavioural control shape investment intentions; however, its rational orientation tends to understate the affective forces influencing actual decisions. Behavioural finance theory and prospect theory (Kahneman & Tversky, 2013; Barberis & Thaler, 2003) broaden this perspective by demonstrating how emotional biases (including loss aversion, overconfidence, and herding) distort rational judgement, particularly within digitally mediated and peer-driven investment settings. Dual process theory (Evans & Stanovich, 2013; Kahneman, 2011) further enriches the analysis by clarifying the interaction between intuitive (System 1) and analytical (System 2) processes, showing how impulsive and reflective mechanisms jointly inform financial judgement. By comparison, Rational Choice Theory (Simon, 1986; Becker, 1976) operates as a normative benchmark, specifying the standards of rational decision-making against which behavioural departures may be assessed.

Taken together, these perspectives underscore the multidimensional nature of young investors' financial behaviour, which emerges from the interplay of rational evaluation, emotional bias, cognitive duality, and social influence. Rational frameworks offer structural precision and predictive logic, whereas behavioural and cognitive models introduce the

psychological and contextual dimensions. Their integration therefore yields a more comprehensive and policy-relevant account of youth investment behaviour in contemporary financial environments. Empirical evidence supports this integrative view. Research shows that higher financial literacy is associated with more deliberate, goal-oriented investment behaviour and improved financial outcomes (Lusardi & Mitchell, 2014). At the same time, behavioural distortions (such as overconfidence, loss aversion, and risk misperception) continue to shape investment choices (Edeh, 2020; Kahneman & Tversky, 2013). Studies applying the theory of planned behaviour consistently report that attitudes, subjective norms, and perceived behavioural control predict young investors' intentions (Akhtar & Das, 2019), while demographic factors including gender, parental background, and field of study moderate these relationships, illustrating the complex social and cognitive ecology underlying youth investment decisions (Manocha, Bhullar, & Sachdeva, 2023).

As shown in Table 1, these theoretical perspectives collectively acknowledge that no single framework sufficiently explains the diverse psychological, social, and cognitive influences shaping young investors' behaviour. Accordingly, future research would benefit from integrative or hybrid approaches that combine complementary constructs across theories to better represent the multifaceted character of youth financial decision-making. Building on these theoretical insights, the next section presents the empirical review. It synthesises existing evidence on young consumers' investment behaviour, highlighting principal determinants, measurement strategies, and unresolved research gaps. This progression from theory to empirical evidence ensures that the subsequent analysis remains both conceptually anchored and empirically substantiated, thereby offering a coherent basis for subsequent hypotheses formulation and model specification.

Table 1: Summary of theories explored in review

Theory	Key Proponents	Major Dimensions of Theory	Dimensions Proposed by Recent Authors	Dimensions Found to Significantly Influence Youth Investment Behaviour
Theory of Planned Behaviour (TPB)	Ajzen (1991)	Attitude, subjective norm, perceived behavioural control	Perceived value, financial literacy, and digital influence (Baihui et al., 2024; Paramita et al., 2018)	Attitude, subjective norm, perceived behavioural control, and perceived value significantly predict investment intention among young adults.
Behavioural Finance Theory	Kahneman and Tversky (2013); Barberis and Thaler (2003)	Loss aversion, overconfidence, herding, mental accounting, risk perception	Emotional bias, financial literacy, and cognitive reflection (Agyemang-Mintah et al., 2021; Aren & Aydemir, 2014)	Loss aversion, overconfidence, and herding strongly shape risk-taking and impulsive investment tendencies in youths.
Dual Process Theory	Kahneman (2011); Evans and Stanovich (2013)	Intuitive (System 1) and analytical (System 2) thinking	Cognitive reflection and education level as moderators (Frederick, 2005; Othman, 2024)	Intuitive (System 1) thinking dominates youth investment behaviour, though education and experience encourage analytical (System 2) reasoning.
Prospect Theory	Kahneman and Tversky (2013)	Loss aversion, reference dependence, diminishing sensitivity	Emotional regulation and gain–loss framing (Wang et al., 2017)	Loss aversion and reference dependence explain risk-averse tendencies and short-term trading patterns among young investors.
Rational Choice Theory (RCT)	Smith (2002); Becker (1976)	Rational evaluation, cost–benefit analysis, and self-interest	development of a "third-generation" rational choice theory by introducing a Multiple Player Approach (Brandt, Poulsen, & Svendsen, 2024)	Rational decision processes are present but often constrained by bounded rationality and emotional biases among youths.

Source: Authors' Compilation (2026)

4. Investment Behavior: Methodological Review

This section examines the research designs and statistical techniques used in studies of investment behaviour among young adults, including youths, adolescents, and undergraduates. Table 2 summarises selected contributions in this area. Across the reviewed literature (see Table 2), there is evident methodological convergence around quantitative, theory-driven designs, reflecting the influence of structured frameworks such as the Theory of Planned Behaviour (Ajzen, 1991), Behavioural Finance Theory (Kahneman & Tversky, 2013), Dual Process Theory (Kahneman, 2011), and Prospect Theory (Barberis & Thaler, 2003). Most empirical studies apply regression-based methods, Analysis of Variance (ANOVA), or Partial Least Squares Structural Equation Modelling (PLS-SEM) to examine predictive relationships among attitudinal, cognitive, and behavioural variables (Baihui, Bahador & Saat, 2024; Aboluwodi et al., 2022; Kolade, Orekoya & Adeniyi, 2022; Sapkota, 2022). This quantitative emphasis facilitates systematic hypothesis testing and yields statistically robust evidence on the determinants of youth investment behaviour.

Findings across studies consistently identify behavioural and cognitive factors (particularly financial literacy, perceived behavioural control, attitude, loss aversion, and overconfidence) as significant predictors of investment intention and behaviour (Kolade et al., 2022; Sapkota, 2022; Lusardi & Mitchell, 2014). Research grounded in the Theory of Planned Behaviour underscores the importance of attitude and perceived control in shaping intention (Baihui et al., 2024; Paramita et al., 2018), whereas applications of Behavioural Finance and Prospect Theory highlight the persistent influence of biases such as herding, loss aversion, and overconfidence in distorting rational decision-making (Edeh, 2020; Kahneman & Tversky, 2013;).

Notwithstanding these contributions, notable methodological and contextual gaps remain. Longitudinal and experimental designs capable of capturing the temporal and situational dynamics of youth financial decision-making are relatively scarce. Cultural and contextual moderators (including digital finance exposure, social influence, and economic background) are also seldom incorporated into analytical models, despite evidence that they significantly shape financial attitudes and risk perceptions (Aboluwodi et al., 2022; Owusu et al., 2020). Moreover, limited effort has been made to integrate multiple theoretical perspectives, such as combining Rational Choice and Behavioural Finance approaches, to generate a more comprehensive account of investment behaviour.

Although many reviewed studies appropriately employ advanced quantitative tools (including regression analysis, ANOVA, and structural equation modelling) consistent with theories that conceptualise investment behaviour as multidimensional (Baihui, Bahador & Saat, 2024; Aboluwodi et al., 2022), the predominance of cross-sectional quantitative designs signals a key limitation: the relative absence of qualitative and mixed-method approaches. Consequently, important psychosocial and contextual factors (such as family narratives, peer culture, and emotional triggers) remain insufficiently examined (Gainau, 2020; Muhoza, 2019). Qualitative interviews, focus groups, and sequential mixed-method designs could provide deeper insight into how undergraduates interpret financial risk, engage with digital investment tools, and internalise parental financial norms, thereby strengthening existing models. Furthermore, while some recent studies have adopted more sophisticated techniques, including PLS-SEM, Probit regression, and mediation analysis, few extend these approaches through longitudinal or experimental methods capable of establishing causality (Kolade, Orekoya & Adeniyi, 2022; Guo & Schonleber, 2020). Emerging methodologies, such as machine learning–based predictive analytics and hybrid modelling, therefore offer promising directions for advancing both theoretical and empirical understanding of youth investment behaviour.

Overall, the empirical literature reviewed affirms that youth investment behaviour is inherently multidimensional, arising from the interaction of rational, behavioural, and contextual influences. At the same time, further advancement in this field depends on greater methodological diversity, stronger theoretical integration, and heightened cultural sensitivity. These observations lay the groundwork for the ensuing methodological review, which examines how research design decisions have shaped empirical outcomes and highlights emerging pathways for more refined and contextually attuned investigation.

Author (Year)	Country	Sample (size/frame)	Independent variables	Dependent variable(s)	Method	Statistical tool(s)	Theory / theoretical lens	Key findings
Aboluwodi et al. (2022)	South Africa	344 Business students at a South African University	Gender, field of study, socio-demographics	Intuitive vs analytical investment behaviour	Quantitative (survey)	ANOVA; logistic regression	Dual-Process Theory	Gender and field of study influenced intuitive vs analytical behaviour; socio-demographics not significant
Sapkota (2022)	Nepal	n = 284 (Masters students; usable response rate ≈60%)	Loss aversion, overconfidence, risk perception, herding	Stock investment decision / intention	Quantitative (survey)	Descriptive statistics; multiple regression	Behavioural Finance	Herding, loss aversion, overconfidence and risk propensity has significant positive influence on stock investment decisions among investors
Muhoza (2019)	Kenya (Nairobi SE)	n = 378 (students surveyed)	Knowledge of financial products; financial skills; access to information	Investment behaviour / participation	Quantitative (survey)	Descriptive stats, regression	Financial literacy lens	Financial literacy positively associated with investment behaviour
Kolade, Orekoya and Adeniyi (2022)	Nigeria	n ≈ 300 (university undergraduates; number of observations reported: 259 in logistic model)	Gender, faculty, level, work experience	Financial behaviour / choice of instrument	Quantitative (survey)	Logistic regression; ANOVA	Financial literacy theory	Male, finance faculty, higher level, work experience are positive determinants of financial literacy, and higher financial literacy resulted in better financial behaviour
Paramita et al. (2018)	Indonesia	n not reported (Students of the faculty of Economics, who had invested in the Indonesian Stock Exchange)	Attitude; subjective norms; perceived behavioural control	Investment intention; behaviour	Quantitative (survey)	PLS-SEM	Theory of Planned Behaviour	Attitude, PBC and subjective norms affect intention; intention determined actual behaviour
Baihui, Bahador and Saat (2024)	China	n not reported (University students in China)	Attitude; subjective norms; PBC; perceived value (functional, emotional,	Investment intention (IMMFs)	Quantitative (Survey)	Descriptive stats; regression	TPB	Attitude, PBC, norms and perceived value significantly predicted IMMF investment

			efficiency, social)					intention
Guo and Schönleber (2020)	US/Global mutual funds dataset	49,000 fund-month observations (paper analyses secondary data)	Prospect-theory value; fund characteristics	Mutual fund flows	Quantitative (secondary market data)	Fama-MacBeth regressions; panel tests	Prospect Theory	Prospect-theory value predicts future fund flows above traditional performance measures (loss-aversion signal)
Hoffmann and Post (2017)	Netherlands	N varied for each month covered: Individual investors from the Netherlands for the period April 2008 through March 2009	Past returns; realised risk; return experiences	Beliefs (return expectations), risk perception, risk tolerance	Combined administrative and survey	Panel regressions; fixed effects	Behavioural finance / experience effects (Prospect-related)	Past returns positively impact return expectations and risk tolerance, and negatively impact risk perceptions. Realized risk, however, has no effect.
Menkhoff and Kaiser (2018/2022 RCT studies)	Myanmar / other developing contexts	n ≈ 1,200, (multi-site RCTs; cluster randomised; see Menkhoff et al.)	Financial education / training interventions	Savings / investment behaviour; knowledge	Field RCT	OLS, clustered SEs; IV where applicable	RCT / intervention evaluation (bounded rationality focus)	Interactive training and incentives increase knowledge and some measures of saving/investment behaviour (effects vary by design)

Table 2: Summary of empirical studies employed in methodological review
Source: Authors' Compilation (2026)

5. Practical Implications

The findings of this review hold important implications for marketers, policymakers, and educators committed to fostering responsible financial behaviour among young consumers. Financial institutions and fintech firms can draw on identified behavioural drivers (such as attitudes, perceived control, and emotional value) to craft youth-oriented marketing strategies that prioritise empowerment, trust, and long-term financial growth over short-term speculation.

Educational institutions, in turn, can embed behavioural finance principles within financial literacy curricula, equipping students to identify and manage biases including overconfidence and herding. For policymakers, the evidence underscores the value of early financial education and equitable access to secure digital investment platforms. Marketers designing products for the youth segment should therefore anchor brand communication in transparency and social responsibility, framing investment not solely as profit maximisation but as a means of economic participation and empowerment. Ultimately, recognising young investors as responsible consumers allows stakeholders to cultivate a financially informed generation capable of contributing to sustainable economic and social development.

6. Conclusion and Recommendations for Further Studies

This study has examined the principal theories applied in explaining student investment behavior, including the theory of planned behavior (TPB), prospect theory, dual-process theory, behavioral finance theories, and rational choice theory (RCT). It has also reviewed methodological approaches used in prior research, notably cross-sectional surveys and analytical tools such as structural equation modeling. The analysis reveals an overreliance on quantitative techniques, which has limited the depth of insight within this domain. Accordingly, broader sampling strategies, longitudinal designs, experimental methods, and

mixed-method approaches are needed to generate a more comprehensive understanding of how students' investment decisions evolve over time. Based on this review, several research gaps emerge as avenues for further inquiry:

Employing qualitative approach: Greater use of qualitative methods would support the development of new theoretical perspectives on investment behaviour among young adults.

Adoption of mixed method approaches: Integrating quantitative and qualitative techniques would provide deeper insight into why young people invest as they do. Given that prior studies have relied heavily on self-reported surveys and regression analysis, causal relationships between investment behaviour and its determinants may not be fully captured. Longitudinal research, experimental designs, and behavioural simulations should therefore be incorporated to observe changes in students' investment behaviour over time.

Investigate behavior on digital financial platforms: Future studies should examine how online investment tools influence young people investment behaviour.

Inclusion of more diverse samples: Expanding representation across age groups, academic disciplines, income levels, and cultural backgrounds would enhance generalisability and contextual relevance.

Development of hybrid theoretical frameworks: Future models should integrate the intentional dimension of TPB, the emotional realism of behavioural finance, and the cognitive mechanisms of dual process theory. Such synthesis can advance behavioural finance scholarship while informing responsible marketing and financial education practices. Additionally, exploration of less-utilised perspectives, such as regret theory, social learning theory, self-determination theory, cognitive dissonance theory, and institutional theory, may open promising research streams and uncover latent variables that enable marketers to better understand and strategically engage the young consumer investment market.

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Portfolio Management and Financial Performance of Listed Deposit Money Banks in Nigeria

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Abstract. Portfolio Management and Financial performance are key indicators used to measure the growth and activities of listed deposit money banks in Nigeria. Portfolio management involves investment and administration of a portfolio of securities, in accordance with the investors' preference while reducing risk and increasing the returns. This study investigated the effect of portfolio management and financial performance of listed deposit money banks in Nigeria. To achieve this, secondary data obtained from the annual financial statement of the Nigerian Exchange Group (NEX) as at 31st December, 2024 were used as the primary source of data for the study. The research population was all the 24 listed deposit money banks in Nigeria, out of which a sample size of ten (10) listed deposit money banks were chosen using purposive sampling. Validated data were obtained from the annual published reports of the sampled banks for a period of 10 years (2015-2024). The data were descriptive in nature. The study adopted the ex post facto research design and regression analysis to analyze the relationship between portfolio management activities and the financial performance of the sampled deposit money banks. The results of the study shows that Portfolio management has positive significant effect on return on asset of listed deposit money banks in Nigeria, positive significant effect on return on equity of listed deposit money banks in Nigeria. The results of the study concluded that portfolio management activities have positive and significant effects on the financial performance of the listed deposit money banks in Nigeria. The study recommended that deposit money banks should invest more in portfolio management activities in order to drive better financial performance. In addition, the study recommended better monitoring of portfolio management activities by deposit money banks in order to ensure proper utilization of funds and resources.

Keywords: Portfolio Management, Financial Performance, Return on Assets, Return on Equity and Net Profit Margin.

1. Introduction

The critical role of banks as financial intermediaries in the normal running of an economy cannot be emphasized. The financial system in Nigeria is characterized by a broad market base, a broad market base that includes a broad instrument base, participants and institutions that all work together to provide financial services in the country. Portfolio management is important to the success and stability of Deposit Money Banks (DMBs). Asset selection choices, diversification, and continuous portfolio management play an important role in determining financial performance of a bank. The assets that may form part of portfolios are equities, bonds, derivatives like options and futures, gold certificates, real estate, production facilities or other assets that are expected to hold their value. Ideally, one ought to make both short term and long-term financial plans that will guide them to make financial decisions (Fajinmi, Onuka, and Ayeni, 2023).

A portfolio may be defined as a collection of different investments. The general properties of a portfolio cannot be the same as those of the constituent securities. A portfolio is essentially the collection of investments held by an individual, financial institution, hedge fund or an investment company in order to attain participation in risky assets. Portfolio investment is useful in alleviating the effects of

variation in returns of various investment choices (Obiora and Ujam, 2021). Portfolio management is particularly important to the bank and is a very important aspect in the lending process. Portfolio management enables banks to maximize returns and manage the risk through a well-managed credit exposure, as a result reducing any potential negative impacts of credit risk (Njoku and Ezeudu, 2017). Deposit money banks are a key component of the financial sector of any economy and their operations, whether they are thriving or not can have significant impacts on the stability of an economy, which are either positive or negative (Obiora and Ujam, 2021).
The portfolio management is concerned with the review of individual portfolio on a periodical basis to determine the quality of assets in the portfolio and guard against depreciation of assets in the portfolio by taking necessary corrective measures accordingly and in time. To manage the credit portfolio, the banks can separate its total credit assets in various portfolios or sub portfolios (Hamidovich, 2016). Globally, credit risk constitutes more than 50 percent of the total risk factors in Banks and Financial Institutions (BFIs). As a result, credit risk management has been a burning issue of top priority to BFIs. Credit risk management is a number of processes that include: identifying, measuring, mitigating, monitoring and controlling of exposure to risks related to credit (Lalon, 2015).

Within a portfolio management setting, investors must always look into their portfolios besides carrying out asset allocation. This makes sure that returns of the portfolio are in line with the expectations of the investor, and allows one to know whether any changes in the strategic asset allocation are needed. Frequent tracking also gives specific information on the investments made by the investor and results of such monitoring may lead to the adjustment of assets to ensure that they remain on course according to the long-term investment needs. It is important to note that portfolio management, as an investment process, is not a static, but a dynamic one, where you should regularly adapt your decisions to changes in the market and in your own circumstances. (Bhunia, Mukhuti & Roy 2011).

Portfolio management enhances the liquidity of banks, as professional fund managers can accumulate portfolios that can be readily converted into cash within a relatively short timeframe. This increase in available funds benefits lenders, who play a pivotal role in allocating resources in the economy. Moreover, the borrowed funds can be directed towards investments, further boosting overall expenditure and gross domestic product. In Nigeria, the Central Bank of Nigeria (CBN) and the Securities and Exchange Commission (SEC) have issued guidelines that regulate portfolio management activities, including the careful selection and supervision of liquid assets. As an example, in 2019, the CBN introduced guidelines that required Deposit Money Banks (DMBs) to address credit concentration in their portfolios and adopt information technology infrastructure to effectively monitor credit concentration (CBN, 2019).

Organizational performance is the outcomes of the actions undertaken by the individuals and different units of an organization. The evaluation tool used to measure performance depends on the reason of the evaluation. One of the key principles in modern financial management is that managers have to make a decision that will maximize the value of equity of shareholders. In general, performance refers to how well an organization is performing its goals whereas financial performance is a performance that refers to financial well-being of an organization. In easier terms, financial performance could be described as the degree to which an organization is effective in using its available resources in business activities to make income; it simply shows the financial health of a company within a given time (Bhunia, Mukhuti and Roy, 2011). It is usually required to analyze financial performance of a company to gain an overall insight in terms of financial performance of a company. This analysis is usually based on financial statements of a firm and it gives an insight on the operations of the firm and financial aspects as well. The main aim of the financial performance analysis is to assess the performance and efficiency of management as reported in the financial records of the organization (Bhunia, Mukhuti and Roy, 2011).

Despite the significance of portfolio management and financial performance, many Deposit Money Banks in Nigeria continue to face challenges in these areas. This problem is exacerbated by the country's volatile economic environment, which is characterized by inflation, fluctuating exchange rates, and high interest rates. It should also be noted that there is a significant lack of research on portfolio management, both at a global and local level (Campbell, 2022). Given the considerable importance of portfolio management in shaping policies and development strategies, scholars, policymakers, and donors are now giving more attention to its impact on the performance of financial institutions.

Consequently, this study examined the effect of portfolio management on financial performance of listed deposit money bank in Nigeria. This study

answered and tested the following research questions and hypotheses.

Research Questions:

- How does portfolio management affect Return on Asset of listed deposit money bank in Nigeria?.
- To what extent do Portfolio Management affect Return on Equity of Listed Deposit Money Banks in Nigeria?

Research Hypothesis:

- Portfolio Management does not significant effect on Return on Asset of Listed Deposit Banks in Nigeria.
- There is no significant effect of Portfolio Management on Return on Equity of Listed Deposit Banks in Nigeria.

The rest of the study was structured as follows:

- Section 2 provides a brief literature review on the portfolio management and its determinants as well as the financial performance, its measures and the theoretical frame work.
- In section 3, the study considered methodology looking at the sources of data employed and analyses.
- Section 4 provide the empirical results and discussions.
- The study ends in section 5 with a conclusion and recommendation.

2. Literature Review

2.1 Concept of Financial Performance

Financial performance is the manner in which a company efficiently utilizes its funds during a specific time such as the activity of raising and distributing money. It is measured through a few metrics including capital adequacy, liquidity, solvency, operational efficiency, leverage and profitability. The success of the management of these resources is an indication of the financial competence of the organization. In order to make strategic decisions, corporate managers often rely on data in cash flow statements, balance sheets, income statements, and changes in capital. Fatihudin, Jusni, and Mochklas (2018) define financial performance as a subjective measure of the effectiveness with which an organization uses its primary business resources in generation of revenue. It is also a general measure of the financial soundness of a firm within a given timeframe and it can be used to compare performance with those of other companies operating in the same industry or even different sectors (Charles, 2013).

Return on Asset

The dependent variable in this study is the organizational performance that will be measured by the proxy of Return on Assets (ROA). Performance is a concept that describes the level at which a firm uses the major business resources to generate revenue and this success is a measure of the success by the management to use the available resources to gain profit. Business performance can be measured with the help of various indicators, and ROA is one of the most commonly applied indicators.

Abaanewe, Ogbulu, and Ndugbu (2013) state that ROA is a financial ratio that measures the profitability of a company in terms of its total assets, which gives an indication of the efficiency of assets to earn profits. This ratio is of great use especially in the case of deposit banks in Nigeria because it shows the capability of a bank to generate profits out of its assets base. Investors and analysts also find ROA useful as it provides an accurate measure of the financial well-being and profitability of a company as well as provides opportunities to compare and contrast the results of companies in the same industry and monitor the investment progress over time (Ajayi and Omankhanlen, 2020). The formula for calculating ROA is:

ROA = Net Income (Profit before tax) / Average Total Assets

2.2 Return on Equity

Return on Equity (ROE) is a key financial ratio used to evaluate a firm's profitability by expressing net income as a percentage of shareholders' equity. It indicates how efficiently a company utilises owners' funds to generate earnings. Within the Nigerian deposit money banking sector, ROE serves as an important indicator of financial performance and overall stability. According to Adegbaju and Isibor (2017), ROE reflects the profit attributable to shareholders after accounting for all equity contributions, thereby showing the return generated on invested capital.

$$\text{Return on Equity} = \frac{\text{Net profit after tax}}{\text{Shareholders' Equity}}$$

Return on Equity (ROE) is another financial metric applied to evaluate the profitability of the company relative to the invested money of the shareholders. It

is calculated by dividing net after tax profit by the total shareholders equity. ROE is a valuable indicator of financial performance and efficiency to the deposit money banks in Nigeria. The ratio indicates the ability of a bank to make profits out of the capital that is invested in the bank by its shareholders. High ROE is an indication that the bank is well utilizing its equity base to generate profits. Also, the ROE allows making significant comparisons between the banks that work in the same industry and aids in assessing the performance pattern over the course of time. In the Nigerian banking industry, the regulatory bodies set a minimum ROE of 10 percent that deposit banks have to maintain. The Central Bank of Nigeria has set this benchmark and is aimed at making sure that banks gain sufficient profitability to continue their operations and encourage the stability of the entire financial system (Oladipupo & Adeoti, 2018)

2.3 Concept of Portfolio Management

The Association of Project Management (2018) defines a portfolio as a collection of projects or programs organized and managed at an organizational or functional level to optimize strategic benefits or operational efficiency. It can be managed either at the organizational level or the functional level. On the other hand, portfolio, as described by Ajose (2022), refers to an individual's or firm's complete collection of financial assets, which may include treasury bills, debenture bonds, stocks, mutual funds, real estate, cryptocurrencies, and other valuable items. The portfolio is simply a collection of investments which can be dispersed over various accounts.

Portfolio management refers to managing a portfolio of investments with a view of attaining a certain financial objective, say, maximizing returns or reducing risks. This involves the creation and execution of a plan of choosing and distributing investments in different classes of assets e.g. stocks, bonds, and property to attain the targeted goals. Portfolio management has gained significance in the corporate field, and its performance is also useful in minimizing fraud, dealing with possible threats, and using assets more productively (Axelos Global Best Practice, 2014).

Portfolio management is a management of the portfolio of securities, held by an investor, which is managed and invested as per their choice, and the goal of the portfolio is to reduce the risks and maximize returns. The investor usually leaves the decision-making of investment to a managing entity whereby the managing entity makes decisions as per the preference of the investor. By applying the needs of the investors, Rubinstein (2006) came up with the conclusion that peripheral aspects of portfolio management rely on the needs of the investors such as capital appreciation, constant or regular returns, investment safety, marketability and liquidity and minimizing tax liabilities. Portfolio management needs to be a systematic consideration, action and good judgment in order to successfully implement the investment plans of the assets and securities within the portfolio.

2.4 Liquidity Risk

Liquidity means the ability of a person or a company to meet his or her short term and immediate financial commitments. This is done through the presence of enough cash or holding an asset that is easily converted to cash. In accounting, the liquidity is measured in terms of current assets being able to meet the current liabilities. Liquidity in the context of investment is associated with the simplicity and rapidity through which an investment portfolio can be translated into cash without incurring large losses in value. Some banks may not be able to handle their own funds because they do not understand liquidity risk although they make a profit. The liquidity position of the commercial banks determines their viability, as they can finance the growth of their assets and fulfill their obligations without suffering too much loss (Ngari, 2016).

Wuava, Yua, and Yua (2020) define liquidity as the capacity of a bank to fund the growth in assets and satisfy the requirements as they occur without experiencing intolerable losses. An efficient liquidity risk management is very essential to guarantee the commitment of a bank to respond to the uncertain cash flow requirements that arise as a result of the occurrence of external events and actions of other agents. The liquidity risk is the most critical to be managed as the liquidity deficit in one organization can have an extensive impact on the whole financial system. Banking being a financial intermediary, which carries out maturity transformation of short-term deposits into long-term lending, is vulnerable to both idiosyncratic (institution-specific) level and systemic liquidity risk (Obiora & Ujam, 2021).

2.5 Credit Risk

Credit is the association between a borrower and a lender in which the former acquires funds by the latter in a promise of repaying the loaned funds with interest at a later time. Credit risk or default risk or counterparty risk is the risk that the borrower or counterparty will default on his or her financial

responsibilities in accordance with the accord and cause losses to the lender or investor. Adequate regulation of credit risk is very important in ensuring lenders and investors do not incur financial losses. Credit risk management aims at maximizing the risk-adjusted rate of return, through keeping the credit risk exposure within a reasonable range. Another essential element of a holistic approach to risk management is credit risk management that is the key to long-term success of any banking institution (Ahmad, 2017).

There are two major types of credit risk; the individual credit risk, and the systemic credit risk. Individual credit risk refers to the risk of default of a particular borrower or counterparty with regard to their loan or financial obligation. Systemic credit risk on the other hand entails the risk of default or financial distress on a financial system or market wide. Credit risk may be as a result of a number of factors, such as the creditworthiness of the borrower or counterparty, actual economic conditions, and the nature of the financial instrument used. As an example, a poor credit history or a borrower with little collateral presents a greater risk in credit than a borrower with a good credit rating and lots of assets.

2.6 Financial Risk

Financial risk is any form of riskiness that is linked to financing and investment activities. In the case of banks, it may be especially disastrous, both insofar as it entails monetary losses, and it also brings about a tarnished reputation. It is usually assumed to include downside risk only. Financial risk concept is mainly associated with risks that the Deposit Money Banks (DMBs) face in their daily operations, turning it into one of the oldest and most difficult types of risks that the latter face (Mostafa, Mahmoud, Jalal and Elahe, 2016). Financial risk events can arise from various causes, such as defaulting on loan repayments resulting in nonperforming loans (NPL) or credit risk (CR), liquidity risk (LIQR), insolvency risk (INSRK), and market risk (MKTR). Additionally, financial risk may also encompass interest rate risk, currency risk, and business risk that can emerge during financial transactions.

According to Muriithi and Muigai (2017), financial risk poses a threat to the financial stability and performance of the financial sector. It is defined as all risks that could introduce volatility in a bank's reserves, expenses, and the overall value of their business. If not systematically addressed, financial risk can lead to inconsistent performance and earnings for stakeholders, impacting banks' revenues and net worth, and in some cases, resulting in disastrous systemic consequences, as demonstrated by Benlian & Hess (2011)

2.7 Tenor

Tenor denotes the remaining time until a financial contract reaches its maturity, and it is often used interchangeably with the term "maturity." In the context of banking, tenor refers to the duration within which the borrower is expected to repay the loan along with the interest. For instance, a home loan may have a tenor ranging from 5 to 20 years, with some banks allowing up to 25 years. In specific cases, such as project financing, the loan tenor may extend from 5 to 25 years, or in exceptional circumstances, up to 30 years, depending on the project type and its ability to service debt (Perez, 2015).

Tenor basis risk emerges when a basis swap is involved. Despite re-pricing on the same date, being in the same currency, and being linked to the same benchmark, issues can arise if they re-price for different periods or tenors. Understanding the tenor of financial instruments, whether short- or long-term derivatives, is essential for maintaining a steady cash flow and assessing the risk associated with a contract (Bismak & Chengyi, 2015).

Deposit Mix

Bank deposits encompass different types of accounts, namely Savings Bank Accounts, Current Accounts, and Term Deposits. The combination of Savings Account and Current Account is commonly referred to as "CASA" (Current Account, Savings Account), which holds significant importance. Currently, Current Accounts come at no cost, while Savings Accounts have a relatively low cost, typically around 3%. Maintaining a high percentage of CASA, preferably above 40%, in a bank's deposit portfolio is considered favorable. The remaining 60% of deposits consist of various types of term deposits, which offer interest rates ranging from 6% to 15% per annum.

The principle of buy low, sell high is applicable in the banking industry in regard to profit margin. In the case of banks, margins are influenced by the difference between the yield on the advances (interest earned on loans) and the cost of money (interest paid on deposits) that is the net interest income. Banks who are able to source out funds at a low cost can make huge returns. The yield on advances is comparably constant among banks owing to stiff competition on the interests charged on loans. Therefore, the cost of raising funds becomes a key element of forecasting the profitability of a bank. Banks with reduced interests on deposits have high chances of drawing more borrowers thus

more profits. Thus, the low cost of funds and a desirable proportion of deposits is extremely important to the overall profitability of a bank (Ngari, 2016). Deposit mix is a term that is used to describe the composition of the deposit of a financial institution in the form of their source and type. It also gives the insight about the funding structure of the institution and may have implications on its liquidity, interest rate risk and its profitability. Deposit mix is measured through a study of how deposits are distributed in terms of different attributes. The important metrics that could be used to gauge the deposit mix are:

3. Theoretical Frame Work

3.1 Markowitz Portfolio Theory

The Markowitz Portfolio Theory was invented by Harry Markowitz in 1952 and has transformed the modern portfolio management and has been a fundamental concept in finance. The theory of diversification was included in the theory by Markowitz, which stated that both risk and return should be considered when making an investment portfolio. The theory offered a quantitative analysis of how best an investor can make decisions about investments depending on the level of the risk taken and the amount of desired returns. According to the Markowitz Portfolio Theory, an investor cannot simply concentrate on the expected performance of individual investments but should also be concerned with the risk of an investment and its correlation with other investments within a portfolio. Markowitz states that the well-diversified portfolio must not only maximize the expected value but also reduce the risk or volatility, in general.

According to the theory, a perfect balance between the return and the risk can be obtained by mixing the assets with various risk and returning properties in a portfolio. The point is that it is important to choose assets which are negatively correlated with each other or have low correlation. Markowitz developed the efficient frontier concept that is portfolios that maximize expected return given a certain amount of risk and minimizes risk given a certain amount of expected return.

The Markowitz Portfolio Theory has found a lot of support and acknowledgment among the finance fraternity. It is the foundation of the current methods of portfolio management and has found wide application in educational programs and practice by investment practitioners around the globe. The mathematical way of the theory offers a methodological way of portfolio making where investors are able to make rational decisions regarding the goals of risk and returns.

The Markowitz Portfolio Theory has been criticized and limited despite its popularity. The major criticisms are:
Assumptions: The theory has a number of simplifying assumptions, including the normality of the distribution of the returns on the assets, the fact that the correlation is constant and no transaction costs exist, which are not necessarily true in the real world.

3.2 Stakeholder Theory

The Stakeholder Theory is a theory in the business ethics and management field that was initially introduced, in 1984, by R. Edward Freeman, in his book, Strategic Management: A Stakeholder Approach. According to the theory, a business organization must pay and take into consideration the interests of all its stakeholders and not just maximizing profits to shareholders alone. The Stakeholder Theory states that companies are not only obliged to the shareholders but also to more people or groups (stakeholders). The stakeholders can be the employees, the customers, the suppliers, the communities, government agencies and even the environment. The theory suggests that all stakeholders should be considered when making decisions and running of business; instead of focusing on the interests of shareholders. According to the theory, businesses can improve their sustainability and success in the long term by taking into account the interests of the stakeholders and managing the stakeholders. It also underlines the need to create a good rapport with stakeholders, their needs, and how business is carried out should mirror what stakeholders expect. In this way, organizations can not only be able to create value to shareholders but also the society.

R. Edward Freeman: Freeman as the founder of the theory still promotes its implementation in the contemporary business practices. According to him, competitive advantages can be attained when businesses are commendably involved in and are satisfying to their stakeholders. The Stakeholder Theory is also supported by many scholars in the business ethics, management, and corporate social responsibility disciplines. They claim that the theory gives a more holistic approach to making decisions, which covers the ethical issues and sustainability of business in the long run.

Milton Friedman: Milton Friedman is one of the most vocal critics of the Stakeholder Theory. He claims that it is the only duty of a corporation to make

profit maximally to shareholders. Friedman believes that the process of serving the interests of stakeholders may be regarded as a distortion of the main objective and lead to the decrease in the market efficiency.

4. Empirical Review

Fajinmi, Onuka, and Ayeni (2023) have investigated the correlation between portfolio management and the performance of deposit money banks in Nigeria. The purpose of the study was to establish the possibility of using portfolio management as a predictor of the profitability of these banks beyond the sample period. Based on the Markowitz portfolio theory, the study utilized time series of data between 1990 and 2020 and included the liquidity, financial assets, foreign portfolio holdings, deposit composition and concentration of deposit money by the private sector of the deposit banks. The findings showed that portfolio management and its various methods have a considerable impact on the most notable performance indicators, such as profit after tax (PAT), return on investment (ROI), asset quality (ASQ) and capital adequacy (CA) of the Nigerian banks.

On the same note, Obiora and Ujam (2021) examined how portfolio management has affected the performance of listed deposit money banks in Nigeria. The Modern Portfolio and Shiftability Theories led them in their study and the ex post facto research design was used. The annual reports of the banks that had international authorization within the years 2016 to 2020 were used to source data and analyzed with the help of the linear regression model. The results indicated that credit risk management and liquidity risk management had positive and significant relationship with the performance of the banks in terms of NAPS. The study therefore established an effect of portfolio management in improving the financial performance of the deposit money banks. It advised banks to be very careful with the liquidity and ensure that the liquidity is maintained at optimal levels to enhance the financial performance.

Olagbenga and Oluwafemi (2020) in another study investigated the impacts of portfolio management practice on bank performance in Nigeria, especially with regard to loan risk analysis, loan risk diversification, and loan risk monitoring. Primary data used in the study comprised a portfolio management scale, which was used to gather the primary data, and secondary data, which were financial statements of the annual statements. The SPSS 20.0 was used to analyze the data by providing multiple and logit regression methods. The findings showed that the analysis of loan risk, diversification, and the monitoring of the loan risk had immense positive impacts on the bank performance, in terms of return on assets. The research established that proper management of the loan portfolios has a positive contribution towards the overall performance of the deposit money banks in Nigeria.

5. Research Methodology

In this chapter, the author aims at analyzing the correlation between managing the portfolio and the financial performance of the deposit money banks in Nigeria. Regression analysis was utilized to measure the interactions among the variables and measure the strength of each independent variable on the dependent variables. The researchers applied the macroeconomic data obtained in the published annual financial reports of 10 deposit money banks in Nigeria within a period of 10 years, that is, between 2015 and 2024. In estimating the multiple regression model, the panel least squares (PLS) method was used because of the cross-sectional data. The independent variables were Liquidity Risk (LR), Credit Risk (CR), Financial Risk (FR), Tenor (TN), and Deposit Mix (DM), whereas the dependent variables were Return on Assets (ROA) and Return on Equity (ROE). In order to guarantee the validity of the results and prevent the spurious regression outcomes, the preliminary tests were carried out. In particular, the Augmented Dickey-Fuller (ADF) test was used to test the presence of unit roots as well as, the stationarity of the variables. All the variables were also computed using descriptive statistics. The E-Views statistical software version 9.0 was used to carry out the analysis. The statistical significance level was considered 0.05 p-value, the value used to assess the relationships and effects to be tested in the study.

5.1 Model Specification

In order to test for the relationship between Portfolio Management on Financial Performance, the regression model was adopted. The independent variable of the study is Portfolio Management, and the following proxies were used to measure it; liquidity risk, credit risk, financial risk, tenor, and deposit mix. The dependent variable is financial performance and the proxies used were Return on Asset (ROA), and Return on Equity (ROE) . The multiple linear regression analysis model which would be used is given as follows:

$Y= f(X)$

Where;
Y= Dependent Variable
X= Independent Variable
FP = f (PM
PM = Portfolio Management
FP = Financial Performance
Y = Financial Performance
Y = y_1 , y_2 , y_3
y_1 = Return on Asset (ROA)
y_2 = Return on Equity (ROE)

While,
X = Portfolio Management
X =X_1 , X_2 , X_3 , X_4 , X_5
X_1 = Liquidity Risk (LR)
X_2 = Credit Risk (CR)
X_3 = Financial Risk (FR)
X_4 = Tenor (T)
X_5 = Deposit Mix (DM)
y_1 = f(x)
y_2 = f(x)
y_3 = f(x)
Therefore, FP= f (X_1 , X_2 , X_3 , X_4 , X_5)
ROA= f (LR, CR, FA, T, DM)……f1……Equation 1
ROE= f (LR, CR, FA, T, DM)……f2……Equation 2
F1, F2 and F3 are the working functional relationships that would be used to determine the impact of Portfolio Management and Financial Performance of Selected Money Banks in Nigeria.
Given the above mathematical equation, the econometric model expresses Financial Performance as a function of Portfolio Management. The model for the regression analysis is presented below as:
$ROA_{it} = \beta_0 + \beta_1(LR)_{it} + \beta_2(CR)_{it} + \beta_3(FR)_{it} + \beta_4(T)_{it} + \beta_5(DM)_{it} + e_{it}$ ……...Model 1
$ROE_{it} = \beta_0 + \beta_1(LR)_{it} + \beta_2(CR)_{it} + \beta_3(FR)_{it} + \beta_4(T)_{it} + \beta_5(DM)_{it} + e_{it}$ ……...Model 2

Where;
ROA= Return on Asset
ROE = Return on Equity
LR = Liquidity Risk
CR = Credit Risk
FR = Financial Risk
T =Tenor
DM = Deposit Mix
β_0 represent regression intercept (constant parameter/intercept);

6. Data Analysis, Results and Discussions

Table 6.1: Unit Root Test Using Augmented Dickey Fuller (ADF) 2015-2024.

Variables	ADF-Statistic	Critical Values	Order of Integration
LR	-8.515384 (0.0000)	1% = -4.226815 5% = -3.536601 10% = -3.200320	Stationary at level
CR	-4.509501 (0.0049)	1% = -4.509501 5% = -4.226815 10% = -3.536601	Stationary first difference
FR	-7.452877 (0.0000)	1% = -4.226815 5% = -3.536601 10% = -3.200320	Stationary at level
TN	-6.567140 (0.0000)	1% = -4.234972 5% = -3.540328 10% = -3.202445	Stationary at second difference

DM	-9.667270 (0.0000)	1% = -6.055378 5% = -4.321562 10% = -3.972089	Stationary at level
ROA	-6.702505 (0.0000)	1% = -4.509501 5% = -4.226815 10% = -3.536601	Stationary first difference
ROE	-6.667344 (0.0000)	1% = -4.234972 5% = -3.540328 10% = -3.202445	Stationary at second difference
NPM	-8.515384 (0.0000)	1% = -4.226815 5% = -3.536601 10% = -3.200320	Stationary at first difference

Source: *Researchers Compilation 2025.*

The results of the Stationarity (unit root) test indicate that ROA, NPM, and CR were stationary at first difference; ROE and TN stationary at second difference while LR, FR and DM was stationary at level. Therefore, it indicated that most of the variables were stationary at the different levels. Hence, further analysis could be carryon to test the long run relationship among the variables.

Table 4.2: Descriptive Statistics of the Variables (Sample: 2015- 2024)

Statistics	CR	DM	NPM	ROA	ROE	FR	LR	T
Mean	54263963	2598.029	43755917	0.038561	0.160202	66131670	1.50E+09	5.800000
Median	309512.0	2191.440	159241.5	0.025636	0.161331	218421.5	5272476.	5.500000
Maximum	4.03E+08	6362.462	2.15E+08	0.318244	0.339435	2.54E+08	1.06E+10	12.00000
Minimum	5885.000	7.120000	2180.000	0.007708	0.007868	614.0000	5751.000	1.000000
Std. Dev.	90403064	2327.428	63776688	0.053801	0.077145	88279197	2.44E+09	3.023716
Skewness	1.949449	0.176756	1.225862	4.083505	0.149212	0.801032	1.963887	0.434896
Kurtosis	6.617998	1.371419	3.251195	19.85656	2.926171	2.007693	6.656145	2.276228
Jarque-Bera	58.94024	5.785930	12.65427	730.9244	0.196890	7.398509	59.98917	2.667468
Probability	0.000000	0.055412	0.001787	0.000000	0.906245	0.024742	0.000000	0.263492
Sum	2.71E+09	129901.4	2.19E+09	1.928056	8.010109	3.31E+09	7.52E+10	290.0000
Sum Sq. Dev.	4.00E+17	2.65E+08	1.99E+17	0.141833	0.291614	3.82E+17	2.92E+20	448.0000
Observations	100	100	100	100	100	100	100	100

Source: *Researchers Compilation 2025.*

The descriptive statistics presented in Table 2 indicate notable variations across the study variables. Credit Risk (CR) recorded an average value of ₦54,263,963 million, with a maximum of ₦403,000,000 million and a minimum of ₦5,885 thousand. The distribution is positively skewed (1.949449), and the probability value of 0.000000 is below the 0.05 threshold, indicating statistical significance at the 5% level. Deposit Mix (DM) shows a mean value of ₦2,598,029 million, a maximum of ₦6,362,462 million, and a minimum of ₦7,120 thousand. The skewness value of 0.176756 suggests a slight positive distribution. However, the probability value of 0.055412 exceeds 0.05, indicating that the variable is not statistically significant at the 5% level.

Net Profit Margin (NPM) has an average value of ₦43,755,917 million, with a maximum of ₦215,000,000 million and a minimum of ₦2,180 million. The data remain positively skewed (1.225862), and the probability value of 0.001789 confirms significance at the 5% level. Return on Assets (ROA) records a mean of 0.038561 (3.8%), a maximum of 0.318244 (31.8%), and a minimum of 0.007708 (0.7%). The distribution is highly positively skewed at 4.083505, with a probability value of 0.000000, indicating strong statistical significance. Similarly, Return on Equity (ROE) shows an average of 0.160202 (16.0%), with a maximum of 0.318244 (31.8%) and a minimum of 0.007868 (0.7%). The skewness value of 0.149212 reflects a mild positive distribution. However, its probability value of

0.906245 exceeds 0.05, suggesting that it is not statistically significant at the 5% level. Financial Risk (FR) reports a mean value of ₦66,131,670 million, with a maximum of ₦254,000,000 million and a minimum of ₦6,140,000 million. The variable is positively skewed (0.801032), and the probability value of 0.024742 indicates statistical significance at 5%. Liquidity Risk (LR) has an average value of ₦1,500,000,000 billion, reaching a maximum of ₦10,600,000,000 billion and a minimum of ₦5,751,000 million. The skewness statistic of 1.963887 shows a positive distribution, while the probability value of 0.000000 confirms statistical significance. Lastly, Tenor (TN) records an average duration of 5 years and 8 months, with a maximum of 12 years and a minimum of 1 year. The skewness value of 0.434896 indicates a moderate positive distribution. However, the probability value of 0.263492 is above 0.05, implying that it is not statistically significant at the 5% level. Overall, the findings suggest that most of the variables exhibit positive skewness. While several variables are statistically significant at the 5% level, others do not meet the required threshold, indicating varying levels of statistical relevance within the model.

Figure 4.1: Stationary Graph at Level for the Combined Variables

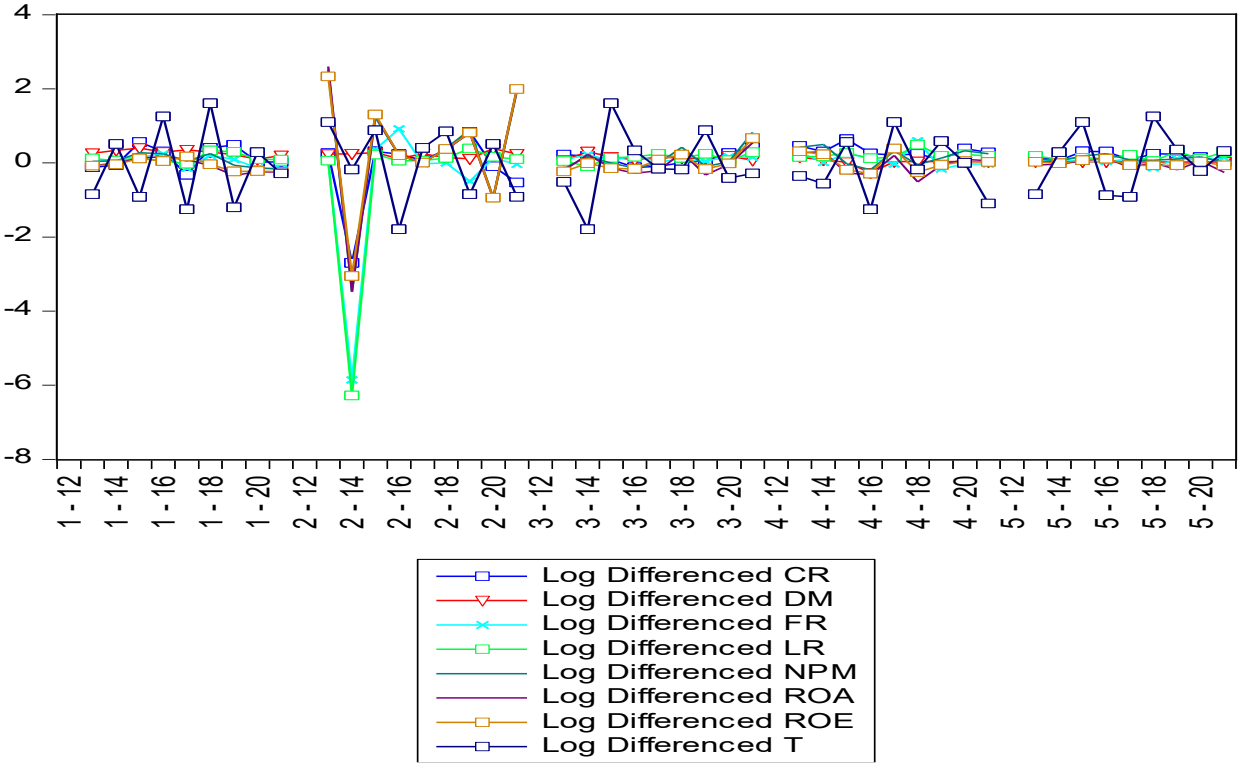
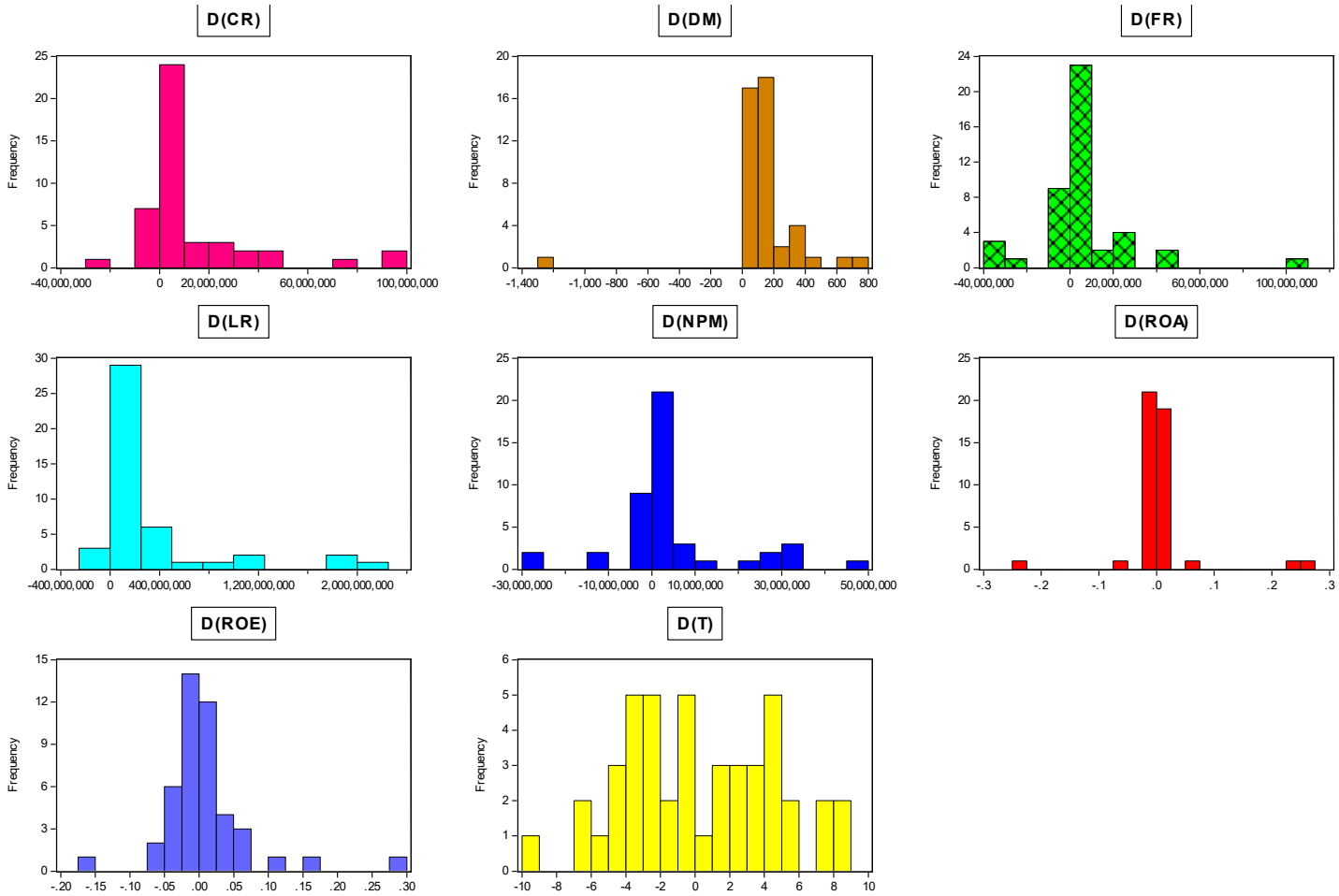


Figure 4.2 Stationary Graphs at the Level for Individual Variables



6.3 Research Hypotheses

6.3.1 Hypothesis One

H_0: Portfolio Management has no significant effect on Return on Asset of Selected Deposit Money Banks in Nigeria.

Model Representatives (1)
Estimation Equation:
==========
ROA = C(1) + C(2)*LR + C(3)*CR + C(4)*FR + C(5)*T + C(6)*DM

Substituted Coefficients:
==========
ROA = 0.0786714546659 + 3.05302613704e-12*LR - 1.04091991735e-10*CR - 8.52868673764e-11*FR - 0.00249522283549*T - 7.29145260171e-06*DM
Dependent Variable: ROA
Method: Panel Least Squares
Date: 05/26/25 Time: 06:55
Sample: 2014 2025
Periods included: 10
Cross-sections included: 10
Total panel (balanced) observations: 100

Table 6.3

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.078671	0.019210	4.095418	0.0002
LR	3.054562	1.992011	3.153156	0.0090
CR	1.042710	5.371510	1.193783	0.0472
FR	8.539511	1.682510	2.508742	0.0135
TN	0.872495	0.204645	0.943378	0.0506
DM	7.291706	3.831906	1.905200	0.0333

R-squared	0.548601	Mean dependent var	0.038561
Adjusted R-squared	0.051851	S.D. dependent var	0.053801
S.E. of regression	0.052388	Akaike info criterion	1.948124
Sum squared resid	0.120757	Schwarz criterion	2.718681
Log likelihood	79.70310	Hannan-Quinn criter.	-2.860751
F-statistic	31.53593	Durbin-Watson stat	0.504616
Prob(F-statistic)	0.000001		

Source: *Researchers Compilation 2025*

6.4 Hypothesis Two

H_0: Portfolio Management has no significant effect on Return on Equity of Selected Deposit Money Banks in Nigeria.

Model Representatives (2)

Estimation Equation:

==========

ROE = C(1) + C(2)*LR + C(3)*CR + C(4)*FR + C(5)*T + C(6)*DM

Substituted Coefficients:

==========

ROE = 0.115203480782 + 4.87790249236e-11*LR + 5.45143010215e-10*CR + 1.05424528481e-09*FR - 0.00208604643709*T + 1.20076527979e-05*DM

Dependent Variable: ROE
Method: Panel Least Squares
Date: 05/26/25 Time: 06:57
Sample: 2014 2025
Periods included: 10
Cross-sections included: 10
Total panel (balanced) observations: 100

Table 6.4

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.115203	0.022731	5.068027	0.0000
LR	4.884311	2.36E-11	2.067898	0.0446
CR	5.454710	6.36E-10	0.857633	0.3957
FR	1.058909	1.98E-10	5.314335	0.0000
T	0.012086	0.003130	-0.666489	0.5086
DM	1.207705	4.53E-06	2.651410	0.0111

R-squared	0.420146	Mean dependent var	0.160202
Adjusted R-squared	0.354254	S.D. dependent var	0.077145
S.E. of regression	0.061992	Akaike info criterion	-2.611450
Sum squared resid	0.169093	Schwarz criterion	-2.382007
Log likelihood	71.28625	Hannan-Quinn criter.	-2.524077
F-statistic	16.37642	Durbin-Watson stat	0.301098
Prob(F-statistic)	0.000156		

Source: *Researchers Compilation 2025.*

6.5 Interpretation of the coefficients of determination

The regression findings show that multiple regression analysis was done to test the relation between the independent variables and the dependent variable. The results indicate that Liquidity Risk (LR), Credit Risk (CR), Financial Risk (FR), Tenor (TN), and Deposit Mix (DM) have statistically significant positive effect on Return on Assets (ROA) with a 5% level of significance. The coefficient of determination (R2) of the model is 0.548601 and this indicates that the overall explanation of the variations in the ROA with the help of the explanatory variables incorporated in the model is approximated to be 54.86. This means that the regression model has a moderate explanatory power. Further analysis of the unstandardized beta coefficients depicts that LR (= 3.054562), CR (= 1.042710), FR (= 8.539511), TN (= 0.872495), and DM (= 7.291706) have positive coefficients. This means that a one percent change in Liquidity Risk and Credit Risk and Financial Risk, Tenor, and Deposit Mix will be observed to be accompanied by a change of about 30.5, 10.4, 85.3, 8.7, and 72.9 in ROA, respectively. Since they all have a p-value that is less than 0.05 (0.0000-0.05), the relationships are not statistically insignificant. On the whole, the findings indicate that the model is a good fit because the independent variables make a significant contribution to the variation in the dependent variable.

6.6 Decision Rule

Durbin-Watson statistic is employed to identify whether there exists autocorrelation in the returns of a regression equation. It is a value that lies between 0-4 with a closer value of 2 showing no autocorrelation. Values that are closer to 0 indicate positive autocorrelation whereas those that are closer to 4 indicate negative autocorrelation. The estimated value of 0.504616 (Durbin-Watson) implies that the model has a positive serial (first-order) autocorrelation. Also, F-statistic of 31.53593 with a probability value of 0.000001 supports the fact that the overall regression model is significant. This implies that the explanatory variables together do have a significant influence on the dependent variable. According to the general findings, Liquidity Risk, Credit Risk, Financial Risk, Tenor, and Deposit Mix have a significant impact on Return on Assets. Thus, the null hypothesis (H 0) that there is no significant impact of portfolio management on the Return on Assets of the listed Deposit Money Banks in Nigeria is rejected and the alternative one is accepted.

7. Discussion of Findings

Study has empirically investigated the links between Portfolio Management and Financial Performance in Selected Deposit Money Banks under three specific objectives. The first objective is explained below:

The hypothesis one summary indicates that the coefficient of determination is R-squared is 0.548601, this therefore reveals that all the explanatory variables jointly account for 54.8% changes in Return On Asset determined by all the predictors. It indicates that the first objective found that Liquidity Risk (LR), Credit Risk (CR), Financial Risk (FR), Tenor (T), and Deposit Mix (DM) have significant positive effect on the Return on Asset (ROA) at the 5% alpha level of significance. The results of the findings of this study is in line with the findings and study of Olokoyo, (2012); Akinlo & Akinlo, (2016), who had similar results that portfolio management has a positive relationship with financial performance of listed deposit money banks in Nigeria otherwise, the study of Babajide & Olufemi, 2018 and Ajayi & Omankhanlen (2020); Mwatuwano (2012); Joan, (2021) shows a negative significant relationship.

8. Implication of Findings

The finding of the study show that Portfolio Management has a significant positive effect on Return on Assets (ROA) indicates that effective portfolio management strategies can lead to improved asset utilization and higher profitability for the company. Some key implications of this finding are; efficient asset allocation, Risk diversification, optimal resource utilization, Focus on value creation, Enhanced decision-making, Investor confidence and valuation, and Competitive advantage. It is therefore important to highlight that the implications mentioned above assume that portfolio management is carried out skilfully and aligns with the company's objectives and risk tolerance. Poorly executed portfolio management strategies may lead to adverse effects on ROA and overall financial performance. Therefore, companies should ensure that they have competent professionals overseeing their portfolio management activities and regularly review and adjust their strategies as needed.

9. Conclusion and Recommendation

The study analyzed the effect portfolio management on financial performance of listed deposit money banks in Nigeria. Based on the findings, the study concluded that portfolio management has positive significant effect on the financial performance of listed

deposit money banks in Nigeria. Based on the findings, the following were recommended:

Financial institutions, particularly deposit money banks, should prioritize and enhance their portfolio management practices. This incorporates the adoption of strong measures of diversifying and managing their investment portfolios. In such a manner, banks will have a chance to increase their ROA and general financial performance. Moreover, banks should also be encouraged to frequently review and evaluate the performance of their portfolios, and pinpoint any risks in their portfolios and implement the required amendments to maximize returns.

Portfolio management should be considered an issue of importance by financial institutions to maximize on their Return on Equity (ROE). As a way of exploiting this beneficial influence, banks ought to concentrate on creating sound portfolio management procedures that conform to its business purposes and risk propensity. This is why it is also desirable that banks maintain a clearly defined risk management structure to ensure that the portfolio is duly diversified and the risk is adequately addressed.

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Imperativeness of Trade Unionism to Employee Engagement: Evidence from Manufacturing Companies in Nigeria

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Abstract. The trade union movement all over the world has always served as platform to support decent work and check managerial rascality there by making labour partners in progress and not just dispensable tools. In spite of the presence of labour organization employees are still faced with threat, opposition, unjustifiable dismissal, denial of statutory rights, alienation and executive excesses. Hence, the need to examine the imperativeness of trade unionism to employee engagement. The study seeks to establish a connection between trade unionism and employee engagement in a unionized organization by determining the veracity of employee contract at ensuring production-stimulated work environment. The study used six hundred and four (604) participants drawn from the total population of two thousand six hundred and eighty (2,680) employees through stratified random sampling techniques. Primary data was collected from the respondents using Likert format questionnaire and data analyzed using Linear regression analysis. The reliability of the measuring instruments was determined by means of Cronbach Alpha Coefficients, and the validity was confirmed using Confirmatory Factor Analysis through Structural Equation Modelling. The Kaiser Mayer Oklin was used as a prerequisite for conducting Confirmatory Factor Analysis. The results showed that there were positive ($r>0.5$) correlations between trade union participation, employee welfare, employee contract and employee engagement. Furthermore, the results showed that there were strong ($r>0.5$) positive correlations between employee engagement, communication and work environment. Findings from the study revealed that trade unionism enhances employee engagement and ensure production-stimulated work environment because labour organization always pressured organization to do the right thing; but collective bargaining is losing its potency as employers of labour always most time have reasons to renege on their promise for better welfare package mostly in developing world due to weak contract enforcement mechanism. The study concluded that trade union leaders need to do more and be more assertive in ensuring that agreements bargained is executed. Based on the conclusion, the study recommended that the management must do everything within its power to manage labour movement in the organization through employee engagement, ensuring employee welfare, working conditions and timely compensation and other benefits so that trade unionism does not turn to be a menace to organizational stability.

Keywords: Trade union, employee engagement, collective bargaining, employment contract, welfare package.

1. Introduction

Industrial relations practice has become one of the most delicate and complex problems of modern industrial society. Industrial progress is impossible without cooperation of labour and other related bodies. One can equally argue that industrial relations is a major factor that affects directly or indirectly workplace employment and productivity through such variables as managerial competence, workers motivation, and institutional backup (Osarenmwinda & Prince, 2023). In this era of globalization, coupled with complex organizational structures and changing workplace environment, no nation's industrial sector can function effectively without the cooperation of employers, employees, government, and labour unions culminating in a tripartite relationship, integrated for nation's development. Since labour force serves as a critical factor for organizational and nation's development, the relationship between employees, employers, trade union and government has become an important issue to address for smooth functioning of labour union organizations, government, employers of labour and employees. According to Thompson (2011) many organizations today value their labour force and see them as major contributors to the achievement of corporate goals, and they recognize that employing effective employment relationships and engagement can enhance their organizations' strength. Labour unions and employment engagement have been the most critical element to address in both the public and private sectors since the conception of modern economic organizations (Akume & Abdullahi, 2013). All over the world, trade unions have become important agents of socio-economic transformation and class struggle always representing the working-class interests against capitalist exploitations. In contemporary times, trade

unionism has become an indispensable tool in ensuring industrial harmony between employer and employee, especially in developing countries. It is well known that trade unions have emerged throughout the world to improve workers living and working conditions (Okechukwu, 2016).

The relationship between employees and employers and trade union has been seen as tripartite relationship of which its effective management leads to favourable workplace employment relations and contributes maximally to nation's economic development, growth, stability, success of labour unions as well as friendly work environment (Budd, 2018). Employment relations focuses on managing the relationship between employees and employers to enhance their engagement (Sholokwu, 2020).

1.1 Statement of the Problem

Trade union has always been posited as a pressure group by all standards and purposes and by this stands to defend the rights of their members and the populace in general. Trade unionism ensures that workers are given the right attention and social contracts as agreed by both the employers and the employees are executed. Gradually we see trade unions in Nigeria sliding and not having the right bite they use to have some years back. This has greatly affected employee engagement and workers right denied. It is not out of place to see workers at the mercy of their employers. Lack of vibrant trade union has caused denial of employees' rights, unjustified dismissal, retrenchment without statutory payments, lopsided and inequitable salary, unjustified deductions and surcharges that are unexplainable, and precarious work environment. Employee engagement, which is the level of enthusiasm, commitment, and emotional investment an employee has in their role and the company's success, goes beyond job satisfaction and extends to how connected employees feel to their colleagues, leaders, and the organization's mission. The connection cannot be ascertained where workers' rights and privileges cannot be ascertained and institutionalized. At times employers does not do enough to align the employees with the objectives of the organization; tools are not provided and compensation and other things that motivates are not within the reach of the employees, hence the essence of trade union that can engage the employees productively. However, trade unions in Nigeria face several obstacles and that should boost our curiosity of the imperativeness and relevance of trade union in modern and contemporary employment structure. Internal divisions, political meddling, and limited bargaining strength frequently reduce the effectiveness of unions in achieving their goals.

These challenges call for a deeper analysis of trade unions' role in promoting employee engagement, especially in Nigerian public and private institutions where bureaucratic hurdles, financial limitations and compromise of union officials through inducements are widespread, expanding the continuous debate on the relevance of trade unionism in Nigeria. This study aims to fill this gap by examining the imperativeness of trade unionism in ensuring employee engagement in the Nigerian manufacturing companies. Specifically, the study seeks to achieve the following:

- Examine the effect of collective bargaining on employee welfare
- Determine whether lobbying ensures working conditions
- Investigate the influence of strikes on compensation and other benefits.

1.2 Research Hypotheses

The following research hypotheses will be tested to validate the research objectives

Ho – Collective Bargaining does not have any significant effect on employee welfare

Ho - Lobbying does not have any significant effect on working conditions

Ho – Strikes does not have any significant effect on compensation and other benefits

2. Literature Review

2.1 General Concept of Trade Unionism

A labour union otherwise known as a trade union refers to the organization of workforces in the workplace who share the same agenda of attaining joint objectives in crucial matters such as terms and conditions of work. According to Emmanuel, Ismaila & Mustapha (2020), trade union is a constant group of wage recipients who have the resolution to maintain in addition to improving the situations of more than six persons with the principal aim of constituting and regulating the relationship between employees and employers which may take account of negotiating on employees' remuneration and compensation, rules of work, procedures for complaints in the workplace, rules and regulations having to do with hiring, firing and elevation of employees together with safety at work. According to the Nigerian labour law, specifically Section 1(1) of the Trade Unions Act, a trade union is any combination of workers or employers, whether temporary or permanent, formed to regulate the terms and conditions of employment. Its primary purpose is to protect and advance the collective interests of its members in the workplace, which can include improving working conditions, advocating for fair wages, and providing support against unfair treatment, stipulating that at least minimum of fifty people can sign to form a trade union in an organization.

Ogundare (2023) posited that trade union or labor union, often simply referred to as a union, is an organization of workers whose objective is to maintain or improve the conditions of their employment contract, such as attaining better wages and benefits, improving working

conditions, improving safety standards and ensuring the overall well-being and better condition of their members by engaging employers of labour to do what is right and justifiable for those who are in their employment, who create economic values for the sustenance of the organization. According to the International Labour Organization (ILO), a trade union is defined as a workers' organization formed for the purpose of furthering and defending the interests of workers. This encompasses protecting workers' rights, improving conditions of employment like wages and safety, and increasing workers' bargaining power, often through collective bargaining with employers. Akume & Abdullahi (2013) aver that the main justification for labour action is the failure of collective bargaining. When workers and employers engage in collective bargaining, there is no guarantee that it will be successful. Even when successful, there is no guarantee that it will be honoured. Consequently, unsuccessful bargaining and failure to adhere to agreed terms naturally lead to labour conflicts and dislocation of labour harmony (Ibrahim & Bamidele, 2019).

2.2 Activities of trade union in Nigeria

According to Bala & Sadeeq (2024) the key reason for trade unions' establishment is to re - establish the power balance between employers and employees, and to make these employees in the organization to have a common voice through which their grievances could be heard. This is also to give them greater influence on how they should undertake their work and to boost their input in organizational decision-making in such a manner that this will be beneficial not only to themselves, but also to their employers. However, to achieve these purposes, the unions' main activities within the associations must be effectively undertaken and carefully carried out as these comprise, but not limited to:

Purposeful Representation of the Employees' Interests to the Employers: Generally, good unions with purposeful and selfless leadership at work are always preoccupied with activities that will promote the general welfare of the members. The unions' executives ensure that they represent their members to their employers in a meaningful or purposeful manner. According to Armstrong (2006), this may be through collective bargaining or mutual agreement with the management of the organization in which the unions are formed.

Engagement in Diverse Exercises to Press for Workers' Demands when Negotiations Fail: As said by Griswold (2010), trade unions sometimes do not hesitate to engage in some exercises deem necessary to promptly draw attention of the organizations' management teams to their requests. These, most times, are in form of organization of demonstrations, picketing, embarking on strikes, etc., all is with a view to attract the management's attention. These actions are opted for when all other efforts made by the unions have proved abortive. Griswold (2010) added that in the past, labour unions have influenced a lot not only organizations, but also governments of many countries as the key reason for their formation and development in the first place is to fight for the workers' welfare and rights in public and private establishments as these unions have always mounted pressures on the employers in the favour of the members.

Having Work Arrangements with the Employer: Jepkorir (2014) maintains that trade unions sometimes do arrange works for performance the employer in the organization. This is in as much as employers and the unions' leaders come to agreement on the set targets, and whereby the unions also guarantee mobilization of their members for the realization of the set targets and on the grounds that the employers are in readiness to offer compensation to the employees for the extra work done.

Industrial action: When negotiations fail, unions may organize or support industrial action, such as strikes, to pressure employers into meeting workers' demands.

Membership support & services: Unions provide various services to their members, including training, professional advice, and sometimes financial or recreational benefits.

Advocacy & policy influence: Unions may engage in broader social and political advocacy, lobbying for legislation and policies that support workers' rights and interests.

Grievance handling: Unions represent their members in handling individual complaints and disputes with management, acting as a bridge between employees and employers.

2.3 Assessment of Trade Union activities in Nigeria

The advent of the colonial government heralded wage employment relationship in Nigeria and this brought about employer - employee relationship whereby employer is the master and employee as the servant. In order to strike a balance in this relationship, the colonial master allowed formation of trade union for the first time in Nigeria in 1912 and since that time, the development of trade union has undergone series of transformation although the objectives remained the same as many of the unions were born out of necessity (Oginni, Faseyiku & Ajani, 2019). . Considering the time of the formation of the first trade union which was during colonial era, all the union formed in Nigeria before independence added political emancipation i.e. political struggle for independence to the union's objectives and this endeared the struggle of the union to many people and their leaders were popular and synonymous with deliverer of the masses from the oppression of the colonial government (Odey, & Owan, 2014). We can assert that trade union plays significant role in the realization of independence for Nigeria and remains as one of the oldest institution in Nigeria even though it has undergone series of reformations since Trade Union Ordinances of 1938 to Trade Union Act of 2005 Amendment (Ojomo, 2017).

Oginni et al (2019) opined that over the years, the labour union in Nigeria favours the use of militant approach over fraternal approach and that the fraternal approach has been relegated on account of the behaviour of employers towards union activities. The rationale behind this was evidence in the work of (Ojomo, 2017) when it was opined that behaviour of employers in the last two decades towards the requests of the unions towards fulfilling their obligations to members has been lackadaisical, suppressive and unfriendly. Despite this suppressive behaviour of the employer, the unions had survived and enjoyed active participation from members towards engaging employers for the purpose of actualizing their demands during colonial and post-colonial eras. However, at the return of Nigeria to civil rule in 1999, the trends in successes recorded by unions in the wake of advancing the interests of Nigerian workers towards a remarkable quality of life could not be compared with what had been the in place before 1999. The success was largely due to members' participation because it was considered to be the surest way to survive and meet their collective needs even though not all members were favourably disposed to this collective struggle but majority of the members displayed favourable attitude towards unions' activities and those who stayed away often supported the course of the union by attending meetings whenever it called with maximum cooperation with the directives of the unions' leadership. Since the return of Nigeria to civil rule in 1999, the success recorded in terms of advancing members' interests was very low in comparison with what was obtainable between 1955 - 1999. In the study advance by Edet & Emmanuel (2024) in challenges confronting Nigerian trade union in the 21st Century, members' participation in union activities has gone low because of low level of interest and leadership lack of direction were among reasons adduced forward to explain the decline in members' participation in union activities. The results afterward made Nigerian workers to develop apathy towards unionism with drastic implication on involvement and participation in unions' activities.

Considering the significance of members' participation in union activities as a united force towards improving the economic interest of their members as it was in the early days of trade union development in Nigeria as evident in the works of many researchers in the precolonial era and the first decade after independence, the current state of union members' participation in the activities of the union has become a point of concern for researchers in this area in the last two decades because members' participation is the vital ingredient needed for unions' survival and success in fulfilling their obligations towards members.

There is serious poor perception of union leaders as to their seriousness and unbiased stands on issues of welfare that concern workers in Nigeria. Members' perception of union was because of accumulated experiences, and these accumulated experiences are interpreted accordingly to give corresponding behaviour. In the two decades, the experience has not been palatable as members have lost trust in the leadership of the union, and they could no longer be taken seriously in union activities. Olaseni (2019) conducted a research investigating the reaction of union members on the proposed strike by the joint federal unions (Nigerian Labour Congress and Trade Union Congress) on the Federal government position on national minimum wage that was aborted two hours to the commencement of strike. The outcome of the investigation revealed union members were disappointed and decided to distant from any future participation and vented their anger on the union's properties by vandalizing many of these properties and labelled union leadership as corrupt meaning that the Federal government of Nigeria has bribed the union executive and that was why the strike was aborted despite the fact that their demands were not met. As we investigate the world of work in the future, we can only hope that union leaders will get their hearts together and fight the battles they are elected to fight. Mixing politics with union matters or soliciting favours from government of the day amounts to distortion of interest and encroachment of the fundamentals of unionism. An average Nigerian worker is suffering under the exploitative tendencies of their employers and biting economic policies of government with no palliatives to reduce the effect of the economic reform.

2.4 Concept of employee engagement

Employee engagement refers to the positive, affective psychological work-related state of mind that leads employees to actively express and invest themselves emotionally, cognitively, and physically in their role performance. Employee engagement is therefore a psychological facet that encompasses energy, enthusiasm, and engrossed effort (Asuquo, 2023). According to Usoro (2021) employee engagement refers to the emotional and cognitive state of employees characterized by their commitment, dedication, and involvement in their work and the organization. They concluded that characteristically employee engagement is a multidimensional construct that captures the extent to which employees feel connected to their work, experience a sense of purpose, and are motivated to go above and beyond their job requirements.

The impact of employee engagement extends to various organizational performance metrics, including productivity, profitability and customer satisfaction. Organizations with high engagement levels often report significant improvements in productivity, as employees demonstrate a greater willingness to take initiative and solve problems (Udofia, 2020). The engagement of employees who interact with customers can contribute to enhanced customer satisfaction, as their positive attitudes and commitment are often reflected in their interactions with clients and stakeholders (Olayemi, 2023). Ogundare (2023) posited

that employee engagement acts as a catalyst for achieving positive outcomes on multiple organizational levels. Engaged employees are more invested in their work, leading to higher efficiency and better quality. Research indicates significant increases in productivity and profitability in companies with high engagement.

3. Theoretical Review

3.1 Industrial Democracy Theory

Sidney Webb and Beatrice Webb, the British reformers of the socialist wing developed industrial democracy theory close to the end of the 19th century. Trade unions or labour union is an extension of democracy into the workplace directly from the politics. Union in the organization is therefore considered to be the vehicle used by the workers to bring to bear their will or wills when it comes to getting enhanced remuneration, desired working conditions and improved labor contracts for the benefit of the members. It is therefore argued that individual – based whim is not sufficient to form a decision that is capable of being binding on all in the democratic societies, instead, worthy or acceptable decisions are gotten once every stakeholder in a system has agreed on policies and schemes that are beneficial to all individuals that make up such system. The Webbs therefore conclude that trade unions provide in the workplace opportunities through which employees under an umbrella can easily engage in discussions or dialogues, and negotiations with their proprietors to obtain favourable deals that can facilitate their free operation without victimization of the unions' leaders.

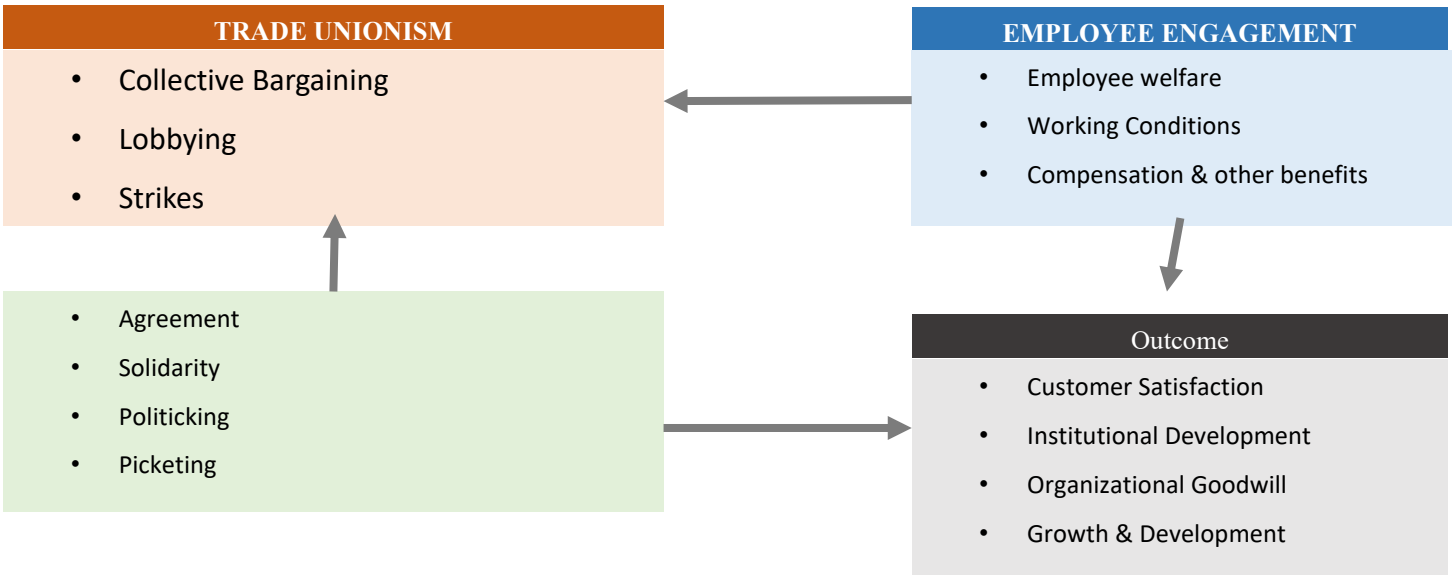
4. Empirical Review

Bala & Sadeeq (2024) examined the effect of trade unionism on the workers' welfare of the Federal Polytechnic Bauchi. The study utilized simple random sampling techniques by administering questionnaires on the respondents to draw the required information. The descriptive statistics used included simple percentages and tables, while inferential statistics utilized was linear regression. The findings of the study established that trade union's actions do have significant effect on employees' wages and salaries; and, that trade union's membership has significant effect on employees' working conditions. The findings of the study indicated further that trade union's negotiation ability plays significant role in improving employees' job security among the Federal Polytechnic staff. The study therefore recommends more encouragement for trade unionism in the Federal Polytechnic Bauchi.

Edet, Etukudoh & Eno (2024) investigated the impact of trade unionism on staff welfare in Nigerian public institutions, with a particular focus on Akwa Ibom State University (AKSU). The study addressed three main objectives: examining the effect of trade union activities on working conditions and benefits at AKSU, assessing the relationship between lobbying efforts and staff welfare, and evaluating the impact of strikes on staff welfare at the university. The findings revealed that trade union activities significantly impacted the working conditions and benefits of employees at AKSU. Unionized staff reported better access to resources, improved remuneration, and more favorable working environments compared to their non-unionized counterparts. The study also found a positive relationship between lobbying and staff welfare in AKSU, as effective lobbying efforts by trade unions contributed to the implementation of policies and programs that enhanced staff welfare, such as salary reviews and career development opportunities. The study concluded that trade unionism played a vital role in shaping staff welfare in Nigerian public institutions, as exemplified by the case of Akwa Ibom State University (AKSU). The findings highlighted the importance of constructive engagement between university management and trade unions to address staff welfare concerns and foster a conducive work environment. The study recommended that the university management and the state government establish regular dialogue and collaborative platforms with trade unions to address staff welfare issues proactively. AKSU should also develop comprehensive staff welfare programs that address the diverse needs of its academic and non-academic staff and strengthen its internal dispute resolution mechanisms to minimize the frequency and impact of strikes.

Emmanuel, Ismaila & Mustapha (2020) investigated the effect of trade unionism on the workers' welfare of the Nigerian Medical Association (NMA) in Kwara State. The study utilized simple random sampling techniques by administering questionnaires on the respondents so as to draw the required information. The descriptive statistics used included simple percentages and tables, while inferential statistics utilized was linear regression. The findings of the study established that trade union's actions do have significant effect on employees' wages and salaries; and, that trade union's membership has significant effect on employees' working conditions. The findings of the study indicated further that trade union's negotiation ability plays significant role in improving employees' job security among the medical staff of the Association. The study therefore recommends more encouragement for trade unionism in the Kwara State chapter of NMA.

5. Conceptual Framework



From the diagram above we saw the connectivity between trade unionism and employee engagement in a typical organization. The variable adopted by the study to represent trade unionism are collective bargaining, lobbying and strikes. Trade union activities alongside these variables are agreements, solidarity, politicking and picketing. Employee engagement includes employee welfare, working conditions, compensation and other benefits. Where there is good relationship between the employer and the employee, it is noticeable in employee engagement, while the study concluded that employee engagement will result into customer satisfaction, institutional development, organizational goodwill, and growth and development.

6. Research Methodology

The study adopted a survey research design which helps in the collection of respondents' opinions on the activities of trade unions in organizations and employee engagement. Primary data were collected through questionnaire administration. The population of this study consists of six hundred and five (605) employees of C-Way Foods Limited, Fidson Glow healthcare Limited, Tuyil drugs manufacturing company Nigeria Limited. The target population includes top management staff including executive directors, middle management staff (departmental heads/supervisors) and lower management staff (operatives). A census sampling approach was adopted for the study, and the entire population constituted the sample size. Validity and reliability of the instrument was carried out using Factor Analysis and Cronbach's Alpha respectively.

Statistics of participants by organizations

Name of Organization	Number of Participants
C-Way Foods Limited, Nigeria	306
Fidson Glow Healthcare Limited, Nigeria	184
Tuyil Drugs Manufacturing Company, Nigeria	115

7. Data Presentation and Analysis

Demographic information of the respondents

Table 4.1: Demographic Information of the Respondent's Firm

Variables	Frequency	Percentage
Gender:		
Male	510	84.3%
Female	95	15.7%
Total	605	100%
Academic Qualification:		
OND/HND holder	11	1.8%
B.Sc holder	315	52.1%
MSc/MBA holder	191	31.6%
PhD holder	50	8.3%
Others	38	6.3%
Total	605	100%

Age Category:		
20-29yrs	259	42.8%
30-39yrs	242	40.0%
40-49yrs	68	11.2%
50yrs and above	36	6.0%
Total	605	100%
Employees' Status:		
Junior Staff	226	37.4%
Senior Staff	131	21.7%
Assistance Directors	92	15.2%
Managing Directors	26	4.3%
Supervisors	130	21.5%
Total	605	100%
Years of Experience in Construction		
1-5yrs	262	43.3%
6-10yrs	176	29.1%
11-15yrs	76	12.6%
16-20yrs	59	9.8%
20yrs & above	32	5.3%
Total	605	100%

Source: *Field Survey (2025)*

Testing of Research Hypotheses

Hypothesis One

H_{01}: Collective Bargaining does not have any significant effect on Employee Welfare.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.134[a]	.118	.116	13.77029	1.811

a. Predictors: (Constant), Collective Bargaining

b. Dependent Variable: Employee Welfare

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	2087.141	1	2087.141	11.007	.001[b]
	Residual	114341.381	603	189.621		
	Total	116428.522	604			

a. Dependent Variable: Employee Welfare

b. Predictors: (Constant), Collective Bargaining

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	56.849	3.475		16.358	.000
	Collective Bargaining	.147	.044	.134	3.318	.001

Dependent Variable: Employee Welfare
Source: Author's computation (2025)

Interpretation of the coefficients

The above result was analyzed using linear regression analysis of the coefficients. The dependent variable of the model is Employee Welfare (EW) while the independent variable is Collective Bargaining (CB). The estimation results show that the variable- Collective Bargaining has significant impact on employee welfare at the 5% alpha level of significance. Therefore, the estimation shows that the co-efficient of determination R-squared is 0.118, implying that explanatory variable accounted for 11.8% changes in Employee Welfare (EW). Un-standardized coefficient of determination value (β= 0.147) indicated that 1% increase in Collective Bargaining led to 14.7% increase in Employee Welfare with (P-value of 0.000 < 0.05%). It tells us the model is of good fit, and that the independent variable to a large degree explains changes in the dependent variable.

Interpretation of Durbin Watson and F- Statistics

The Durbin Watson statistic is a number that tests for autocorrelation in the residuals from a statistical regression analysis. The Durbin-Watson statistic is always between 0 and 4. A value approaching 2 means that there is no autocorrelation in the sample. Values approaching 0 indicate positive autocorrelation and values toward 4 indicate negative autocorrelation. From the estimation, Durbin Watson statistics is (1.811), this implies that there is no serial or positive autocorrelation. Therefore, is no evidence of first order serial correlation in residuals regression analysis. Also, the F-statistics value is (11.007) with a probability or significant level of P-value 0.001 < 0.05 shows the overall analysis of variance of the model; while the result indicates that explanatory variables are fundamental, explaining the overall variation in the dependent variable. In conclusion, since at the overall level, collective bargaining can bring positive effect to the employee welfare, therefore, H_0 that says, "*Collective Bargaining does not have any significant effect on Employee Welfare*", is rejected while the alternative H_1 hypothesis accepted. This finding lends credence to the observation of Olayemi (2023) in his study that unionization of the workforces in the organization has been so helpful in making individuals in the company to put in their best towards the organizational productivity knowing fully well that they would not be denied their rights and that their interests would always be protected by the union.

Hypothesis Two

H_{02}: Lobbying does not have any significant effect on working conditions.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.687[a]	.472	.471	6.55107	1.464

a. Predictors: (Constant), Lobbying

b. Dependent Variable: Working Condition

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	23160.584	1	23160.584	539.667	.000[b]
	Residual	25878.629	603	42.916		
	Total	49039.213	604			

a. Dependent Variable: Working Condition

b. Predictors: (Constant), Lobbying

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	15.473	1.203		12.857	.000
	Lobbying	-.346	.015	.687	23.231	.000

Dependent Variable: Working Condition
Source: Author's computation (2025)

Interpretation of the coefficients

The above analysis was done using linear regression analysis of the coefficients. The dependent variable of the model is Working Conditions (WC) while the independent variable is Lobbying (Lobby). The estimation results show that the variable- Lobbying has significant impact on the Working Conditions at 5% alpha level of significant. Therefore, the estimation shows that the co-efficient of determination R-squared is 0.472, implying that explanatory variable accounted for 47.2% changes in Working Conditions (WC). Un-standardized coefficient of determination value (β= -0.346), indicating that 1% increase in lobbying led to 34.6% decrease in effective administration standard with (P-value of 0.000 < 0.05%).

Interpretation of Durbin Watson and F- Statistics

From the estimation, Durbin Watson statistics is (1.464), implying that there is no serial or positive autocorrelation. While F-statistics value is (539.667) with a probability or significant level of P-value 0.000 < 0.05 showing the overall analysis

of variance of the model; while the result indicates that explanatory variable are fundamental explaining the overall variation in the dependent variable. In conclusion, since at the overall level, lobbying bring negative effect to the working conditions, therefore, H_0 that says, "*Lobbying does not have any significant effect on working conditions*", is rejected while the alternative H_1 hypothesis accepted. The finding corroborates the result of the research undertaken by Emmanuel, Ismaila and Mustapha (2020) which ascertained that the level of negotiation that union's members adopt do go a long way in exerting significant influence on workers' welfare.

Hypothesis Three

H_{03}: Strikes does not have any significant effect on Compensation and Other Benefits.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.358[a]	.128	.126	11.45672	1.731

a. Predictors: (Constant), Strikes

Dependent Variable: Compensation and Other Benefits

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	11600.553	1	11600.553	88.381	.000[b]
	Residual	79147.638	603	131.256		
	Total	90748.192	604			

a. Dependent Variable: Compensation and Other Benefits

b. Predictors: (Constant), Strikes

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	57.457	1.931		29.748	.000
	Strikes	-.227	.024	.358	9.401	.000

Dependent Variable: Compensation and Other Benefits
Source: Author's computation (2025)

Interpretation of the coefficients

The above result was analyzed using linear regression analysis of the coefficients. The dependent variable of the model is Compensation and Other Benefits (COB) while the independent variable is Strikes (Strikes). The estimation results show that the variable- Strikes has significant impact on Compensation and Other Benefits at 5% alpha level of significant. Therefore, the estimation shows that the co-efficient of determination R-squared is 0.128, implying that explanatory variable accounted for 12.8% changes in Compensation and Other Benefits (COB). Un-standardized coefficient of determination value (β= -0.227), indicated that 1% increase in Strikes led to 22.7% decrease in Compensation and Other Benefits with (P-value of 0.000 < 0.05%).

Interpretation of Durbin Watson and F- Statistics

From the estimation, Durbin Watson statistics is (1.731), implying that there is no serial or no positive autocorrelation. So, there is no evidence of first order serial correlation in residuals regression analysis. While F-statistics value is (88.381) with a probability or significant level of P-value 0.000 < 0.05 shows the overall analysis of variance of the model. In conclusion, since at the overall level, strikes bring negative changes to the compensation and other benefits, therefore, H_0 that says, "*Strikes does not have any significant effect on Compensation and Other Benefits*", is rejected while the alternative H_1 hypothesis accepted. This result substantiates the finding of the study that was carried out by Gichaba (2013) which established that strikes by the labour organization exert significant influence on the employees' compensation, conditions and terms of service, and job security at Kisii University, Kenya.

8. Conclusion and Recommendations

From the first objective it indicated that collective bargaining enhances employee welfare with (P-value of 0.000 < 0.05%). Where employers give room for collective bargaining employee welfare will always receive the needed attention. From the second objective the estimation results show that the variable- Lobbying

has significant impact on the Working Conditions at 5% alpha level of significant. Lobbying by the trade union also connotes negotiation, arbitration, diplomacy, consensus and compromise. This process most of the time used by the union comes with benefit of improved and better working conditions. From the third objective the estimation shows that the co-efficient of determination R-squared is 0.128, implying that explanatory variable accounted for 12.8% changes in Compensation and Other Benefits (COB). Un-standardized coefficient of determination value (β= -0.227). Mostly where there is strike action compensation and other benefits are always affected because of man hour lost and production halted for a long time. This affects the bottom line therefore benefits such as bonuses, profit sharing, and even 13th month salary may be affected negatively. Based on the conclusion the study recommended that the management must do everything within its power to manage labour movement in the organization through employee engagement, ensuring employee welfare, working conditions and timely compensation and other benefits so that trade unionism does not turn to be a menace to organizational stability.

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Diversity, Inclusion and Employee Productivity in Transport Companies in Nigeria

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1. Introduction

In today's globalized and diverse work environment, organizations recognize the importance of diversity and inclusion in enhancing employee productivity. Diversity refers to the presence of different groups or individuals with unique characteristics, experiences, and perspectives within an organization, while inclusion refers to the creation of an environment where all individuals feel valued, respected, and empowered to contribute (Rohwerder, 2017). Research has shown that organizations that promote diversity and inclusion experience higher employee engagement, job satisfaction, and productivity.

Studies have consistently demonstrated the positive impact of diversity and inclusion on employee productivity. For instance, a study by Goswami and Goswami (2018) found that workforce diversity and managerial support significantly influenced workplace inclusion, which in turn affected employee engagement. Similarly, Makudza, Muchongwe and Dangoiso (2020) found that workforce diversity was a significant predictor of employee productivity. However, other studies have highlighted the challenges and limitations of implementing diversity and inclusion initiatives, including the potential for negative outcomes.

Given the importance of diversity and inclusion in enhancing employee productivity, this study aims to investigate the relationship between diversity, inclusion, and employee productivity in a specific organizational context. The study will examine the impact of demographics, inclusion strategies, pay equity, and challenges of diversity and inclusion on employee productivity. By exploring these issues, this study seeks to contribute to the existing body of knowledge on diversity, inclusion, and employee productivity, and provide insights for organizations seeking to improve their diversity and inclusion practices.

Organizations today face the challenge of managing a diverse workforce and creating an inclusive culture that fosters employee productivity. Despite the growing recognition of the importance of diversity and inclusion, many organizations struggle to implement effective diversity and inclusion initiatives that positively impact employee productivity. According to a study by McKinsey (2021), diverse companies are more likely to outperform their less diverse peers, highlighting the importance of diversity and inclusion in driving business outcomes.

Managing diversity is a complex issue that requires organizations to create an inclusive culture that values and respects differences (Goswami & Goswami, 2018). Research has shown that employees who feel included and valued are more likely to be productive and engaged, highlighting the importance of creating an inclusive work environment (Nwosu, Amoke, Kinikanwo & Ikeotuonye, 2025). However, many organizations struggle to create an inclusive culture, with research suggesting that unconscious bias and micro aggressions can negatively impact employee productivity (Krieger, 2019). Inclusion strategies are critical in creating an inclusive culture that fosters employee productivity (Okatta, Ajayi, & Olawale, 2024). Research has shown that organizations that implement effective inclusion strategies, such as diversity training and mentorship programs, are more likely to experience positive business outcomes (Hunt, Layton & Prince, 2018). However, more research is needed to understand the impact of inclusion strategies on employee productivity, particularly in diverse work environments like Nigeria. Therefore, this study is focused on determining the relationship and impact of inclusion strategies and pay equity on employee productivity and the associated challenges faced by organizations in Nigeria in implementing diversity and inclusion initiatives

2. Literature Review

2.1 Conceptual Review

2.1.1 Employee Productivity

Productivity is consistently accomplishing essential tasks while balancing all production elements to achieve the highest output with minimal effort. It involves adopting a mind-set that prioritizes progress and continually enhances existing processes (Locke & Latham, 2019). Employee productivity, or workforce productivity, is the quantifiable measure of an

employee's output or efficiency in completing their assigned tasks or responsibilities within a specific period. This can be measured in terms of the work's quantity, quality or timeliness.
Employee productivity measures how efficiently and effectively a worker or a group of workers contribute to accomplishing organizational goals (Huselid, 2018). It is a key performance indicator (KPI) that measures the output of work in relation to the inputs of time, effort and resources. Improving employee productivity is a critical component of organizational success (Manyika, Woetzel, Bission, Chui, Wong & Damales, 2017).

2.1.2 Consequences / Implications of Employee Productivity

Employee productivity has significant implications for organizational performance and overall business success. High productivity enhances profitability, operational efficiency, and competitiveness, as employees contribute more effectively toward achieving corporate goals (Deloitte, 2022). Productive employees enable organizations to deliver higher-quality outputs at lower costs, which strengthens their market position and customer satisfaction levels. Conversely, low productivity can lead to missed deadlines, reduced output quality, and increased operational costs, ultimately undermining an organization's growth potential (McKinsey & Company, 2021).

Another major consequence of employee productivity is its direct impact on organizational culture and morale. When employees are highly productive, it fosters a positive work environment characterized by motivation, teamwork, and engagement (Gallup report, 2023). Productivity improvements often stem from supportive leadership, effective communication, and recognition, all of which enhance job satisfaction. However, consistently low productivity may reflect disengagement or burnout, leading to dissatisfaction and high turnover rates (SHRM, 2022). Thus, maintaining balanced workloads and fair reward systems is essential for sustaining morale and long-term productivity.

Employee productivity also influences innovation and adaptability within organizations. Productive employees often demonstrate higher creativity and problem-solving capabilities, enabling firms to respond swiftly to market changes and technological advancements (World Economic Forum, 2023). Organizations that cultivate productivity through skills development and inclusive workplace practices benefit from greater innovation and resilience in dynamic environments. In contrast, low productivity may limit innovation capacity, making it harder for firms to adapt to competitive pressures or economic fluctuations (PWC, 2021).

2.2. Diversity and Inclusion

Diversity refers to the presence of differences among individuals within an organization, encompassing characteristics such as race, gender, age, ethnicity, religion, disability, sexual orientation, education, and cultural background (Roberson, 2019). It reflects the variety of unique experiences, perspectives, and identities that people bring to the workplace. Diversity is not only about representation but also about recognizing and valuing these differences as a source of innovation and organizational strength (Shore, Cleveland & Sanchez, 2018). Inclusion, on the other hand, is the practice of creating an environment in which all individuals feel respected, accepted, and valued for who they are (Deloitte, 2020). It involves actively engaging diverse individuals in decision-making processes, ensuring equal opportunities, and fostering a sense of belonging where everyone can contribute their full potential. Inclusion transforms diversity from mere representation into meaningful participation, enhancing collaboration and employee well-being (Ferdman & Deane, 2020).

Both aspects of diversity and inclusion (D&I) are essential in building a healthy and effective workplace culture. Diversity without inclusion can result in a toxic environment where employees feel isolated, while inclusion without diversity may lead to groupthink and a lack of innovation. Although many companies are beginning to prioritize diversity, they often overlook the inclusion component. However, without a strategic commitment to both, employees, especially those from underrepresented groups—may feel unsupported or alienated within the organization (Harvard Business Review, 2017).

Diversity in the workplace refers to the presence of different groups or individuals with unique characteristics, experiences, and perspectives (Rohwerder, 2017). Research has shown that diverse workforces can lead to increased creativity, innovation, and problem-solving (Goswami & Goswami, 2018). A study by Makudza et al. (2020) found that workforce diversity was a significant predictor of employee productivity. Inclusion strategies are critical in creating an inclusive culture that fosters employee productivity. Organizations that implement effective inclusion strategies, such as diversity training and mentorship programs, are more likely to experience positive business outcomes. Research has shown that employees who feel included and valued are more likely to be productive and engaged (Nwosu et al., 2025).

Implementing diversity and inclusion initiatives can be challenging, particularly in organizations with entrenched cultures and biases (Rohwerder, 2017). Research has shown that unconscious bias and micro aggressions can negatively impact employee productivity (Krieger, 2019). Organizations must prioritize creating an inclusive culture that values and

respects differences. The social exchange theory provides a framework for understanding the relationship between diversity, inclusion, and employee productivity. According to this theory, employees who feel valued and respected are more likely to engage in productive behaviours. Diversity and inclusion are an organization's effort, policies, and practices that ensure different groups or individuals of different backgrounds are culturally and socially accepted and integrated into the workplace. An organization that focuses on diversity and inclusion will employ a diverse team of people that reflects the society in which it operates.

2.2.1 Measures of Diversity and Inclusion

2.2.1.1 Inclusion Strategies

An effective inclusion strategy involves creating organizational policies, practices, and cultures that actively embrace diversity and ensure equitable participation and opportunity for all employees. This includes fostering psychological safety, addressing unconscious bias, implementing equitable recruitment and promotion processes, and providing diversity and inclusion training. Recent studies emphasize that organizations with strong inclusion strategies not only improve employee engagement and innovation but also achieve higher financial performance and retention rates, as employees are more likely to feel valued and empowered to contribute their unique perspectives (Bourke & Espedido, 2020; Deloitte, 2023). Inclusive environments can lead to increased innovation, improved employee morale, and a stronger sense of belonging, which can contribute to overall organizational success. Some effective inclusion strategies include listening to employees, using inclusive language, holding leaders accountable, practice inclusive leadership and measuring progress.

2.2.1.2 Pay Equity

Pay equity refers to the principle of compensating employees fairly and equally for work of equal value, regardless of gender, race, ethnicity, or other personal characteristics (Heldman, 2025). It ensures that employees performing similar roles with comparable skills, effort, and responsibility receive equitable compensation. Pay equity goes beyond simple wage comparison, it addresses systemic inequalities that influence salary decisions, such as unconscious bias or discriminatory practices in recruitment, promotion, and evaluation processes (World Economic Forum, 2023).

In the modern workplace, pay equity is increasingly recognized as a cornerstone of diversity, inclusion, and organizational fairness. Studies show that equitable pay enhances employee engagement, trust, and retention while reducing turnover and workplace conflict (Tucker, 2024). Moreover, organizations that prioritize pay equity are more likely to attract diverse talent and comply with global labour standards and legal frameworks promoting fair compensation (OECD, 2022). Ultimately, pay equity fosters a culture of transparency and equality, strengthening both organizational performance and social responsibility.

2.3. Challenges of Workplace Diversity and Inclusion

Challenges of workplace diversity and inclusion often arise because organizations bring together people with different backgrounds, experiences, values, and communication styles. Workplace diversity and inclusion (D&I) face several challenges despite growing awareness and organizational efforts to promote equity. One major challenge is unconscious bias, which affects hiring, promotion, and team dynamics. Even when organizations adopt inclusive policies, implicit stereotypes and prejudices often influence decision-making processes, leading to unequal opportunities for minority employees (Roberson, 2019). Such biases can undermine efforts to create a fair and inclusive environment, especially when leaders are unaware of their own prejudgments. Another significant challenge is communication and cultural barriers among employees from diverse backgrounds. Differences in language, cultural norms, and communication styles can lead to misunderstandings and conflict, ultimately affecting teamwork and productivity (Onyebueke, 2024). When employees do not feel understood or respected, it reduces engagement and collaboration, thereby weakening inclusion efforts. Organizations often underestimate the importance of cultural intelligence training to address these issues effectively.

Furthermore, resistance to change remains a major obstacle to diversity and inclusion. Some employees or managers perceive D&I initiatives as threats to established norms or favouritism towards certain groups, creating tension within the workplace (Lima, Rahman, Bhuiyan, & Rahman, 2025). This resistance can manifest in passive non-compliance or active opposition, which hinders the success of inclusion programs. Without strong leadership commitment and continuous education, these negative perceptions persist and weaken organizational culture. Lastly, lack of accountability and measurement limits progress in D&I implementation. Many organizations fail to track diversity metrics or evaluate the real impact of their initiatives, resulting in superficial compliance rather than meaningful change (Bourke & Espedido, 2020). Sustainable inclusion requires setting clear goals, monitoring progress, and holding leaders responsible for outcomes. Without data-driven accountability, diversity efforts risk becoming symbolic rather than transformative.

2.4. Theoretical Framework

The theoretical framework was developed from the integration of Cultural Intelligence (CQ) Theory and Social Exchange Theory (SET). It illustrates how

diversity and inclusion affect employee productivity. Developed by Ang and Dyne (2008), cultural Intelligence refers to the ability to effectively understand, adapt to, and work across different cultural contexts, a skill that is central to authentic inclusion. As organizations become more diverse, the presence of CQ enables individuals and teams to bridge cultural gaps, reduce misunderstandings, and foster trust, making inclusion a natural, everyday reality rather than a checkbox. This inclusive atmosphere promotes collaboration and cohesion, which are essential for optimizing employee productivity. Research also demonstrates that leaders with higher CQ drive better team performance, especially in culturally diverse environments, its predictive validity surpassing that of emotional intelligence in such contexts. Further, employee development of CQ enhances perceived inclusion and belonging, which both directly feed into improved engagement and productivity. Transforming diversity into productive strength thus hinges on cultivating CQ throughout the organization.

Social exchange theory emphasizes that workplace relationships are shaped by a dynamic of reciprocity and a subjective cost–benefit analysis: employees weigh what they invest against what they receive in return. When organizations demonstrate inclusive behaviours, for instance, by recognizing diverse contributions and maintaining fairness, employees experience a positive return on their engagement, fostering higher loyalty, trust, and motivation. This, in turn, enhances their willingness to perform at their best and boosts overall productivity. Moreover, empirical studies have confirmed that inclusive leadership grounded in SET leads to elevated work engagement and innovative behaviours—critical aspects of productivity, particularly through strengthened leader-member exchanges and increased psychological safety. Thus, when employees perceive equitable exchanges and inclusive support, their engagement and performance rise a clear pathway from diversity-sensitive practices to improved productivity.

2.5. Empirical Review

Nwosu et al., (2025) investigates the relationship between diversity management, inclusion, and employee productivity among bank employees in Lagos Metropolis. Specifically, it examines four key areas: the effect of diversity team building, the impact of diversity recruitment, the role of diversity training, and the influence of workplace inclusivity on employee productivity. Using a survey questionnaire, the study collected data from 120 participants, with 115 complete responses returned. The data was analyzed using SPSS software, employing frequency and percentage distributions for descriptive statistics, and multiple regression analysis for hypothesis testing at a 0.05 significance level. The findings from the study revealed that organizations that promote diversity and inclusion experience higher employee engagement, job satisfaction, and productivity. Employees in inclusive work environments, where diverse perspectives are valued, reported increased motivation and commitment to their roles.

Suparyanto, Fauzi, Nungraha, and Tarmizi (2025) explored the impact of diversity and inclusion in the workplace on employee performance and innovation in organizations. In the context of increasing globalization, companies are faced with the challenge of creating an inclusive work environment, where different cultural backgrounds, genders, and experiences can contribute to the maximum. This research methodology uses a quantitative approach with a survey involving 20 respondents from various industrial sectors. The data was analyzed using multiple regression techniques to identify the relationship between diversity, inclusion, employee performance, and level of innovation. The results showed that there is a significant positive relationship between team diversity and improved individual performance as well as collaboration between team members. In addition, an inclusive work environment was shown to encourage creativity and new product innovation.

Atmaja and Dewi (2024) explored diversity management to achieve employee engagement and determine the mediating role of organizational trust and motivation in the relationship between diversity management and employee engagement in e-commerce companies who provide fresh vegetables and fruits. The sampling method is purposive sampling by distributed questionnaires online to 135 respondents and analytical method used Partial Least Square-Structural Equation Modeling (PLS-SEM). The results of the research prove that there is a positive and significant influence of diversity management on employee engagement, diversity management has a positive and significant influence on organizational trust.

Makudza, Muchongwe, and Dangaiso (2020) examined the differential effect of workforce diversity on employee productivity and its subsequent impact on customer experience. A once-off cross-sectional research design was used in this study where the Zimbabwean civil service was targeted. Randomization was used to collect 324 validated responses. The study focused on both primary (age and gender) and secondary (education and political affiliation) dimensions of workforce diversity. The results were confirmatory that workforce diversity is a significant predictor of employee productivity ($\beta = 0.668$, $P < 0.05$), at the same time employee productivity holds explanation to customer experience by 37%. Results also revealed that gender diversity, educational diversity and political diversity were significant determinants of workforce diversity ($P < 0.05$). However, the study established that age diversity was not a significant factor in enhancing employee productivity ($P > 0.05$). The study concluded that workforce diversity is a powerful tool in enhancing both customer experience and

employee productivity. As such, the latter can be augmented through shrewd workforce diversity practices as championed by management. To that end, the study recommends the development of a workforce diversity framework which promotes inclusivity.

3. Methodology

This section covered a detailed account of how this research work was carried out, while revealing the research methods that are used in the research study. With focus on the diversity, inclusion, and employee productivity in Nigeria, land transport companies were understudied. To gather information and describe the phenomena as they are at the time, the survey research approach was adopted and this was justified by the fact that it is necessary to study the link that exists between two or more variables. The population comprises of employees from various departments of some selected transport companies in Nigeria. The employees include Logistics manager, Transport manager, Fleet manager, Dispatchers, Warehouse manager, Logistics analyst, Logistics coordinator, international logistics manager. The choice of transport companies was used based on the ease of accessibility and the surge in the number of transport companies in Nigeria. Their work environment often involves interactions with colleagues, departmental policies, and hierarchical structures, making them suitable for investigating how diversity and inclusion have a significant impact on employee productivity. As such, the population of 100 provided a rich source of data to examine variations in diversity and inclusion and employee productivity. With the Yaro Yamane formula, a total sample size of 88 respondents was arrived.

This paper made use of primary data as the main source of information as it was obtained directly from Transport staff members through the administration of a structured questionnaire. The questionnaire was developed based on previously validated instruments and adapted to suit the context of employees in the transport companies in Nigeria. Each of the variables in the question apart from the demographic section were measured using a 5-point Likert scale, ranging from Strongly Disagree (1) to Strongly Agree (5) on a scale.

4. Empirical Analysis and Results

4.1. Relationship between Workplace Diversity and inclusion and Employee Productivity

Correlation Analysis

Bivariate Pearson correlation coefficients were conducted on the data for all the variables in the study. Table 1 shows the Pearson correlation coefficients among research variables.

Table 1: Pearson Correlation Coefficients among Research Variables

Variable		EP	IS	PE	WPD
Employee Productivity	Pearson Correlation	1	.521	.446	.344
	Sig. (2-tailed)		.000	.000	.001
	N	88	88	88	88
Inclusion Strategies	Pearson Correlation	.521	1	.606	.542
	Sig. (2-tailed)	.000		.000	.000
	N	88	88	88	88
Workplace Diversity	Pearson Correlation	.344	.542	.572	1
	Sig. (2-tailed)	.001	.000	.000	
	N	88	88	88	88

Source: *Researcher's computation (2026)*

Table 1 presents the correlation matrix showing the relationships between Employee Productivity (EP) and the two independent variables Inclusion Strategies (IS) and Workplace Diversity (WPD). The results reveal several significant positive correlations. Employee Productivity (EP) has a moderate positive correlation with Inclusion Strategies (IS) ($r = 0.521$, $p < 0.001$), indicating that improvements in inclusion strategies are associated with higher levels of productivity among employees. Additionally, EP exhibits a weaker but significant positive correlation with Workplace Diversity (WPD) ($r = 0.344$, $p = 0.001$), implying that diversity has a meaningful, though smaller, contribution to employee productivity. The independent variables also demonstrate strong and significant positive associations among themselves. Inclusion Strategies (IS) is also strongly correlated with Workplace Diversity (WPD) ($r = 0.542$, $p < 0.001$), suggesting that inclusion initiatives tend to coexist with a diverse work environment.

Overall, the findings indicate that inclusion strategies and workplace diversity both significantly and positively influence employee productivity, with inclusion strategies showing the strongest relationship. The strong inter-correlations among the independent variables also suggest that these organizational practices tend to reinforce one another, collectively contributing to a more productive and supportive work environment.

4.2 Hypotheses Testing

The hypotheses were tested using the p-values (Sig.) presented in the regression results.

Table 2: Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.137	3.292		.953	.343
	Inclusion strategies	.390	.120	.390	3.241	.002
	Pay Equity	.184	.114	.200	1.620	.000
	Challenges of WPD	.016	.101	.018	.156	.876

Dependent Variable: Employee Productivity

The interpretations based on Table 2 are presented below.

Hypothesis 1

H_{01}: Inclusion strategies have no significant relationship with employee productivity.

Table 2 shows that the regression coefficient for Inclusion Strategies is 0.390, with a p-value of 0.002, which is less than 0.05. Therefore, the null hypothesis is rejected. This implies that inclusion strategies have a significant positive effect on employee productivity. In other words, improvements in inclusion practices are associated with higher levels of employee productivity. This finding supports the conclusions of Shore et al. (2018), who noted that inclusive workplace cultures foster higher engagement, greater job satisfaction, and improved performance outcomes. Similarly, Barak (2016) emphasized that inclusion enhances employees' sense of belonging, which in turn strengthens their willingness to contribute positively to organizational goals.

Hypothesis 2

H_{02}: Pay equity has no significant relationship with employee productivity.

The regression coefficient for Pay Equity is 0.184, with a p-value reported as 0.000, which is below the 0.05 threshold, the null hypothesis is rejected. This indicates that pay equity has a significant positive influence on employee productivity. This suggests that when employees perceive compensation as fair, their productivity increases. This aligns with Adams' Equity Theory (1965), which posits that individuals compare their input–output ratios with those of others, and equitable treatment leads to positive work attitudes and improved performance. Empirical evidence from Heneman and Judge (2019) supports this finding, arguing that equitable pay structures reduce dissatisfaction, enhance morale, and promote higher levels of productivity.

Hypothesis 3

H_{03}: Challenges of workplace diversity have no significant relationship with employee productivity.

Table 2 reveals that the regression coefficient for Challenges of Workplace Diversity is 0.016, with a p-value of 0.876, which is greater than 0.05. Therefore, the null hypothesis cannot be rejected. This means that challenges associated with workplace diversity do not have a statistically significant effect on employee productivity. This suggests that diversity-related challenges do not meaningfully influence productivity levels among the respondents.

Table 3: Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.547[a]	.299	.274	2.81436	1.603

Predictors: (Constant), Challenges of Workplace, Diversity, Inclusion Strategies, Pay Equity
b. Dependent Variable: Employee Productivity

Table 3 presents the model summary of the regression analysis. The model demonstrates a moderate level of explanatory power, with an R value of 0.547, indicating a moderate positive correlation between the independent variables (workplace diversity, inclusion strategies, pay equity, and challenges of the workplace) and the dependent variable (employee productivity).

The R-squared value of 0.299 shows that approximately 29.9% of the variation in employee productivity is explained by the predictors included in the model. The

adjusted R-squared value of 0.274, which adjusts for the number of predictors, confirms that the model retains a reasonable explanatory strength even after accounting for the number of variables. The standard error of the estimate, 2.81436, represents the average distance between the actual values and the predicted values of employee productivity, indicating the level of prediction accuracy within the model.

5. Conclusion

This study examined the impact of diversity and inclusion on employee productivity, with specific attention to the influence of demographic factors, inclusion strategies, pay equity, and the challenges associated with workplace diversity. The findings underscore the growing importance of inclusive practices in strengthening employee performance and improving organizational outcomes. The study revealed that inclusion strategies demonstrated a strong positive and significant influence on productivity, highlighting the role of supportive workplace environments where employees feel valued, respected, and included in decision-making processes. Furthermore, the study found that pay equity has a positive and significant impact on employee productivity, indicating that fair and transparent compensation systems encourage higher motivation, commitment, and work output. In addition, the study established that workplace diversity has a positive but moderately significant relationship with productivity, although certain challenges such as communication gaps, unconscious bias, and resistance to change limit its full potential when not adequately addressed.

Overall, the research concludes that diversity and inclusion are essential drivers of employee productivity, but their effectiveness depends on how well organizations implement supportive strategies and address existing barriers. Practices such as equitable compensation, inclusive leadership, effective communication, and continuous diversity training are crucial for maximizing the benefits of a diverse workforce. Organizations that embrace these principles are more likely to foster a productive, harmonious, and high-performing workplace capable of sustaining long-term success.

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Supply Chain Disruption and Organisational Performance in Manufacturing Industry

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Abstract. The study explored the key dimensions of supply chain disruptions in the manufacturing industry. In the Nigeria manufacturing industry, especially the Nigeria bottling companies experience disruptions that can result from transportation delays, suppliers' failures, economic instability, or political unrest. Additionally, with the current rising cost of materials, insecurity and changing government policies in Nigeria, there was the need for this study. Supply chain disruption was proxy using these variables: supplier failure, defective products or materials and regulatory changes and then measured against organisational performance of bottling companies in Nigeria. The study further looked at the common causes of supply chain disruptions in bottling companies in Nigeria. The study population and sample size was 208 and 137 respectively. The stratified sampling technique was employed to ensure equal and fair representation of different departments, thereafter, simple random sampling was used to select the respondents. Primary data was collected using copies of structured questionnaire to elicit information from respondents. Data analysis was performed using Pearson correlation and regression analysis and the result showed that supplier failures, defective products or materials and regulatory changes has contributed to a minimal to decline in organizational performance. However, regulatory change was found to be the most significant factor influencing organisational performance.

Keywords: Supply Chain Disruption, Supplier Failure, Defective Products, Regulatory Changes, Organisational Performance.

1. Introduction

Supply chain disruption has become a central concern for organization globally, due to their significant impact on organizational performance. Supply chain which is seen as a network of individuals, organizations, resources, activities and technology involved in the creation and sales of a product, is affected by a variety of factors ranging from pandemic, natural disaster, geopolitical instability, and suppliers' failures interrupt the flow of goods and services. Over the past years events has provided stark of reminders of the destructive impact supply chain can have in organizational performance. For instance, the outbreak of COVID 19 which impacted supply chains around the world, the lockdown that took place to prevent the spread of the virus also prevented the flow of raw materials and impacted manufacturing, leaving shortages and long lead times on goods (Ivanov, 2020). A supply chain disruption is an event that disrupts the flow of goods or services in a supply chain system (Revilla and Saenz, 2017; Truong and Hara, 2018) and it have negative impact on the performance of the firm at different levels such as financial outcomes, customer satisfaction, market share, increased cost, production delay and reputation damage. For instance, a study carried out by PWC (2017) found that supply chain disruption cost companies an average of 30% in operational performance decline and up to 7% in market share loss.

While the literature discusses how disruption affect organizational performance, many organization in Nigeria still struggle to develop effective strategies for managing supply chain disruptions. The reason could include a mix of internal and external factors which includes lack of foresight and planning, inadequate data and analytics, reliance on a single source, global events and geopolitical instability and labour shortages and economic downturns. In Nigeria for example the issue is further exacerbated by factors such as inadequate infrastructure, limited technological capacities, poor coordination among supply chain partners, and lack of management systems and government policies often hinder their ability to response effectively to these disruptions (Niser, 2025).

Therefore, the objectives of the paper are to find the causes of supply chain disruptions in organisations; the impact of supplier failures, defective product or materials and regulatory changes on organizational performance in bottling companies in Nigeria.

2. Literature Review

2.1 Organisational Performance

Organisational performance refers to how well an organisation achieves its objectives, including

profitability, efficiency, customer satisfaction, innovation and adaptability. It involves comparing an organisations actual output or results with the intended ones. Recent research has highlighted how organisational performance is deeply influenced by supply chain disruptions. Disruption challenges the flow of goods, information, and finances, which in turn affects performance dimensions such as cost efficiency, customer satisfaction, and market competitiveness (Ivanov and Dolgui, 2020). In manufacturing industry, particularly for firms like Nigeria bottling companies which relies on extensive supply network for raw material such as sugar, concentrates, packaging materials, and distribution logistics, performance depends heavily on the smooth operation of supply chains. When disruption such as shortages, scarcity of materials, or transportation breakdown occurs, NBCs production and operations are directly affected (Adebiyi, Adediran, Shodiya, and Olusola, 2021). Thus, organisational performance in manufacturing industries cannot be fully understood without examining its relationship with supply chains disruption.

Supply chain disruption (SCDs) can have a significant long-term and immediate effects on organisational performance outcomes. For instance, the global crises such as the outbreak of COVID 19 pandemic and the Russia- Ukraine conflict which impacted supply chain around world also preventing the flow of raw materials and impacted manufacturing performance and reduced customer trust. According to Katsaliaki, Galetsi, and Kumar, (2022), such disruptions negatively influence key performance indicators such as operational efficiency, inventory turnover, and service levels.

In summary, for bottling companies, understanding and managing supply chain disruptions is essential not just for operational continuity but for sustaining its overall organisational performance. Supply chain stability enables bottling companies to meet its production targets, satisfy customers, and sustain profitability, reinforcing the strategic importance robust supply chain management within the manufacturing industry (Dolgui and Ivanov, 2021).

2.2 Supply Chain Disruptions

Supply chain disruption refers to any unexpected event that interrupts the normal flow of goods and services within a company's supply network. In the manufacturing industry, especially within the bottling companies in Nigeria, such disruptions can result from transportation delays, suppliers' failures, economic instability, or political unrest (Christopher and Holweg, 2017). In the case of bottling companies in Nigeria, supply chain disruptions often lead to production halts and shortages of finished products like soft drinks. Since bottling companies depends on both local and imported raw materials sugar concentrates, and packing materials any disruption in logistics-whether due to port congestion, road blockages, or foreign exchange challenges can slow down production (Moradeyo, Oke, and Muogboh, 2023).

Additionally, these disruption force bottling companies to spend more on emergency sourcing and logistics to compensate for the interruptions. The cost of bringing in materials through alternative, more expensive routes or suppliers impacts profitability (Eze, 2024). These extra operational costs directly reduce the company's margins (Choi, Rogers, and Vakil, 2021). However, Fiksel, Polyviou, Croxton, and Pettit (2015) asserted that these issues can be mitigated through better supply chain management strategies which includes diversifying its supplier base, investing in local sourcing where possible, and using technology for real-time supply chain monitoring.

2.2.1 Components of Supply Chain Disruption

Disruptions do not occur in isolation but often stem from interconnected issues within the supply chain structures (Christopher and Holweg, 2017). Among the components contributing are supplier failures, defectives products or materials, and regulatory changes. Each of these factors can independently or collectively interrupt production and distribution activities, thereby compromising operational efficiency and profitability (Baryannis, Dani, and Antoniou, 2019).

Supplier Failures: This is a critical component of supply disruption, especially in manufacturing industries where production depends heavily on timely delivery of raw materials and components. Supplier failures can arise from financial distress, operational inefficiencies, labour strikes, or even political instability in supplier regions (Ivanov, 2021). For manufacturing firms like the Nigeria Bottling Company (NBC), supplier failure can cause delays in sourcing essential items like packaging materials, concentrates, and sugar, leading to production slowdown or stoppages. According to Baryannis et al. (2019), supplier failure is one of the most unpredictable risks because companies often lack real time visibility into their suppliers' internal operations. Over dependence on a single supplier or limited suppliers base heightens vulnerability, making the supply chain brittle (Ekpudu, Odigie, Rahim, and Okpala, 2025).
Ho_1: Supplier failure do not have association with organisational performance

Defective Products/Materials: Defective product or raw materials constitute another serious form of supply chain disruption, particularly in manufacturing industry, where quality is tightly linked to brand reputation. Defective materials can disrupt production processes, results in product recalls, and incur significant financial losses due to waste and rework (Fiksel et al., 2015). According to Choi et al. (2021), defective inputs compromise operational flow as defective batches must be identified, isolated, and replaced causing time delays and resource wastage. Inconsistent quality from

suppliers or poor internal quality control mechanisms often exacerbates this issue.
Ho_2: There is no significant relationship between defective product or raw materials and organisational performance

Regulatory Changes: This includes shifts in government policies, tariffs, environmental regulations, and safety standards, can significantly disrupt supply chains (Christopher and Holweg, 2017). For manufacturing firms operating in developing economies like Nigeria, frequent changes in import/export regulations, taxation policies, and quality standards can delay procurement processes and increase compliance costs (Moradeyo, et al, 2023). For instance, bottling companies might face disruptions when sudden bans on certain packaging materials, alterations in excise duties, or stringent food safety laws are introduced without adequate adjustment periods. According to Remko (2020), regulatory changes create uncertainties that ripple through supply networks, affecting sourcing, production, and distribution.
Ho_3: Regulatory changes is independent of organisational performance

2.2.2 Causes of Supply Chain Disruption

Supply chain disruptions in manufacturing industry are caused by a variety of internal and external factors that interfere with the flow of goods, services, and information across supply network. One of the most common causes is supplier related issues, such as late deliveries, financial instability, or complete supplier shutdowns (Ivanov, 2021). Bottling Companies in Nigeria relies heavily on both local and foreign suppliers for raw materials, any delay on or failure on the suppliers' part can halt production and lead to unmet consumer demand. According to Ekpudu, et. al., (2025), suppliers' dependence without proper risk diversification can lead to a systematic breakdown when their suppliers face challenges.

Another major cause is logistics and transportation disruptions: poor infrastructure, fuel scarcity, port congestion, or road insecurity common issues in Nigeria can delay the movement of raw materials or finished products, especially for companies operating in cities like Nigeria (Moradeyo, et al., 2022). These disruptions not only increase transportation cost but also reduce responsiveness and flexibility. Additionally, natural disasters and pandemics, such as COVID-19, have exposed how global events can cause sudden breakdowns in supply chains by restricting movement, limiting workforce availability, or causing border closures (Choi et al., 2021). Technological failures also contribute significantly to supply chain breakdowns. When information systems used to track inventory, monitor supplier performance, or coordinate logistics fail, the entire chain can suffer delays and errors (Baryannis et al., 2019). For instance, delays in digital communication with suppliers or breakdown of inventory systems can results in stockouts or overstocking both of which are costly.

Lastly, regulatory and policy changes play a significant role in causing supply chain disruptions. Changes in import/export laws, tariffs, taxes, or product safety regulations can unexpectedly alter supply routes or restrict access to necessary materials (Remko, 2020). For example, if bottling companies faces new regulations banning a type of plastic used in packaging, they must quickly find alternatives or risk halting production. These types of disruptions require firms to remain agile and maintain strong relationships with both suppliers and regulators to adapt quickly when changes occur.

2.3 Theoretical Framework

This study is anchored on the contingency theory, this theory says there is no single best way to run a business. Instead, the right approach depends on the situation the organisation is facing (Donaldson, 2016). This idea is especially important in supply chain management, where unexpected events like supplier failures, transportation delays, or regulatory changes can suddenly affect how a company operates. When it comes to supply chain disruptions, contingency theory explains that organisations need to be flexible and adaptable in their strategies. This theory also highlights the importance of aligning internal processes with external realities. If an organisation continues to operate as though everything is normal during a disruption, its performance will likely suffer. But if it adjusts its operations such as speeding up decision-making, communicating more frequently with suppliers, or reallocating resources it stands a better chance of maintaining strong performance. In this way, contingency theory supports the idea that organisational success during disruptions depends on how well a company responds to changing conditions.

3. Methodology

To effectively obtain answers to the research objectives, this paper adopted the descriptive survey research design because it enabled the researcher to directly gather information from those involved about issues relating to supply chain interruptions and their effects on organizational success. The survey design also proved useful in exploring the connections between different elements, thus enabling the researcher to draw more general conclusions based on the study's findings. The study population comprised of personnel at the Nigeria Bottling Company Plc. According to company records from the Personnel Department (2024), there were a total of 208 employees, excluding domestic staff. This group was considered significant as its members actively participate in supply chain activities, production processes, and overall organizational operations, therefore making their perspectives valuable to the research. Given the population's size, the Taro

Yamane (1967) formula was employed to determine the suitable sample size which arrived at 137.The study made use of a stratified random sampling technique to ensure a fair representation of different departments, including production, procurement, logistics, sales/marketing, and administration. Within each department, simple random sampling was used to choose the respondents.

This study provides us with a model that explained the functional relationship between SCD and organizational performance. The model was regressed and stated functionally as:

Supply Chain Disruption and Organizational Performance

$OP = f(SF, DP, RC)$…….. (1)

Econometrically, the model can be specified as:

$OPi = \alpha 0 + \alpha 1SFi + \alpha 2DPi + \alpha 3RCi + \xi i$ …… (2)

Where:

OP = Organizational Performance; SF = Supplier Failure; DP = Defective Product; RC= Regulatory Changes; ξ = Error term; α0 = Parametric constant; β0= Parametric constant: α1, α2, and α3 = Parametric coefficients of elasticity of supply chain disruption displaying degrees of explanation power about organizational performance.

4. Empirical Analysis and Result

4.1 Data on Causes of Supply Chain Disruptions in the Organization

Below is a table indicating the level of common causes of supply chain disruptions in bottling companies in Nigeria

Table 1: Common Causes of Supply Chain Disruptions in the Organization

Cause of Disruption	Frequency (n)	Percentage (%)
Logistics and Transportation Issues	109	79.6%
Supplier Failure	95	69.3%
Demand Fluctuations	55	40.1%

Source: *Researchers' computation, 2026*

Table 1 presents the most commonly reported causes of supply chain disruptions based on respondents' experiences within the bottling company. The leading cause identified is logistics and transportation issues, reported by 79.6% of respondents, underscoring the criticality of efficient movement of goods and materials in maintaining supply chain continuity. This is followed by supplier failure (69.3%), which suggest environmental factors remain significant sources of instability in the supply chain. Demand fluctuations, though still notable, were reported by 40.1% of respondents, indicating that while market unpredictability is a concern, operational and environmental challenges appear more immediate or impactful in the organizational context surveyed. Overall, these findings suggest a need for robust risk management strategies focusing on logistics resilience, supplier relationships, and contingency planning against environmental shocks.

4.2 Correlation Analysis of Supply Chain Disruptions and Organizational Performance

The results from the correlation analysis provide insights into the character and orientation of the connection between the dependent and independent variables. While the correlation coefficient does not denote a direct functional dependence, it serves as a preliminary indicator of the strength and trend of this relationship. The details of these findings is as follows:

Table 2: Correlation Results of Supply Chain Disruptions and Organizational Performance

Correlations

		OP	SF	DP	RC	SCD
OP	Pearson Correlation	1				
	Sig. (1-tailed)					
	N	137				
SF	Pearson Correlation	.197*	1			
	Sig. (1-tailed)	.011				
	N	137	137			
DP	Pearson Correlation	.293**	.394**	1		
	Sig. (1-tailed)	.000	.000			
	N	137	137	137		
RC	Pearson Correlation	.507**	.389**	.643**	1	
	Sig. (1-tailed)	.000	.000	.000		
	N	137	137	137	137	
SCD	Pearson Correlation	.413**	.362**	.542**	.713**	1
	Sig. (1-tailed)	.000	.000	.000	.000	
	N	137	137	137	137	137

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed).
Source: *Researchers' computation, 2026*

Table 2 presents the Pearson correlation coefficients between organizational performance (OP) and key supply chain disruption factors: Supplier Failure (SF), Defective Products (DP), Regulatory Changes (RC), and Supply Chain Disruptions (SCD). The results reveal varying degrees of statistically significant positive relationships, indicating that these supply chain-related variables are meaningfully associated with organizational performance.

The correlation between supplier failure and organizational performance is positive and weak ($r = .197$, $p < 0.05$), suggesting that as organizations better manage supplier failures or when such disruptions are acknowledged, performance slightly improves. A moderate and positive correlation exists between defective products and organizational performance ($r = .293$, $p < 0.01$), implying that minimizing defective products contributes meaningfully to enhanced performance. More notably, regulatory changes exhibit a strong and statistically significant relationship with organizational performance ($r = .507$, $p < 0.01$), indicating that effective adaptation to regulatory dynamics considerably enhances operational outcomes. Additionally, supply chain disruptions (SCD) as a broad construct show a moderately strong positive correlation with organizational performance ($r = .413$, $p < 0.01$), reflecting the importance of resilience and adaptability in disrupted supply environments.

4.3 Hypothesis Testing

The research hypotheses were tested utilising regression analysis in order to achieve the current study's objectives.

Table 3: Regression Output of Supply Chain Disruptions and Organizational Performance
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1.609	.382		4.215	.000		
	SF	.000	.070	.000	.003	.998	.805	1.242
	DP	-.094	.128	-.073	-.731	.466	.552	1.812
	RC	.479	.121	.470	3.957	.000	.394	2.537
	SCD	.138	.126	.118	1.089	.278	.475	2.105

a. Dependent Variable: OP
Source: *Source: Researchers' computation, 2026*

Table 3 presents the regression coefficients for the model assessing the effect of supply chain disruption variables, including Supplier Failure (SF), Defective Products (DP), Regulatory Changes (RC), and Supply Chain Disruptions (SCD) on Organizational Performance (OP). Both unstandardized and standardized coefficients are reported, along with their significance levels and multicollinearity diagnostics. The regression model's constant (intercept) is 1.609, indicating the baseline value of organizational performance when all predictors are held at zero.

Hypothesis one revealed that supplier failures do not affect organizational performance. The regression result shows a coefficient (B = 0.000) with a p-value of 0.998, which is far greater than 0.05. Hypothesis 2 showed that defective products (B = -0.094) with a p-value of 0.466, which exceeds 0.05 do not impact organisational performance. However, Hypothesis 3 confirms that regulatory changes (B = 0.479) with a p-value of 0.000, which is less than 0.05 have a significant positive effect on organizational performance. The model indicates that there exists no significant relationship between supply chain disruptions and organizational performance, nevertheless, regulatory changes is the most significant variable impacting organisational performance.

The collinearity statistics indicate acceptable levels of multicollinearity. All Variance Inflation Factor (VIF) values are below the critical threshold of 5, with the highest being 2.537 for RC, and Tolerance values are well above 0.1, confirming that the independent variables do not suffer from severe multicollinearity. Thus, the regression output confirms that regulatory changes are the most influential factor in predicting organizational performance. The other variables, although conceptually important, do not show significant statistical contributions in this model. This suggests that strategic focus on regulatory compliance and adaptation is key to enhancing organizational outcomes in the face of supply chain disruptions.

5. Conclusion

This study has looked at how disruptions in the supply chain affect organizational performance, focusing on Bottling Companies in Nigeria. The study established that supply chain disruption factors like supplier failure, defective materials, and mostly changes in regulations have strong impacts on the performance of bottling companies. These disruptions result in a reduction of production efficiency and increased costs, thereby lowering customer satisfaction. Therefore, efficient supply chain management and resilience strategies are

essential in maintaining performance through disruptions. Organizations should diversify suppliers, operate quality assurance systems, and devise adaptive strategies that deal with policy and regulatory changes. This will result in the company ensuring better operation outcomes through proactive risk management, continuous product and process innovations, and strong partnerships across the supply chain. The study recommends that organisations should establish long-term partnerships with reliable suppliers and diversify its supply base to minimize risks of material shortages. There should be continuous monitoring and evaluation of input materials through advanced quality assurance systems to reduce the incidences of defective materials. Organisations should have a compliance group that would ensure constant surveillance regarding changes in regulations and rapid adaptation to changed requirements. Also, management should incorporate formal risk assessment and mitigation strategies into supply chain planning to anticipate and minimize potential disruptions. Lastly, there should be investment in digital supply chain systems, data analytics, and predictive software that will improve the visibility, traceability and responsiveness across the supply chain.

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Credit Risk Management and Profitability of Deposit Money Banks in Nigeria: A Tobin's Q Approach

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Abstract. This study examines the effect of credit risk management on the profitability of quoted deposit money banks in Nigeria over the period 2015–2024, using a balanced panel of twelve deposit money banks. Adopting a longitudinal research design, the study employs descriptive statistics, correlation analysis, panel unit root and co-integration tests, and feasible generalized least squares (FGLS) estimation to analyse the long-run and short-run relationships among the variables. Bank performance is proxied by Tobin's Q, while credit risk management is measured using non-performing loan ratio, loan and advances to deposit ratio, loan loss provision ratio, and capital adequacy ratio, with leverage ratio included as a control variable. The empirical results reveal that non-performing loans, loan and advances to deposit ratio, loan loss provision ratio, and leverage ratio exert positive and statistically significant effects on bank performance, whereas capital adequacy ratio shows a positive but insignificant relationship. The findings suggest that Nigerian deposit money banks demonstrated resilience during the study period, as increases in credit risk indicators did not necessarily translate into declining market-based performance. Based on these results, the study recommends strengthening credit appraisal and monitoring systems, maintaining optimal loan-to-deposit ratios, adopting prudent provisioning policies, and ensuring balanced leverage management to enhance bank performance and stability.

Keywords: Credit Risk Management; Bank Performance; Tobin's Q; Deposit Money Banks; Nigeria

1. Introduction

In today's increasingly volatile financial environment, effective credit risk management has become essential to the stability and performance of financial institutions. Since the global financial crisis, the role of banks as central providers of credit to businesses and industries has grown significantly (Saeed & Zahid, 2016). However, this expansion has also heightened their exposure to credit risk, particularly due to uncertainties in global markets. Credit risk remains a core threat to the profitability and stability of banks (Berríos, 2013). It has been confirmed that a bank's performance is closely linked to the quality of its credit risk practices (Iwedi & Amako, 2014; Ali, 2015). For deposit money banks, which rely heavily on lending activities, the exposure to default is especially pronounced. While credit risk also extends to off-balance-sheet operations such as guarantees and swaps, loan defaults remain the most significant factor influencing performance (Aduda & Gitonga, 2011).

As the banking sector has evolved, so too have the types of risks that institutions must manage. Credit risk is no longer isolated to lending alone but is intertwined with broader financial risks, including market, liquidity, and operational risks (Li & Zou, 2014). In this context, risk management has shifted from being a support function to a strategic cornerstone in financial decision-making. The growing complexity of banking products and services demands a proactive approach to risk identification and control. Modern financial institutions operate in a space where profit maximization is inseparable from sound risk governance. Failures in credit risk management have led to significant losses globally, prompting banks to revise and upgrade their internal systems and policies to better anticipate and mitigate risk exposure (Osuka & Amako, 2015).

In the Nigerian banking sector, the persistent issue of non-performing loans (NPLs) continues to hinder both operational stability and market-based performance. Defaulted credit weakens asset quality and diminishes investor confidence, ultimately affecting the bank's valuation in capital markets (Osuka & Amako, 2015). In response, some banks have implemented structured credit assessment systems and adopted techniques such as hedging or risk-based pricing to manage their exposure more effectively (Iwedi & Onuegbu, 2014). While these efforts aim to mitigate potential losses, overly cautious risk avoidance may limit a bank's

competitive edge and growth potential. Therefore, striking a balance between risk mitigation and market value enhancement is crucial. This study investigates the impact of credit risk on bank performance by employing Tobin's Q as a measure of market-based performance. Unlike traditional accounting metrics, Tobin's Q provides insight into how efficiently a firm's assets are perceived by the market in relation to their replacement cost, offering a broader perspective on how credit risk management influences investor valuation (Li & Zou, 2014).

Previous research on the relationship between credit risk and bank performance has employed a wide range of empirical methodologies. These include panel data regression models (Adegbie & Otitoloye, 2020; Bhattarai, 2019; Annor & Obeng, 2017; Kishori & Jeslin, 2017), the generalized method of moments (Ajao & Oseyomon, 2019; Kithinji, 2010), and ordinary least squares (Nwude & Okeke, 2018; Ahmed & Ariff, 2007). Other techniques such as multiple regression analysis (Nwanna & Oguezue, 2017; Osuka & Amako, 2015; Li & Zou, 2014), two-stage least squares (Oduro, Asiedu & Gamali, 2019), and correlation analysis (Alalade, Binuyo & Oguntodu, 2014; Kolapo, Ayeni & Oke, 2012) have also been frequently applied. Additionally, some studies have utilized more advanced models, such as error correction models (Harcourt, 2017), structural equation modeling (Gadzo, Kportorgbi & Gatsi, 2019), and analysis of variance (Saeed & Zahid, 2016). While these approaches have their respective advantages and limitations, it is noteworthy that only one known study conducted in Sweden by Hosna and Manzura (2009) applied the feasible generalized least squares (FGLS) estimation. FGLS is particularly effective in addressing econometric challenges such as heteroskedasticity, autocorrelation, and cross-sectional dependence, making it a more efficient alternative to ordinary least squares. Given its robustness, this study adopts the FGLS technique to assess the relationship between credit risk management and market-based performance, using Tobin's Q as the dependent variable.

The findings from earlier studies are mixed. Some researchers report a significant positive association between credit risk indicators and bank performance (Adegbie & Otitolaiye, 2020; Kajola et al., 2019; Ajao & Oseyomon, 2019; Annor & Obeng, 2017; Harcourt, 2017; Abiola & Olausi, 2014), while others document a negative relationship (Oduro et al., 2019; Gadzo et al., 2019; Kajirwa & Katherine, 2019; Kishori & Jeslin, 2017; Alalade et al., 2014). Some studies reveal inconclusive or mixed results, highlighting the influence of context-specific factors (Bhattarai, 2019; Bayyoud & Sayyad, 2015). These variations in outcomes suggest the need for further investigation, particularly using more recent data, an alternative methodological framework, and a broader perspective of performance beyond traditional accounting measures. Accordingly, this study seeks to bridge the gap by evaluating how credit risk management affects the market performance of Nigerian deposit money banks listed on the Nigerian Exchange Group (NGX), using Tobin's Q as the key performance metric.

The remainder of this paper is structured as follows: the next section reviews the relevant literature; this is followed by the research methodology, data analysis, and discussion of findings. The paper concludes with key insights and policy recommendations.

2. Literature Review

2.1 Concept of Profitability

According to Li and Zou (2014), defined profitability as a gauge of capability of the bank to bear risk and/or raise the capital of bank and it implies effectiveness of the bank and gauges the excellence of management. Similar to all businesses, banks earn more money than what they pay in expense to make profit. The bank makes profit by charging fees for its services and the interest earned from its assets (Li & Zou, 2014). The key expense of the bank is due the interest paid for its liabilities. The foremost assets of a bank are the loans provided to individuals, businesses, and other organizations and the securities that it owns, while the liabilities are the deposits, money borrowed from other banks and commercial paper sold in the money market. Banks also increase its profits by using leverage and profits of the banks can be measured as a return on assets and as a return on equity. Leverage has the tendency to make banks earn larger return on equity than on assets. There are several measures of profitability, including Return on assets (ROA), return on equity (ROE), TOBINSQ, among others (Poudel, 2012; Ross, Westerfield, Jaffe & Jordan, 2011). However, this study adopts TOBINSQ as a result of the fact that it provides insight into how efficiently a firm's assets are perceived by the market in relation to their replacement cost, offering a broader perspective on how credit risk management influences investor valuation (Li & Zou, 2014)

2.2 Credit Risk Management

Credit risk management refers to the systematic process by which banks identify, assess, monitor, and control the risk arising from borrowers' failure to meet their contractual debt obligations. Credit risk itself reflects the possibility that actual loan returns will deviate from expected returns due to partial or total default, potentially resulting in the loss of both principal and accrued interest (Boland, 2012). Given

the intermediation role of banks, credit risk has long been recognised as a core source of banking risk, as highlighted by the Basel Committee in the early Basel Accords. Effective credit risk management is therefore essential for safeguarding bank profitability, ensuring institutional viability, and promoting financial system stability. Advances in banking technology have further strengthened credit risk management by enabling faster credit decisions and lowering monitoring costs, thereby improving loan quality and capital allocation efficiency (Das & Ghosh, 2007; Iwedi & Onuegbu, 2014).

The Basel Committee on Banking Supervision (2001) defines credit risk as the potential loss arising from default events on outstanding loans, a view reinforced by Rose (2002), who describes it as the tendency of loan assets to lose value. Empirical studies attribute elevated credit risk to weak credit policies, inadequate capital and liquidity buffers, poor loan underwriting, ineffective credit assessment, weak governance, and insufficient regulatory supervision (Kithinji, 2010). Credit risk commonly manifests through exposure risk, recovery risk, and default risk, and is typically measured using indicators such as non-performing loans, loan loss provisions, capital adequacy ratios, portfolio-at-risk, and operating efficiency (Ahmad & Ariff, 2007; Epure & Lafuente, 2012; Gizaw et al., 2015). When poorly managed, rising credit risk can escalate into liquidity and solvency challenges, underscoring the importance of robust credit risk management frameworks in modern banking systems.

2.2.1 Non-Performing Loans and Profitability

Non-performing loans (NPLs) represent a primary indicator of credit risk in deposit money banks and are commonly measured as the ratio of non-performing loans to total loans and advances. This ratio reflects the quality of a bank's loan portfolio and the proportion of credit facilities that are at risk of default. A persistently high NPL ratio signals weaknesses in credit appraisal, monitoring, and recovery processes, and indicates a higher likelihood that loan principal and interest may not be recovered, thereby eroding profitability (Felix & Claudine, 2008; Kargi, 2011). Regulatory frameworks typically require non-performing facilities to be classified as substandard, doubtful, or lost based on clearly defined criteria, reinforcing the role of NPLs as a critical measure of asset quality and managerial efficiency (Ahmad & Ariff, 2007; Epure & Lafuente, 2012).

2.2.2 Loans, Advances and Profitability

The loans-to-deposit ratio is widely used to assess both the liquidity position and income-generating capacity of banks. It measures the extent to which customer deposits are transformed into earning assets and indicates a bank's ability to satisfy loan demand while meeting withdrawal obligations. While a higher ratio may enhance profitability through increased interest income, excessive loan expansion can expose banks to liquidity pressure and insolvency risk if not supported by sound risk management practices (Kithinji, 2010; Brealey & Myers, 2003). To ensure financial soundness, regulatory authorities require banks to make adequate provisions for expected credit losses based on prescribed loan classification systems. These provisions include specific provisions for identified non-performing facilities and general provisions to cover inherent risk in performing loans, thereby ensuring a more accurate representation of banks' financial condition (Basel Committee on Banking Supervision, 2001; Ahmad & Ariff, 2007).

2.2.3 Loan Loss Provision Ratio and Profitability

Loan loss provisions constitute expenses set aside by banks to absorb expected losses arising from loan defaults and serve as an internal risk-buffering mechanism. By allocating part of current earnings to cover potential future losses, banks protect depositors' funds and enhance balance sheet resilience. The loan loss provision ratio (LLPR) reflects management's assessment of asset quality and anticipated credit losses. An increase in LLPR generally indicates deterioration in loan portfolio quality and is often associated with reduced profitability due to higher provisioning expenses (Gizaw et al., 2015; Epure & Lafuente, 2012). Consequently, while adequate provisioning strengthens financial stability, excessive or persistent increases in LLPR may constrain earnings performance.

2.2.4 Capital Adequacy Ratio and Profitability

Capital adequacy ratio (CAR) measures a bank's capital strength by expressing regulatory capital as a proportion of risk-weighted assets. Adequate capital buffers enhance banks' ability to absorb losses arising from credit risk and reduce the probability of insolvency, which in theory should support profitability and long-term stability (Basel Committee on Banking Supervision, 2001). Empirical evidence on the CAR–profitability relationship remains mixed. While some studies report a positive association between CAR and return on equity, suggesting that well-capitalized banks are better positioned to undertake profitable investments (Hosna et al., 2009), others argue that excessive capital may depress returns or yield ambiguous effects (Goddard et al., 2004). Higher capital levels can enable banks to expand into higher-return activities such as loan commitments and standby credit facilities, but profitability also depends on

effective asset allocation, net interest margins, and liquidity management (Ommeren, 2011; Li & Zou, 2014). Theoretical perspectives such as shiftability theory further suggest that profitability and liquidity are influenced not only by loan portfolios but also by banks' ability to convert assets into cash at predictable prices, highlighting the complex interaction between capital adequacy, risk management, and profitability (Hosna & Manzura, 2009; Kargi, 2011).

2.3 Theoretical Review

This study is anchored on four major theories that explain bank lending behavior, liquidity management, and credit risk exposure, namely the commercial loan theory, shiftability theory, anticipated income theory, and credit risk theory.

Commercial Loan Theory, also known as the real bills doctrine, is one of the earliest banking theories, originally advanced by Adam Smith in The Wealth of Nations (1776). The theory posits that banks should restrict lending to short-term, self-liquidating commercial loans that finance the production, processing, and distribution of goods. Such loans are expected to liquidate themselves through the normal course of business operations, thereby ensuring bank liquidity and reducing the likelihood of loan default. Ugwu et al. (2020) argue that these self-liquidating loans enhance economic liquidity and minimize bad debt occurrence. The theory further suggests that bank lending should adjust in line with aggregate economic activity, serving as a stabilizing force for monetary supply (Hosna & Manzura, 2009). Its appeal lies in the short-term nature of credit, which promotes productivity and steady income generation for banks, although its rigid application has been criticized in modern banking systems.

Shiftability Theory expands the scope of acceptable bank assets beyond self-liquidating commercial loans to include marketable securities that can be easily transferred or sold in secondary markets, such as government bonds (Moti et al., 2012). Rather than invalidating the commercial loan theory, shiftability theory complements it by emphasizing asset marketability as a key determinant of bank liquidity. The theory assumes that liquidity depends on a bank's ability to shift assets at predictable prices when needed. Hosna and Manzura (2009) note that this perspective redirected regulatory and managerial focus from loans to investments as liquidity sources. However, Kargi (2011) criticizes the theory for its systemic limitation, arguing that while an individual bank may achieve liquidity by selling assets, such a strategy may fail if all banks attempt to do the same simultaneously. Additionally, the theory has been criticised for its limited relevance in developing economies, such as Nigeria, where long-term financing is crucial for capital formation and economic growth.

Anticipated Income Theory, developed by Prochnow in 1944, challenges the liquidation-based focus of earlier theories by emphasizing borrowers' future income streams as the primary basis for loan repayment. The theory holds that banks should grant credit based on the expected earnings and cash flows of borrowers rather than relying on asset liquidation or loan transferability (Afriyie & Akotey, 2011). Kolapo et al. (2012) describe this theory as forward-looking and cash-flow oriented, making it particularly relevant for term lending and modern banking practices. While it does not dispute the role of secondary reserves highlighted by shiftability theory, it redefines appropriate lending by aligning credit decisions with projected income rather than current asset values. This approach broadens banks' lending capacity and supports long-term investment financing while maintaining credit discipline (Moti et al., 2012).

Credit Risk Theory focuses on the probability of borrower default and the potential loss faced by lenders when debt obligations are not met. According to Anderson et al. (2002), credit risk arises when borrowers fail to repay principal or interest, leading to partial or total financial loss. The theory emphasizes risk assessment mechanisms such as credit screening, collateral requirements, guarantees, and risk-based pricing, where higher risk exposures attract higher interest rates (Owojori et al., 2011). While recognizing the importance of asset quality, the theory also acknowledges the role of liability management and money markets in addressing liquidity shortages. Shafiq and Nasr (2010) argue that banks actively manage both assets and liabilities to meet deposit withdrawals and loan demand, underscoring the interdependence between credit risk management, liquidity provision, and profitability. The theory thus provides a strong conceptual foundation for examining how credit risk influences bank performance and financial stability.

2.4 Empirical Review

Ugwu and Okwo (2025) examined the effect of credit risk management on financial performance of deposit money banks in Nigeria from 2014 t0 2023 adopting panel ordinary least squares as method of data analysis. The study revealed that loan loss provision and capital adequacy ratio have positive and significant impact on return on asset why non-performing loan has negative and significant impact on financial performance of deposit money banks in Nigeria. Onyegiri et al. (2024) assessed how risk management strategies impact the financial

performance of DMBs in Nigeria. Using an ex post facto research design and the Auto-Regressive Distributed Lag (ARDL) model on data covering 29 years (1994–2022), the findings indicated that credit and liquidity risks were not significant determinants of return on assets, while operational risk and capital adequacy risk exerted significant influence on ROA.

Olawale (2024) investigated the role of capital adequacy in enhancing the stability of Nigerian banks within a volatile economic environment. Employing OLS analysis on data from 2005 to 2020, the study found that capital adequacy ratio (CAR) and firm size positively contributed to stability, whereas non-performing loans (NPL) and loans and advances (LA) had adverse effects; monetary policy and capital regulation were also found to be important. Ojiegbe (2024) evaluated the effect of capital adequacy on profit before tax in Nigerian banks using time-series data from 2004 to 2022 and an ARDL approach. The results showed that total qualifying capital negatively affected profit before tax, while adjusted shareholders' funds had a positive and significant impact on profitability.

Ajagbe et al. (2024) analyzed the relationship between financial risk management and the performance of Nigerian commercial banks over the period 2009 to 2022. Using return on assets (ROA) as the performance indicator and capital risk (CAR), liquidity risk (LQR), market risk (MKR), and operational risk (OPR) as proxies for financial risk, the study employed fixed effects panel regression on 70 observations drawn from five major banks. The findings indicated that none of the individual risk variables had a statistically significant effect on ROA.

Al Zaidanin and Al Zaidanin (2021) conducted a study on the impact of credit risk management on the financial performance of commercial banks in the United Arab Emirates using audited financial statements covering 2013–2019 and applying descriptive statistics and random effects panel regression. Their findings revealed that non-performing loans and cost–income ratios exerted a significant negative effect on profitability, while capital adequacy, liquidity, and loan-to-deposit ratios were statistically insignificant. Similarly, Uzoedika and Orjinta (2021) examined deposit money banks in Nigeria and Botswana using panel regression analysis on data from 2010–2019 and found that non-performing loans negatively and significantly affected profitability in Nigeria but positively in Botswana, while capital adequacy, liquidity risk, and loan loss provisions were insignificant in both countries. Alnajjar and Othman (2021), using fixed and random effects models on panel data from Islamic banks in selected MENA countries between 2017Q1 and 2019Q4, reported a statistically significant negative effect of capital adequacy ratio on both ROA and ROE, while Omiagbo and Daniel (2021) found a positive and significant relationship between credit and liquidity risk management and return on assets of Nigerian commercial banks using panel regression techniques.

Adegbie and Otitolaiye (2020) investigated the relationship between credit risk management and financial performance of Nigerian deposit money banks using panel data from 2006–2018 and random effects regression, concluding that credit risk management significantly influences bank performance. Adegbie and Adebanjo (2020), focusing on financial stability rather than profitability, analysed data from quoted Nigerian banks between 2008 and 2017 using multiple regression and found that non-performing loans, loan loss provisions, and loan-to-deposit ratios significantly affected financial stability. Onyefulu, Okoye, and Orjinta (2020) extended the analysis to West Africa by examining banks in Nigeria and Ghana using correlation, descriptive, and panel regression analyses on data from 2009–2018, revealing that credit risk indicators exerted a significant negative effect on return on equity.

Empirical studies published in 2019 provide cross-country insights from Africa and Asia. Oduro, Asiedu, and Gamali (2019) examined Ghanaian banks listed on the stock exchange using financial data from 2003–2017 and two-stage least squares estimation, finding that capital adequacy, operating efficiency, profitability, and net interest margin were inversely related to credit risk, while bank size increased credit risk exposure. Bhattarai (2019) analysed ten commercial banks in Nepal using balanced panel data from 2001–2016 and regression analysis, showing that capital adequacy, non-performing loans, and management quality significantly influenced ROA, while credit-to-deposit ratio and risk sensitivity were insignificant. In Kenya, Kajirwa and Katherine (2019) employed correlation and regression techniques on listed banks from 2014–2018 and found that credit risk had a significant negative impact on financial performance. Similarly, Ajao and Oseyomon (2019) used dynamic GMM and Granger causality methods on Nigerian banks from 2006–2016 and reported that capital adequacy, non-performing loans, and loan loss provisions positively and significantly affected ROA, while liquidity risk exerted a negative influence.

Further African evidence from 2019 and earlier years highlights the complexity of credit risk–profitability relationships. Kajola et al. (2019) examined Nigerian deposit money banks between 2005 and 2016 using random effects GLS regression and found that non-performing loans, capital adequacy, and loan-to-

deposit ratios significantly influenced ROA and ROE. Gadzo, Kportorgbi, and Gatsi (2019) analysed universal banks in Ghana using structural equation modelling and found that both credit risk and operational risk negatively affected financial performance. Gambo et al. (2019), using OLS and GLS panel regression on Nigerian banks from 2010–2018, reported that solvency risk and firm size positively affected profitability, while credit risk and capital adequacy were insignificant. Nwude and Okeke (2018) also found that credit risk management significantly improved ROA, ROE, and total loans and advances of Nigerian banks using OLS regression on data from 2000–2014.

Nwanna and Oguezue (2017) analysed Nigerian banks using multiple regression on data from 2006–2015 and found that sound credit management improved profitability, although non-performing loans had a negative but insignificant effect. Annor and Obeng (2017) examined Ghanaian banks using random effects panel estimation and reported a significant relationship between credit risk management and profitability. Kishori and Jeslin (2017) found a significant negative impact of credit risk management on bank performance in India using data from 2001–2011. Harcourt (2017), applying ECM and Granger causality techniques to Nigerian data from 1989–2014, confirmed that credit risk indicators significantly influenced ROA and ROE. Saeed and Zahid (2016), studying UK banks during the financial crisis period using correlation, ANOVA, and OLS, found a positive association between credit risk indicators and profitability.

Li and Zou (2014) analysed 47 large European banks using descriptive statistics and multiple regression on data from 2007–2012 and found that credit risk management did not positively affect profitability. Abiola and Olausi (2014) reported a significant relationship between non-performing loans, capital adequacy, and profitability of Nigerian banks using panel regression, while Aialade et al. (2014) found that credit risk reduced profitability based on survey and correlation analysis. Kaaya and Pastory (2013) observed a negative relationship between credit risk and ROA in Tanzanian banks using regression analysis, while Samuel (2013) and Poudel (2012) found that non-performing loans and default-related indicators adversely affected profitability in Nigerian and Nepalese banks, respectively. Earlier studies by Kargi (2011), Al-Khouri (2011), Kithinji (2010), Hosna and Manzura (2009), Felix and Claudine (2008), and Ahmad and Ariff (2007) consistently emphasised that poor credit risk management, particularly high non-performing loans and weak provisioning practices, undermines bank profitability, with stronger effects observed in emerging economies.

3. Methodology

This study adopts a longitudinal research design to examine the effect of credit risk management and profitability of deposit money banks in Nigeria, a design that is particularly suitable given the historical and non-manipulable nature of the data. The population comprises all thirteen (13) deposit money banks listed on Nigerian Exchange Limited as at 31 December 2024; however, a census approach was employed in which all listed banks were initially included, with Ecobank Plc excluded due to data inconsistencies. The final sample therefore consists of twelve deposit money banks, namely Access Bank Plc, First Bank of Nigeria Plc, FCMB, Fidelity Bank Plc, Guaranty Trust Bank Plc, Stanbic IBTC Plc, Sterling Bank Plc, United Bank for Africa Plc, Union Bank Plc, Unity Bank Plc, Wema Bank Plc, and Zenith Bank Plc. The study covers a ten-year period from 2015 to 2024, selected to capture developments in the post-consolidation era and ensure contemporary relevance. Data for the study were obtained exclusively from secondary sources, specifically audited annual financial statements of the sampled banks and the Central Bank of Nigeria Statistical Bulletins.

3.1 Model Specification

This model was hinged on the anticipated income theory postulated by Prochanow (1944) adopted as the theoretical framework as discussed in chapter two. In order to examine the impact of credit risk management on the performance of deposit money banks, this study adopted the model of Annor and Obeng (2017).

The model of Annor and Obeng (2017) is stated as;

$ROE_{it} = \alpha 0 + \beta_1 NPL_{it} + \beta_2 LLPR_{it} + \beta_3 CAR_{it} + \beta_4 LARt + \varepsilon_{it}$…….. ..(1)

The model introduces the variables; loan and advances and leverage ratio to suit our study.

The functional forms of the models are stated below as:

Tobin Q = F (NPL, LA, LLP, CAR, LR) ……. (2)

The econometric forms of the models are expressed in the equation below:

Tobin Qit = $\alpha_0 + \beta_1 NPLit + \beta_2 LAit + \beta_3 LLPit + \beta_4 CARit + \beta_5 LRit + \varepsilon it$ ……..(3)

Where;

Tobin Q = Market base measure of Performance

NPL = Non-performing Loans

LA = Loans and Advances

LLP = Loans Loss Provision

CAR = Capital Adequacy Ratio

LR = Leverage Ratio

εit = error term

β_0, β_1, β_2, β_3, β_4 and β_5= are parameters to be estimated

Apriori expectation = β_1 to $\beta_5 > 0$

3.2 Methods of Data Analysis

This study employed a combination of descriptive statistics, correlation analysis, panel unit root tests, panel co-integration analysis, and feasible generalized least squares (FGLS) estimation. Descriptive statistics were used to provide a preliminary overview of the distributional properties and normality of the variables, while correlation analysis examined the strength and direction of relationships among the model variables. Panel unit root tests were conducted to assess the stationarity of the series and ensure the reliability of the data, given that non-stationary variables may produce spurious results. Based on the unit root outcomes, panel co-integration tests were applied to determine the existence of long-run relationships among the variables. The study ultimately adopted the FGLS estimation technique because of its robustness to heteroskedasticity, serial correlation, and cross-sectional dependence, making it more efficient and reliable than the ordinary least squares estimator for panel data analysis.

3.3 Operationalization and Measurement of Variable

S/N	Variables	Definition	Type of Variables	Measurement	Authors
1	Tobin Q	Market measurement of performance.	Dependent	Ratio of market values to replacement cost	Daines (2001)
2	NPL	Non-Performing Loans	Independent	Proportion of loan loses amount in relation to total loans amount	Ara, Bakaeva and Sun (2009)
3	LA	Loans and Advances	Independent	Total loans divided by total deposits	Ogboi and Unuafe (2013)
4	LLP	Loan Loss Provisions Ratio	Independent	Ratio of loan loss provision to average gross loans in Naira	Zheng, Perhiar, Gilal and Gilal (2019)
5	CAR	Capital Adequacy Ratio	Independent	Shareholders' fund divided by total risk weighted assets.	Poudel (2012)
6	LR	Leverage Ratio	Independent	Total debts divided by total equity.	Ali (2015).

Source: *Researcher's Compilation, (2025)*

4. Findings and Discussions

The empirical results are presented in this section using descriptive, correlation, unit root, Estimated/Feasible Generalized Least Squares (EGLS or FGLS) technique, and granger causality.

Table 2: Descriptive Statistics of all Variables Employed

stat	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability	Sum	Obs
Capital Adequacy Ratio	13.06	19.73	44.00	-213.6	36.53	-5.41	32.35	4852.27	0.00	1554.09	119
Loan and advances to deposit ratio	0.67	0.66	1.43	0.03	0.20	0.33	4.66	15.98	0.00	80.80	120
Loan Loss Provision Ratio	0.06	0.02	2.93	-0.02	0.27	10.15	108.02	57203.50	0.00	6.79	120
Leverage Ratio	8.06	6.26	191.21	-9.64	17.27	10.08	107.30	56420.72	0.00	967.21	120
Non-Performing Loan Ratio	7.43	4.03	98.00	0.00	12.23	4.61	29.19	3855.83	0.00	891.57	120
Tobin's Q	1.18	0.70	20.72	-2.25	2.23	6.29	51.77	12680.51	0.00	141.19	120

Source: *Author's Computation (2025) using E-Views 12*

The descriptive statistics show substantial variation across the variables over the 120 observations, indicating heterogeneous financial conditions among the sampled banks. Capital adequacy ratio recorded a mean of 13.06 with a wide range from –213.60 to 44.00 and a high standard deviation of 36.53, suggesting significant dispersion and extreme observations. The loan and advances to deposit ratio averaged 0.67 with relatively low variability (standard deviation of 0.20), indicating moderate lending activity relative to deposits. Loan loss provision ratio and non-

performing loan ratio had mean values of 0.06 and 7.43 respectively, but both exhibited high skewness, kurtosis, and large Jarque–Bera statistics, reflecting the presence of outliers and non-normal distributions. The leverage ratio, included as a control variable, showed a mean of 8.06 with considerable dispersion (standard deviation of 17.27), highlighting differences in banks' capital structures. Tobin's Q averaged 1.18, indicating that market valuation slightly exceeded book value on average, though its wide range and non-normality further confirm significant cross-bank variability in performance.

Table 3: Correlation Statistics of All Variables Employed

correlation	Capital Adequacy Ratio (CAR)	Loan and advances to deposit ratio	Loan Loss Provision Ratio	Leverage Ratio	Non-Performing Loan Ratio	Tobin's Q
CAR	1.000	0.330	-0.520	0.090	-0.078	0.031
LA	0.330	1.000	-0.318	-0.077	0.267	0.099
LLP	-0.520	-0.318	1.000	-0.038	0.017	-0.059
LR	0.090	-0.077	-0.038	1.000	0.036	0.200
NPL	-0.078	0.267	0.017	0.036	1.000	0.110
TOBINQ	0.031	0.099	-0.059	0.200	0.110	1.000

Source: *Author's Computation (2025) using E-Views 12.*

The correlation results indicate generally weak to moderate associations among the variables, suggesting the absence of severe multicollinearity in the model. Capital adequacy ratio shows a moderate positive relationship with loan and advances to deposit ratio (0.330) but a relatively strong negative association with loan loss provision ratio (–0.520), implying that better-capitalised banks tend to make lower provisions for credit losses. Loan and advances to deposit ratio is negatively related to loan loss provisions (–0.318) but positively associated with non-performing loans (0.267), indicating that higher lending intensity may increase credit risk exposure. The leverage ratio, used as a control variable, exhibits weak correlations with most variables but shows a modest positive relationship with Tobin's Q (0.200), suggesting a limited link between leverage and market valuation. Overall, the low magnitude of most correlation coefficients confirms that the explanatory variables can be jointly included in the regression model without multicollinearity concerns.

Table 4a: Panel Unit Root Test at Levels- The Levin, Lin and Chu; Im, Pesaran and Shin; ADF - Fisher and PP - Fisher Approaches

Variables	Levin, Lin and Chu			Im, Pesaran and Shin W-stat			ADF - Fisher Chi-square			PP - Fisher Chi-square		
	Null Hypothesis: Unit root (assumes common unit root process)			Null Hypothesis: Unit root (assumes individual unit root process)			Null Hypothesis: Unit root (assumes individual unit root process)			Null Hypothesis: Unit root (assumes individual unit root process)		
	Stat	*Prob*	*Remark*	*Stat*	*Prob*	*Remark*	*Stat*	*Prob*	*Remark*	*Stat*	*Prob*	*Remark*
CAR	-7.89099	0.0000	Stationary	-3.92848	0.0000	Stationary	60.2001	0.0001	Stationary	81.5468	0.0000	Stationary
LA	-2.79	0.0027	Stationary	-0.33	0.3716	Non-Stationary	24.5186	0.4323	Non-Stationary	32.3846	0.1177	Non-Stationary
LLP	-17.35	0.0000	Stationary	-6.86	0.0000	Stationary	81.1891	0.0000	Stationary	105.280	0.0000	Stationary
LR	-9.37	0.0000	Stationary	-3.67	0.0001	Stationary	52.9170	0.0006	Stationary	56.9656	0.0002	Stationary
NPL	-22.23	0.0000	Stationary	-9.11	0.0000	Stationary	83.1251	0.0000	Stationary	89.7005	0.0000	Non-Stationary
TOBINQ	-14.84	0.0000	Stationary	-5.85	0.0000	Stationary	66.6349	0.0000	Stationary	80.1106	0.0000	Stationary

Note: Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.
Source: Author's Computation (2025) using E-Views 12.

Table 4b: Panel Unit Root Test at First Difference- The Levin, Lin and Chu; Im, Pesaran and Shin; ADF - Fisher and PP - Fisher Approaches

Variables	Levin, Lin and Chu			Im, Pesaran and Shin W-stat			ADF - Fisher Chi-square			PP - Fisher Chi-square		
	Null Hypothesis: Unit root (assumes common unit root process)			Null Hypothesis: Unit root (assumes individual unit root process)			Null Hypothesis: Unit root (assumes individual unit root process)			Null Hypothesis: Unit root (assumes individual unit root process)		
	Stat	*Prob*	*Remark*	*Stat*	*Prob*	*Remark*	*Stat*	*Prob*	*Remark*	*Stat*	*Prob*	*Remark*
CAR	-13.4	0.00	Stationary	-5.95	0.00	Stationary	82.70	0.00	Stationary	101.0	0.00	Stationary
LA	-6.05	0.00	Stationary	-2.75	0.00	Stationary	49.70	0.00	Stationary	51.1	0.00	Stationary
LLP	-13.2	0.00	Stationary	-6.58	0.00	Stationary	89.94	0.00	Stationary	108.4	0.00	Stationary
LR	-18.3	0.00	Stationary	-9.23	0.00	Stationary	110.4	0.00	Stationary	126.4	0.00	Stationary
NPL	-25.3	0.00	Stationary	-10.1	0.00	Stationary	99.69	0.00	Stationary	110.0	0.00	Stationary
TOBINQ	-17.2	0.00	Stationary	-6.91	0.00	Stationary	89.1259	0.00	Stationary	123.37	0.00	Stationary

Note: Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.
Source: Author's Computation (2025) using E-Views 12.

Table 4a and Table 4b report the panel unit root results at levels and first differences using the Levin–Lin–Chu, Im–Pesaran–Shin, ADF–Fisher, and PP–Fisher tests. At levels (Table 4a), most variables (CAR, LLP, LR, and Tobin's Q) are stationary across the majority of tests, while the loan and advances to deposit ratio (LA) is largely non-stationary and non-performing loans (NPL) show mixed evidence of stationarity. After first differencing (Table 4b), all variables become stationary under all test statistics, indicating integration of order one where applicable. Overall, the results suggest a mixture of I(0) and I(1) series, justifying the subsequent application of panel co-integration techniques to examine long-run relationships among the variables.

Table 4c Cointegration Test Results for the TOBINQ model variables

Pedroni Residual Cointegration Test
Series: CAR LA LLP LR NPL TOBINQ

Included observations: 120
Null Hypothesis: No cointegration
Trend assumption: Deterministic intercept and trend
User-specified lag length: 0
User-specified bandwidth: 0 and Bartlett kernel
Alternative hypothesis: common AR coefs. (Within-dimension)

		Statistic	Prob.	Weighted Statistic	Prob.
Panel PP-Statistic		-11.02	0.0000***	-5.03	0.0000***
Panel ADF-Statistic		-11.02	0.0000***	-5.03	0.0000***
Alternative hypothesis: individual AR coefs. (Between-dimension)					
		Statistic	Prob.		
Group PP-Statistic		-7.7493	0.0000***		
Group ADF-Statistic		-7.7493	0.0000***		

NB: ***Significant at 1%.
Source: *Author's Computation (2025) using E-Views 12.*

Table 4c presents the Pedroni residual cointegration test results for the Tobin's Q model, and the findings provide strong evidence of a long-run equilibrium relationship among the variables. Both the within-dimension statistics (Panel PP and Panel ADF) and the between-dimension statistics (Group PP and Group ADF) are negative and statistically significant at the 1% level, leading to the rejection of the null hypothesis of no cointegration. This indicates that capital adequacy ratio, loan and advances to deposit ratio, loan loss provision ratio, leverage ratio, non-performing loan ratio, and Tobin's Q move together in the long run, thereby justifying the estimation of long-run coefficients using a panel regression technique such as feasible generalized least squares (FGLS).

Table 5: Panel Data Estimation Results

Variable	TOBINQ MODEL		
	Coef	t-Stat	Prob.
C	0.21	2.93	0.00***
NPL	0.01	6.36	0.00***
LA	0.96	9.25	0.00***
LLP	0.33	8.97	0.00***
CAR	0.001	1.10	0.27
LR	0.03	19.38	0.00***
R-squared		0.93	
Adjusted R-squared		0.93	
S.E. of regression		0.98	
F-statistic		294.97	
Prob(F-statistic)		0.00	
Mean dependent var		0.63	
S.D. dependent var		3.69	
Sum squared resid		109.39	
Durbin-Watson stat		1.96	

Residual Cross-Section Dependence Test: Test employs centered correlations computed from pairwise samples			
Null hypothesis: No cross-section dependence (correlation) Weighted Statistics			
Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	28.25	66	1
Pesaran CD	0.49		0.62

NB: *Significant at 10%, **Significant at 5%,***Significant at 1%.
Source: *Author's Computation (2025) using E-Views 12.*

Table 5 reports the FGLS panel estimation results for the Tobin's Q model and shows that credit risk management variables jointly exert a strong and statistically significant influence on the market-based performance of quoted deposit money banks in Nigeria. Non-performing loan ratio (NPL), loan and advances to deposit ratio (LA), loan loss provision ratio (LLP), and leverage ratio (LR) all display positive and statistically significant coefficients at the 1% level, indicating that increases in these variables are associated with higher Tobin's Q. In contrast, capital adequacy ratio (CAR) is positive but statistically insignificant, suggesting a weak direct effect on market valuation during the study period. The high explanatory power of the model ($R^2 = 0.93$), a significant F-statistic, a Durbin–Watson statistic close to 2, and insignificant cross-sectional dependence tests confirm that the estimates are robust, reliable, and free from autocorrelation and cross-sectional bias.

When juxtaposed with the literature reviewed, the results present both convergence and divergence. The positive and significant effect of loan and advances to deposit ratio aligns with studies such as Taiwo et al. (2017) and Nwanna and Oguezue (2017), which argue that efficient intermediation enhances bank performance. Similarly, the positive role of loan loss provisions supports evidence from Serwadda (2018) and Curcio and Hasan (2015), who view provisioning as a prudential buffer that strengthens confidence and performance. However, the positive and significant coefficient of non-performing loans contradicts dominant empirical findings that report a negative relationship between NPLs and profitability (Felix & Claudine, 2008; Kargi, 2011; Nwanna & Oguezue, 2017), suggesting that Nigerian banks during the study period may have absorbed rising credit risk without an immediate deterioration in market valuation. The insignificance of capital adequacy ratio is consistent with studies such as Alnajjar and Othman (2021) but contradicts others that find a positive effect (Hosna et al., 2009). Overall, the findings indicate that while traditional credit risk indicators behave largely in line with existing literature, the Nigerian banking sector exhibits context-specific dynamics where resilience, pricing strategies, and market perceptions moderate the expected adverse effects of credit risk.

Table 6: Pairwise Dumitrescu Hurlin Panel Causality Tests

Sample: 2010-2019			
Lags: 1			
Null Hypothesis:	W-Stat.	Zbar-Stat.	Prob.
TOBINQ does not homogeneously cause CAR	1.81	0.30	0.77
CAR does not homogeneously cause TOBINQ	4.99	3.45	0.00***
TOBINQ does not homogeneously cause LA	2.03	0.55	0.58
LA does not homogeneously cause TOBINQ	1.74	0.25	0.81
TOBINQ does not homogeneously cause LLP	1.68	0.19	0.85
LLP does not homogeneously cause TOBINQ	7.81	6.52	0.00***
TOBINQ does not homogeneously cause LR	0.67	-0.86	0.39
LR does not homogeneously cause TOBINQ	1.89	0.40	0.69
TOBINQ does not homogeneously cause NPL	2.20	0.73	0.47
NPL does not homogeneously cause TOBINQ	1.10	-0.41	0.68

NB: *Significant at 10%, **Significant at 5%,***Significant at 1%.
Source: *Author's Computation (2025) using E-Views 12.*

Table 6 presents the Dumitrescu–Hurlin panel causality results and indicates limited causal interactions between credit risk management variables and bank performance. The findings reveal unidirectional causality running from capital adequacy ratio (CAR) to Tobin's Q and from loan loss provision ratio (LLP) to Tobin's Q, as the null hypotheses of no causality are rejected at the 1% significance level in both cases. This suggests that changes in banks' capital buffers and provisioning policies precede and help explain variations in market-based performance. Conversely, no causal relationship is observed between Tobin's Q and loan and advances to deposit ratio, leverage ratio, or non-performing loan ratio, and Tobin's Q does not Granger-cause any of the credit risk variables. Overall, the results imply that bank performance in Nigeria during the study period was primarily driven by internal prudential policies related to capital adequacy and loss provisioning rather than by feedback effects from market valuation.

5. Conclusion and Recommendation

This study examined the relationship between credit risk management and the performance of quoted deposit money banks in Nigeria using a panel data framework. The empirical findings reveal that credit risk management variables jointly and significantly influence bank performance as measured by Tobin's Q, confirming the relevance of credit risk practices in shaping market-based valuation. Specifically, loan and advances to deposit ratio, loan loss provision ratio, non-performing loan ratio, and leverage ratio were found to exert positive and statistically significant effects on performance, while capital adequacy ratio showed a positive but insignificant relationship. The results further indicate that Nigerian banks exhibited a degree of resilience during the study period, as rising credit risk indicators did not necessarily translate into declining performance. Overall, the study concludes that effective credit allocation, prudent provisioning, and balanced leverage management are critical in sustaining the performance and stability of deposit money banks in Nigeria.

Based on the findings of the study, the following recommendations are proposed:

- Strengthening credit appraisal and monitoring: Deposit money banks should enhance loan evaluation, monitoring, and recovery mechanisms to ensure that increases in lending do not escalate into unsustainable credit risk.
- Optimising loan-to-deposit management: Banks should maintain an optimal loans-to-deposit ratio that balances profitability objectives with liquidity and solvency considerations.
- Prudent loan loss provisioning: Bank management should sustain adequate and forward-looking loan loss provisions to absorb potential future losses and reinforce market confidence.
- Balanced leverage strategy: Banks should avoid excessive reliance on debt financing and pursue an optimal capital structure that supports performance without increasing financial vulnerability.
- Capital adequacy oversight: Regulators should continue to enforce capital adequacy requirements while ensuring that such regulations do not unduly constrain banks' ability to invest in profitable opportunities.
- Regulatory and supervisory vigilance: The Central Bank of Nigeria and other relevant authorities should strengthen supervisory frameworks to ensure consistent implementation of sound credit risk management practices across the banking sector.

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The Impact of Digital Transformation on Consumer Green Purchase Intentions: Evidence from Gen Z in the Nigerian Retail Sector

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Abstract. The digital transformation is still transforming the consumer behaviour of consumers around the world, but little has been done to determine how Generation Z consumers impact on sustainability driven decisions in emerging economies. This paper focuses on exploring the role of the main constructs of digital transformation such as perceived transparency, brand trust, influencer influence, social media use, eco-literacy, the use of AR/VR, and eco-knowledge in influencing green purchase intentions in the Nigerian retail market among Gen Z consumers. The quantitative research design was used, and 1,000 Gen Z participants were surveyed on the basis of the structured online questionnaire. To evaluate the measurement as well as structural models, Structural Equation Modelling (SEM) was used. The results show that brand trust is a significant positive effect of the perceived transparency that positively modulates the green purchase intention. Influencer influence was also found to be a good predictor especially among the respondents who had a high rate of social media use. Digital literacy and eco-knowledge had considerable positive impacts on sustainability-oriented behaviour indicating the importance of environmental awareness and technological competence. Conversely, the impact of AR/VR engagement on green purchase intention was not significant and direct, which indicates that the adoption of immersive technologies in the Nigerian retail environment is in its early phases. Further multi-group analysis revealed gender variations as the female respondents were more susceptible to influencer-based sustainability cues. Generally, the research paper offers empirical data that transparency tools, influencer networks, and digital competencies are key in determining the green consumption among Gen Zs in Nigeria. The insights can be useful to retailers, marketers, and policymakers interested in ensuring sustainability by promoting digitally enabled strategies.

1. Introduction

The digital transformation has emerged as a characteristic of the modern business practice that has changed the way individuals conduct business, communicate value, and interact with consumers in the world and emerging markets. Technological progress in the retail industry has not only changed the channels of consumption and the brand-consumer dynamics, but also the digital marketing driven by data and the ability to create a virtual environment through the application of immersive technologies like Augmented Reality (AR) or Virtual Reality (VR). The changes are especially strong among the representatives of Generation Z, a cohort demographic most of which is highly digitally fluent, actively engages with social media platforms, and is becoming increasingly conscious of sustainability-related matters (Ameen et al., 2023). With the growing focus of retailers on digital tools as a way of improving transparency and the capacity to build sustainability communication, the questions regarding the impact of these changes on the green purchase intentions of young consumers have become a crucial topic of investigation in the research field and a significant focus of managerial activities.

This nexus between digital transformation and sustainable consumption is particularly useful in the context of emerging economies like Nigeria, where the mobile network is proliferated, social media users grow, and online stores are available, offering new opportunities to companies that want to advertise environmentally friendly products. Nevertheless, even with these changes, the issue of misinformation, the lack of consistent disclosure of sustainability, and the very existence of the so-called perceived greenwashing are obstacles to gaining the trust of younger consumers. Previous research indicates that transparency with verifiable digital information (e.g. product traceability, certifications,

disclosures with blockchain) could enhance credibility and consumer reactions to sustainability statements (Holloway, 2024; Dobrowolski et al., 2022). Nevertheless, there is a dearth of empirical data about the functioning of these mechanisms in the context of Nigerian Gen Z consumers whose buying behavior is determined by the distinctive sociocultural, economic, and digital situations.

Moreover, the role of social media influencers has been more dominant in influencing consumer attitudes and behaviour especially in the youth-dominated digital ecosystems. The influencers can serve as the mediating factors that convert sustainability information into terms that are relatable, boost pertences to authenticity, and have the power to modify peer norms all of which can lead to green purchase intention. Nevertheless, this influence differs significantly at different contexts, platforms, and product types, and it may be necessary to study the matter context-sensitively within the population of African Gen Z. Likewise, the users of AR and VR are changing how potential consumers assess the product features and respond to sustainability communications and purchase intentions due to new digital retail experiences. To what extent these immersive technologies contribute to increased interest in sustainable products as compared to standard digital formats is a question that has not gotten much research in the area of sub-Saharan Africa.

In light of these trends, this paper will be looking at how green purchase intentions of Nigerian Gen Z consumers in the retail industry are influenced by digital transformation. It concentrates on three aspects that are interconnected to each other: (i) the role of the perceived transparency in online marketing in shaping trust in sustainability statements; (ii) the role of social media influencers in mediating between sustainability communication and the green purchase intention; and (iii) whether the AR/VR-enhanced retail experiences increase the interest in purchasing eco-friendly products. Answering these questions will offer the theoretical and practical understanding of how digital systems can facilitate the sustainability-oriented consumer behaviour in an African setting.

The research is placed in context of the aims and scope of the Management and Development Review (MDR), in the specific context of its interests in the digital transformation, sustainable development, and modern business issues in Africa. The study places the analysis into Nigeria, which is a fast-digitizing retail sector and concentrates on the behaviour of a key consumer group, thus adding to the current scholarly and policy discussion on sustainable consumption, adoption of technology, and digital innovation in developing economies. It also provides practical implications on retailers, policymakers, and sustainability strategists who may want to adopt evidence-based solutions to facilitate the adoption of greener purchasing behaviour in the region.

2. Literature Review

Digital Transformation and Retail Sustainability: Digital transformation has reshaped the retail environment by expanding the use of online platforms, digital traceability tools, and data-driven communication strategies. These technologies have enabled firms to provide clearer sustainability disclosures that enhance consumer understanding of product origins and environmental impacts. Multiple studies emphasise that digital transparency improves consumer evaluations of sustainability performance, particularly when supported by verifiable information sources such as supply-chain visibility tools, blockchain-enabled traceability, and open-data reporting systems (Dobrowolski et al., 2022; Holloway, 2024; Ramdhani & Pradisti, 2025). Emerging research further demonstrates that digital transparency mechanisms—such as sustainability dashboards, platform-integrated environmental labels, and ethical digital marketing—strengthen credibility and improve consumer responses to sustainability messaging in both developed and emerging markets (Holloway, 2024; Theocharis & Tsekouropoulos, 2025; Nekmahmud et al., 2022). In contexts like Nigeria, digital habits and online engagement have additionally been shown to shape sustainable shopping decisions among young consumers (Khairul Haizat & Ahmad, 2024).

Green Purchase Intention: Green purchase intention reflects a consumer's willingness to select environmentally responsible alternatives. This intention is influenced by perceived credibility of sustainability claims, environmental awareness, accessibility of information, and digital engagement. As noted across several analyses, product-level transparency, accurate environmental reporting, and reduced scepticism toward green claims encourage consumers to engage more readily with green offerings (Orea-Giner & Fusté-Forné, 2023; Di Pillo et al., 2025; Tass & Malik, 2025). In emerging economies, including Nigeria, green knowledge, perceived behavioral control, digital exposure, and consumer trust have also been identified as key drivers of such intentions among younger cohorts (Haruna Karatu & Mat, 2015; Filip et al., 2025; Panopoulos et al., 2022).

Perceived Transparency in Digital Marketing: Perceived transparency is a central determinant of consumer trust in sustainability claims. Transparent disclosures—such as environmental certifications, lifecycle information, traceable production

pathways, and third-party verifications—help mitigate information asymmetry and greenwashing concerns. A growing body of literature indicates that transparent sustainability communication increases perceived authenticity, reduces consumer skepticism, and fosters more favourable evaluations of green products (Kara & Min, 2023; Ramdhani & Pradisti, 2025; Di Pillo et al., 2025). For digitally native cohorts like Generation Z, transparency is particularly crucial as they tend to question unsupported environmental claims and rely heavily on digital cues to verify credibility (Robichaud & Yu, 2021; Sun & Fernandez, 2025).

Social Media Influencers and Sustainability Messaging: Social media influencers shape consumer attitudes through mechanisms such as perceived expertise, authenticity, trustworthiness, and entertainment value (Xu, 2024). They influence sustainability behaviours by framing environmental information in relatable narratives that resonate with peer-driven digital communities. Empirical findings from multiple contexts show that influencer credibility significantly enhances green purchase intention among young consumers, particularly when sustainability claims are consistent, value-aligned, and supported by engaging content (Pop et al., 2020; Xu, 2024; Tass & Malik, 2025; Panopoulos et al., 2022). Additionally, green product knowledge and brand loyalty often mediate the relationship between influencer communication and eco-friendly purchasing behaviours (Firmansyah & Artanti, 2022; Theocharis & Tsekouropoulos, 2025), while platform-specific dynamics and social media marketing contribute to heterogeneous effects across markets, including emerging economies such as Nigeria (Harmon et al., 2022; Dharma et al., 2024; Nekmahmud et al., 2022). Among Gen Z consumers, the influence of digital personalities is especially strong due to their immersion in algorithmic content streams and socially networked consumption patterns (Ko & Jeon, 2024).

Augmented and Virtual Reality in Sustainable Retailing: Augmented Reality (AR) and Virtual Reality (VR) enhance consumer engagement by offering immersive product experiences. These technologies allow users to visualise product attributes, examine materials, and understand environmental impacts in interactive formats. Studies indicate that virtual product exploration can increase perceived value and deepen sustainability awareness by making environmental claims more vivid and experiential (Kholkina et al., 2024; Orea-Giner & Fusté-Forné, 2023). In digitally transformed retail systems, AR/VR thereby functions as both an educational and persuasive mechanism that may increase engagement with sustainable products, although adoption and behavioural effects vary by technological infrastructure and digital literacy levels in emerging markets (Khairul Haizat & Ahmad, 2024).

3. Theoretical Framework

The theoretical framework guiding this study integrates the Theory of Planned Behaviour (TPB) (Ajzen, 1991) as its core foundation with complementary insights from Signalling Theory and Social Influence Theory to explain how digital transformation shapes green purchase intentions among Nigerian Gen Z consumers in the retail sector. TPB remains the most robust and widely validated model for predicting sustainable consumption behaviours, positing that behavioural intention is directly determined by three antecedents: attitude toward the behaviour, subjective norms, and perceived behavioural control. In sustainability contexts, especially among digitally native youth, these constructs are strongly influenced by environmental knowledge, social pressures, and self-efficacy. Recent empirical extensions of TPB in emerging markets have successfully incorporated digital variables, demonstrating that social media engagement, influencer messaging, and green awareness significantly enhance green purchase intentions (Nekmahmud et al., 2022; Tass & Malik, 2025; Panopoulos et al., 2022). Nigerian studies have similarly applied TPB to link perceived knowledge, trust, and behavioural control with green intentions, confirming its contextual relevance (Haruna Karatu & Mat, 2015).

To address the unique role of digital transparency, the framework incorporates Signalling Theory (Spence, 1973; Holloway, 2024; Kara & Min, 2023). This theory explains how credible signals—such as verifiable sustainability disclosures, blockchain traceability, and digital certifications—reduce information asymmetry and build brand trust, which in turn strengthens consumer attitude and perceived behavioural control. Perceived transparency therefore functions as a signal that fosters trust, partially mediating its effect on green purchase intention, consistent with the study's mediation results.

Social Influence Theory complements TPB by elucidating how influencers and social media platforms operate as opinion leaders that amplify subjective norms. Influencers generate normative pressure through authentic, value-aligned content, while social media engagement moderates this pathway, intensifying the translation of influencer cues into sustainable intentions (Pop et al., 2020; Xu, 2024). Digital literacy and eco-knowledge further enhance perceived behavioural control, whereas AR/VR engagement is expected to enrich

attitude formation, although its direct effect may remain limited in early-adoption contexts like Nigeria.

This integrated framework maps all study constructs directly onto TPB antecedents, provides clear testable pathways for SEM analysis, and addresses the literature gap in African digital-sustainability research. It offers both theoretical rigor and practical relevance for retailers and policymakers seeking to leverage transparency, influencers, and digital competencies to drive greener consumption among Gen Z. (398 words)

4. Empirical Review

Recent studies highlight several pathways through which digital transformation shapes green consumption. For example, transparent sustainability disclosures increase perceived brand authenticity and reduce scepticism toward environmental claims (Dobrowolski et al., 2022; Orea-Giner & Fusté-Forné, 2023). Empirical findings also show that influencer credibility positively affects green purchase intention, with expertise and authenticity identified as strong predictors of persuasive effectiveness (Xu, 2024; Pop et al., 2020). Moreover, product knowledge often mediates the influencer–intention relationship, suggesting that informative content is particularly impactful among younger consumers (Firmansyah & Artanti, 2022). Research further demonstrates that immersive retail technologies, including AR and VR, increase consumer engagement and strengthen sustainability-related behavioural responses (Kholkina et al., 2024).

However, contextual studies in African markets remain limited. Existing global evidence highlights market-specific contingencies, suggesting that cultural, economic, and digital infrastructure factors influence the effectiveness of transparency mechanisms, influencer strategies, and immersive retail tools (Harmon et al., 2022). This gap underscores the importance of generating context-specific evidence on how digital transformation shapes green purchase intention among Nigerian Gen Z consumers.

5. Research Methodology

This study employed a quantitative, cross-sectional survey design to examine the impact of digital transformation factors on green purchase intentions among Generation Z consumers in the Nigerian retail sector. A quantitative approach is appropriate for studies that seek to test relationships between predefined constructs and evaluate variance across large populations (Creswell & Creswell, 2018). The cross-sectional design was selected because it enables data collection at a single point in time, allowing researchers to capture consumer attitudes and behavioural intentions efficiently (Saunders et al., 2019).

The target population comprised Generation Z consumers aged 18–25 in Nigeria who use digital retail platforms, social media, and online shopping applications. This group was selected because of its strong digital orientation and demonstrated engagement with technology-mediated retail environments. The sample size was guided by recommendations for Structural Equation Modelling (SEM), which require a minimum of 10–20 respondents per estimated parameter or at least 300 participants to achieve stable model estimation (Kline, 2016; Hair et al., 2020). Based on this guidance, the study targeted more than 400 respondents to ensure sufficient statistical power and model reliability.

A non-probability purposive sampling technique was used to recruit respondents who met the inclusion criteria of being active digital consumers within the Gen Z cohort. Purposive sampling is appropriate when the research aims to access participants with specific characteristics relevant to the study objectives (Sekaran & Bougie, 2020). Data collection occurred via online platforms such as Instagram, TikTok, and X (formerly Twitter), where Nigerian youths are highly active. This approach aligns with methodological recommendations for studies involving digitally engaged populations (Bryman, 2016).

Data were collected using a structured questionnaire consisting of closed-ended items measured on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The questionnaire included indicators measuring perceived transparency, brand trust, influencer impact, AR/VR engagement, and green purchase intention. The use of Likert-type scales is well suited for capturing attitudes and behavioural dispositions in consumer behaviour research (DeVellis, 2017). All constructs were measured using multi-item scales adapted from established studies and modified to fit the context of digital transformation and sustainable retailing.

Content validity was established through expert review to ensure clarity, relevance, and representativeness of the items. Construct validity was assessed through Confirmatory Factor Analysis (CFA), following established guidelines for latent variable measurement (Kline, 2016). Reliability was examined using Cronbach's alpha and Composite Reliability (CR). According to Hair et al. (2020), acceptable thresholds are $\alpha \geq .70$ and $CR \geq .70$ for internal consistency. Convergent validity was evaluated using Average Variance Extracted (AVE),

with values of .50 or higher considered satisfactory, while discriminant validity followed the Fornell–Larcker criterion (Fornell & Larcker, 1981).

Data were collected using an online questionnaire administered through Google Forms. Online data collection is effective for reaching large, geographically dispersed populations and supports anonymity, which may enhance response accuracy (Saunders et al., 2019). Respondents were informed of the voluntary nature of participation and assured of the confidentiality of their responses.

Data were analysed using both descriptive and inferential statistics. Descriptive statistics (means, standard deviations, and frequencies) were employed to profile the respondents and summarise key variables. SEM was used to test the hypothesised relationships among constructs because it allows for simultaneous estimation of both measurement and structural models, offering superior accuracy for modelling latent variables (Hair et al., 2020). Model fit was assessed using standard indices including the Comparative Fit Index (CFI), Tucker–Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardised Root Mean Square Residual (SRMR), consistent with recommended benchmarks for SEM (Kline, 2016).

6. Results and Discussion

This section presents the key empirical results from the Structural Equation Modelling (SEM) analysis of 1,000 Gen Z respondents and immediately discusses their theoretical and practical implications in relation to the integrated framework (Theory of Planned Behaviour extended with Signalling Theory and Social Influence Theory) and the reviewed literature.

Table 1: Descriptive Statistics for Study Constructs (N = 1000)

Construct	Items	Mean	SD	Min.	Max.
Perceived Transparency	PT1–PT4	3.49	0.76	1	5
Brand Trust	BT1–BT4	3.60	0.74	1	5
Influencer Impact	II1–II4	3.81	0.77	1	5
Social Media Engagement	SME1–SME4	3.99	0.73	2	5
AR/VR Engagement	AR1–AR3	3.24	0.82	1	5
Eco-Knowledge	EK1–EK3	3.39	0.77	1	5
Digital Literacy	DL1–DL3	4.06	0.72	2	5
Green Purchase Intention	GPI1–GPI4	3.69	0.89	1	5

Respondents were primarily aged 18–25 years (M = 21.51, SD = 2.28), with 50.3% female. The highest means were recorded for social media engagement (M ≈ 3.99) and digital literacy (M ≈ 4.06), confirming the digitally native profile of Nigerian Gen Z. Green purchase intention was moderately high (M = 3.69), while AR/VR engagement remained lower (M = 3.24), reflecting early-stage adoption of immersive technologies in the retail sector.

Table 2: Measurement Model Results (Factor Loadings, Reliability, AVE)

Construct	Items	Loading	α	CR	AVE
Perceived Transparency	PT1–PT4	0.72–0.84	0.83	0.86	0.60
Brand Trust	BT1–BT4	0.75–0.88	0.87	0.90	0.68
Influencer Impact	II1–II4	0.78–0.89	0.88	0.91	0.71
Social Media Engagement	SME1–SME4	0.80–0.91	0.90	0.93	0.76
AR/VR Engagement	AR1–AR3	0.68–0.82	0.79	0.85	0.65
Eco-Knowledge	EK1–EK3	0.74–0.88	0.82	0.88	0.71
Digital Literacy	DL1–DL3	0.81–0.89	0.89	0.92	0.76
Green Purchase Intention	GPI1–GPI4	0.77–0.90	0.90	0.93	0.76

The measurement model demonstrated excellent fit ($\chi^2/df = 2.41$; CFI = 0.953; TLI = 0.946; RMSEA = 0.038; SRMR = 0.041). All constructs met reliability (α, CR ≥ 0.79) and convergent validity (AVE ≥ 0.60) thresholds, establishing that the scales were psychometrically sound and permitting reliable structural interpretation.

Table 3: Structural Model Estimates (Path Coefficients, p-values, R^2)

Hypothesised Path	β	SE	p	Result
PT → BT	0.41	0.04	<.001	Supported
BT → GPI	0.36	0.05	<.001	Supported
SME → II	0.47	0.06	<.001	Supported
II → GPI	0.28	0.05	<.001	Supported
EK → GPI	0.32	0.04	<.001	Supported
DL → AR/VR	0.29	0.05	<.01	Supported
AR/VR → GPI	0.08	0.05	.11	Not Supported

Note: R^2(GPI) = 0.59; BT R^2 = 0.42; II R^2 = 0.44.

The structural model explained 59% of variance in green purchase intention. Perceived transparency strongly predicted brand trust (β = 0.41), which in turn drove green purchase intention (β = 0.36). This pathway directly supports Signalling Theory: transparent digital disclosures act as credible signals that reduce information asymmetry and build trust, thereby enhancing attitude and intention within the TPB framework (Holloway, 2024; Kara & Min, 2023). Eco-knowledge also exerted a significant direct effect (β = 0.32), reinforcing TPB's emphasis on cognitive control and environmental awareness (Ajzen, 1991; Firmansyah & Artanti, 2022).

Social media engagement strongly influenced influencer impact (β = 0.47), which significantly predicted green purchase intention (β = 0.28). AR/VR engagement, although predicted by digital literacy (β = 0.29), had no direct effect on green purchase intention (β = 0.08, p = .11), indicating that immersive technologies have not yet translated into behavioural outcomes in Nigeria's emerging retail context (Kholkina et al., 2024).

Table 4: Moderation Effect of Social Media Engagement on Influencer Impact → Green Purchase Intention

Predictor	B	SE	p
Influencer Impact (II)	0.28	0.05	<.001
Social Media Engagement	0.22	0.04	<.001
Interaction (II × SME)	0.17	0.06	<.01

The significant interaction (β = 0.17, p < .01) shows that social media engagement strengthens the influencer–intention link (high SME: β = 0.41; low SME: β = 0.19). This finding validates Social Influence Theory: influencers exert greater normative pressure among highly engaged Gen Z users on digital platforms (Pop et al., 2020; Xu, 2024).

Mediation analysis confirmed partial mediation by brand trust (indirect effect = 0.15, 95% CI [0.11, 0.20]; direct effect = 0.19, p < .01), further illustrating how transparency operates through trust to drive sustainable intentions.

Table 5: Multi-Group Structural Equation Model Results by Gender

Structural Path	Male (β)	Female (β)	Δβ	p-value (Difference Test)	Interpretation
Perceived Transparency → Brand Trust	0.38	0.44	0.06	.072	Not significantly different
Brand Trust → Green Purchase Intention	0.32	0.39	0.07	.048	Stronger for females
Influencer Impact → Green Purchase Intention	0.23	0.33	0.10	.021	Significantly stronger for females
Eco-Knowledge → Green Purchase Intention	0.29	0.34	0.05	.081	Not significantly different
Digital Literacy → AR/VR Engagement	0.27	0.31	0.04	.114	Not significantly different
AR/VR Engagement → Green Purchase Intention	0.06	0.10	0.04	.203	Not significant

The multi-group analysis ($\Delta\chi^2(7) = 16.88$, p < .05) revealed that females responded more strongly to influencer impact (β = 0.33 vs. 0.23) and brand trust pathways. This gender difference aligns with literature showing greater female susceptibility to social and ethical marketing cues (Kim & Kim, 2022).

Collectively, the results demonstrate that perceived transparency, brand trust, influencer influence, social media engagement, eco-knowledge, and digital literacy are powerful drivers of green purchase intention among Nigerian Gen Z consumers. The integrated TPB framework is strongly supported, with Signalling Theory explaining the transparency–trust mechanism and Social Influence Theory accounting for the moderated influencer pathway. The non-significant AR/VR effect highlights contextual readiness gaps in Nigeria, while the gender moderation underscores the need for targeted digital strategies. These findings advance African-centred research on digital transformation and sustainable consumption and provide actionable insights for retailers, marketers, and policymakers.

Figure 1: Path diagram for Digital Transformation and Green purchase intention among Gen Z consumers in Nigeria

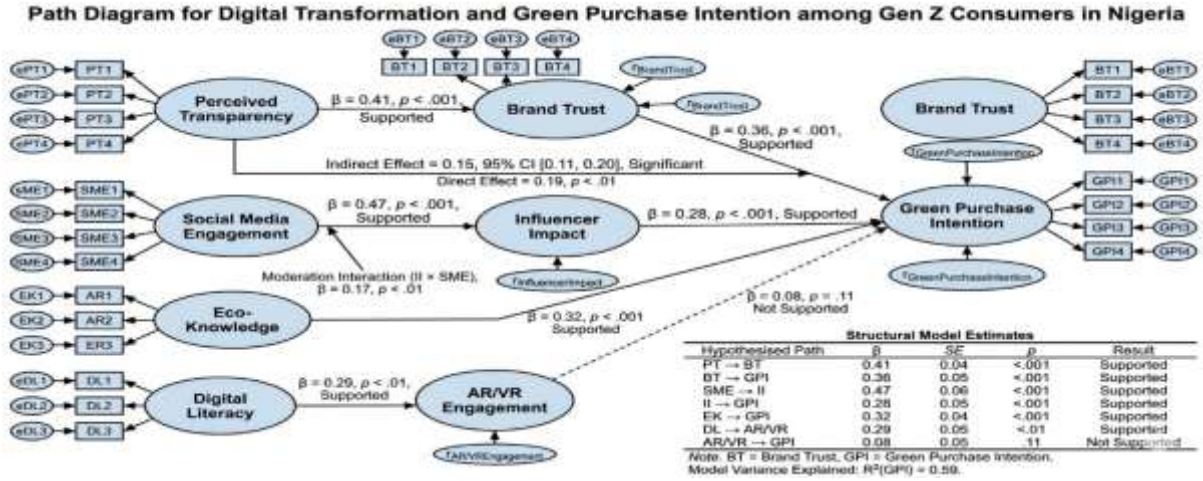

Figure 1 visually represents the pathways connecting digital transformation variables to green purchase intention among Gen Z consumers in Nigeria. The diagram illustrates how perceived transparency and brand trust, as well as influencer impact and social media engagement, interact to shape sustainability-oriented behavior. Eco-knowledge and digital literacy are shown as foundational drivers, strengthening the overall model. Notably, the figure indicates that while AR/VR engagement is included as a potential pathway, its effect on green purchase intention is not significant, highlighting the contextual readiness gap for immersive technologies in the Nigerian market. The diagram also suggests that gender moderates certain relationships, particularly those involving influencer impact and brand trust, with females responding more strongly to these cues. Overall, Figure 1 integrates core theoretical frameworks—Theory of Planned Behavior, Signalling Theory, and Social Influence Theory—to provide a holistic view of how digital strategies can foster green purchasing among digitally active youth.

7. Conclusion

This study investigated how digital transformation influences green purchase intentions among Generation Z consumers in Nigeria. The findings show that transparent digital disclosures, brand trust, influencer impact, social media engagement, eco-knowledge, and digital literacy play crucial roles in shaping sustainability-oriented behaviour. While AR/VR engagement did not significantly influence green purchase intention, the results overall highlight the importance of credible communication, social influence, and consumer capability in fostering sustainable purchase decisions. The study contributes valuable insights for retailers, policymakers, and sustainability practitioners seeking to promote environmentally responsible consumption within digitally active youth populations.

8. Recommendations

Based on the findings, several actionable recommendations emerge for retailers, marketers, and policymakers in the Nigerian retail sector. First, retailers should strengthen digital transparency by providing verifiable sustainability information through blockchain-enabled traceability, QR codes, and detailed product life-cycle disclosures. Enhancing transparency will build trust and reduce scepticism among Gen Z consumers. Second, marketers should strategically collaborate with credible micro- and macro-influencers whose values align with sustainability principles. These influencers should deliver consistent, authentic, and evidence-based content to positively shape green purchase intentions. Third, retailers are encouraged to invest in digital literacy campaigns, particularly through youth-focused digital platforms, to help consumers better understand eco-labels, sustainability certifications, and environmental claims. Fourth, although AR/VR did not significantly influence purchase intentions in this study, retailers should continue exploring low-cost immersive experiences to support sustainability education, as adoption rates are expected to rise with improving technological access.

9. Implications for Further Studies

Future studies may expand this research by adopting longitudinal designs to capture changes in Gen Z behaviour as digital transformation evolves in Nigeria. Researchers could also incorporate qualitative approaches to gain deeper insights into psychological drivers of green consumption. In addition, future studies may explore comparative

analyses between Nigerian Gen Z and their counterparts in other African countries to determine whether cultural or infrastructural differences moderate digital sustainability behaviour. Further work could also examine the specific content characteristics of influencers that most strongly drive sustainable choices.

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Industrial Sector and Economic Growth in Nigeria: A Subsector Analysis

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Abstract. This study investigated the impact of the industrial sector on Nigeria's economic growth from 1996 to 2023. The industrial sector was disaggregated into key subsectors, namely the manufacturing industry, mining and quarrying industry, construction industry, electricity, gas, steam and air-conditioning industry, and water supply, sewage and waste management sector, while the interest rate served as a macroeconomic control variable. Data were sourced from the Central Bank of Nigeria statistical bulletin and analyzed using the autoregressive distributed lag approach, which accounts for both short-run and long-run dynamics among variables. The Bounds test for cointegration confirmed a long-run relationship between industrial sectors and economic growth in Nigeria. In the long run, the results indicated that manufacturing, mining and quarrying, construction, and electricity and gas industries had positive and significant impacts on Nigeria's economic growth, while the water supply, sewage and waste management sector had a negative but insignificant effect. The interest rate exhibited a positive and significant long-run effect on growth. In the short run, manufacturing, mining, and electricity sectors maintained significant positive influences on gross domestic product growth, whereas the construction and water supply sectors showed negative and insignificant effects. The error correction term was correctly signed as negative and significant, indicating that about 67.9% of short-run disequilibrium is corrected annually toward long-run equilibrium. Diagnostic tests confirmed that the model satisfied the assumptions of normality, homoscedasticity, and stability. The study concludes that Nigeria's industrial sector remains a key driver of economic growth, with manufacturing, mining, construction, and energy subsectors playing dominant roles. The study recommended that the government should promote manufacturing diversification, invest in infrastructure and energy, reform the mining sector, maintain stable interest rates, enhance industrial financing, and ensure policy consistency to sustain industrial-led growth and long-term economic development.

Keywords: Industrial Sector, Economic Growth, Manufacturing Industry, Mining and Quarrying, Construction Industry, Electricity and Energy Sector and ARDL Model.

1. Introduction

The industrial sector remains a cornerstone of economic growth and national development, particularly for developing economies. Abdu and Bassey (2018) noted that industrialization is central to economic transformation, providing employment opportunities, raising incomes, and stimulating the production of goods and services for domestic consumption and export. Economies that have attained high levels of industrialization are often classified as developed, as industrial growth drives productivity, technological advancement, and structural transformation.

The industrial sector comprises activities that convert raw materials into finished goods and services, spanning construction, mining, quarrying, and manufacturing. Within Nigeria, the manufacturing industry is widely recognized as one of the country's foremost growth drivers (Ogundipe, 2022). However, empirical evidence suggests that Nigeria still requires deeper industrialization, particularly through manufacturing expansion to attain optimal levels of economic growth and development (Ibitoye, Ogunoye, & Kleynhans, 2022). The Central Bank of Nigeria (CBN, 2020) classifies Nigeria's industries into five broad categories: Mining and Quarrying including crude petroleum, natural gas, coal, metal ores, and other minerals. The manufacturing sector covers oil refining, cement, food and beverages, textiles, footwear, wood and paper products, chemicals and pharmaceuticals, plastics, metals, vehicles, and electronics. Electricity, gas, steam

and air conditioning, water supply, sewage, and waste management and the construction industry.

Industrialization in Nigeria has historically been pursued through several policy frameworks, including import-substitution strategies, export-promotion measures, and foreign direct investment-driven industrialization (Arize, 2023). Successive governments introduced structural adjustment programmes and public investment initiatives, such as the Ajaokuta steel plant, Warri and Kaduna rolling mills, aluminum smelter plants, petroleum refineries, fertilizer factories and cement industries (Okorontah & Uruakpa, 2023). Recent economic data underscore both the importance and fragility of the sector, the industrial sector contributed 30.8% to gross domestic product in 2022 and slightly improved to 32.2% in 2023 (CBN, 2023). However, its share remains modest compared to global standards. The manufacturing subsector contributed only 12.7% to GDP in 2023 (CBN, 2023), reflecting persistent structural bottlenecks.

The mining and quarrying subsector, dominated by crude petroleum and natural gas, remains Nigeria's largest industrial contributor. Oil revenues provide a substantial share of fiscal earnings and foreign exchange, but the sector's volatility exposes the economy to global price shocks. For instance, the mining sector's GDP contribution fell from 5.47% in 2024 Q1 to 4.38% in 2025 Q1, while crude petroleum demonstrates a strong positive impact on GDP (Saka & Adegbembo, 2022), the solid minerals subsector remains underdeveloped, contributing only 0.8% to GDP in 2022 (NEITI, 2023).

The manufacturing subsector holds greater promise for sustainable development due to its potential for value addition, employment generation, and structural transformation. Yet, it has experienced inconsistent growth. Between 2018 and 2022, it contributed approximately 9% of GDP (Kolawole, 2023). However, its share declined from 16.04% in Q4 2023 to 12.68% in Q2 2024, recording a modest 1.28% year-on-year growth in Q4 2024. Persistent challenges include unreliable electricity, inadequate infrastructure, and dependence on imported raw materials. Nevertheless, manufacturing remains integral to Nigeria's growth prospects through its forward and backward linkages, productivity gains, and export diversification potential (IJSRM, 2023). The construction subsector plays an equally significant role by facilitating infrastructure development, including roads, housing, bridges, and industrial facilities, which, in turn, enhance productivity across sectors. Studies confirm the sector's positive effect on GDP (Saka & Adegbembo, 2022), though benefits materialize gradually. It also provides substantial employment and stimulates industries such as cement, steel, and real estate. However, corruption, project abandonment, and fluctuating government expenditure continue to undermine its performance (Multitech Journal, 2023).

Overall, the mining, manufacturing, and construction subsectors present both opportunities and challenges. While mining guarantees revenue but fosters dependence on oil, manufacturing offers long-term transformation but suffers from infrastructural constraints, and construction drives infrastructure and job creation but is hindered by governance inefficiencies. Achieving sustainable growth requires Nigeria to diversify into solid minerals, deepen value addition in manufacturing, and sustain infrastructure investment. Such outcomes depend on sound macroeconomic policies, infrastructure upgrades, human capital development, and robust institutional frameworks to ensure efficiency and accountability. Against this backdrop, this study investigates the industrial sector's impact on Nigeria's economic growth, with particular focus on mining and quarrying, manufacturing, electricity, gas, steam, and air conditioning, water supply, sewage, and waste management and construction. This research will enable policy makers to adequately and effectively formulate designs and implement appropriate policies and regulations in managing the various challenges in the industrial sub sector of mining and quarrying, manufacturing, electricity, gas, steam, and air conditioning, water supply, sewage, and waste management and construction and as it affects economic growth which has not been carryout by other researchers.

This study is divided into five sections. Section one deals with the general introduction of the study which encompasses, background to the study, statement of the problem, research questions, objectives of the study, hypotheses, significance of the study, scope and organization of the study. Section two reviews related literature. Section three deals with research methods and theoretical framework, section four shows the presentation of data, analysis and discussion of results, while section five contains the conclusion and recommendations.

2. Literature Review

2.1. Conceptual Review

2.1.1 The Industrial Sector

The industrial sector is that sector of the economy that deals with the conversion of raw materials taken from the primary sector into end-user products. Thus, industrialization could be described as the process of transforming raw materials, with the aid of human resources and capital goods into consumers goods, new capital goods which allows more consumers goods (including food) to be produced with the same human

resources, and social overhead capital, which together with human resources provides new services to both individuals and businesses (Ekpo, 2018). The term industrialization is an offshoot of the industrial sector; therefore, industrialization is basically the process of transforming an extraction-based economy (raw materials) into a manufacturing one. With the help of industries, raw materials are transformed into finished goods that are ready for local consumption and exportation.

As noted by Enwerem and Gylch (2017) industrialization can also be defined "in terms of income levels reaching a certain threshold. It is on the basis of this that countries are classified into, low-income; lower middle income, higher middle income, lower upper income, higher upper income and high-income countries". Industrialization is the process by which an economy is changed from a primarily agricultural one to an economy that is based on the manufacturing of goods. This has to do with a change from manual labour to a mechanized mass production. Some characteristics of industrialization are economic growth, increased efficient division of labour, improvement in the use of technological innovations (Rasure, 2021).

While noting the critical place industrialization occupies, Okosodo (2006) posited that industrialization helps in curbing inflation especially in Africa where inflation comes about from inadequate supply of basic industrial goods and services leading to reliance on imported materials including machinery, spare parts and raw materials through industrialization these goods will be made available locally and also halt persistent excess demand. Achieving industrialization in Nigeria, though desirable, has faced myriads of challenges. As Nafisat (2018) rightly noted, inadequate access to credit facility; huge interest rate on loans for entrepreneurs; industrialist not willing to partake in partnership with other investors; imported expensive machineries; poor infrastructures; militants and insurgency problems are some of the reasons the Nigerian economy remains underdeveloped and non-industrialized. These issues and challenges are capable of stalling or slowing down Nigeria's potential for industrialization and industrial growth.

The term industrial growth could be understood from different perspectives. As Clunies-Ross, Foresyth, and Huq (2016) noted "it can be conceived as a shift in a country's pattern of output and workforce towards manufacturing or secondary industry". It can also be defined in terms of the expansion of a country's manufacturing activities, which includes the generation of electricity and also the development of the country's communications network activities; industrial growth reduces the emphasis on the extractive industries while it increases the emphasis on secondary and tertiary sector of the economy (Akinwumi, Omotayo & Alani, 2020).

2.1.2 Mining and Quarrying Industry

According to the European Commission, mining and quarrying include the extraction of minerals occurring naturally as solids (coal and ores), liquids (petroleum) or gases (natural gas). Extraction can be achieved by different methods such as underground or surface mining, well operation, seabed mining etc. This section includes supplementary activities aimed at preparing the crude materials for marketing, for example, crushing, and grinding, cleaning, drying, sorting, concentrating ores, liquefaction of natural gas and agglomeration of solid fuels.

2.1.3 Manufacturing Industry

According to Wikipedia, manufacturing is the creation or production of goods with the help of equipment, labor, machines, tools, and chemical or biological processing or formulation. It is the essence of secondary sector of the economy. The term may refer to a range of human activity, from handicraft to high-tech, but it is most commonly applied to industrial design, in which raw materials from the primary sector are transformed into finished goods on a large scale. Such goods may be sold to other manufacturers for the production of other more complex products (such as aircraft, household appliances, furniture, sports equipment or automobiles), or distributed via the tertiary industry to end users and consumers (usually through wholesalers, who in turn sell to retailers, who then sell them to individual customers)

2.1.4 Construction Industry

The construction industry is a vital component of any nation's economy, serving as the backbone of infrastructural development and physical transformation. It encompasses the processes involved in the design, planning, financing, and execution of projects such as buildings, roads, bridges, dams, and other civil engineering works. According to Ofori (2015), the construction industry is a major driver of economic growth because it provides the necessary infrastructure that facilitates the operation of other sectors, including manufacturing, transport, health, and education. In Nigeria, the construction industry plays a significant role in job creation, poverty reduction, and capital formation.

It is often regarded as a catalyst for development due to its strong linkages with industries that supply construction materials, such as cement, steel, and glass. Despite its potential, the Nigerian construction sector faces several challenges, including inadequate financing, corruption, insufficient technical expertise, and policy instability. Nonetheless, the industry remains a key contributor to the nation's Gross Domestic Product

(GDP) and an essential driver of sustainable economic growth and urbanization.

2.1.5 Electricity, gas, steam and air conditioning industry

The electricity, gas, steam, and air conditioning industry comprises activities related to the generation, transmission, and distribution of electrical power; the production and supply of gaseous fuels; and the provision of steam and air conditioning systems. This sector is fundamental to industrialization and economic performance as it provides the energy necessary for production, transportation, and household consumption. The International Energy Agency (IEA, 2022) notes that reliable and affordable energy access is critical for productivity enhancement, investment attraction, and technological advancement. In Nigeria, the electricity sub-sector has long been constrained by limited generation capacity, transmission inefficiencies, and frequent outages, which have adversely affected industrial growth.

However, the gas sub-sector holds immense potential due to Nigeria's abundant natural gas reserves, which, if properly harnessed, can boost electricity generation and industrial productivity. The steam and air conditioning segment also contributes significantly to industrial processes requiring temperature control and environmental management. Therefore, this industry is central to improving production efficiency, supporting business operations, and enhancing living standards in the economy.

2.1.6 Water Supply, Sewage and Waste Management Industry

The water supply, sewage and waste management industry is responsible for the provision of clean water, sewage treatment, and solid waste management services. It is a crucial pillar of public health, environmental protection, and sustainable economic development. According to the United Nations (2020), effective water supply and waste management systems are vital to ensuring environmental sustainability, improving public health, and achieving the Sustainable Development Goals (SDGs). In Nigeria, this sector plays a key role in providing safe water for households and industries, preventing waterborne diseases, and maintaining sanitation through effective waste collection and disposal systems. The sewage and waste management sub-sector also contributes to pollution reduction and natural resource conservation through recycling and waste-to-energy initiatives. However, inadequate infrastructure, weak institutional frameworks, and insufficient funding, remains the major constraints. Strengthening this industry is therefore necessary to enhance environmental quality, safeguard public health, and support industrial and agricultural activities across the country.

2.1.7 Economic Growth

Economic growth can be defined as a long-term expansion of the productive potential of a country's economy. This expansion has to do with all the sectors of the economy, high standards of living, high levels of productivity and the country being able to achieve all her macroeconomic objectives- high output, high rate of employment and reduction in inflation rate (Babatunde and Seiyefa 2017). Potters (2021) defines Economic growth as a rise in the production of economic goods and services compared from one particular period of time to another in a given country. This growth can be measured in nominal or real terms i.e. adjusted for inflation. Economic growth is said to have occurred when there is an increase in capital goods, in technology, labour force and also in human capital. Growth in economics is mostly modelled as a function of the following: labour force, physical capital, technology and human capital. Economic growth has been conceived as increase in per capital income over a period of time (Clunies – Ross, et al., 2016; Jhingan, 2018). According to Iganiga (2006) Economic growth can be seen as the rate of change in national output or income in a given period of time, the increase in output could result from an increase in the capital stock, increase in the population of the country or increase in the productivity of the labour force or increase in the technological innovations of that economy; It could be measured in terms of; i. Nominal value (output), ii. Real value (output), iii. Per capita value measurement of growth. Abbott (2003) considers the following as key positive factors stimulating industrialization in an economy: good governance, good legal framework, availability of natural resource, relative low-cost, skilled labour, and technology.

2.2. Theoretical Review

The relationship between industrial development and economic growth is deeply rooted in economic theory, with various schools of thought providing complementary explanations of how the industrial sector drives productivity, structural transformation, and long-run development. A synthesis of these theories reveals that industry serves as a central engine of growth through capital accumulation, technological progress, labour reallocation, and productivity enhancement.

The Structural Transformation Theory, as articulated by Arthur Lewis (1954) and Simon Kuznets (1971), directly links industrialization to economic growth. Lewis (1954) argues that the transfer of surplus labour from the low-productivity agricultural sector to the high-productivity industrial sector increases overall output and income. This process not only raises wages but also stimulates

urbanization and modernization. Kuznets (1971) reinforces this view by emphasizing that industrialization is the hallmark of sustained economic growth, as it drives structural shifts that enhance productivity and income levels. In this context, the expansion of the industrial sector is both a cause and consequence of economic growth, particularly in developing economies such as Nigeria.

The Cobb–Douglas Production Theory, developed by Charles Cobb and Paul Douglas (1928), provides a microeconomic foundation for understanding how industrial output contributes to growth. The model specifies that output is a function of capital and labour inputs, both of which are heavily utilized in the industrial sector. Industrialization typically involves increased capital intensity, technological adoption, and improved labour productivity. Through this framework, the industrial sector enhances economic growth by increasing total factor productivity and optimizing the use of production inputs. Empirically, improvements in industrial efficiency translate into higher aggregate output and economic expansion.

The Classical Growth Theory, associated with Adam Smith (1776), David Ricardo (1817), and Thomas Malthus (1798), also underscores the importance of industry in economic growth. Smith (1776) emphasized that industrial activities promote division of labour and specialization, which significantly enhance productivity. Ricardo (1817) highlighted how industrial specialization and comparative advantage in manufacturing can boost international trade and economic growth. Although Malthus (1798) focused on resource constraints, industrialization has historically mitigated these constraints through technological innovation and increased production capacity. Thus, the classical perspective suggests that industrial expansion is essential for overcoming the limitations of agrarian economies and achieving sustained growth.

The Neoclassical Growth Theory, developed by Robert Solow (1956) and Trevor Swan (1956), further explains the role of industry in growth through capital accumulation and technological progress. The industrial sector is a major recipient of investment and a key driver of capital formation. As industries expand, they contribute to increases in the capital stock, which raises output in the short run. However, due to diminishing returns to capital, sustained growth in the industrial sector depends on continuous technological innovation. Industrial activities often serve as channels for the diffusion of new technologies, thereby enhancing productivity and supporting long-term economic growth. The convergence hypothesis also implies that countries with developing industrial sectors can catch up with advanced economies by adopting modern industrial technologies.

The Endogenous Growth Theory, advanced by Paul Romer (1990) and Robert Lucas (1988), provides a stronger link between industry and sustained economic growth. This theory posits that industrial sectors are key sites for innovation, research and development (R&D), and knowledge spillovers. Romer (1990) emphasizes that industrial firms invest in innovation, which generates new technologies and drives long-run growth. Lucas (1988) highlights that industrialization promotes human capital development through skill acquisition, training, and learning-by-doing. Unlike the neoclassical model, endogenous growth theory suggests that the expansion of the industrial sector can generate self-sustaining growth through continuous innovation and productivity improvements.

The Harrod–Domar Model, developed by Roy Harrod (1939) and Evsey Domar (1946), emphasizes the importance of investment in driving economic growth, with the industrial sector playing a central role. Industrialization requires substantial capital investment in machinery, infrastructure, and technology. According to the model, higher savings lead to increased investment in industries, which in turn boosts output and employment. However, the model also highlights the need for balanced growth, as insufficient or excessive investment in the industrial sector may lead to macroeconomic instability. Nevertheless, the framework supports the view that industrial expansion is a critical pathway to accelerating economic growth in developing economies.

In conclusion, all the major growth theories converge on the idea that the industrial sector is a key driver of economic growth. Structural transformation theory highlights labour reallocation into industry; the Cobb–Douglas model explains productivity gains from industrial inputs; classical theory emphasizes specialization and industrial trade; neoclassical theory underscores capital accumulation and technological diffusion; endogenous growth theory focuses on innovation and human capital within industry; and the Harrod–Domar model stresses investment-led industrial expansion. Collectively, these perspectives affirm that a robust and dynamic industrial sector is indispensable for achieving sustained economic growth, particularly in developing economies seeking structural transformation and long-term development.

2.3 Empirical Review

Several studies have been carried out to examine the impact of industrial sector performance on economic growth. Kida and Angahar (2020) examined impact of industrialization on economic growth in Nigeria. As a result of the link between industrialization and economic growth, both theoretical and econometric analysis were

used to examine the contribution of industrialization to economic growth in Nigeria, using GDP as the dependent variable and crude petroleum and natural gas, manufacturing and solid mineral as independent variables from 1981 to 2018. The study adopted ordinary least squares (OLS) in formulating the model. The methods of analysis included, augmented dickey-fuller (ADF) unit root test, Johansen co-integration test and error correction method (ECM). The results show that crude petroleum and natural gas, manufacturing and solid mineral, significantly contribute to economic growth. The study recommended creating a conducive environment to achieve strong performance of the industrial sector. Sustaining efforts at generating local materials for infant industries and supporting the campaign of the local contempt initiative.

Kazeem (2020) carried out a study on industrial sector and the finance-growth nexus: using Nigeria as a case study, time series data from 1986–2018 and autoregressive distributed lag (ARDL) approach to co-integration proposed by Pesaran and Shin (2001) found that financial development exerts a positive impact on economic growth in Nigeria in both short and long terms while industrial sector development insignificantly enhances economic growth in Nigeria both in the short and long run. The study concludes that financial development (proxied by domestic credit to the private sector) and industrial sector stimulates economic growth. Oburota, Eke, and Adeyemi (2024) investigated the effect of manufacturing output on economic growth using disaggregated data that covers food, beverages, tobacco and textiles. Employing time series econometric techniques, the study found that manufacturing output showed a positive and statistically significant effect on economic growth in both the short and long run. The authors emphasized that different manufacturing subsectors contribute unevenly to GDP growth, reinforcing the importance of sectoral disaggregation in empirical analysis. Similarly, Shaka, Gatawa, and Olarinde (2022) worked on the industrial development and economic growth nexus in Nigeria by disaggregating the sector into manufacturing, solid minerals, and crude petroleum and gas. Using the Autoregressive Distributed Lag framework, the study stated that all subsectors positively influence economic growth, although the petroleum and gas subsector exerts the strongest effect. This finding underscores Nigeria's continued reliance on extractive industries despite policy emphasis on diversification.

Uzoma and Kevin (2024) extended this line of inquiry by examining the restructuring of the industrial sector and its implications for growth. The study revealed that manufacturing and crude petroleum and gas significantly stimulate economic growth, whereas the solid minerals subsector shows a positive but statistically insignificant effect. Beyond output measures, Adeosun, Odior, Shittu, and Adegbite (2023) incorporated human capital development into the industrial growth framework, the study made use of time series data from 1981 to 2020, the authors found that industrial sector performance positively influences economic growth, but the magnitude of this effect depends significantly on the quality of human capital. The study demonstrates that industrial expansion alone is insufficient; complementary investments in education and skills development are essential for sustainable growth.

Anibuko and Otto (2025) adopted a broader disaggregation by examining manufacturing, mining, electricity, construction, and water and waste management. Their analysis revealed mixed short run effects but confirmed that long run industrialization contributes meaningfully to economic growth. Notably, electricity and construction exhibited significant long run relationships with GDP, suggesting that infrastructure related subsectors serve as critical enablers of industrial productivity and macroeconomic expansion. Ijokoh (2025) approached the issue from a financial intermediation perspective by examining the nexus between capital market performance and industrial sector output. The findings indicate that capital market development significantly influences industrial output, which in turn supports economic growth. Joseph and Dimosi (2025) examined industrial sector performance and economic development using a vector autoregression model. The study established a significant positive relationship between industrial output and economic development indicators. Importantly, manufacturing capacity utilization and industrial employment were identified as key transmission mechanisms linking industrial activity to broader development outcomes.

Nwogo and Orji (2019) examined the impact of industrialization on the growth of the Nigerian economy. The study adopted the ex-post facto research design based on its efficacy in facilitating the projection of future outcomes with past occurrences. The dependent variable was real gross domestic product (RGDP) while the independent variables were the manufacturing sector contribution to the gross domestic product (MSO), crude petroleum and natural gas output (CPNGO), solid mineral mining output (SMMO), and real exchange rate (REXR); data analysis was done using the vector error correction and system equation estimation technique. The study found that there is a positive and significant impact of the manufacturing sector output, crude petroleum and natural gas output, and solid mineral and mining output on the real gross domestic product; also, a long-run relationship was found to exist among the variables used.

Otalu and Keji (2019) adopted the co-integration and error correction model to evaluate the determinants of

industrial sector growth in Nigeria. The results indicated that all the identified determinants have more of permanent effect on industrial output than transitory effect. Labour and capital have significant impact; exchange rate shows a positive and significant impact indicating that currency appreciation might be inimical to the growth of the industrial sector. There was evidence of co-integration between industrial output and it's identified determinants in Nigeria, describing the long run relationship. Obioma, Anyanwu and Kalu (2015) examined the effect of industrial development on economic growth in Nigeria from 1973-2013. The study concluded that the influence of industrial output on economic growth is not statistically significant, though the sign obtained from its àpriori expectation is positively related to (economic growth) GDP, savings has a positive relationship and also significant impact on the economy.

Okuneye (2019) examined the industrial sector performance and economic growth in Nigeria. The scope of the study was within the period of 1981 to 2016 using the ordinary least squares (OLS) method of analysis to evaluate the empirical model within the framework of the classical linear regression model. The study found that the industrial sector performance, proxied by industrial output exerts a significant positive effect on economic growth in Nigeria at 1% level of significance, while economic growth is positively influenced by inflation rate, interest rate does not exhibit any significant effect on growth in Nigeria. Using the pairwise granger causality tests, the results showed that the causality between economic growth and industrial output, inflation rate and economic growth and also industrial output and inflation rate in Nigeria was uni-directional. It was recommended that, there is need for the government to initiate and pursue policies that will help stimulate private sector-driven industrialization in Nigeria and also high interest rate should be reviewed.

Mandara (2018) worked on the appraisal of the impact of industrialization on economic growth in Nigeria from 1981 to 2015. The data was analysed using augmented dickey fuller test, KwiatkowskiPhillips-Schmidt-Shinto, Zivot-Andrews mechanism to ascertain the stationarity of the variables and ARDL technique was also used for the regression analysis. The result of the ARDL regression showed that there is a positive and significant impact between industrial output and gross domestic product. The result of the Bound test showed that the study variables were co integrated in the long run, meaning that the government should revive the key industries like the textile and steel industries.

Abdu and Bassey (2018) investigated the evaluation of the Nigerian industrial sector and economic growth in the face of sustainable development goals. The research used time series and secondary for the study covering the period of 1981 to 2016. Using stata to analyze the results, the study found that the industrial output has a positive effect on economic growth in Nigeria.

Enwerem and Gylych (2017) assessed the impact of industrialization on economic growth within ECOWAS Members' States. The study selected ten Economic Communities of West Africa States (ECOWAS) and member states within the period of 2000-2013. Namely; Republic of Nigeria, Benin Republic, Cabo Verde, Cote D'Ivoire, The Gambia, Ghana, Guinea-Bissau, Mali, Niger, and Senegal. The ordinary least square (OLS) technique was used for the analysis, revealing that industrialization has a negative impact on economic growth in Nigeria in the long run. Abubakar (2017) examined external financing and industrialization in Nigeria within the period of 1985 to 2016 using the Johansen co-integration test and error correction model for the data analysis. The study revealed that there is a negative relationship between external financing and industrialization in Nigeria, while foreign direct investment had a positive impact on industrial output.

Ogbonna and Uma (2017) worked on Re-strategizing Nigeria's industrialization and industrial policy for economic recovery in South Korea. The study showed industrialization strategy and policies adopted by Nigeria and South Korea over the years which made South Korea to rise from poverty status to a rich industrialized economy because of their successful execution of policies and strategies. The study found that South Korea industrialization strategy and policies began with sufficient reform of macroeconomic environment, infrastructural reforms, development of domestic machines, establishment of interdependent industries, great reliance on domestic resources for production, special manpower training and the government's determined aspiration to uplift the economy overshadowed every other motive which Nigerian approach could not adopt and apply. They recommended that industrialization strategy in Nigeria should involve the government, taking time to look inwards so as to develop indigenous technology and manpower and also, should guide against termination of industrial production due to lack of affordability of foreign raw materials, spare parts and required expatriate manpower.

Abdu and Anam (2018) evaluated the nexus between industrial sector and economic growth in Nigeria, quantitative research, time series and secondary data was used for the study over a period of 35 years from 1981 to 2016. The secondary data used, was extracted from the World Bank indicators. Stata software was used to analyze the data and the results revealed that industrial output has a positive effect on economic growth in Nigeria.

Momodu (2017) examined manufacturing sector indicator and economic growth in Nigeria. Through the use of empirical methods such as Exploratory data analysis (EDA), and a range of qualitative and quantitative data, the relationship between oil and GDP growth is studied to show the impact oil has had on the Nigerian economy since 1969. The findings of this research demonstrate there is a positive correlation between manufacturing sector indicator and GDP growth which is affected by a lack of diversification and the fluctuations in world oil price.

Ibitoye, Ogunoye and Kleynhans (2022) examine the impact of industrialization on economic growth in Nigeria. Employing the co integration techniques, the results show that industrialization is a significant driver of economic growth in Nigeria. Furthermore, Chukwu and Nduka (2022) explored the effect of the manufacturing sector on the economic development of Nigeria. Annual data from 1999 to 2021 were obtained from the statistical bulletin of the Central Bank of Nigeria and were used to test the effect of explanatory variables (average manufacturing capacity utilization, manufacturing production index, contribution of manufacturing sector to gross domestic product and foreign direct investment) on the dependent variable (human development index). The auto regressive distributed lag technique (ARDL) were employed to analyze the data and the result indicates that the manufacturing sector has an insignificant effect on the human development index in Nigeria. The study therefore recommends the need to encourage local production while investing in infrastructure like power, water, roads and transportation. The study also recommends the need for the manufacturing sector to have access to finance, also tax incentives should be given to manufacturers as this will encourage local investors and attract foreign investors.

2.4 Gap in Literature

This study provides an up-to-date comprehensive and disaggregated analysis of five key industrial subsectors (manufacturing industry, mining and quarrying industry, construction industry, electricity, gas, steam and air-conditioning industry, and water supply, sewage and waste management sectorMAN, MAQ, CON, EGA and WSE), it also made use of modern econometric techniques (ARDL) which is capable of distinguishing both short run and long run effects. Clear policy insights based on the individual performance of each subsector, rather than the industrial sector as a single block was considered.

3. Research Methods

3.1 Theoretical Framework

This study is hinged on the Cobb Douglas Production theory, which is also known as the Cobb-douglas production function. The theory was developed by Charles W. Cobb (a mathematician) and Paul H. Douglas (an economist) in 1928. It provides insights into the determinants of long run economic growth and also emphasizes the role of capital accumulation, labour or population growth and technological progress.

When applied to the industrial sector, the theory helps to analyze how the different industrial subsectors contribute to Nigeria's economic growth. The Cobb Douglas production theory conforms to the basic properties of production theories and suits the nature of growth of the real sectors (Castiglione, 2012). It is thought to be a plausible way of characterizing many real-world production processes and it is often used by economists to study issues related to input productivity or production costs (Hajkova & Hurnik, 2007). It explains the functional relationship between inputs used in production and the resulting output. It is widely applied in economics to analyse productivity, efficiency and growth.

The theory assumes, diminishing marginal returns to each input, substitutability between capital and labour, competitive factor markets and technology captured by parameter A remains constant in the short run. For empirical analysis, the function is transformed into a linear form using logarithms, this allows researchers to estimate the elasticities using regression analysis. As a theoretical framework, the Cobb–Douglas model provides a structured explanation of how input variables determine output. It helps to examine the contribution of different factors to productivity, measure efficiency, analyse growth patterns and determine returns to scale.In applied research, capital and labour can be replaced with context specific variables. The Cobb–Douglas theory offers a clear analytical foundation for examining how input factors influence output. Its mathematical simplicity and empirical usefulness make it a strong theoretical base for productivity and performance related studies.

The popularity of this function is due to the fact, it is amenable to mathematical manipulations and it satisfies the restrictions imposed on production function. These restrictions are: (1) both inputs are essential for production such that no output can be produced without using at least some of both inputs; (2) The marginal product of each input is positive (3) the marginal product diminishes with increased use of each of the inputs; (4) The marginal product of an input increases with increased use of the other input (Husain & Islam, 2016).

The function can be generalised in the case of 'n' factors of production. The unknown parameters, α and β in the function can be easily computed. The parameters α and β measure the responsiveness of output to changes in capital and labour. For example, if α is 0.4, a one percent increase in capital will increase output by 0.4 percent, holding labour constant. The sum of α and β determines returns to scale:
If $\alpha + \beta = 1$, there are constant returns to scale.
If $\alpha + \beta > 1$, there are increasing returns to scale.
If $\alpha + \beta < 1$, there are decreasing returns to scale.

The Cobb-Douglas production function is expressed quantitatively as:

$$Q = AK^{\alpha}L^{\beta} \quad (3.1)$$

Where Q is output and L, K are inputs of labor and capital respectively. A is Total factor productivity or technology level, α is Output elasticity of capital while β is Output elasticity of labour.
A, a and b are positive parameters where $\alpha > 0, \beta > 0$. The equation tells that output depends directly on L and K and that part of output which cannot be explained by L and K is explained by A which is the 'residual', often called technical change. Although the Cobb - Douglas production function is a multiplicative type and is non-linear in its general form, it can be transformed logarithmic form.

$$\text{Log } Q = \log A + \alpha \log L + \beta \log K \quad (3.2)$$

The Cobb-Douglas production is adapted in its log - linear form from equation (3.2) and it is specified in stochastic form as:

$$ln_{it} = \beta_0 + \beta_1 lnK_{it} + \beta_2 lnL_{it} + u_{it} \quad (3.3)$$

Where y = output of quoted real industrial sector, K = capital input of real sector, L = labour input of real sector, ln = natural logarithm, $\beta_0 - \beta_2$ are unknown parameters to be estimated, i = individual firms, t = time dimension, u = the stochastic term errors. Equation (3.3) is used in this study to calculate the impact of changes in the inputs such as industrial infrastructure on economic growth in Nigeria.

3.2 Model Specification

The empirical model of Kida and Angahar (2020) was adapted for the study. In their study, they examined the contribution of industrialization to the economic growth in Nigeria, where GDP is specified as a function of crude petroleum and natural gas, manufacturing, labour force, solid mineral and interest rate. This is shown in equation [3.4]:

GDP=F (PNG, MAN, SOM, LF, INTR) (3.4)

Where GDP is Gross Domestic Product, PNG is petro and natural gas, MAN is manufacturing industry, SOM is solid mineral industry, LF is labour force and INTR is interest rate.
For the purpose of this study, the model of Kida and Angahan (2020) was strictly modified by adding
Mining and quarrying (MAQ), electricity, gas, steam and air conditioning (EGA), water supply, sewage and waste management (WSE) and construction industry (CON) on economic growth.
GDP was replaced with GDPGR (GDP growth rate). The functional form of the equation is given below as:

GDPR =F (MAQ, MAN, CON, EGA, WSE, INTR) (3.5)

The structural form of the model is shown in equation (3.6)

$$GDPR = \alpha_0 + \alpha_1 MAQ + \alpha_2 MAN + \alpha_3 CON + \alpha_4 EGA_t + \alpha_5 WSE_t + \alpha_6 INTR_t + u_t \quad (3.6)$$

From equation (3.6), a natural log was introduced to the series measured in monetary terms to reduce the large values. The transformed equation is given as:

$$GDPGR = \alpha_0 + \alpha_1 l_{og} MAQ + \alpha_2 l_{og} MAN + \alpha_3 l_{og} CON + \alpha_4 \log EGA_t + \alpha_5 \log WSE_t + \alpha_6 INTR_t + u_t \quad (3.7)$$

The apriori expectation requires that $\alpha_1 - \alpha_5 > 0$ while $\alpha_6 < 0$
Where;
GDPGR =Gross Domestic Product Growth Rate (%)
MAN=Manufacturing sector (in billion)
MAQ=Mining and Quarrying sector (in billion)
CON=Construction sector (in billion)
EGA= Electricity, gas, steam and air conditioning sector (in billion)
WSE= Water supply, sewage and waste management (in billion)
INTR=Interest rate (%)
α_0 = Constant
α_1- α_6 are coefficients estimated
l_{og} =Natural logarithm
u_t = Error term

The ARDL model and the inclusion of the Error Correction mechanism for equation (3.7) in logarithm form is expressed as follows:

$$\Delta GDPR_t = \alpha_0 + \sum_{i=1}^{p} \alpha_1 \Delta GDPR_{t-i} + \sum_{i=0}^{p} \alpha_2 \Delta \ln(MAQ)_{t-i} + \sum_{i=0}^{p} \alpha_3 \Delta In(MAN)_{t-i} + \sum_{i=0}^{p} \alpha_4 \Delta In(CON)_{t-i}$$
$$+ \sum_{i=0}^{p} \alpha_5 \Delta In(EGA)_{t-i} + \sum_{i=0}^{p} \alpha_6 \Delta In(WSE)_{t-i} + \sum_{i=0}^{p} \alpha_7 \Delta In(INTR)_{t-i} + +\delta_1 (GDPGR)_{t-1} +$$
$$\delta_2 \ln(MAQ)_{t-1} + \delta_3 In(MAN)_{t-1} + \delta_4 In(CON)_{t-1} + \delta_5 In(EGA)_{t-1} + \delta_6 In(WSE)_{t-1} +$$
$$+ \delta_7 (INTR)_{t-1} + \beta ECM_{t-1} + \upsilon_t \qquad (3.8)$$

The coefficients from α_1 to α_7 represent the short-run coefficients whereas the coefficients from δ_1 to δ_7 represent the long-run coefficients of the ARDL model. Also, α_0 is the drift component, "p" is the maximum lag length while v_t is the stochastic error term. β is the coefficient of the error correction term (ECM) and it measures the speed of adjustment towards the long run equilibrium. The bound F-statistic test was used to check the existence of a stable, long-run relationship among the variables in the model. For instance, if the calculated F-statistic in equation (3.8) is greater than the appropriate upper bound critical values, the null hypothesis is rejected implying the existence of co-integration relationship. But if the value of the F-statistic is below the lower bound, the null cannot be rejected, indicating the absence of co-integration. Besides, if the F-statistic value lies within the lower and upper bounds, the results are considered inconclusive (Pesaran et al., 2001), if the bound test shows evidence of co-integration among variables specified for example as in equation (3.8).

3.3 Sources of Data

The data set was annual time series data which were sourced from the Central Bank of Nigeria Statistical Bulletin (2023) and the World Bank Development Indicators. The data set was collected for a period which spanned from 1996 to 2023.

3.4 Method of Data Analysis.

The Autoregressive Distributed Lag (ARDL) methodology developed by Pesaran & Shin (1999) and Pesaran et al. (2001) was used to investigate the long and short-run relationship among industrial subsector of mining and quarrying, manufacturing, electricity, gas, steam, and air conditioning, water supply, sewage, and waste management and construction industry and the growth of the Nigerian economy. The ARDL bound model has three advantages when compared with the Engle and Granger (1987) two-step method and Johansen and Juselius (1990) cointegration method. The ARDL method is applied to deal with the series having mixed stationary issues (i.e. the mixture of I(0) and I(1)). Hence, it relaxes the assumption that all series must be integrated in the same order. The next advantage is that the ARDL test is relatively more efficient in the case of small and finite sample data sizes. The method produced unbiased estimates of the long-run model (Harris & Sollis, 2003). The bounds test is a simple technique because it allows the co-integration relationship to be estimated by OLS once the lag order of the model is identified, unlike other multivariate co-integration methods. Furthermore, to determine the performance of the estimated model, RESET test, Serial correlation, normality and Heteroscedasticity tests were conducted, whereas the Cumulative Sum (CUSUM) and Cumulative Sum of Square (CUSUM Q) of residual of the ARDL model test was conducted to verify the stability nature of the model.

4. Data Analysis and Interpretation of Results

4.1 Data Presentation

The study examines the impact of the industrial sector on Nigeria economic growth. The data for the model estimation are presented in appendix A. The data used includes: gross domestic product growth rate (GDPGR) proxy for economic growth which is the dependent variable while the explanatory variables are mining and quarrying industry (MAQ), manufacturing industry (MAN), construction industry (CON), electricity, gas, steam and air conditioning industry (EGA), water supply, sewage and waste management industry (WSE) and Interest rate (INTR).

4.2 Descriptive Statistics

This study commences its empirical analysis by examining the characteristics of the series used in the study. The descriptive statistics of the entire series is presented in Table 4.1.

Table 4.1: Descriptive Statistics for the Series

Date: 10/04/25
Time: 15:18
Sample: 1996 2023

	GDPGR	WSE	MAQ	MAN	INTR	EGA	CON
Mean	4.693214	140.1118	6453.624	7069.203	17.14750	478.8768	4060.789
Median	4.625000	40.35500	5390.250	3335.255	17.10000	169.0650	1427.220
Maximum	15.33000	933.3800	14866.30	28442.90	24.85000	2427.590	22142.59
Minimum	-1.790000	11.46000	433.2000	780.4800	11.48000	3.160000	59.22000
Std. Dev.	3.503282	221.7111	4848.050	8339.794	2.874225	629.7948	6035.677
Skewness	0.617849	2.278282	0.207540	1.591180	0.195702	1.671701	1.864417
Kurtosis	4.495534	7.651635	1.571143	4.314125	3.652234	5.054041	5.322047
Jarque-Bera	4.390836	49.46665	2.582911	13.83006	0.675040	17.96365	22.51213
Probability	0.111312	0.000000	0.274870	0.000993	0.713538	0.000126	0.000013
Sum	131.4100	3923.130	180701.5	197937.7	480.1300	13408.55	113702.1
Sum Sq. Dev.	331.3706	1327206.	6.35E+08	1.88E+09	223.0515	10709322	9.84E+08
Observations	28	28	28	28	28	28	28

***Source**: Author's computation*

The descriptive statistics in Table 4.1 gave the characteristics of the variables. These statistics provide useful insights into the central tendency, dispersion, and distributional properties of each variable over the study period. The key measures analyzed include the mean, median, maximum, minimum, standard deviation, skewness, kurtosis, and the Jarque–Bera test for normality. The analysis covers 28 annual observations.

The mean values indicate the average performance of each variable over the period under review. The average economic growth rate (GDPGR) in Nigeria stood at 4.69%, suggesting that the country experienced moderate economic expansion during the study period. The manufacturing sector (MAN) and mining and quarrying sector (MAQ) recorded mean outputs of ₦7,069.20 billion and ₦6,453.62 billion, respectively, indicating that both sectors made substantial contributions to Nigeria's industrial output. Similarly, the construction industry (CON) and the electricity, gas, steam and air-conditioning (EGA) sector had average outputs of ₦4,060.79 billion and ₦478.88 billion, respectively. In contrast, the water supply, sewage and waste management (WSE) sector had the lowest mean output of ₦140.11 billion, implying relatively lower investment and output levels in this component of the industrial sector. The interest rate (INTR) averaged 17.15%, which reflects the high cost of borrowing in Nigeria's financial system over the years.

Examining the median values shows that most variables are close to their respective means, indicating moderate symmetry in distribution for some sectors. However, substantial differences between the mean and median values, as observed in MAN (mean = 7,069.20; median = 3,335.26) and CON (mean = 4,060.79; median = 1,427.22), suggest the presence of a few exceptionally high values that raised the average, implying a positively skewed distribution. This is corroborated by the skewness coefficients. The maximum and minimum values reflect the range of fluctuations within each variable. Economic growth (GDPGR) varied between –1.79% and 15.33%, indicating that Nigeria experienced both economic recessions and expansions during the period. The manufacturing sector ranged from ₦780.48 billion to ₦28,442.90 billion, while the mining and quarrying sector fluctuated between ₦433.20 billion and ₦14,866.30 billion, suggesting wide variability in industrial performance. The construction industry exhibited an even broader spread, ranging from ₦59.22 billion to ₦22,142.59 billion, signifying strong growth in construction activities in certain years. Similarly, the EGA sector recorded significant variation from ₦3.16 billion to ₦2,427.59 billion, implying fluctuations in energy production and consumption. The interest rate ranged from 11.48% to 24.85%, highlighting notable variations in monetary policy and lending conditions during the period.

The standard deviation values reveal the degree of dispersion around the mean. The largest standard deviations are observed in MAN (₦8,339.79 billion), CON (₦6,035.68 billion), and MAQ (₦4,848.05 billion), indicating high variability in these sectors. In contrast, GDPGR (3.50) and INTR (2.87) show moderate variability, while WSE (221.71) and EGA (629.79) indicate relatively smaller but noticeable fluctuations. The high degree of dispersion in the industrial output variables reflects the instability often associated with Nigeria's industrial sector, which is sensitive to economic shocks, policy shifts, and global commodity price fluctuations. The skewness statistics indicate the symmetry of the data distribution. A perfectly symmetric distribution has a skewness value of zero. In this study, all the variables exhibit positive skewness, implying that their distributions are right-skewed, meaning that higher-than-average values are more frequent. Notably, WSE (2.278), CON (1.864), and EGA (1.672) are highly skewed, showing the presence of outlier years where output was significantly above average. This may reflect periods of expansion in infrastructure investment or sectoral reforms. The kurtosis values measure the peakedness of the data distribution. A normal distribution has a kurtosis value of 3. Values above 3 indicate a leptokurtic distribution, meaning the data are more peaked with heavy tails. In this analysis, all variables except MAQ (1.57) have kurtosis values greater than 3. Specifically, WSE (7.65), CON (5.32), and EGA (5.05) display high kurtosis, implying that these series are prone to extreme values, consistent with periods of strong sectoral booms and contractions.

The Jarque–Bera (JB) test assesses the normality of the data distribution. A probability value greater than 0.05 indicates normality, while a value below 0.05 suggests deviation from normality. The results show that GDPGR ($p = 0.111$), MAQ ($p = 0.275$), and INTR ($p = 0.714$) are normally distributed. However, WSE ($p = 0.000$), MAN ($p = 0.001$), EGA ($p = 0.0001$), and CON ($p = 0.00001$) deviate from normality, implying the presence of skewness and kurtosis in these variables. Nevertheless, given the sample size and the characteristics of macroeconomic data, mild departures from normality are not unusual and do not invalidate further econometric analysis.

4.3 Unit Root Test:

The Augmented Dickey–Fuller (ADF) unit root test was conducted to determine the stationarity properties of the variables used in the study. Stationarity is an essential prerequisite in time series analysis because using non-stationary data may lead to spurious regression results and unreliable inferences. The null hypothesis of the ADF test assumes the presence of a unit root, implying non-stationarity, while the alternative hypothesis suggests that the series is stationary. The test was carried out at both level and first difference, and the results are summarized in Table 4.2.

Table 4.2: Results of Augmented Dickey Fuller (ADF) Unit Root Test

Variable	ADF Calculated Value in Level	ADF Calculated Value at 1st Difference	Mckinnon 5% Critical Value	Order Of Integration
GDPGR	-3.0358*	-	-2.9763	1(0)
LOG(CON)	-0.4707	-4.3480*	-2.9810	1(1)
LOG(EGA)	-1.1562	-5.3809*	-2.9810	1(1)
INTR	-2.7181	-6.7357*	-2.9810	1(1)
LOG(WSE)	-6.1405*	-	-2.9763	1(0)
LOG(MAN)	-1.2429	-8.1521*	-2.9810	1(1)
LOG(MAQ)	-1.1491	-4.6002*	-2.9810	1(1)

Source: Regression Output using Eviews (2026)
*Significant at 5 per cent

The unit root results reported in Table 4.2 indicate that interest rate (INT), construction sector output (CON), electricity, gas, steam and air conditioning (EGA), manufacturing sector output (MAN), and mining and quarrying sector output (MAQ) are all stationary at first difference, that is, I(1). This is because their calculated Augmented Dickey-Fuller (ADF) statistics exceed the MacKinnon 5% critical values in absolute terms after first differencing. In contrast, water supply, sewage and waste management (WSE) and GDP growth rate are stationary at level, that is, I(0), since their ADF statistics at level are greater than the MacKinnon 5% critical values.

4.4. Lag Length Criteria

The next step is determining the appropriate lag. The lag-length selection criteria such as sequential modified LR test statistic (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), and Hanna-Quinn information criterion (HQ) were employed to determine the appropriate lag length of the models. The test results of the different lag selection methods are reported in Table 4.3. After a meticulous examination of the different lag lengths by estimating the VAR at each lag length and diagnosing the whiteness of resulting residuals, two (2) lag lengths was recommended by Aikaike Information Criteria AIC statistic, was selected for the model.

Table 4.3: VAR Lag Order Selection Criteria

VAR Lag Order Selection Criteria
Endogenous variables: GDPGR LOG(MAN) LOG(MAQ) LOG(CON01) LOG(EGA) INTR LOG(WSE)
Included observations: 26

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-209.3048	NA	0.039714	16.63883	16.97755	16.73637
1	-57.17712	210.6383*	1.65e-05	8.705932	11.41568*	9.486241
2	19.20239	64.62882	5.38e-06*	6.599816*	11.68059	8.062895*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
Source: Regression Output using Eviews (2026)

4.5. Bounds Test for Co-Integration

The next step after determining the order of integration and lag length of the variables was to apply the bound F-test in order to establish the existences or otherwise of long-run relationship among the variables. The summary results of the bounds test for co-integration for the model is shown in Tables 4.5 alongside with critical values. The computed F-statistic from bound test for the models is 16.8959. These values exceed the upper bounds critical value of 3.28 at 5% significance level. This implies that the null hypothesis of no co-integration is rejected.

Table 4.4: Summary of ARDL Bound Test Results

Models	**Test statistic**	**Computed F-statistic**	**Lag**	**Significance level**	**Bound Critical values**	
					Lower Bounds I(0)	Upper Bounds I(1)
Model 1	F-statistic	16.8959	2	5%	2.27	3.28

Source: *Regression Output using Eviews (2026)*

4.6 Long Run Regression Results of the ARDL Model

The results of the estimated long-run coefficients using the ARDL approach are presented in Table 4.5. The models selected by AIC are (2,2,0,2,2,2,2).

Table: 4.5. Summary of the Long Run ARDL Regression Results

Variable	**Coefficient**	**Standard Error**	**t-Statistic**	**Prob.**
LOG(MAN)	0.1218*	0.0514	2.3685	0.0497
LOG(MAQ)	0.1758*	0.0374	4.6983	0.0022
LOG(CON)	0.4156*	0.0815	5.0993	0.0014
LOG(EGA)	0.1465*	0.0415	3.5281	0.0096
INTR	0.6557	0.1540	4.2584	0.0038
LOG(WSE)	-0.0295	0.0446	-0.6609	0.5298
C	3.0358	0.6363	4.7713	0.0020

Note: * is significant at 5% level of significance.
Source: Regression Output using Eviews (2026)

From Table 4.5, it can be observed that the coefficient of manufacturing industry (MAN) has a direct and significant impact on the growth of Nigeria's economy. One percent increase in MAN leads to a 0.1218 percent increase in the growth of the Nigerian economy. This is consistent with the apriori expectation. The variable is statistically significant with a probability value of 0.0497 and a T-value of 2.3685 which is greater than the critical value of 2.167. Thus, we reject the null hypothesis that the manufacturing industry has a significant impact on the growth of Nigeria's economy.

The coefficient of the mining and quarrying industry (MAQ) has a direct and significant impact on the growth of the Nigerian economy. One percent increase in MAQ leads to a 0.1758 percent increase in the growth of the Nigerian economy. This is consistent with the apriori expectation. The variable is statistically significant with a probability value of 0.0022 and a T-value of 4.6983 which is greater than the critical value of 2.167. Thus, we reject the null hypothesis that the mining and quarrying industry has a no significant impact on the growth of Nigeria's economy.

The coefficient of the Construction industry (CON) is positively signed which indicates that a direct relationship exists between the construction industry and Nigeria's economic growth. This is consistent with the apriori expectation. The value of the coefficient is 0.4155, which implies that a one percent increase in (CON) leads to a 0.4155 percent increase in Nigeria's economic growth. The coefficient of the variable is significant at a 5 percent level of significance with a probability value of 0.0014 and a T-value of 5.0993 which is greater than the critical value of 2.167. Thus, we reject the null hypothesis, and conclude that the construction industry has a significant impact on the growth of the Nigerian economy. This result supports the fact that in the long run, increase in the construction industry will contribute to the growth of the Nigerian economy. This finding is in line with Okoye, Mbakwe and Igbo (2018) who showed that the construction sector has a direct impact on the Nigerian economy.

The results revealed that the coefficient of electricity, gas, steam and air conditioning industry (EGA) is positively signed which indicates that a direct relationship exists between EGA and Nigeria's economic growth. This is consistent with the apriori expectation. The value of the coefficient is 0.1465, which implies that a one percent increase in (EGA) leads to a 0.1465 percent increase in Nigeria's economic growth when other regressors are held constant. The coefficient of the variable is significant at a 5 percent level of significance with a probability value of 0.0096 and a T-value of 3.5281 which is greater than critical value of 2.167. Thus, the null hypothesis is rejected, and concludes that, the electricity, gas, steam and air conditioner industry variable has a significant impact on the growth of the Nigerian economy in the long run.

The coefficient of water supply, sewage and waste management sector (WSE) is negatively signed which indicates that an inverse relationship exists between water supply, sewage and waste management industrial sector and Nigeria's economic growth. The value of the coefficient is -0.0295, which implies that a one percent increase in (WSE) leads to a 0.0295 percent decrease in Nigeria's economic growth. The coefficient of the variable is insignificant at a 5 percent level of significance with a probability value of 0.5298 and a T-value of 0.6609 which is less than the critical value of 2.167. Thus, we fail to reject the null hypothesis, and conclude that water supply, sewage and waste management industrial sector has no significant impact on the growth of the Nigerian economy.

The coefficient of interest rate (INTR) is positively signed. This shows that the variable has a direct relationship with the growth of Nigeria's economy. The value of the coefficient is 0.6557 which implies that a one percent increase in INTR leads to a 0.6557 per cent increase in the growth rate of Nigeria's economy in the long run. The variable is statistically significant with a probability value of 0.0038 and a T-value of 4.2584 which is greater than the critical value of 2.167. Thus, we reject the null hypothesis that interest rate as a macroeconomic policy variable has significant impact on the growth of Nigeria's economy. This is in line with Ademola, Alalade, Ogbebor and Aworinde (2023) who concluded that interest rate is a significant factor influencing real GDP growth in Nigeria. Therefore, maintaining a stable lending rate is one of the basic requirements for developing countries to attain high level of economic growth.

4.7 Short Run Estimation of the ARDL Model

In order to capture the short run deviations that might have occurred in estimating the long run co-integration equation, a dynamic parsimonious error correction estimate is reported in Table 4.7.

Table 4.6: Summary of Short Run Estimations of the ARDL model

Variable	Coefficient	Standard Error	t-Statistic	Prob.
GDPGR(-1)	-0.5069*	0.0708	-7.1572	0.0002
DLOG(MAN)	0.0200*	0.0060	3.3131	0.0129
DLOG(MAN(-1))	-0.0203*	0.0050	-2.9084	0.0227
DLOG(MAQ)	0.0300*	0.0081	3.7075	0.0013
DLOG(CON01)	0.0155	0.0215	0.7220	0.4937
DLOG(CON(-1))	-0.0913*	0.0213	-4.2819	0.0036
DLOG(EGA)	0.0600*	0.0085	7.0533	0.0002
DLOG(EGA(-1))	0.0194*	0.0082	2.4020	0.0473
DLOG(INTR)	0.0376	0.0265	1.4204	0.1985
DLOG(INTR(-1))	-0.1604*	0.0334	-4.7963	0.0020
DLOG(WSE)	-0.1076*	0.0360	-2.9903	0.0202
DLOG(WSE(-1))	-0.0973*	0.0388	-2.5072	0.0406

ECM(-1)	-0.6794*	0.0413	-16.4414	0.0000
R-squared		0.9750		
Adjusted R-squared		0.95553		
Durbin – Watson stat		1.9398		

Note: * is significant at 5% level of significance.
Source: Regression Output using Eviews (2026)

Table 4.7 indicates that the model demonstrates a very high explanatory power, with an R-squared value of 0.9750, indicating that approximately 97.5% of the variations in Nigeria's economic growth are explained by changes in the included industrial sectors and interest rate. The adjusted R-squared (0.9555) confirms that the model remains robust even after adjusting for degrees of freedom. Furthermore, the Durbin–Watson statistic of 1.9398 suggests the absence of significant autocorrelation, confirming the reliability of the regression estimates.

The results revealed that the coefficient of the manufacturing Sector (MAN) is 0.0200 with a t-statistic of 3.3131 and a probability value of 0.0129, which is statistically significant at the 5% level. This implies that a one percent increase in manufacturing output leads to a 0.02 percent increase in economic growth in the short run which is consistent with the long run findings. However, the lagged term DLOG(MAN(-1)) = -0.0203 (p = 0.0227) indicates a negative adjustment from the previous period, suggesting that short-term shocks in manufacturing output tend to stabilize after a lag.
The mining and quarrying sector has a positive and significant effect on economic growth, with a coefficient of 0.0300 (t = 3.7075, p = 0.0013). This implies that a 1% rise in mining and quarrying activities increases GDP growth by 0.03%, highlighting the sector's immediate contribution to Nigeria's industrial and overall economic performance. While the contemporaneous effect of construction (DLOG(CON01) = 0.0155) is positive but not statistically significant (p = 0.4937). However, the lagged value DLOG(CON(-1)) = -0.0913 (p = 0.0036) is significant and negative, indicating that while short-term construction activities do not immediately influence growth, previous expansions may generate temporary costs or adjustments that negatively affect GDP growth in subsequent periods.

The coefficient of electricity, gas, steam and air conditioning industry (EGA) exhibits a strong positive relationship with GDP growth. The coefficient for DLOG(EGA) is 0.0600 (t = 7.0533, p = 0.0002), indicating that a 1% increase in this sector's output results in a 0.06% rise in GDP growth. The lagged term DLOG(EGA(-1)) = 0.0194 (p = 0.0473) is also positive and significant, emphasizing that both current and previous increases in electricity and gas output foster economic expansion. This underscores the critical role of energy supply in driving industrial productivity and overall growth. The water supply, sewage and waste management (WSE) both the current (DLOG(WSE) = -0.1076, p = 0.0202) and lagged (DLOG(WSE(-1)) = -0.0973, p = 0.0406) coefficients are negative and statistically significant. This suggests that an expansion in the WSE sector, possibly reflecting higher public expenditures without corresponding efficiency gains, may temporarily reduce economic growth in the short run. The results imply inefficiencies or non-productive investments in this sector during the study period.

The immediate effect of the interest rate (DLOG(INTR) is 0.0376, p = 0.1985 is positive but insignificant, implying that short-term changes in interest rates may not immediately affect growth. However, the lagged interest rate (DLOG(INTR(-1)) = -0.1604, p = 0.0020) is significantly negative, suggesting that higher interest rates in the previous period tend to suppress economic growth. This aligns with theoretical expectations that elevated interest rates increase borrowing costs and reduce investment. The error correction term (ECM(-1)) has a coefficient of -0.6794 (t = -16.4414, p = 0.0000), which is highly significant and carries the expected negative sign. This indicates that approximately 67.9% of short-run disequilibrium from the previous period is corrected within one year. In essence, the model quickly adjusts back to the long-run equilibrium after a shock, reflecting a strong level of economic stability and the capacity of Nigeria's industrial structure to recover from short-term fluctuations. The ARDL regression results reveal that manufacturing, mining and quarrying, and electricity, gas, steam and air-conditioning sectors exert positive and significant short-run impacts on Nigeria's economic growth. In contrast, the construction and water supply sectors show mixed or negative short-run influences, suggesting possible inefficiencies in these industries. In addition, the interest rate exerts a lagged negative effect on growth, emphasizing the importance of monetary policy management to stimulate investment. The significant and negative ECM term further confirms the existence of a long-run equilibrium relationship between industrial output and economic growth in Nigeria, with a relatively rapid speed of adjustment.

4.8 Diagnostic statistical testing

The results of the ARDL estimation for the model are subjected to statistical diagnostic tests. The diagnostic test results is reported in Table 4.7.

Table 4.7: Diagnostic Tests on the ARDL Estimated

Purpose of test	Test	Test statistic	Probability	Conclusion
Normality	Jarque-Bera	0.7465	0.6885	Normal
Heteroscedasticity	Breusch–Pagan-Godfrey Heteroskedasticity Test	1.4419	0.3231	No heteroscedasticity
Serial correlation	Breusch–Godfrey serial correlation LM test	2.4260	0.1835	No serial correction
Ramsey RESET	Model Specification fitness	0.5580	0.5970	Correctly Specified

Source: *Author's Compilation with Information from Regression Output (2026)*

From Table 4.7, the tests as captured by Jarque-Bera, Breusch-Godfrey LM test, Breusch–Pagan-Godfrey Heteroskedasticity and Ramsey RESET test among others, revealed the fitness of the estimated equation results and the desired properties of an econometric model. The diagnostic tests confirm the suitability of the estimated model. Thus, the model residual series are normally distributed as suggested by the Jarque–Bera statistic, while the Breusch–Godfrey LM test statistics indicate that the model does not have significant serial correlation problem. Moreover, the Breusch–Pagan-Godfrey test show that the residuals are homoscedastic and the model has correct functional form while Ramsey RESET test shows that the ARDL models are correctly specified.

4.9 Stability Test

Stability test was also performed using Cumulative Sum (CUSUM) and Cumulative Sum of Square (CUSUM Q) of residual of the ARDL model. The results are shown in Figure 4.1 and 4.2

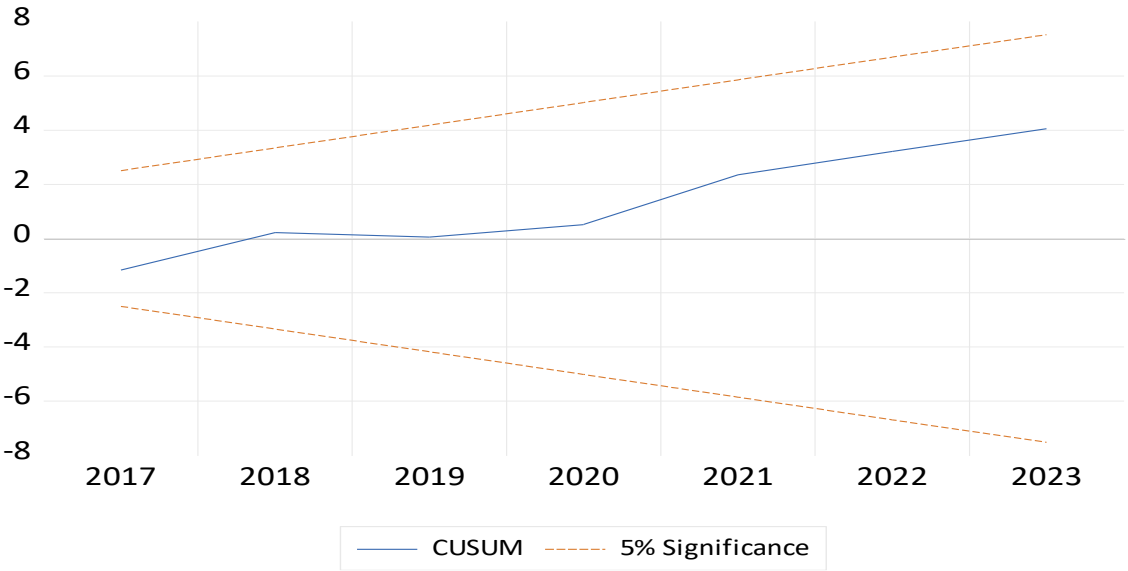

Figure 4.1: Plot of Cumulative Sum of Recursive Residual for the ARDL Model

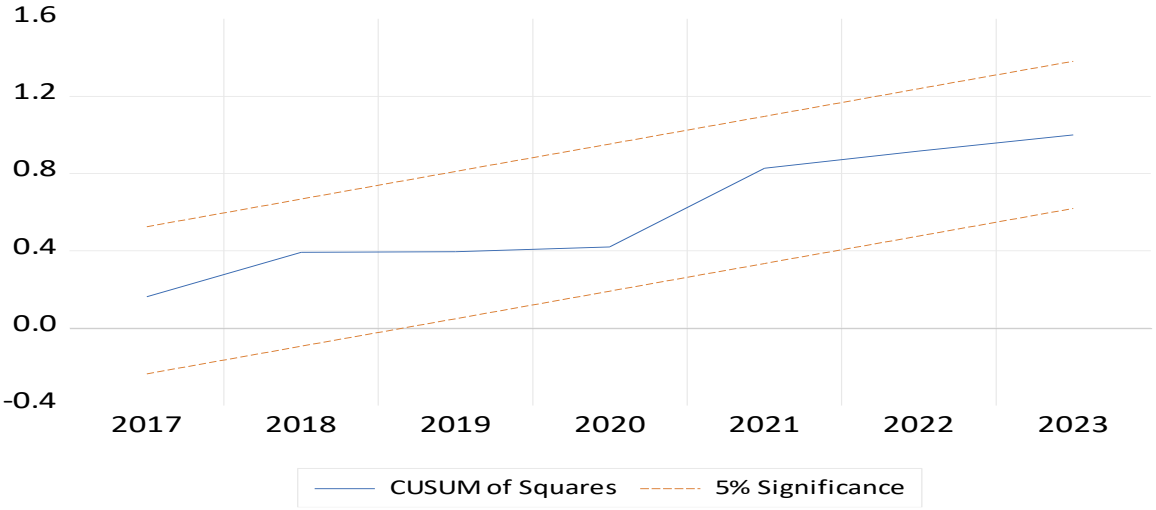

Figure 4.2: *Plot of Cumulative Sum of Square of Recursive Residual for the ARDL Model*

The existence of model stability is established if the Cumulative Sum of the residual goes outside the area between the critical (dotted bounded) lines. It is estimated at a 5 per cent critical level. From Figures 4.1 and 4.2 it can be inferred that the ARDL model at a 5 per cent level of significance has been stable over time.

5. Conclusion and Policy Recommendations

5.1 Conclusion

The study examined the impact of the industrial sector on Nigeria's economic growth using annual time series data from 1996 to 2023. The industrial sector was disaggregated into five key components; manufacturing (MAN), mining and quarrying (MAQ), construction (CON), electricity, gas, steam and air-conditioning (EGA), and water supply, sewage and waste management industry (WSE) while interest rate (INTR) served as a macroeconomic control variable. Economic growth, proxied by Gross Domestic Product Growth Rate (GDPGR), was the dependent variable. The study employed descriptive statistics, the augmented dickey Fuller (ADF) unit root test, Bounds cointegration test, and the autoregressive distributed lag (ARDL) estimation technique to capture both the long-run and short-run dynamics among the variables. Based on the empirical evidence obtained, the study concludes that industrial sector development significantly drives economic growth in Nigeria in both the short and long run. Specifically, the construction, manufacturing, mining and quarrying, and electricity and gas sectors exert strong positive impacts on GDP growth, while water supply and waste management sector shows an inverse and significant relationship in the long run but significant in the short run. The positive and significant coefficients of the key industrial sectors imply that improvements in industrial capacity utilization, infrastructure development, and access to energy are essential pathways for achieving sustainable economic growth. The speed of adjustment (ECM) further indicates that deviations from equilibrium are quickly corrected, signifying the robustness of the long-run relationship between industrialization and growth. Therefore, the study reinforces the Classical and Keynesian arguments that industrialization remains the engine of economic transformation, and that sustained industrial expansion is a prerequisite for long-term growth and development in Nigeria.

5.2 Recommendations

Based on the findings and conclusion of the study, the following recommendations are advocated:

The government should promote manufacturing diversification by prioritizing industrial policies that encourage local production and stable power supply, as this will enhance productivity and value addition within the manufacturing sector.

The mining and quarrying sector should be reformed through strengthened policies that promote transparency, environmental standards, and technology adoption, while incentivizing private investment and addressing security challenges to boost the sector's growth impact.

The government should increase investment in infrastructure and construction, to stimulate employment, enhance productivity, and create multiplier effects across other sectors of the economy.

There should be sustainable investment in the energy sector, especially in electricity generation and gas distribution, to expand energy access, reduce production costs, and promote industrialization and foreign investment.

To address inefficiencies, the government should enhance the efficiency of the water supply, sewage and waste management sector by promoting public-private partnerships that improve service delivery, resource management, and recycling systems.

Finally, the Central Bank of Nigeria should maintain a stable and moderate interest rate regime to stimulate private sector investment, enhance credit accessibility, and sustain macroeconomic stability.

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Petroleum Sector and Exchange Rate Appreciation in Nigeria

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Abstract. This paper investigates the impact of Petroleum Sector on Exchange Rate Appreciation in Nigeria over the period 1990–2025. Crude Oil Production, Crude Oil Export, Oil Export Revenue and OPEC Quota Compliance were used as a proxy for petroleum sector while exchange rate was used as a stand in for exchange rate appreciation. Secondary data were sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin, NNPCL OPEC Report Various Issues 2025. The Augmented Dickey-Fuller unit root test was employed to examine the stationarity properties of the variables, while Johansen Co-integration and Ordinary Least Square analysis were utilized to estimate short-run. The empirical result showed that crude oil export and oil export revenue had a negative and significant relationship with exchange rate while crude oil production exhibited a positive and significant relationship with exchange rate. However, OPEC quota compliance reported a negative and insignificant relationship with exchange rate. The study concludes that petroleum sector remains a critical lever in influencing exchange rate in Nigeria. It was recommended amongst other that the Nigerian Upstream Petroleum Regulatory Commission and Nigerian National Petroleum Company Limited should intensify efforts toward increasing and sustaining crude oil production by investing in modern extraction technologies, strengthening pipeline surveillance, and reducing operational disruptions in oil-producing regions. This will ensure consistent foreign exchange inflows and support currency stability.

Keywords: Crude Oil Production, Crude Oil Export, Oil Export Revenue, OPEC Quota Compliance Exchange Rate.

1. Introduction

The petroleum sector is widely recognized as a key driver of economic growth and foreign exchange earnings in oil-dependent countries. Its performance has direct implications for macroeconomic stability, particularly exchange rate movements, as fluctuations in petroleum production and export revenues influence the value of the domestic currency relative to foreign currencies. The petroleum sector refers to the segment of the economy involved in the exploration, extraction, refining, transportation, and marketing of crude oil and petroleum products. According to the Organisation of the Petroleum Exporting Countries (OPEC, 2020), the petroleum sector comprises upstream, midstream, and downstream activities that collectively contribute to foreign exchange earnings and fiscal revenues. The International Energy Agency (IEA, 2023) states that petroleum exports are a major source of hard currency inflows for oil-exporting economies, which can strengthen a country's currency when managed effectively.

Exchange rate appreciation occurs when a domestic currency increases in value relative to other currencies. The International Monetary Fund (IMF, 2024a) defines the exchange rate as the price of one country's currency expressed in terms of another, reflecting its relative value in foreign exchange markets. Likewise, the World Bank (2024) explains that currency appreciation enables a unit of domestic currency to purchase more foreign currency than before, typically resulting from increased demand for the domestic currency driven by strong external earnings. Higher inflows of foreign exchange from petroleum exports can increase demand for the domestic currency, potentially leading to exchange rate appreciation, reducing the cost of imports and stabilizing inflation, as noted in the World Bank's global exchange rate analysis and foreign reserve data.

In Nigeria, the petroleum sector dominates key macroeconomic indicators, especially foreign exchange earnings and export receipts. According to the National Bureau of Statistics (NBS, 2024), petroleum-related exports accounted for about 88 percent of total exports in the first quarter of 2024,

with crude oil export earnings rising to approximately 15.4 trillion naira, marking a 50.2 percent increase from the previous quarter. On an annual basis, total crude oil export revenue reached approximately 29.0 trillion naira in 2023, reflecting about 80.6 percent of overall export receipts, and crude oil production averaged 1.433 million barrels per day in 2023. These figures show that a large volume of foreign currency continues to enter the country through oil exports, highlighting the sector's role in shaping Nigeria's external sector performance.

Despite production challenges in recent years, Nigeria's petroleum export earnings continue to be central to external accounts. According to OPEC's Monthly Oil Market Report (OPEC, 2025), Nigeria's crude oil exports were valued at about 31.54 billion US dollars in 2025, which, despite being lower than in 2024, underscores the persistence of oil as a major source of foreign exchange. Nigeria's crude oil output also shifted periodically, with average daily production reported between 1.6 and 1.8 million barrels per day, reflecting recovery efforts and changes in global demand conditions. The contribution of the petroleum sector to Nigeria's economy remains significant. Statista (2024) indicates that the oil and natural gas industry accounted for 5.57 percent of Nigeria's Gross Domestic Product (GDP) in the third quarter of 2024, while it represented roughly 92 percent of the value of total exports during that period. This dominant export share illustrates how heavily Nigeria relies on petroleum for foreign currency earnings that can influence exchange rate movements through increases in foreign exchange inflows.

Empirical investigations from recognized institutions further affirm the link between petroleum sector performance and exchange rate behavior. For instance, the Central Bank of Nigeria (CBN, 2025) Foreign Exchange Market Report notes that fluctuations in crude oil export proceeds have historically correlated with movements in the naira's exchange rate against major currencies, suggesting a transmission mechanism from oil earnings to currency value adjustments. Additionally, the International Monetary Fund (IMF, 2024b) Working Paper on Oil Price Shocks and African Economies identifies significant responses of exchange rate adjustments in oil-exporting countries like Nigeria following global oil price changes, indicating that shocks to petroleum revenues can affect the external value of the local currency. To this end this paper, therefore, investigates how variations in petroleum sector performance influence exchange rate appreciation in Nigeria, emphasizing the mechanisms through which oil export earnings, international oil prices, and foreign exchange inflows affect the domestic currency.

1.1 Statement of Problem

Despite Nigeria's heavy dependence on the petroleum sector as the primary source of foreign exchange earnings, the sector has been plagued by several structural and operational challenges that have limited its ability to support exchange rate appreciation. Key challenges include fluctuating global oil prices, declining oil production due to pipeline vandalism and oil theft, inadequate refining capacity, policy inconsistencies, and overdependence on crude oil exports. According to the Organisation of the Petroleum Exporting Countries (OPEC, 2025), Nigeria's crude oil production has remained unstable, fluctuating between approximately 1.2 and 1.8 million barrels per day in recent years due to operational disruptions and security issues. Similarly, the International Energy Agency (IEA, 2023) highlights that oil price volatility continues to expose oil-dependent economies like Nigeria to external shocks, thereby weakening the stability of foreign exchange inflows. In addition, Nigeria's oil production dropped to as low as 1.1 million barrels per day in 2022, before recovering slightly, indicating persistent structural inefficiencies in the sector.

These challenges have significantly affected Nigeria's ability to achieve sustained exchange rate appreciation. In theory, increased petroleum export earnings should lead to an appreciation of the domestic currency through higher foreign exchange inflows. However, in practice, Nigeria has experienced persistent depreciation and volatility of the naira. Data from the Central Bank of Nigeria (CBN, 2025) indicate that the naira depreciated from about ₦197 per US dollar in 2015 to over ₦1,400 per US dollar in 2025 across official and parallel markets, despite periods of relatively high oil prices. More recent data show that the naira traded above ₦1,500 per US dollar in the parallel market in early 2026, reflecting continued pressure on the currency. This suggests that petroleum earnings have not translated effectively into exchange rate appreciation. Further statistical evidence reinforces this concern. The National Bureau of Statistics (NBS, 2024) reports that although petroleum exports accounted for about 88 percent of total exports and generated over ₦15.4 trillion in the first quarter of 2024, Nigeria continued to face foreign exchange shortages and declining external reserves at different periods. On an annual basis, total crude oil export earnings were estimated at over ₦29 trillion in 2023, yet foreign exchange supply constraints persisted.

Additionally, the World Bank (2024) notes that Nigeria's foreign reserves have experienced fluctuations, falling below 34 billion US dollars at certain periods and declining further to around 33 billion US dollars in 2025, limiting the capacity of monetary authorities to defend the naira. These trends indicate that the volume of petroleum revenue alone is insufficient to guarantee exchange rate appreciation, especially in the presence of structural inefficiencies. Moreover, Nigeria's heavy reliance on crude oil exports without corresponding diversification of the economy has exacerbated exchange rate instability. The International Monetary Fund (IMF, 2024) emphasizes that oil-exporting countries with weak economic diversification often experience exchange rate volatility due to their vulnerability to external shocks. In Nigeria's case, high import dependence accounting for over 60 percent of total consumption of refined petroleum products and limited domestic refining capacity reduce the net foreign exchange benefit from crude oil exports. Furthermore, Nigeria spends billions of dollars annually on fuel imports, with estimates exceeding 10 billion US dollars per year, thereby exerting additional pressure on foreign exchange reserves and weakening the potential for currency appreciation.

Although existing empirical studies and institutional reports acknowledge a relationship between petroleum sector performance and exchange rate movements, findings remain mixed and inconclusive. While some studies suggest that increases in oil prices and export earnings can positively influence exchange rate appreciation, others indicate that such effects are either insignificant or short-lived due to macroeconomic distortions and policy constraints. For instance, Adeniyi et al. (2012), examining the Nigerian economy over the period 1980–2010, found that oil price shocks exert a significant but unstable influence on exchange rate movements, with effects dissipating in the long run. Similarly, Iwayemi and Fowowe (2011), using a VAR framework for the period 1985–2007, reported that oil price increases lead to exchange rate appreciation, but the magnitude of the effect is weak and highly sensitive to external shocks. In contrast, Aliyu (2009), covering 1986–2007, found that oil price increases significantly appreciate the real exchange rate, although the effect is mediated by inflationary pressures and monetary policy responses.

Further evidence from Hasanov (2010), focusing on oil-exporting countries including Nigeria between 1995 and 2008, suggests that oil revenue positively affects exchange rate appreciation, but structural inefficiencies reduce the sustainability of such gains. In addition, Olomola and Adejumo (2006), analyzing Nigeria from 1970 to 2003, found that oil price shocks do not significantly influence real exchange rate volatility, thereby questioning the strength of the oil–exchange rate nexus. Supporting this position, Akpan (2009), using quarterly data from 1970 to 2007, revealed that exchange rate movements in Nigeria are driven more by monetary variables than by oil sector performance. This gap in the literature creates the need for a more comprehensive and focused investigation into the extent to which structural and operational challenges in the petroleum sector affect exchange rate appreciation in Nigeria.

1.2 Objective of the Study

The objective of the study is to investigate the relationship between petroleum sector and exchange rate appreciation in Nigeria.

The Specific objectives are:

- To examine the impact of crude oil production on exchange rate appreciation in Nigeria
- To evaluate the impact of crude oil export on exchange rate appreciation in Nigeria
- To analyze the impact of oil export revenue on exchange rate appreciation in Nigeria
- To investigate the impact of OPEC quota compliance on exchange rate appreciation in Nigeria

1.3 Research Hypothesis

The following hypothesis were formulated in null form to guide the study:

Ho_1 There is no significant relationship between crude oil production and exchange rate appreciation in Nigeria
Ho_2 There is no significant relationship between crude oil export and exchange rate appreciation in Nigeria
Ho_3 There is no significant relationship between oil export revenue and exchange rate appreciation in Nigeria
Ho_4 There is no significant relationship between OPEC quota compliance and exchange rate appreciation in Nigeria

1.4 Significance of the Study

This study on the relationship between the petroleum sector and exchange rate appreciation in Nigeria is of immense importance to various institutions, policymakers, and stakeholders due to its implications

for macroeconomic stability, foreign exchange management, and economic diversification.

First, the study is highly beneficial to the Central Bank of Nigeria (CBN), as it provides empirical insights into how petroleum sector performance influences exchange rate dynamics. The findings will assist the Bank in designing effective monetary and foreign exchange policies aimed at stabilizing the naira and improving liquidity in the foreign exchange market.

Second, the Federal Ministry of Finance will benefit from this study through a better understanding of how oil revenues impact exchange rate appreciation and fiscal stability. This will enhance budget planning, revenue forecasting, and the formulation of policies that reduce overdependence on petroleum earnings.

Third, the study is relevant to the Nigerian National Petroleum Company Limited (NNPC Ltd), as it highlights the implications of petroleum sector performance on macroeconomic outcomes. The findings can guide strategic decisions on oil production, export efficiency, and revenue optimization.

Fourth, the National Bureau of Statistics (NBS) will find this study useful in improving data collection, analysis, and reporting on petroleum sector performance and exchange rate trends. It will also provide a framework for better integration of macroeconomic indicators.

Fifth, the study is significant to the Nigerian Upstream Petroleum Regulatory Commission (NUPRC), as it offers insights into how upstream activities such as crude oil production affect foreign exchange inflows and currency stability. This will aid in regulatory policies that enhance production efficiency and sector performance.

Sixth, the Nigerian Midstream and Downstream Petroleum Regulatory Authority (NMDPRA) will benefit from the findings in understanding how inefficiencies in refining and distribution affect foreign exchange demand, especially through fuel importation, thereby influencing exchange rate movements.

Seventh, the study will be valuable to the Budget Office of the Federation, as it provides insights into the volatility of petroleum revenues and their implications for exchange rate projections. This will improve fiscal planning, expenditure management, and macroeconomic forecasting.

Finally, the study is important to academic institutions, researchers, and students in Nigeria, particularly those in economics and related fields. It contributes to existing literature by providing empirical evidence on the nexus between the petroleum sector and exchange rate appreciation, thereby serving as a reference material for future studies.

2. Literature Review

2.1 Conceptual Literature

2.1.1 Petroleum Sector

The petroleum sector occupies a strategic and indispensable position in the global economy, serving as a dominant source of energy, foreign exchange earnings, and fiscal revenue for many nations. In resource-rich economies such as Nigeria, the sector not only drives industrial activities but also significantly shapes macroeconomic outcomes, including exchange rate dynamics, economic growth, and external sector stability. Khatib (2013) defines the petroleum sector as encompassing all activities related to the exploration, extraction, and production of crude oil and natural gas, with emphasis on its revenue-generating capacity and industrial relevance. The view of this study aligns with Khatib's definition by recognizing the petroleum sector as a fundamental productive sector whose upstream activities form the basis for foreign exchange generation and economic performance, particularly in oil-exporting economies. Argüello (2013) sees the petroleum sector as a strategic economic component that influences macroeconomic stability through its strong linkages with foreign exchange earnings, trade balance, and fiscal operations. This study supports Argüello's perspective by emphasizing that the petroleum sector goes beyond production to play a crucial role in determining external sector outcomes, especially exchange rate movements in developing economies like Nigeria.

Similarly, Zand (2024) describes the petroleum sector as a complex and dynamic system comprising exploration, production, refining, and transportation activities, whose performance is influenced by global demand, technological innovation, and government policies. The study aligns with this modern view by acknowledging that the petroleum sector is not static but continuously shaped by global economic forces and policy environments, which in turn affect its contribution to macroeconomic stability. Accordingly, OPEC, (2024) defines the petroleum sector as a comprehensive value chain comprising upstream, midstream, and downstream activities, including

exploration, production, transportation, refining, and marketing of petroleum products. Recent OPEC reports further highlight that the sector operates within a volatile global environment characterized by fluctuations in oil prices and investment patterns. The position of this study is consistent with OPEC's definition, as it adopts a holistic view of the petroleum sector, recognizing that each segment contributes differently to foreign exchange inflows and overall economic performance.

Correspondingly, the International Energy Agency (IEA, 2023) describes the petroleum sector as a major driver of global energy supply and a critical source of foreign exchange earnings for oil-exporting countries. More recent outlooks emphasize that oil price volatility and global energy transition trends continue to shape the sector's performance and economic relevance. This study agrees with the IEA's perspective by highlighting the sector's central role in generating external revenues that influence exchange rate appreciation and macroeconomic stability. Furthermore, the World Bank (2024) views the petroleum sector as a key determinant of economic growth, fiscal sustainability, and balance of payments stability, particularly in developing countries. The study adopts this viewpoint by acknowledging that petroleum sector performance has far-reaching implications for both internal and external economic stability, especially in economies that depend heavily on oil exports.

The Nigerian Extractive Industries Transparency Initiative (NEITI, 2024) emphasizes that the petroleum sector remains central to revenue generation and fiscal operations in Nigeria, with detailed reporting on production, exports, and revenue flows within the industry. Additionally, the Major Oil Marketers Association of Nigeria (MEMAN, 2025) highlights that Nigeria's petroleum sector continues to face structural challenges such as production fluctuations and infrastructure constraints, despite improvements in refining capacity and output levels. The Lagos Chamber of Commerce and Industry (LCCI, 2026) further reports that the oil and gas sector remains a dominant contributor to foreign exchange earnings, though its performance is increasingly influenced by global energy transitions and domestic policy reforms. This paper, sees the petroleum sector as a broad and integrated economic sector that encompasses all processes involved in the discovery, extraction, processing, transportation, and distribution of crude oil and natural gas. It is commonly divided into upstream activities, which involve exploration and production; midstream activities, which include transportation and storage; and downstream activities, which involve refining and marketing of petroleum products.

2.1.2 Exchange Rate Appreciation

Exchange rate appreciation represents a critical concept in international economics, reflecting the strengthening of a nation's currency in the global financial system. In an increasingly interconnected world, movements in exchange rates play a decisive role in shaping trade competitiveness, capital flows, and macroeconomic stability. For developing economies, particularly those reliant on export commodities such as crude oil, exchange rate appreciation is often closely linked to external earnings and foreign exchange inflows. Krugman and Obstfeld (2018) describe exchange rate appreciation as a situation where a country's currency rises in value relative to another currency, thereby increasing its purchasing power in international markets. This study aligns with their view by recognizing appreciation as an outcome of favorable external sector performance, particularly through increased foreign currency inflows. Mishkin (2019) defined exchange rate appreciation as a macroeconomic phenomenon driven by demand and supply forces in the foreign exchange market, where increased demand for a country's currency leads to its strengthening. The position of this study supports Mishkin's argument by emphasizing that sectors generating foreign exchange—such as the petroleum sector—play a fundamental role in driving currency demand and appreciation.

Also, the International Monetary Fund (IMF, 2024) defines exchange rate appreciation as an increase in the value of a domestic currency relative to foreign currencies under a given exchange rate regime, often influenced by capital inflows, export performance, and macroeconomic fundamentals. This study adopts the IMF's standpoint by highlighting that exchange rate appreciation is not only market-driven but also influenced by policy interventions and external sector dynamics. Similarly, the World Bank (2024) explains that currency appreciation occurs when a country experiences strong foreign exchange inflows, improved trade balance, or increased investor confidence, leading to higher demand for its currency. The study agrees with this position, particularly in the context of oil-exporting economies, where export revenues significantly shape exchange rate behavior. Aizenman et al. (2022) argue that exchange rate appreciation in resource-rich economies is often associated with commodity price booms, which increase export revenues and strengthen the domestic currency. This study aligns with this modern perspective by recognizing that fluctuations in

commodity-dependent sectors, especially petroleum, can directly influence the direction and magnitude of exchange rate movements.

3. Theoretical Literature

3.1 Dutch Disease Theory

The Dutch Disease Theory was first formulated by Corden and Neary (1982) to explain the economic effects of a resource boom on a country's economy. The term originated from the Netherlands' experience in the 1960s, when the discovery of natural gas led to a significant appreciation of the Dutch guilder. While the resource boom increased foreign exchange earnings, it simultaneously created challenges for other sectors, particularly manufacturing and agriculture, by making them less competitive internationally. At its core, the theory posits that a surge in resource exports, such as petroleum, generates a substantial inflow of foreign currency, which leads to the appreciation of the domestic currency. This exchange rate strengthening improves the purchasing power of the country for imports and helps stabilize macroeconomic indicators. However, it may also result in deindustrialization or reduced competitiveness of non-resource sectors due to higher relative costs.

Proponents of the theory argue that resource booms are a powerful driver of macroeconomic stability. Corden and Neary (1982) note that increased resource exports generate foreign currency inflows that strengthen the domestic currency, allowing countries to import capital goods and consumer products at lower costs, which can stimulate overall economic growth. Similarly, Aizenman et al. (2022) emphasize that in resource-rich economies, such inflows are essential for sustaining exchange rate appreciation and maintaining fiscal stability. They argue that when managed effectively, resource-led currency appreciation can improve living standards, reduce import costs, and enhance a country's international financial position. Opponents, however, caution against the potential negative effects of over-reliance on resource-driven currency appreciation. Gelb (2010) contends that resource booms can crowd out investment in non-resource sectors, leading to reduced economic diversification and increased vulnerability to commodity price volatility. Van Wijnbergen (1984) further argues that the theory may oversimplify economic dynamics, as currency appreciation does not always lead to deindustrialization if appropriate fiscal and monetary policies are in place. Critics therefore highlight the risk of excessive dependence on petroleum revenues, which may render an economy fragile, particularly in countries like Nigeria, where oil revenue represents a significant share of government income and foreign exchange earnings.

The Dutch Disease Theory is relevant to this study because it provides a direct theoretical link between petroleum sector performance and exchange rate appreciation. In Nigeria, petroleum exports are the primary source of foreign exchange inflows, and the theory explains how increased oil revenues can strengthen the Naira while also highlighting potential risks such as sectoral imbalances and over-dependence on oil. It allows the study to examine both the benefits, including currency strengthening and import cost reduction, and challenges, such as vulnerability of non-oil sectors and oil price dependence, associated with petroleum-driven exchange rate movements. This theory was chosen to anchor the study because it clearly explains the economic process through which petroleum exports influence exchange rate appreciation, aligns perfectly with the study's focus, and has strong empirical support in resource-dependent economies. By using this theory, the study can draw insights into how Nigeria's reliance on petroleum affects exchange rate stability and provide recommendations for managing external sector risks, while offering a holistic understanding of both the positive and negative implications of resource-driven currency movements.

3.2 Resource-Based View Theory

The Resource-Based View Theory was developed by Barney (1991). The theory emphasizes that resources, whether tangible or intangible, are central to performance outcomes and sustainable competitive advantage. In the context of national economies, natural resources, such as petroleum, can be viewed as strategic assets that generate significant revenue, enhance external sector performance, and stimulate economic growth. According to Barney (1991), the mere possession of resources is not sufficient; their strategic deployment is what drives economic benefits and strengthens macroeconomic variables. In this sense, the petroleum sector in resource-rich economies like Nigeria can be seen as a pivotal resource whose optimal use can impact exchange rate movements through foreign currency generation. Proponents of Resource-Based View Theory argue that leveraging unique resources enables economies or organizations to outperform others. Peteraf (1993) asserts that the strategic exploitation of valuable and rare resources fosters sustainable economic advantages and enhances resilience against external shocks. In the Nigerian context, petroleum resources, when effectively managed and exported, serve as a source of foreign

exchange that can strengthen the Naira and improve macroeconomic stability. Similarly, Wernerfelt (1984) notes that resource-based advantages are durable and difficult for competitors to replicate, highlighting the importance of natural resource endowments as key drivers of external sector performance. These perspectives suggest that the petroleum sector's contribution to Nigeria's exchange rate appreciation can be understood through the lens of Resource-Based View Theory, as it treats petroleum as a strategic national asset that generates tangible economic value.

Opponents, however, caution against overreliance on resource endowments. Critics argue that Resource-Based View Theory may overemphasize the role of existing resources while underestimating the importance of institutional frameworks, policy effectiveness, and global market dynamics. Collis and Montgomery (1995) argue that resources alone cannot guarantee economic success without appropriate management, policy interventions, and complementary capabilities. In the Nigerian context, mismanagement of petroleum resources or overdependence on oil revenues can reduce the effectiveness of this resource in driving sustainable currency appreciation, especially during periods of global oil price volatility. The Resource-Based View Theory is relevant to this study because it provides a framework to understand how Nigeria's petroleum resources, as strategic national assets, can influence the appreciation of the domestic currency. By focusing on the strategic importance of petroleum, Resource-Based View Theory allows the study to analyze the mechanism through which resource endowments translate into external sector benefits, particularly exchange rate strengthening. The theory also provides insights into the conditions under which petroleum resources contribute positively to macroeconomic stability, emphasizing the role of effective management and utilization.

3.3 Empirical Literature

Adamu (2025) investigated the interaction between oil price, exchange rate, and petroleum product pricing in Nigeria's downstream sector using weekly data (2024–2025). The ARDL model was employed with variables including crude oil price (OP), exchange rate (EXR), inflation rate (INF), and premium motor spirit price (PMS). Findings revealed that exchange rate (EXR) has a positive and significant effect on PMS prices, indicating strong exchange rate pass-through. Crude oil price (OP) also positively affects PMS, while inflation (INF) reinforces price increases in the downstream petroleum sector. Additionally, Olu, et al. (2025) examined the nexus between oil price, exchange rate volatility, and trade transactions in Nigeria from 2008–2024. The study used a GARCH (1,1) model and included variables such as crude oil price (OP), exchange rate volatility (EXRV), and trade transactions (TRD). The findings showed that crude oil price (OP) significantly increases exchange rate volatility (EXRV), while exchange rate volatility negatively affects trade transactions (TRD). This implies that instability in the petroleum sector transmits into the external sector.

Adamu (2025) further showed that exchange rate fluctuations significantly influence petroleum import dependence and supply dynamics in Nigeria. The ARDL model included variables such as exchange rate (EXR), petroleum import dependency (PID), crude oil price (OP), and domestic supply (DS). Findings indicated that exchange rate depreciation increases petroleum import costs and dependency (PID), while also raising domestic petroleum prices. Still, Olu et al. (2025) also revealed that oil price volatility transmits into exchange rate volatility, which negatively affects Nigeria's external trade balance. The variables used include crude oil price volatility (OPV), exchange rate volatility (EXRV), and trade balance (TB). The findings showed that OPV significantly increases EXRV, while EXRV negatively impacts TB, leading to trade imbalances.

Danjuma and Abu (2024) examined effects of oil (crude and premium motor spirit (PMS)) price fluctuations on real exchange rate in Nigeria using annual time series data ranging from 1980 to 2022. In addition, the study employed Nonlinear Autoregressive Distributed Lag Model (NARDL) Bound test within the ARDL framework to capture asymmetries effects of oil price fluctuations on real exchange rate. The study further employed Granger causality test to assess for causal relationship among the variables. The NARDL Bound test of co-integration confirmed long-run relationships between oil price fluctuations and real exchange rate. The result of NARDL revealed that positive and negative fluctuations in crude oil price have negative effect on real exchange rate in Nigeria in the long-run, but have fluctuating (appreciate and depreciate) effects on real exchange rate in the short run. In the same vein, positive and negative fluctuations in the price of PMS depreciated real exchange rate in Nigeria in the long-run, but positive fluctuations in price of PMS increased real exchange rate in the short run, but negative fluctuation in price of PMS reduced real exchange rate in the short run. Granger causality test indicated bi-directional relationship between price of premium motor spirit and real exchange rate in Nigeria.

Igbinovia and Ogiemudia (2021) analyzed oil price and exchange rate volatility in Nigeria over the period 1983–2019. The study employed VECM and Granger causality techniques, using variables such as crude oil price (OP), exchange rate (EXR), interest rate (INT), inflation rate (INF), and external reserves (EXRsv). Findings indicated that crude oil price (OP) significantly influences exchange rate (EXR) volatility both in the short run and long run. Interest rate (INT) and inflation (INF) also contributed to exchange rate instability, while external reserves (EXRsv) helped stabilize the exchange rate. Similarly, Igbinovia et al. (2021) further confirmed that oil price shocks contribute significantly to exchange rate instability using simultaneous equation modeling and cointegration techniques. The variables used include crude oil price shocks (OPS), exchange rate (EXR), and macroeconomic stability indicators. The findings showed that positive oil price shocks lead to exchange rate appreciation, while negative shocks cause depreciation, confirming the volatility of EXR in response to petroleum sector fluctuations.

Lawal (2021) examined asymmetric effects of oil price changes on Nigeria's exchange rate from 1996–2019 using a Nonlinear ARDL (NARDL) model. The study used variables such as Brent crude oil price (OP), exchange rate (EXR), and decomposed oil price into positive changes (OP^+) and negative changes (OP^-). Findings showed that positive oil price shocks (OP^+) lead to exchange rate appreciation, while negative shocks (OP^-) cause more pronounced depreciation, indicating asymmetric effects in both the short and long run. Furthermore, Usman (2018) investigated the impact of crude oil price and exchange rate on economic growth in Nigeria from 1970–2016. The study used the Vector Error Correction Model (VECM) and included variables such as GDP, crude oil price (OP), exchange rate (EXR), inflation rate (INF), and interest rate (INT). The results showed that crude oil price (OP) has a positive and significant long-run relationship with GDP, while exchange rate (EXR) also positively influences GDP in the long run but exhibits short-run fluctuations. Inflation (INF) negatively affects growth, while interest rate (INT) showed an insignificant effect.

Eze and Okpala (2016) evaluated the causal relationship between oil price and exchange rate in Nigeria for the period 1985–2014 using Granger causality and VECM techniques. The model included oil price (OP), exchange rate (EXR), and foreign reserves (RES). The results showed a unidirectional causality running from oil price (OP) to exchange rate (EXR), while foreign reserves (RES) were found to buffer exchange rate volatility. Moreover, Osigwe (2015) examined the relationship between oil price, exchange rate, and economic performance in Nigeria covering the period 1980–2012. The study employed OLS and Two-Stage Least Squares (TSLS) techniques using variables such as crude oil price (OP), exchange rate (EXR), and gross domestic product (GDP). The findings revealed that crude oil price (OP) has a positive and significant effect on GDP, while exchange rate (EXR) fluctuations significantly influence economic performance. Specifically, exchange rate depreciation was found to negatively affect GDP, indicating that instability in EXR undermines economic growth.

Umar and Kilishi (2015) examined the impact of oil price volatility on exchange rate and economic growth in Nigeria covering 1980–2013. The study adopted the GARCH model, using oil price volatility (OPV), exchange rate (EXR), and GDP growth (GDPG). Findings revealed that oil price volatility (OPV) significantly drives exchange rate instability (EXR), while exchange rate fluctuations negatively affect GDP growth (GDPG), highlighting the vulnerability of the economy to oil shocks. Consequently, Ayadi (2014) investigated the transmission mechanism between oil revenue and exchange rate fluctuations in Nigeria from 1981–2012. The study used Ordinary Least Squares (OLS) and included oil revenue (OREV), exchange rate (EXR), government expenditure (GEXP), and external debt (EXTD). The results indicated that oil revenue (OREV) significantly influences exchange rate (EXR), with higher oil earnings leading to currency appreciation. Government expenditure (GEXP) was found to exert upward pressure on exchange rate depreciation.

Oladipo (2013) analyzed the effect of oil price shocks on exchange rate dynamics and macroeconomic stability in Nigeria over the period 1980–2011. Using the Autoregressive Distributed Lag (ARDL) approach, the study incorporated oil price (OP), exchange rate (EXR), inflation rate (INF), and trade openness (TOP). Results showed that oil price (OP) has a statistically significant positive impact on exchange rate (EXR), while inflation (INF) weakens the domestic currency. Trade openness (TOP) was found to intensify exchange rate responsiveness to oil shocks. Accordingly, Akinlo (2012) examined the long-run relationship between oil prices and exchange rate volatility in Nigeria from 1986–2010. The study employed Johansen cointegration and GARCH models, including variables such as oil price (OP), exchange rate volatility (EXRV), and interest rate (INT). The findings confirmed that oil price volatility significantly increases exchange rate volatility

(EXRV), while interest rate (INT) plays a mitigating role in the adjustment process.

Adeniyi (2011) explored the dynamic interaction between oil price movements and exchange rate behaviour in Nigeria over the period 1986–2008. The study utilized the Vector Autoregression (VAR) framework, incorporating crude oil price (OP), exchange rate (EXR), money supply (MS), and output (GDP). Empirical results revealed that shocks to oil price (OP) exert a strong influence on exchange rate (EXR), with oil price increases leading to exchange rate appreciation, while monetary variables (MS) moderate the magnitude of this effect. Likewise, Omojimite and Akpokodje (2010) assessed the responsiveness of exchange rate to oil price fluctuations during the period 1970–2008. The study applied cointegration and Error Correction Model (ECM) techniques, using exchange rate (EXR), oil price (OP), external reserves (RES), and government expenditure (GEXP). The results showed that oil price (OP) has a significant positive effect on exchange rate (EXR), while external reserves (RES) help stabilize the currency. Government expenditure (GEXP) was found to amplify exchange rate pressures. Finally, Aliyu (2009) investigated oil price shocks and their macroeconomic implications in Nigeria between 1970 and 2007 using a Structural VAR (SVAR) approach. The model included variables such as oil price (OP), real exchange rate (RER), real GDP (GDP), and inflation (INF). Findings indicated that oil price shocks significantly appreciate the real exchange rate (RER), while inflation (INF) responds positively to oil price increases. The study emphasized that exchange rate movements in Nigeria are largely driven by oil sector developments.

3.4 Gaps and Value Addition

The empirical literature on the petroleum sector and exchange rate dynamics in Nigeria reveals a rich but somewhat fragmented body of evidence shaped by differences in scope, variables, and methodology. A careful review shows that most studies, particularly recent ones such as Adamu (2025) and Olu et al. (2025), concentrate on short-term dynamics within the downstream petroleum sector and external sector linkages. These studies, largely based on ARDL and GARCH frameworks, consistently demonstrate that crude oil price (OP) and exchange rate (EXR) interactions are significant, with exchange rate pass-through strongly influencing petroleum product prices (PMS) and trade outcomes (TRD, TB). Similarly, Danjuma and Abu (2024), using a more advanced NARDL framework, extend the discussion by capturing asymmetries, revealing that both positive and negative oil price fluctuations exert varying effects on the real exchange rate in the short and long run. Earlier studies such as Igbinovia and Ogiemudia (2021), Lawal (2021), and Usman (2018) reinforce the dominant narrative that oil price (OP) remains the central driver of exchange rate (EXR) behaviour in Nigeria. These studies, employing VECM, NARDL, and related cointegration techniques, highlight the presence of both short-run volatility and long-run equilibrium relationships, with macroeconomic controls such as inflation (INF), interest rate (INT), and external reserves (RES) playing complementary roles.

Even earlier contributions including Eze and Okpala (2016), Osigwe (2015), Umar and Kilishi (2015), and Ayadi (2014) adopt OLS, VECM, and GARCH methodologies to show that oil revenue (OREV) and oil price volatility (OPV) significantly influence exchange rate movements, often leading to appreciation during oil booms and depreciation during downturns. Foundational studies such as Oladipo (2013), Akinlo (2012), Adeniyi (2011), Omojimite and Akpokodje (2010), and Aliyu (2009) further confirm that oil price shocks are key determinants of exchange rate dynamics, with consistent evidence of volatility transmission and macroeconomic vulnerability in Nigeria. Despite this extensive body of work, a critical gap remains evident when the literature is assessed in relation to the present study's focus, scope, and variables. First, the overwhelming majority of studies rely heavily on crude oil price (OP) or oil price volatility (OPV) as the primary proxy for the petroleum sector, thereby neglecting other critical dimensions such as crude oil production (COP), crude oil export (COE), oil export revenue (OER), and OPEC quota compliance (OQC). This narrow measurement fails to fully capture Nigeria's oil sector performance, particularly the role of production capacity, export volumes, and institutional compliance in shaping exchange rate outcomes. Second, while several studies address exchange rate volatility and depreciation, limited attention has been given specifically to exchange rate appreciation, which is central to understanding the Dutch Disease phenomenon in an oil-dependent economy like Nigeria.

In terms of scope, many existing studies either cover earlier periods (1970–2015) or focus on more recent short-term windows (e.g., 2024–2025), thereby creating a temporal disconnect. There is a lack of a comprehensive analysis spanning a broader and more policy-relevant period such as 1990–2025, which captures major structural changes in Nigeria's oil sector, including deregulation efforts, OPEC policy

shifts, and external shocks. Methodologically, although advanced techniques such as NARDL, VECM, VAR, and GARCH have been widely applied, most studies emphasize price-based transmission mechanisms rather than structural and institutional variables like OPEC quota compliance (OQC), which can significantly influence production and export behaviour. Consequently, this study departs from existing literature by incorporating a more robust and disaggregated petroleum sector framework using crude oil production (COP), crude oil export (COE), oil export revenue (OER), and OPEC quota compliance (OQC) as explanatory variables of exchange rate (EXR). By extending the scope to 1990–2025 and focusing explicitly on exchange rate appreciation, the study provides a more comprehensive and policy-relevant understanding of how petroleum sector performance and institutional compliance shape exchange rate dynamics in Nigeria. This approach not only fills the identified gaps in variable selection and scope but also strengthens the empirical linkage between the petroleum sector and exchange rate behaviour within the Nigerian context

4. Methodology

This study used ex-post facto research design. The ex-post factor research design was used because the facts has been established and cannot be manipulated by the researcher while secondary data were collected from the Central Bank of Nigeria (CBN) Statistical Bulletin, NNPCL, OPEC Report Various Issues 2025 on Crude Oil Production (COP); Crude Oil Export (COE): Oil Export Revenue (OER) and OPEC Quota Compliance (OQC): were used to proxy petroleum sector while Exchange Rate (EXR), serves as the dependent variable. The Augmented Dickey Fuller (ADF) method was used in order to do the unit root test on the model that was developed. Taking into consideration the results of the ADF, the research used the Ordinary Least Square (OLS).

4.1 Analytical Framework

The Dutch Disease Theory was formulated by Max Corden and Peter Neary (1982). The theory explains how a boom in the natural resource sector particularly oil sector can lead to an appreciation of the real exchange rate, thereby reducing the competitiveness of other sectors such as manufacturing and agriculture. In the context of Nigeria, increased oil production, export, and revenue inflows tend to strengthen the domestic currency (naira), which may distort the structure of the economy and create overdependence on the oil sector. This framework is therefore suitable for analyzing how oil-related variables influence exchange rate dynamics in Nigeria.

4.2 Model Specification

The model of this study is built on the work of Danjuma and Abu (2024), who examined the impact of oil price fluctuations on exchange rate in Nigeria. Their baseline model is specified as:

RERt =*f* (OP, PMS, INF) 1

Where

RER = Real Exchange Rates, OLPt= Crude Oil Price, PMSt = Premium Motor Spirit, INF = Inflation Rate, oil price

However, to better capture the structural realities of Nigeria's oil-dependent economy and align the study with the Dutch Disease framework, certain modifications were made to the baseline model. Specifically, oil price (OP) was replaced with broader oil sector performance indicators such as crude oil production (COP), crude oil export (COE), and oil export revenue (OER), which more directly reflect Nigeria's oil sector dynamics. Additionally, OPEC quota compliance (OQC) was introduced to capture institutional and regulatory influences on oil output. Furthermore, the dependent variable was modified from real exchange rate (RER) to nominal exchange rate (EXR) to reflect the practical policy relevance in Nigeria.

Thus, the modified model is specified as:

EXR=f (COP, COE, OQC OER) *2*

The mathematical model could be symbolically expressed as;

$EDI = \beta_0 + \beta_1 DCPS + \beta_2 MS + \beta_3 SMCP + \beta_4 BDP$ 3

$EDI = \beta_0 + \beta_1 DCPS + \beta_2 MS + \beta_3 SMCP + \beta_4 BDP + e$ 4

Where:

EXR= Exchange Rate, COP = Crude Oil Production, COE = Crude Oil Export, OER = Oil Export Revenue, OQC = OPEC Quota Compliance, f = functional relationship β_0 = Intercept of relationship in the model/constant B_1-B_4 = Coefficients of each independent or explanatory variable e= Stochastic or Error term.

4.3 Description of Variables in the Model

Exchange Rate (EXR): This is the value of a country's currency relative to another currency, typically expressed as the amount of domestic currency needed to purchase one unit of foreign currency. Exchange rate is measured in US$

Crude Oil Production (COP): This refers to the total volume of crude oil extracted from the country's oil fields over a given period. An increase in crude oil

production will have positive effect on exchange rate. Crude of Production is measured in US$. Thus β1 >0

Crude Oil Export (COE): This measures the quantity of crude oil sold to foreign markets. Higher exports generate more foreign exchange, which can appreciate the domestic currency, strengthening the exchange rate. Crude Oil Export is measured in Billions of Naira Annually. Hence, β2 >0

Oil Export Revenue (OER): This represents the total income earned from selling crude oil abroad. An increase in oil export revenue usually improves the exchange rate as it raises foreign currency inflows, enhancing the balance of payments and demand for the domestic currency. Oil Export Revenue is measured in Billions of Naira Annually. Hence, β3 >0

OPEC Quota Compliance (OQC): This measures how closely a member country adheres to its assigned production limit set by OPEC. Higher compliance may negatively affect the exchange rate if it limits production and reduces oil exports, lowering foreign exchange earnings. Conversely, low compliance that increases output may temporarily boost currency inflows, though it can risk long-term market stability. OPEC Quota Compliance is measured in %. Thus, β4s >0

5. Results and Discussion of Findings

Table 1: Descriptive Statistics

	EXR	COP	COE	OQC	OER
Mean	181.7139	1510556.	1355278.	93.88889	6575.000
Median	132.0000	1600000.	1500000.	94.00000	6750.000
Maximum	415.0000	1900000.	1700000.	98.00000	10000.00
Minimum	4.500000	1000000.	900000.0	90.00000	3500.000
Std. Dev.	136.7998	293782.7	241808.5	2.594255	2265.944
Skewness	0.634378	-0.362840	-0.490588	0.073966	0.086373
Kurtosis	3.065958	1.531030	2.681140	1.797426	1.642535
Jarque-Bera	3.723263	4.026729	4.053150	2.202102	2.808827
Probability	0.155419	0.133539	0.131786	0.332521	0.245511
Sum	6541.700	54380000	48790000	3380.000	236700.0
Sum Sq. Dev.	654996.7	3.02E+12	2.05E+12	235.5556	1.80E+08
Observations	36	36	36	36	36

Source: *E-view 13 Output*

The descriptive statistics for Exchange Rate (EXR), Crude Oil Production (COP), Crude Oil Export (COE), OPEC Quota Compliance (OQC), and Oil Export Revenue (OER) provide insight into their central tendencies, dispersion, and distributional characteristics over the 36 observations. The mean value of EXR is 181.7139, indicating the average exchange rate over the study period. The maximum value of 415.0000 and minimum value of 4.500000 reveal a very wide range, reflecting substantial fluctuations in the exchange rate. The high standard deviation of 136.7998 further confirms significant volatility, implying that the exchange rate deviates considerably from its mean, which is consistent with periods of both stability and sharp depreciation. This large deviation suggests instability in the foreign exchange market over time. For COP, the mean value is 1,510,556 barrels per day, with a maximum of 1,900,000 and a minimum of 1,000,000. The standard deviation of 293,782.7 indicates moderate variability in crude oil production. The deviation from the mean suggests fluctuations in output levels, likely influenced by operational challenges, OPEC restrictions, and external shocks.

The mean value of COE is 1,355,278 barrels per day, with a maximum of 1,700,000 and a minimum of 900,000. The standard deviation of 241,808.5 shows moderate dispersion around the mean. This implies that crude oil exports vary over time, reflecting changes in production levels, export capacity, and global demand conditions. The deviation indicates that export performance is not constant and responds to both domestic and international factors. OQC has a mean value of 93.88889 percent, with a maximum of 98.00000 and a minimum of 90.00000. The relatively low standard deviation of 2.594255 indicates minimal dispersion, suggesting that Nigeria's compliance with OPEC quotas is relatively stable over the study period. The small deviation from the mean implies consistency in adherence to production quotas. For OER, the mean value is 6,575.000, with a maximum of 10,000.00 and a minimum of 3,500.000. The standard deviation of 2,265.944 indicates substantial variability in oil export revenue. This large deviation from

the mean reflects fluctuations in global oil prices, export volumes, and exchange rate movements, which significantly affect revenue generation.
In terms of distributional properties, the skewness values indicate that EXR (0.634378), OQC (0.073966), and OER (0.086373) are positively skewed, suggesting a longer right tail and the presence of higher extreme values. Conversely, COP (-0.362840) and COE (-0.490588) are negatively skewed, indicating a longer left tail and relatively more lower values in the distribution.

The kurtosis values show that EXR (3.065958) is approximately mesokurtic, implying a distribution close to normal. However, COP (1.531030), COE (2.681140), OQC (1.797426), and OER (1.642535) are platykurtic, indicating flatter distributions with thinner tails compared to the normal distribution. The Jarque-Bera statistics and corresponding probability values further confirm the normality of the variables. The probability values for EXR (0.155419), COP (0.133539), COE (0.131786), OQC (0.332521), and OER (0.245511) are all greater than the 0.05 significance level. This implies that the null hypothesis of normal distribution cannot be rejected for all variables. Conclusively, the results indicate that all variables are approximately normally distributed. Consequently, the data satisfy the normality assumption, and it is appropriate to proceed with further econometric analysis, including the unit root test.

Unit Root Test

A unit root test known as the Augmented Dickey Fuller (ADF) test was used in the research project to determine the order of integration of the variables that were being investigated. This was done in order to pick the proper approach and prevent false regression.

Table 2: Unit Root Test Using Augmented Dickey Fuller (ADF)

Variables	Levels		First Difference		Order of Integration	P-value
	T. Statistics	5% Critical Value	T. Statistics	5% Critical Value		
LEXR	-2.594729	-2.948404	-6.725051	-2.951125	I(1)	0.0000
LCOP	-1.838858	-2.948404	-6.962632	-2.951125	I(1)	0.0000
LCOE	-2.183601	-2.948404	-5.507559	-2.951125	I(1)	0.0001
OQC	-2.462819	-2.983972	-6.166548	-2.951125	I(1)	0.0000
LOER	-1.156876	-2.948404	-5.130784	-2.951125	I(1)	0.0002

Source: Extracts from E-view 13. * Level of significance at 5%

This study employs the Augmented Dickey-Fuller (ADF) unit root tests to check the order of integration of the variables and the results are presented in Table 2 The results of Augmented Dickey-Fuller (ADF) showed that the variables were not stationary at level I(0) but became stationary after first difference I(1). The ADF result revealed that LEXR, LCOP, LCOE, OQC and LOER are all stationary after first difference. This outcome makes the Johansen co-integration appropriate for investigating the long-run relationship among these variables.

Johansen Co-integration Test

Table 3: Test for Johansen co-integration using Trace and Max-Eigen statistic

Hypothesized	Trace	0.05		Hypothesized	Max-Eigen	0.05	
No. of CE(s)	Statistic	Critical Value	Prob.*	No. of CE(s)	Statistic	Critical Value	Prob.*
None	69.28709	69.81889	0.0551	None	25.05555	33.87687	0.3812
At most 1	44.23153	47.85613	0.1052	At most 1	19.54986	27.58434	0.3731
At most 2	24.68168	29.79707	0.1731	At most 2	11.36786	21.13162	0.6106
At most 3	13.31382	15.49471	0.1038	At most 3	7.820036	14.26460	0.3973
At most 4 *	5.493780	3.841465	0.0191	At most 4 *	5.493780	3.841465	0.0191

Source: Authors compilation from E-Views 13

Table 3 depicts the Johansen test for the presence of a cointegrating relationship among the time series data in the study of the impact of petroleum sector on exchange rate appreciation in Nigeria. Relying on the exposition of the trace statistics and the max-eigen statistic, we assert that there are no cointegrating relationships in the study. This assertion became necessary since the trace statistics values are less than their critical values. Also, the max-eigen statistics values are less than their critical values. On the basis of the above, the null hypothesis of no cointegrating relationship among the series is hereby accepted. Given the absence of long-run convergence among the series, we then proceed to estimate their short-run dynamics using the ordinary least square (OLS).

Short-Run Estimation Results for the Model

The results of the short-run dynamics association of the model are presented in table 4 below

Table 4: ARDL Short and Long-run Result for the Model

Variable	Coefficient	Std. Error	t-Statistics	Prob
C	0.276890	0.064679	4.280988	0.0002
LCOP	0.960666	0.314942	3.050296	0.0007
LCOE	-0.445714	0.177810	-2.506687	0.0057
OQC	-0.001686	0.107089	-0.015741	0.9875
LOER	-0.664072	0.212261	-3.128568	0.0007
Adj R^2 =0.668592, F-statistics = 18.65247 (0.000000), DW = 1.987311				

Source: *Authors computation using E-view 13 2026*

Table 5 presents the Ordinary Least Square (OLS) results, capturing the short-run between petroleum sector and exchange rate appreciation in Nigeria. The model exhibits a high explanatory power with an adjusted R^2 of 0.668592, implying that approximately 67% of the variations in exchange rate appreciation (EXR) are explained by the included regressors. The Durbin-Watson statistic of 1.987311 confirms the absence of first-order autocorrelation, while the F-statistic of 18.65247 underscores the overall statistical robustness and goodness-of-fit of the model.

The logarithm coefficient of crude oil production (LCOP) is positive (+0.960666), indicating that a 1% increase in the logarithm coefficient of crude oil production (LCOP) is associated with 0.96% increase in the log value of exchange rate appreciation (LEXR). The p-value (0.0007) confirms statistical significance at the 5% level, validating the theoretical proposition that crude oil production will have positive effect on exchange rate. Thus, the null hypothesis of no significant relationship is rejected. Similarly, the log value of crude oil export revenue (LCOE) is negative (-0.445714). This implies that a unit increase in the log value of crude oil export (LCOE) will lead to about 0.45% fall in the log value exchange rate appreciation (LEXR). The p-value (0.0057) confirms statistical significance at the 5% level. These outcomes do not validate the theoretical proposition that higher exports generate more foreign exchange, which can appreciate the domestic currency, strengthening the exchange rate. Thus, the null hypothesis of no significant relationship is rejected.

Interestingly, the log value of crude oil export revenue (LCOE) is negative (-0.001686). This suggests that a unit increase in the log value of OPEC quota compliance (OQC) will lead to about 0.002% decrease in the log value exchange rate appreciation (LEXR). The p-value (0.9875) confirms statistical insignificance at the 5% level. These results validate the theoretical proposition that higher compliance may negatively affect the exchange rate if it limits production and reduces oil exports, lowering foreign exchange earnings. Thus, the null hypothesis of no significant relationship is accepted. Finally, the log value of oil export revenue (LOER) is negative (-0.664072). This implies that a unit increase in the log value of oil export revenue (LOER) will lead to about 0.66% decrease in the log value exchange rate appreciation (LEXR). The p-value (0.0007) confirms statistical significance at the 5% level. These outcomes do not validate the theoretical proposition that increase in oil export revenue usually improves the exchange rate as it raises foreign currency inflows, enhancing the balance of payments and demand for the domestic currency. Therefore, the null hypothesis of no significant relationship is rejected.

Diagnostic Test

Table 5: Ramsey Reset Test, Serial Correlation LM Test and Homoscedasticity Test Results

	F-Statistic	Prob-Value
Ramsey Reset Test	3.555414	0.1527
Breusch-Godfrey Serial Correlation LM Test	2.435561	0.3164
Breusch-Pagan-Godfrey Heteroskedasticity Test	1.275924	0.8150

Source: *Author's Computation 2026*

From Table 5, the results of the diagnostic test shows that the linearity test using Ramsey Reset test indicates that the f-statistic (3.555414) with computed p-value of 0.1527 which is greater than 5 percent (0.05) critical value, hence the study reject the null hypothesis and conclude that the model is correctly specified. The result of the Serial or Autocorrelation Test using Breusch-Godfrey Serial Correlation LM Test shows that the f-statistic is 2.435561, with a

Chi-Square probability value is 0.3164. This indicates that the probability value of about 31 percent (0.3164) is greater than 5 percent (0.05) critical value; hence the study confirms no serial correlation in the model. The result of the heteroscedasticity test using Breusch-Pegan-Godfrey test shows that the f-statistic is 1.275924 with a Chi-Square probability value of 0.8150 The result suggests that there is no evidence of heteroskedasticity in the model since the probability Chi-square value is more than 5 percent (P >0.05). So, residuals do have constant variance which is desirable in regression meaning that residuals are Homoscedastic.

Figure 1: Normality Test

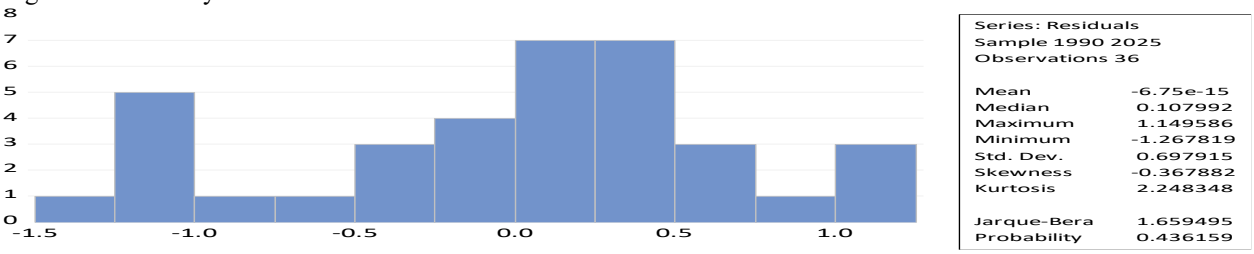

Figure 1, shows summary of the normality test with Jarque-Bara value of 1.659495 and a corresponding probability value of 0.436159 more than 0.05 level of significance, indicating that the residuals are normally distributed

Figure 2: Stability Test

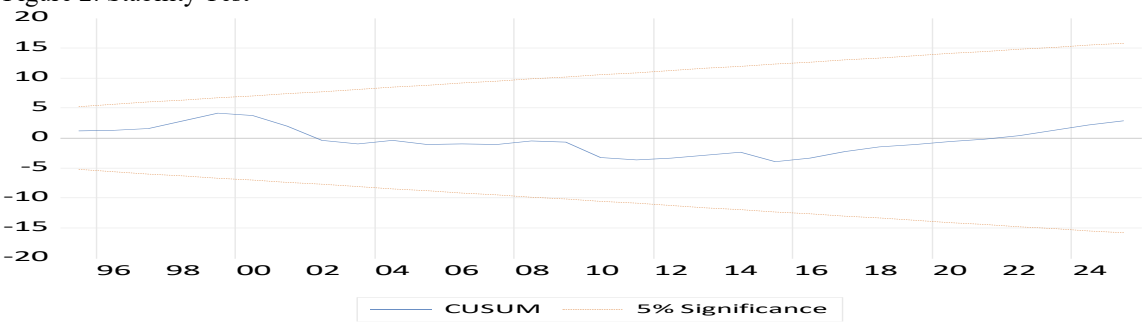

Figure 2 shows summary of the stability test, the result showed that the model is stable. This is evident to the fact that the blue line is in-between the two red (-5 & +5) or less than 0.05 level of significance.

6. Discussion of Findings

6.1 Crude Oil Production and Exchange Rate Appreciation in Nigeria.

The Ordinary Least Square (OLS) estimation indicates that crude oil production (COP) exerts a positive (+0.960666) and statistically significant (0.0007) impact on exchange rate (EXR), suggesting that increase in crude oil production will have positive effect on exchange rate. The statistical significance, as evidenced by the p-value, confirms that crude oil production (COP) is a key determinant of exchange rate in Nigeria. Consequently, the null hypothesis of no significant relationship between crude oil production and exchange rate is decisively rejected. This implies that there is a significant relationship between crude oil production and exchange rate

6.2 Crude Oil Export and Exchange Rate Appreciation in Nigeria.

The Ordinary Least Square (OLS) estimation indicates that crude oil export (COE) had a negative (-0.445714) but statistically significant (0.0057) impact on exchange rate (EXR), suggesting that increase in crude oil export will negatively affect exchange rate. The statistical significance, as evidenced by the p-value, confirms that crude oil export (COE) is a major determinant of exchange rate in Nigeria. Consequently, the null hypothesis of no significant relationship between crude oil export and exchange rate is rejected. This means that there is a significant relationship between crude oil export and exchange rate

6.3 OPEC Quota Compliance and Exchange Rate Appreciation in Nigeria.

The Ordinary Least Square (OLS) estimation indicates that OPEC quota compliance (OQC) had a negative (-0.001686) and statistically insignificant (0.9875) impact on exchange rate (EXR), suggesting that increase in OPEC quota compliance will negatively affect exchange rate. The statistical insignificance, as evidenced by the p-value, confirms that OPEC quota compliance (OQC) is a key determinant of exchange rate in Nigeria. Consequently, the null hypothesis of

no significant relationship between OPEC quota compliance (OQC) and exchange rate is accepted. This means that there is no significant relationship between OPEC quota compliance (OQC) and exchange rate

6.4 Oil Export Revenue and Exchange Rate Appreciation in Nigeria.

The Ordinary Least Square (OLS) estimation indicates that oil export revenue (OER) had a negative (-0.664072) and statistically significant (0.0007) impact on exchange rate (EXR), suggesting that increase in oil export revenue will negatively affect exchange rate. The statistical significance, as evidenced by the p-value, confirms that oil export revenue (OER) is a key determinant of exchange rate in Nigeria. Consequently, the null hypothesis of no significant relationship between oil export revenue (OER) and exchange rate is rejected. This means that there is a significant relationship between oil export revenue (OER) and exchange rate

7. Conclusion and Recommendation

7.1 Conclusion

The study on the relationship between petroleum sector and exchange rate appreciation concludes that crude oil export and oil export revenue had a negative and significant relationship with exchange rate while crude oil production exhibited a positive and significant relationship with exchange rate. However, OPEC quota compliance reported a negative and insignificant relationship with exchange rate. The study concludes that petroleum sector remains a critical lever in influencing exchange rate in Nigeria

7.2 Recommendations

The Nigerian Upstream Petroleum Regulatory Commission and Nigerian National Petroleum Company Limited should intensify efforts toward increasing and sustaining crude oil production by investing in modern extraction technologies, strengthening pipeline surveillance, and reducing operational disruptions in oil-producing regions. This will ensure consistent foreign exchange inflows and support currency stability.

Additionally, the Nigerian Export Promotion Council in collaboration with the Central Bank of Nigeria should promote export diversification within the petroleum sector by encouraging local refining and value addition. Policies aimed at reducing dependence on crude oil exports while improving the efficiency of export proceeds repatriation will strengthen the foreign exchange market and reduce pressure on the naira.

Furthermore, the Federal Ministry of Petroleum Resources should work closely within the framework of the Organization of the Petroleum Exporting Countries to ensure effective monitoring and strategic compliance with production quotas. Aligning international obligations with domestic economic priorities will improve coordination and enhance the overall effectiveness of petroleum sector policies.

Finally, the Central Bank of Nigeria alongside the Federal Ministry of Finance Nigeria should strengthen foreign exchange management and revenue utilization frameworks by ensuring that oil export earnings are efficiently managed, transparently accounted for, and strategically invested through institutions such as the Nigeria Sovereign Investment Authority. This will help build external reserves, reduce exchange rate volatility, and promote long-term macroeconomic stability in Nigeria.

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