

Reverse Logistics in E-Commerce Returns Management: A Review of Advances, Practices, and Emerging Challenges

Priscilla Agboada^{1*}, Rosalyn Ezeako², Ifeoma E. Okoli³, Chikodiri Scholastica Uzundu⁴,

¹ Owen Graduate School of Management,
Vanderbilt University, Nashville, Tennessee,
USA. priscillaagboada@gmail.com

² University of Central Missouri, Warrensburg,
Missouri, USA. ezeakononye@gmail.com

³ Salesforce Development Company,
Canada. ifeomaokoli47@gmail.com

⁴ Anambra State Polytechnic, Mgbakwu, Anambra
State, Nigeria. chikaogbogu22@gmail.com

* Corresponding author: Priscilla

Agboada, priscillaagboada@gmail.com

DOI: 10.56201/ijebm.vol.11.no8.2025.pg260.298

Abstract

Product returns have become a defining strategic, financial, and regulatory problem for online retail. In 2025 the National Retail Federation projected roughly USD 849.9 billion in returned merchandise in the United States, about 15.8 percent of annual sales, with the e-commerce share materially higher at an estimated 19.3 percent of online sales. This review synthesises academic, practitioner, and regulatory literature on reverse logistics in e-commerce returns management for 2018 to 2025, asking how the conceptual foundations of the field have been reframed, what advances now shape returns handling, what practices firms have adopted, how emerging-market conditions alter the applicability of dominant models, and what remains unresolved. Because reverse logistics sits across operations, procurement, analytics, information systems, marketing, finance, law, and environmental policy, the review draws deliberately on adjacent literatures spanning supplier management, predictive analytics, warehouse robotics and safety, distributed ledger infrastructure, enterprise data governance and cybersecurity, fraud and audit analytics, treasury and financial control, CRM platform engineering, geospatial monitoring, workforce systems, AI governance, trade regulation, and carbon accounting. The field has shifted from cost minimisation toward constrained value recovery, driven by the maturation of artificial intelligence in prediction, inspection, and disposition, the rise of the secondary market as a designed channel, and binding regulation, most visibly the European Union's Ecodesign for Sustainable Products Regulation, which treats returned and unsold goods as a regulated stream rather than a private commercial matter. The synthesis is consolidated into the Constrained Value-Recovery model, a four-layer framework yielding six testable propositions. Persistent gaps are identified in return fraud, the environmental accounting of returnless refunds, the transferability of Global North models, and the absence of longitudinal work linking returns policy to lifetime customer value.

Keywords

Reverse logistics; e-commerce returns; returns management; circular economy; closed-loop supply chains; disposition decisions; return fraud; recommerce; predictive analytics; extended producer responsibility; supply chain governance

1. Introduction

Every online transaction carries an implicit option: the customer buys a product they have not touched and retains the right to unwind that purchase within a defined window. For two decades retailers subsidised that option in pursuit of conversion. At current volumes the subsidy is no longer sustainable.

Reverse logistics, defined by Rogers and Tibben-Lembke as the planning and control of the efficient flow of goods and information from the point of consumption back toward the point of origin to recapture value or ensure proper disposal, was conceived for warranty claims, recalls, and end-of-life equipment. E-commerce inverted the flow: returns are now high in volume, low in unit value, sharply seasonal, dispersed at household level, and dominated by items that are functionally perfect but unwanted. The inversion matters because the available managerial machinery was built for a forward chain in which goods move one way and value accrues along the way (Okonkwo et al., 2024a; Efobi et al., 2021). Reverse flows invert the value gradient: each handling step consumes value, and the objective becomes recovery rather than throughput.

The scale is no longer marginal. The 2025 Retail Returns Landscape report projected USD 849.9 billion in United States retail returns, or 15.8 percent of sales, down from 16.9 percent and USD 890 billion in 2024, with an estimated 19.3 percent of online sales returned. Apparel and footwear are commonly cited at 20 to 40 percent and beauty and health often below 10 percent; roughly 9 percent of returns were classified as fraudulent, though Appriss Retail and Deloitte place return and claims fraud considerably higher. Meanwhile 82 percent of consumers treat free returns as an important purchase consideration, up from 76 percent a year earlier, and 76 percent prefer instant refund or exchange. Unit cost is rising while tolerance for friction falls, which has made customer service analytics a strategic rather than a support function, since the returns interaction is among the highest-frequency touchpoints a retailer has (Sakyi et al., 2022a).

Four developments since 2022 make a further synthesis worthwhile. The technology base changed, as vision-based grading, gradient-boosted and neural propensity models, autonomous mobile robotics, and generative and agentic systems moved from prototype to production (Akanbi & Sunday, 2024, 2025; Nwakamma et al., 2024b; Ogundairo, 2025). The commercial logic changed, as returnless refunds became an algorithmically governed instrument while most large retailers introduced return fees, reversing fifteen years of liberalisation; both are marketing decisions with operational consequences (Sanni & Atima, 2021a; Sanni, Atima, et al., 2022). The legal environment changed, as the Ecodesign for Sustainable Products Regulation (EU) 2024/1781 entered into force in July 2024 and, from 19 July 2026, will prohibit large enterprises from destroying unsold apparel, clothing accessories, and footwear, while parallel AI regulation constrains how returns decisions may lawfully be automated (Ominyi & Anichukwueze, 2024; Ominyi et al., 2024b; Annan, 2025a). And the geography changed, as growth concentrated in markets where card payment, dense parcel networks, formal addressing, and enforceable return rights do not hold (Akokodaripon et al., 2023; Jones & Ominyi, 2024b).

The review accordingly examines how the conceptual foundations of the field have been reframed and whether prevailing taxonomies remain adequate; which advances have materially changed capability, and how strong the supporting evidence is; which practices firms have adopted, and

how these vary by category, channel, and scale; how emerging-market conditions alter the applicability of dominant models; and what remains unresolved. In doing so it integrates perspectives usually reviewed separately, establishes a current empirical baseline, examines returnless refunds against the evidence available for them, gives explicit attention to the refused-delivery reverse flow that dominates cash-on-delivery markets, and draws systematically on adjacent literatures, on the argument that the binding constraints on returns capability now sit outside reverse logistics narrowly defined.

2. Methodology

This is a semi-systematic, integrative review. The subject spans operations research, information systems, marketing, finance, environmental policy, and law, and much current evidence sits in practitioner reports, regulatory instruments, and industry surveys that a database-only protocol would exclude. Snyder's typology identifies this approach as appropriate where a topic is conceptualised differently across disciplines and the purpose is to map development and identify gaps rather than aggregate effect sizes. The approach also permits deliberate inclusion of adjacent work: a protocol restricted to the phrase reverse logistics would exclude the procurement analytics supplying the cost-modelling apparatus (Akinleye et al., 2023), the data governance literature determining whether disposition data is capturable at all (Aliliele et al., 2024a), and the technology law governing how returns decisions may be automated (Annan, 2024).

Literature was identified through Scopus, Web of Science, and Google Scholar using combinations of reverse logistics, product returns, returns management, e-commerce returns, closed-loop supply chain, disposition decision, return policy, recommerce, and return fraud, with a second layer targeting procurement analytics, supplier relationship management, demand forecasting, warehouse robotics, supply chain visibility, ESG-integrated procurement, algorithmic accountability, and cross-border trade compliance. Priority went to work published from 2018 onward. Included were studies of consumer returns, disposition and secondary markets, policy design, governing regulatory instruments, and adjacent work with a clear mechanism linking it to returns capability. Excluded were industrial remanufacturing without a consumer-returns component, general waste management, reusable transit packaging, and recalls. Sources were coded against conceptual, technological, practice, regulatory, and geographic dimensions, then mapped onto the process chain from initiation through gatekeeping, transport, receipt, inspection, grading, disposition, and settlement. That mapping produced a principal finding: research density concentrates at network and policy design, and thins at inspection, grading, and settlement, precisely where cost concentrates. Limitations arising from this design are set out in Section 7.

3. Literature Synthesis

This section synthesises the evidence across sixteen strands, from conceptual foundations and the current empirical baseline, through technological and methodological advances, to practice, geography, and regulation. Section 3.16 draws the strands together into four patterns that inform the framework developed in Section 4.

3.1 Conceptual foundations of reverse logistics

Three constructs are often conflated. **Reverse logistics** is the flow itself; **closed-loop supply chain management**, associated with Guide and Van Wassenhove, integrates forward and reverse flows into one design problem; and **returns management** is broader still, spanning policy design, gatekeeping, avoidance, and the marketing consequences of the returns experience. The closed-

loop framing suits e-commerce because reverse volume now materially affects forward availability, pricing, and assortment, and secure, scalable supply chain architectures are what make that integration operable at national scale (Okonkwo et al., 2024b). No returns capability exceeds the visibility beneath it, making end-to-end visibility a precondition rather than an enhancement (Nnabueze et al., 2021; Okonkwo, Mayo, et al., 2023), and the problem is harder than in the forward chain because the item leaves custody entirely, its condition is unknown until inspection, and the identifier attached at sale often does not survive the round trip; integrated procurement and transparency platforms address the first and partially the third (Okoruwa, Babatope, et al., 2024; Okoruwa, Babatope, et al., 2025).

Type	Trigger	Typical condition	resale	Preventability
Fit and sizing returns	Product does not fit as expected	Usually as-new		High, via sizing technology and better data
Expectation-gap returns	Product differs from listing	Usually as-new		High, via improved content and imagery
Bracketing returns	Multiple variants ordered with intent to return most	As-new		Moderate, via policy and pricing design
Change-of-mind returns	No product defect	Usually as-new		Moderate
Defective and damaged returns	Product fault or transit damage	Requires repair or scrap		High, via quality and packaging
Wardrobing and fraudulent returns	Intentional misuse of policy	Variable, often used		Depends on detection capability
Delivery-failure returns	Undelivered, refused, address error	As-new		High, via address validation and delivery options

The taxonomy carries a governance implication: fit returns belong to merchandising, defect returns to supplier quality, and fraudulent returns to risk, so a single functional owner guarantees that most causal levers sit outside that owner's authority (Akin-Oluyomi & Akhigbe, 2023b). Gatekeeping, screening for eligibility at the earliest feasible point, is the highest-leverage step, because every subsequent activity is cost applied to a possibly ineligible item; portal design is a workflow automation problem (Akinleye & Adeyoyin, 2021), and procedure design is decisive because consistency across channels determines whether a policy exists in practice or only on paper (Eyetsemitan et al., 2022). Disposition then runs from restock through repackaging, refurbished and third-party sale, liquidation, donation, and recycling to disposal. The marginal cost of descending one step often approximates the marginal value lost, making the decision sensitive to labour cost and unstable across geographies (Akokodaripon et al., 2023); it is increasingly constrained rather than optimised, since regulation removes disposal from the feasible set; and it

is informational before it is analytical, which is why disposition performance correlates more strongly with data architecture maturity than with decision-rule sophistication (Aliliele et al., 2025b). Return cost is chronically underestimated because much of it is never booked against returns, most notably the working capital cost of cash refunded before goods are recovered. Variance analytics decomposes where realised cost diverges from standard cost (Aliliele et al., 2024), and data-led cost governance, requiring that a cost figure carry its scope definition, would resolve most of the apparent disagreement behind the widely quoted USD 10 to 40 range (Adesuyi, Kalu, et al., 2023).

3.2 The empirical landscape in 2025

The blended United States rate of 15.8 percent for 2025, down from 16.9 percent, coincides with the spread of return fees and shortened windows, suggesting policy-induced suppression rather than improved purchase accuracy. Category is the strongest single predictor: apparel at 20 to 40 percent, footwear near the upper twenties, consumer electronics at 8 to 15 percent with higher unit values and more complex refurbishment, and beauty and health below 10 percent but with the tightest restrictions on resale of opened items. Pharmaceutical and health-adjacent categories are the limiting case, where chain-of-custody and cold-chain requirements make consumer returns essentially unrecoverable (Aneke & Adesemoye, 2021, 2025; Eze et al., 2023). Bracketing is structurally encouraged by free returns and poor fit information, while serial returning concentrates volume in a small share of accounts, the empirical basis for account-level risk scoring. The finding that consumers aged 18 to 30 average 7.7 online returns annually is better read cautiously, since segmentation research shows apparent differences between demographic groups frequently dissolve once purchase frequency and category exposure are controlled (Atima et al., 2022; Oghenemaiga et al., 2024).

Fraud estimates range from roughly 9 percent of returns to figures approaching USD 103 billion and around 15 percent, a divergence that is definitional rather than empirical, turning on whether wardrobing, receipt manipulation, empty-box returns, substitution, false damage claims, and organised retail crime resale are counted, and whether the denominator is value or count. Returns fraud is structurally similar to transaction fraud in financial services, where detection research is more mature: machine learning for financial fraud detection, anomaly detection in transaction time series, adaptive real-time risk scoring, and synthetic identity fraud detection in e-commerce all match the statistical structure of returns abuse (Atakpa & Abetoh, 2022; Atakpa & Fobellah, 2023; Fadayomi et al., 2024; Elebe et al., 2023), though transfer is not automatic, since returns fraud has a physical component payment fraud lacks. Environmental claims are frequently made with untraceable numbers; the defensible policy-grade figure is the European Commission estimate that 4 to 9 percent of textiles placed on the EU market are destroyed before use, associated with roughly 5.6 million tonnes of CO₂ equivalent annually. Improving on it requires carbon accounting infrastructure most retailers lack, and accuracy problems in corporate carbon accounting are well documented (Lamidi, 2023). Beneath this sits a measurement deficit that real-time KPI and dashboard architectures directly address, their absence in returns being conspicuous given their penetration elsewhere (Tonoyan et al., 2024b; Sanni & Atima, 2021b).

3.3 Prediction, forecasting, and decision analytics

The most commercially significant advance is the shift from aggregate rate forecasting to transaction-level propensity prediction over customer history, session behaviour, product attributes, size-chart deviation, price state, and review signals. The lineage runs through demand

forecasting, where machine learning for revenue projection and planning accuracy was developed first (Tonoyan et al., 2021a), and predictive demand models target the inventory inefficiency returns exacerbate, the natural extension being a net-demand formulation subtracting expected returns from gross demand at SKU and location level (Basnet et al., 2021). Work on forecasting accuracy and bottleneck reduction explains why reverse-direction error propagates forward with a lag (Akin-Oluyomi & Akhigbe, 2023c). Outputs serve inventory planning, real-time checkout intervention structurally identical to funnel intervention design (Sanni & Wedraogo, 2024; Eyetsemitan et al., 2024b), and risk-based policy differentiation, the last being where prediction meets governance, since a propensity score used to deny or price a service is an automated decision about an individual (Annan, 2025a).

Cost models remain underdeveloped relative to prediction models. Predictive cost optimisation supplies one apparatus (Tonoyan et al., 2022c) and simulation-based financial impact assessment another suited to returns, where policy, volume, and capacity interact non-linearly (Tonoyan et al., 2022b). Residual value depends on condition, channel, timing, and category depth, which retail asset valuation frameworks formalise (Tonoyan et al., 2023), while predictive budgeting applies to reserving for returns (Adesuyi, Kalu, et al., 2023). Where returns are collected is a location decision, for which predictive geospatial store-location methods transfer directly (Tonoyan et al., 2022a), geospatial vendor evaluation provides a template for assessing drop-off partners against catchment, cost, and service simultaneously (Ahiaeké Patrick et al., 2021). Two weaknesses recur: class imbalance is handled inconsistently, and almost all models are evaluated offline, which cannot capture the feedback effect of acting on the prediction, so a model that predicts returns accurately is not one that reduces them profitably. The attribution literature has faced the identical problem and developed partial solutions that explicitly model bias in observational journey data (Sanni, Atima, et al., 2022; Sanni & Atima, 2021a), and uncertainty quantification remains a gap, since capacity planning needs interval rather than point estimates (Wedraogo & Sanni, 2024).

Business intelligence practice from adjacent sectors supplies further methods the returns literature lacks. Subscriber-base expansion analytics parallels the problem of identifying which returning customers are worth retaining (Seyi-Lande et al., 2024), frameworks translating large data estates into strategy describe the organisational step most returns functions have not taken (Oziri et al., 2025), predictive and prescriptive analytics extend description toward recommendation (Rukh et al., 2023b), and integrated frameworks for artificial intelligence in supply chain management connect the domains explicitly (Rukh et al., 2024). Attribution and yield optimisation models supply a further method for valuing the returning customer (Basnet et al., 2024), cross-functional key performance indicator frameworks address the alignment problem created when returns costs and benefits sit in different functions (Seyi-Lande et al., 2022), frameworks for artificial intelligence in strategic decision-making describe the governance layer (Shah et al., 2025), and analytics-driven digital inclusion is relevant where returns infrastructure must serve customers with limited digital access (Rukh et al., 2023a).

3.4 Physical automation, warehouse robotics, and facility safety

Inspection and grading are the labour bottleneck. Vision systems now perform defect detection, completeness verification, cosmetic grading, and item identification reliably where SKU variety is bounded and presentation controlled, and multi-modal models combining images with metadata and stated return reason outperform image-only classifiers. The unsolved problems are informative: grading soft goods for wear, odour, and pilling remains poorly automated; verifying a sealed box's contents requires weight, dimensional, or X-ray sensing; and grading consistency

across facilities, which determines secondary-market pricing credibility, is a data governance problem as much as a model problem. Autonomous mobile robots have reached production in high-density warehousing, where integrated path-planning and slotting models show that robotics and inventory placement must be solved jointly, applying directly to returns because returned stock arrives in a slotting pattern no forward-planning model would choose (Akanbi & Sunday, 2024); review evidence on micro-fulfilment indicates the economic case strengthens as density rises and the mix shifts to single-unit handling, precisely the returns profile (Akanbi & Sunday, 2025), with swarm coordination addressing fleet scheduling beyond the point where centralised control remains tractable (Akanbi et al., 2025). Penetration nonetheless lags forward fulfilment, since returns arrive in unpredictable mixes, non-standard packaging, single units, and variable condition. Facilities are capital-intensive and peak-loaded, making equipment availability a first-order constraint, which predictive maintenance for e-commerce systems addresses (Mayo et al., 2021), supported by service-platform automation research showing that availability rather than diagnostic accuracy is usually binding (Okonkwo et al., 2024f). Digital twins allow policy to be tested before deployment, a pattern demonstrated in adjacent transactional domains (Akinlade et al., 2024) and extended to carrying regulatory as well as operational obligations (Ike et al., 2025).

Returns processing is also a physical work environment, combining manual handling, unknown package contents, occasionally damaged or leaking goods, and heavy seasonal use of temporary labour, a recognised high-risk combination that the safety literature addresses and returns research does not. Proactive hazard identification using digital safety data streams provides the leading-indicator apparatus (Obriki & Arumosoye, 2023; Obogo et al., 2021), models of recurrence mechanisms in unsafe behaviour explain why procedural violations persist under throughput pressure (Obriki & Arumosoye, 2022), and continuous hazard monitoring extends detection beyond periodic inspection, which matters because returns headcount expands sharply and briefly during peak (Obriki et al., 2023). Facility reliability is the complementary constraint, and the maintenance literature supplies the methods: sensor-based fault detection in HVAC plant, which matters where temperature-sensitive returned goods are held (Sunday & Omoegun, 2022), vibration-based condition monitoring of rotating machinery (Omoegun et al., 2023).

3.5 Network design, routing, and operational optimisation

The operations research literature on reverse network design is deep, covering facility location, routing with pickup and delivery, capacity allocation, and multi-echelon inventory with returns, with recent emphasis on stochastic and robust formulations, bi-objective cost-carbon models, and matheuristics. Its assumptions have drifted from practice: many assume returns arrive at a central facility rather than through third-party drop-off with consolidated linehaul, many assume disposition options are freely available, and few incorporate the fact that the retailer often does not control the reverse network. Route optimisation linking algorithmic pathways to delivery profitability is an important reframing, making the objective economic rather than distance-based (Tonoyan et al., 2025), which matters more in the reverse direction, since minimising distance while collecting low-value items may be value-destroying. The forward-side counterpart is the delivery promise itself: work on online lead time quotation under contingency treats the quoted date as a decision variable set under uncertainty, trading the conversion benefit of an aggressive promise against the cost of failing it (Ekun & Muriel, 2024). That trade-off is a direct antecedent of two return types above, since an unmet promise generates expectation-gap returns and, where the customer is no longer available to receive the parcel, refused deliveries, which places quotation policy in Layer 1 of the model in Section 4 rather than in forward-chain scheduling.

Returns volume is peaked and correlated with periods of maximum network stress. Lean and Six Sigma remain the most widely applied process apparatus: Lite-DMAIC adaptations answer the objection that classical Six Sigma is too heavy for firms without dedicated quality functions (Ambali et al., 2021), Lean Six Sigma supplies the underlying method (Ezeugwa et al., 2023a), cycle-time redesign demonstrates application to a process analogous to returns intake (Oyeleye et al., 2022), and lean supply chain practices provide the strategic justification (Ike et al., 2022; Efobi et al., 2022b). Humanitarian logistics offers a close analogue for peak surge, since frameworks integrating predictive analytics, IoT, and localised distribution are built for volume arriving faster than standing capacity can absorb, and their emphasis on localised buffering rather than centralised scaling applies to the January surge (Anene & Clement, 2022, 2024). Cross-border flows face a further inefficiency domestic models omit, described precisely by post-pandemic resilience research: goods stall not for want of transport capacity but because documentation, clearance, and coordination fail (Efobi et al., 2023).

3.6 Distributed ledger infrastructure, traceability, and the Digital Product Passport

Blockchain has been proposed for provenance, warranty verification, authentication, and settlement, with an applied literature covering supply chain and logistics performance (Ekwunife et al., 2024), tamper-proof regulatory recordkeeping and real-time audit readiness (Anichukwueze et al., 2021), and smart supply chain management with attribute-based encryption access control, addressing the permissioning problem arising once multiple parties share a returns ledger (Shittu & Nabil, 2023). Enthusiasm has outrun documented deployment, and most proposed use cases are satisfied by a permissioned shared database with strong identity management; the exceptions are settlement and dispute resolution between parties with no prior trust relationship. A return is a reversal of a payment as much as a movement of goods, and the reverse financial flow is often the slower and more contested. Smart contract automation shows how contractual conditions execute on verified events (Akomolafe et al., 2022) and smart contract dispute resolution addresses disagreement over whether the triggering event occurred (Akomolafe et al., 2024b), both mapping onto marketplace returns where platform, seller, carrier, and buyer routinely dispute condition and receipt. Scalable gateway architectures address throughput at retail volumes (Akomolafe et al., 2024a), interoperability models address the fragmentation making cross-border refund settlement slow and expensive (Adesuyi, Akomolafe, et al., 2023), compliance adaptation models show the binding constraint is usually legal rather than technical (Olaogun et al., 2023), correspondent banking monitoring describes the control architecture any cross-border refund mechanism must satisfy (Okafor et al., 2024), and AI-enabled fraud detection for international payment channels completes the risk picture (Adesuyi et al., 2025a).

Traceability is the substantive requirement blockchain is usually proposed to serve, and it is achievable by other means. Risk-based interdiction models for pharmaceutical distribution set the highest bar (Aneke & Adesemoye, 2021), and data integrity work in regulated life sciences documents failure modes recurring in returns: identifier loss, unrecorded handoffs, and retrospective reconstruction of events never captured contemporaneously (Aneke et al., 2023). The more consequential development is regulatory. The Digital Product Passport creates a mandated, machine-readable product record accessible through a QR code or RFID tag, with a central registry of unique identifiers and metadata planned while detailed data remains decentralised. For reverse logistics this supplies, by legal mandate, an authoritative item-level substrate against which returns can be authenticated, graded, routed, and reported. Research treating the DPP as enabling infrastructure rather than a disclosure exercise is thin, the nearest analogue being ESG-integrated

procurement, which treats a compliance data structure as an operational asset (Okojie, Filani, et al., 2023).

3.7 Generative systems, agentic automation, and model governance

Large language models have enabled capabilities not previously feasible: classifying free-text return reasons at scale into actionable taxonomies, conversational initiation that performs gatekeeping while remaining low-friction, automated adjudication of disputed claims, and synthesis of return-reason data into product and content recommendations, closing a loop between reverse logistics and merchandising that has traditionally been broken. AI-assisted content optimisation operates on the same substrate and addresses the upstream half of the problem, since a large share of returns originates in inadequate product content (Sanni & Attah, 2023b). Agentic systems executing multi-step returns workflows, including disposition routing and secondary-market listing, are emerging ahead of academic treatment; the most relevant work argues that agentic supply chain orchestration requires explicit guardrails and a multi-enterprise data architecture rather than agent capability alone (Ogundairo, 2025), and that autonomous agents force a rethink of how products and services are presented and consumed (Ogundairo & Ayivi-Donkor, 2024b). Process mining supplies the auditability layer, providing a verifiable record of what an automated lifecycle did rather than what it was configured to do (Sanni et al., 2025), while security exposure remains underexamined, since agentic workflows are vulnerable to prompt injection, tool poisoning, memory manipulation, and excessive agency, and a returns agent authorised to issue refunds is an attractive target (Nwakamma et al., 2024b).

Model governance is not optional once models make consequential decisions about individuals. LLM-as-a-judge approaches describe one emerging control pattern (Nwakamma et al., 2024a), multi-agent quality control for regulated documents another (Ominyi et al., 2025a). Human-in-the-loop design is the practical middle path, and human-centred annotation research establishes both its value and its difficulty, including the disagreement problem arising when reviewers do not agree with each other (Ladapo et al., 2024); for adjudication the appropriate design is automated decision with mandatory human review above a value or risk threshold, the threshold itself a governed parameter. Some decisions must be made at the point of physical handling, where connectivity is unreliable and latency budgets tight, which model compression for edge deployment addresses (Oyesiji et al., 2025), with cloud identity and access governance controlling what may invoke those centralised components (Mbonu et al., 2022b).

3.8 Data architecture, security, and enterprise systems

Effective returns management requires joining order data, product master data, logistics events, inspection outcomes, disposition records, and resale realisation, which in most organisations sit in separate systems owned by separate functions and frequently by third parties, so the advances above are gated by integration rather than by model capability. Frameworks integrating IT systems engineering with supply chain operations address this directly (Okonkwo, Ahiaekwe Patrick, et al., 2023), as do national-scale models treating integrated IT and procurement systems as a single design object (Okonkwo et al., 2025), while reviews of procurement strategy, ERP adoption, and logistics performance establish the association between integration and operational outcome (Okonkwo et al., 2024d) and digital supply chain models for cost control describe the mechanism (Okonkwo et al., 2024e). Data protection impact assessment models for multi-cloud financial infrastructure treat control and agility as complements rather than substitutes, the correct framing for a returns system that must be both fast and auditable (Mbonu et al., 2022a). Data sensitivity

classification and regulatory traceability supply the control apparatus (Aliliele et al., 2024a), lakehouse governance architectures address the storage and lineage layer at which returns analytics must sit to be auditable (Aliliele et al., 2025b), returns data is behavioural data about identifiable individuals whose use for risk scoring engages data protection law directly (Ominyi & Anichukwueze, 2022a), and federated approaches offer cross-organisational learning without data pooling, attractive in marketplace settings where sellers will not share raw data (Sanni et al., 2023). Returns platforms are also an under-defended attack surface, holding payment credentials, addresses, purchase histories, and refund authority, and frequently exposed to third parties. The enterprise security literature supplies the control architecture: breach and attack simulation frameworks for continuous control validation establish the baseline (Dosunmu & Ogundele, 2024a), enterprise-scale continuous security validation addresses the perimeter (Dosunmu & Ogundele, 2024c), incident response and digital forensics address containment when prevention fails (Dosunmu & Ogundele, 2021), threat intelligence integration supports proactive posture (Dosunmu & Ogundele, 2022), cyber risk quantification prioritises investment against exposure rather than intuition (Dosunmu & Ogundele, 2024b), and security orchestration and automation accelerate detection and response at returns-scale volumes (Dosunmu & Ogundele, 2025c). Insider threat is a specific concern, since refund authority is a monetisable privilege, and threat actor analysis models for enterprise security planning address it directly (Dosunmu & Ogundele, 2023), with identity-centric zero trust architecture providing the structural response (Ogbole et al., 2021). Enterprise cybersecurity threat-evolution analysis (Okoruwa, Fadayomi, et al., 2024) addresses the design layer. Availability attacks matter operationally, since a returns portal offline during peak converts directly into contact-centre cost, and amplification denial-of-service analysis describes the mechanism and its mitigation (Jimoh & Ahmed, 2024). Where returns facilities run automated material-handling equipment, information and operational technology converge, and the security architecture literature for that convergence applies (Adegbite et al., 2022; Ahmed et al., 2021). Service reliability sits alongside security: predictive capacity planning addresses the peaked compute and staffing demand of returns processing (Edivri & Oteri, 2022), KPI-driven decision frameworks supply the management layer (Edivri & Oteri, 2024). At item level, radio frequency identification remains the most widely deployed technology for automated identification and reconciliation (Yusuf et al., 2023).

3.9 Returns policy, the marketing interface, and return avoidance

Return policy is a marketing instrument with operational consequences. Leniency increases both purchase and return probability, with the net profit effect category- and firm-dependent, and is multi-dimensional across time, monetary, effort, scope, and exchange. The dominant movement since 2023 has been monetary retrenchment, with most large United States retailers applying fees to at least some returns, including label fees around USD 4.95 at Zara and USD 9.95 at Dillard's. This sits in tension with the finding that 82 percent of consumers treat free returns as important, and the resolution most firms adopt is segmentation, preserving free returns for loyalty members, in-store drop-off, exchanges, and defective items. Segmentation requires analytics the marketing literature developed independently, notably predictive lifecycle management, which supplies the customer-value estimates against which differentiation must be evaluated (Ogundairo & Ayivi-Donkor, 2023a). The central measurement difficulty is that the benefit of leniency accrues at purchase and the cost accrues later, often to a different budget, which is the classic attribution problem addressed through multi-touch attribution and models of measurement challenges in marketing return on investment (Sanni, Atima, et al., 2022; Sanni & Atima, 2021a), with data-

centric funnel optimisation as the operational counterpart (Sanni & Wedraogo, 2024). Absent an attribution model spanning purchase and return, policy defaults to the function that owns the cost, producing systematic over-tightening.

Returnless refunds have moved from exception to policy instrument, formalised through Amazon's FBA non-return arrangements and now offered by roughly a third of retailers. The logic is that where fully loaded recovery cost exceeds net recovery value, recovering the item destroys value. Three critiques deserve attention. The **environmental** critique is that eliminating a reverse shipment helps only if the item is used or donated; if discarded, the outcome is disposal of a functional good with no resale possibility, and no published study establishes the retention proportion. The **moral hazard** critique is that algorithmic targeting is learnable, so customers can identify trigger conditions, converting a cost-saving mechanism into systematic leakage, an adversarial-learning problem the fraud literature handles routinely and the returns literature does not (Eboh & Aliliele, 2024). The **transparency** critique is that such policies are undisclosed, discretionary, and inconsistent between customers for identical products, which is commercially defensible but sits uneasily with emerging expectations around algorithmic differentiation (Annan, 2025a; Ominyi & Anichukwueze, 2024). Avoidance remains cheaper than any of this, through richer content and dimensional data, fit recommendation, virtual try-on, and structured feedback routing return-reason data upstream. Predictive segmentation supplies the targeting apparatus, since a nudge delivered to everyone is both expensive and conversion-suppressing (Atima et al., 2022; Oghenemaiga et al., 2024), and adaptive control models for marketing automation in compliance-sensitive environments describe how such interventions can be governed rather than merely deployed (Sanni, Iwuanyanwu, et al., 2022). The feedback loop to merchandising is the most underrated lever, and the adoption-gap literature explains its failure, showing that technically sound supply chain AI fails when the organisational work required for adoption is treated as an afterthought (Ogundairo & Ayivi-Donkor, 2024a).

3.10 Operations, workforce, and organisational capability

The most visible operational innovation of the past five years is the third-party drop-off network: box-free, label-free returns aggregated at retail partners, pharmacies, parcel shops, and lockers, then consolidated for linehaul, which improves unit economics by replacing parcels with freight, removes the packaging burden, and enables immediate refund at drop-off. Buy-online-return-in-store remains the highest-value channel for retailers with physical estates, shifting transport cost to the customer, enabling immediate inspection, allowing same-day local restock, and generating an incremental store visit, offset by store labour consumption and assortment mismatch. Multi-site efficiency frameworks built on data-driven performance indicators supply the apparatus for coordinating this across an estate (Akin-Oluyomi & Akhigbe, 2023b; Akin-Oluyomi, Okoruwa, et al., 2023). Because returns data feeds merchandising, sizing, and supplier quality management, outsourcing the flow without retaining the data creates a durable capability gap, and regulatory-compliant procurement frameworks provide the template for a relationship in which compliance obligations cannot be transferred even when operations are (Okonkwo, Ogunwole, et al., 2021). Returns processing is labour-intensive and violently seasonal, making workforce capability the practical constraint on peak throughput: workforce optimisation frameworks addressing staffing volatility during rapid expansion describe the problem exactly (Falemi et al., 2023b), enterprise risk models integrating human resource strategy with operations address the medium-term response (Falemi et al., 2024), and retention-productivity frameworks matter because grading quality is experience-dependent, so turnover in inspection degrades output invisibly until

secondary-market return rates rise (Falemi et al., 2025). Technology adoption readiness is the complementary constraint, explaining why automation underperforms its business case when the workforce dimension is unmanaged (Akhigbe et al., 2023). Almost the entire returns literature concerns large retailers, yet small and medium-sized sellers face the same return rates with none of the fixed-cost absorption; integrated lean-digital frameworks for scaling small business operations are the closest treatment of proportionate capability at that scale (Eyetsemitan et al., 2025), with sustainable procurement frameworks for local manufacturing making the parallel point on the sourcing side (Efobi et al., 2022a).

3.11 Value recovery, secondary markets, and circularity

Recommerce has shifted from a salvage channel to a designed one, with retailer-operated resale, open-box storefronts, brand-controlled refurbished channels, and business-to-business liquidation absorbing a substantial share of returned inventory, driven by consumer acceptance of used goods, platform infrastructure making single-unit resale viable, and regulatory pressure removing disposal as an option. The strategic risk is cannibalisation, on which evidence is mixed and category-dependent; the opportunity is that a credible resale channel raises the residual value of every unit sold, improving the economics of the original sale, an effect few firms quantify but which retail asset valuation frameworks provide the method to capture (Tonoyan et al., 2023), with multi-vertical platform orchestration describing the ecosystem architecture large resale operations increasingly resemble (Osuji et al., 2024). Where resale is impossible, material recovery becomes terminal and carries its own regulatory complexity: decision frameworks reconciling chemical safety with circular-economy targets for post-consumer recycled polymers show that recycling routes are themselves compliance-constrained and that naive circularity targets can conflict with product safety regulation (Abioye et al., 2023), while green procurement strategies describe the trade-off at the sourcing end, where recoverability is largely determined (Akin-Oluyomi et al., 2023a). Reported disposition outcomes require measurement infrastructure: data-driven evaluation of supplier sustainability metrics supplies the upstream apparatus (Akin-Oluyomi, Okoruwa, et al., 2023), ESG-integrated supply chain models establish the reporting architecture (Okojie, Filani, et al., 2023), quantitative evaluation of ESG adoption in SME supply chains addresses proportionality (Akinleye, 2023), and predictive analytics for emissions and infrastructure risk demonstrates the modelling pattern disposition-level carbon reporting will require (Okojie, Ike, et al., 2023).

3.12 Emerging markets and cross-border reverse flows

The literature's implicit model is a high-wage, parcel-dense, card-payment, developed-market retailer, and it transfers poorly. Where cash on delivery remains prevalent, including much of Sub-Saharan Africa, South Asia, and Southeast Asia, the dominant reverse flow is not the post-delivery return but the refused delivery, which produces a return without a completed transaction, without customer data attached to a payment instrument, and with the entire outbound cost already sunk. Failed-delivery rates in such markets can dwarf post-purchase return rates, and the operational and fraud dynamics differ entirely from those modelled in the mainstream literature. Other structural differences include informal address systems complicating delivery and reverse pickup, fragmented last-mile networks with limited reverse capability, thin formal secondary-market infrastructure alongside large informal resale markets, lower labour costs that shift the automation calculus toward manual processing and make intensive refurbishment rational, and weaker enforcement of statutory return rights. Comparative procurement cost analysis across the United

Kingdom, Nigeria, and other emerging economies quantifies the labour and infrastructure differentials driving these divergences (Akokodaripon et al., 2023), localised supply chain models for community economic development describe the distributed, low-capital network form emerging-market reverse logistics actually takes (Anene & Clement, 2024), and digital procurement transformation and integrated transparency platforms describe the direction of travel as these markets formalise (Okoruwa, Babatope, et al., 2025; Okoruwa, Babatope, et al., 2024). Cross-border returns face customs, duty drawback, VAT recovery, and documentation complexity that frequently makes recovery uneconomic, and direct-from-origin platforms have made this a mass-market problem. The trade law literature is more developed here than the returns literature: frameworks for harmonising digital trade regulation address the fragmentation that makes settlement difficult (Jones & Ominyi, 2024b), applications of artificial intelligence in customs administration describe the emerging automation of clearance processes on which reverse flows depend (Jones & Ominyi, 2024a), market access research on free trade agreements and duty preference programmes explains why returns economics differ sharply between corridors (Jones & Ominyi, 2022b). The payments and banking literature adds further mechanism: value-chain automation analysis using queueing methods describes how throughput and cost avoidance are jointly determined in logistics operations (Akinola et al., 2024), fintech-enabled transaction banking demonstrates the infrastructure on which marketplace seller refunds depend (Okafor et al., 2021), high-throughput digital collections platforms describe the scale requirement for refund processing (Osuji et al., 2021), predictive analytics for anti-money laundering detection describes the transaction-monitoring apparatus refund channels also require (Atakpa, 2021), and market research frameworks for highly regulated service sectors address the statutory constraints that define the outer bound of policy design across jurisdictions (Sanni & Attah, 2023c).

3.13 Sustainability, regulation, and compliance

Reverse logistics is the operational precondition for circularity: without a functioning recovery mechanism, the reuse, repair, refurbish, remanufacture, and recycle hierarchy is aspirational. E-commerce returns are distinctive because recovered goods are frequently in as-new condition, placing them at the top of the value-retention hierarchy. The most important development for the field is the transition of returns handling from private commercial discretion to regulated obligation. The Ecodesign for Sustainable Products Regulation (EU) 2024/1781 entered into force on 18 July 2024, imposing from that date a general obligation to take reasonable measures to prevent the need to destroy unsold consumer products, with delegated and implementing acts expected to clarify the transparency obligations and the scope of the prohibition. From 19 July 2026 destruction of unsold apparel, clothing accessories, and footwear will be prohibited for large enterprises, extending to medium-sized enterprises from 19 July 2030, with micro and small enterprises exempt; standardised disclosure covering the number and weight of unsold products discarded, the reasons, and the proportion routed to reuse, recycling, and disposal applies from February 2027. The decisive point is definitional: unsold consumer products include goods returned under withdrawal rights, while preparatory steps intended for reuse, recycling, or remanufacturing are not treated as destruction, so a retailer's disposition policy becomes a compliance artefact subject to public disclosure. Textile extended producer responsibility under the revised Waste Framework Directive will require producers to pay a fee for each textile product placed on the EU market from 17 April 2028 at the latest, with used textiles assessed as fit for reuse falling outside the obligation.

Obligations of this kind require organisational readiness most retailers have not built. Systematic review evidence on readiness for the EU Artificial Intelligence Act describes the general pattern, in which firms discover late that compliance requires data they never collected (Ominyi et al., 2024b), regulatory technology frameworks describe the tooling response (Bello et al., 2025), and greenhouse gas disclosure provides the closest analogue for what returns disclosure will feel like in practice: an initially unfamiliar obligation that rapidly becomes a governed process with audit exposure (Ominyi & Anichukwueze, 2022a; Lamidi, 2023). Four implications follow. Disposition optimisation becomes constrained optimisation. Data infrastructure becomes mandatory, since disclosure cannot be met without item-level tracking. Reuse and resale capacity become a compliance requirement rather than a discretionary revenue opportunity. And a competitive asymmetry emerges between firms with mature returns data infrastructure and those facing a capability build under deadline pressure.

3.14 Financial control, working capital, and audit of the reverse flow

Returns are a financial process as much as a physical one. The reverse flow consumes working capital in a distinctive pattern: cash leaves at refund, inventory returns later and at uncertain value, and the firm finances the gap. Data-driven cost management supplies the apparatus for measuring this (Oduleye & Medon, 2021), quantitative models linking financial analysis to enterprise growth establish why the measurement matters strategically (Oduleye & Medon, 2023b), multinational cash flow consolidation with tiered treasury architecture describes how such exposures are managed at group level, relevant because cross-border returns generate foreign exchange exposure on the refund leg (Dada et al., 2021a), and CFO-led strategic finance models address governance where responsibility spans entities (Isiekwu et al., 2021).

Planning and forecasting form a second cluster. Data-analytics-driven financial decision making establishes the framing (Oluwo et al., 2025), integrated predictive analytics for strategic financial forecasting and the alignment of planning analytics with corporate strategy address connecting an operational flow to enterprise plans (Medon & Oduleye, 2024; Lawal & Oduleye, 2021b), capital allocation models supply the investment logic for returns infrastructure (Lawal & Oduleye, 2021a), and decision analytics for sustainable profitability frame the objective (Lawal & Oduleye, 2023a). Behavioural financial analytics is unexpectedly relevant, since returns reserving is a judgement-laden estimate subject to systematic optimism (Lawal & Oduleye, 2023b). Financial planning models for dynamic environments (Medon & Oduleye, 2023) and predictive budgeting using operational and market signals (Adesuyi et al., 2022) apply directly to reserving, while executive financial dashboards and capital efficiency optimisation address the reporting and allocation layers (Walawalkar, Adesuyi, et al., 2025; Walawalkar, Kalu, et al., 2025). Comprehensive financial reporting models strengthen accountability around these estimates (Medon & Oduleye, 2022), and machine learning in underwriting demonstrates replacing judgemental estimates with modelled ones in an adjacent risk-pricing context (Oluwo et al., 2024).

Assurance forms a third cluster, and becomes materially more important once disposition outcomes are publicly disclosed. Quantitative models for assessing compliance risk in emerging economies establish the baseline (Akomolafe et al., 2023b), conceptual models for strengthening audit quality through data analytics supply the design (Ozowara et al., 2025), audit analytics leveraging data science strengthens oversight where fraud exposure is highest (Abetoh & Atakpa, 2024), and integrated cybersecurity risk management and regulatory compliance frameworks describe the resilience objective (Bello et al., 2024). Risk-based auditing (Akomolafe et al., 2023a) and data-driven compliance analytics (Akomolafe et al., 2025) describe the direction of travel,

with comparative review of cross-border compliance frameworks relevant wherever returns disclosure obligations differ by jurisdiction (Agu et al., 2023a). Integrated data management for forecasting accuracy (Agu et al., 2023b) and predictive financial risk assessment (Agu et al., 2025) connect assurance back to the analytics layer, while data-driven procurement risk management extends the logic upstream to the suppliers whose defect rates generate returns (Bello et al., 2023). Automated financial consolidation in multinational corporations (Bola-Sadipe et al., 2023) address reporting infrastructure; public-sector work adds a perspective on statutory reporting discipline and corrective action planning (Ebhojie et al., 2023a); and embedding automated close controls in enterprise systems offers a concrete model for the audit readiness returns disclosure will require (Oyeleye et al., 2025).

3.15 Service platforms, CRM governance, and the returns interface

The returns experience is delivered through a customer relationship management platform, whose engineering and governance determine whether policy is applied consistently. Control frameworks for AI-enabled IT general controls and audit automation are the closest available treatment (Mbonu et al., 2022), risk-based business intelligence architecture addresses integration of returns events with order and customer records (Mbonu et al., 2021a), and enterprise service bus integration patterns address the multi-system reality in which returns data moves between commerce, logistics, and finance platforms (Badmus et al., 2022b). Release discipline matters because returns rules change seasonally and erroneous deployment has immediate financial consequence, which governance frameworks for AI-assisted CRM workflows (Badmus et al., 2025) address. Privacy-by-design role-based security architecture applies directly, since returns records contain sensitive personal data accessible to many service agents (Badmus et al., 2024). Analytically, CRM-based forecasting demonstrates how relationship data supports prediction (Dada et al., 2021b), blockchain-based cross-border data exchange addresses regulatory transparency where returns cross jurisdictions (Kumuyi et al., 2023).

3.16 Synthesis of themes

The strands above resolve into four patterns. **Pattern 1: the capability frontier has moved from algorithms to data.** Prediction, vision, robotics, and generative systems are mature enough for production; what limits realised performance is whether order data, product master data, logistics events, inspection outcomes, disposition records, and resale realisation can be joined at item level (Okonkwo et al., 2024d; Mbonu et al., 2022a; Aliliele et al., 2025b). **Pattern 2: the objective function has changed from cost to constrained value recovery,** since regulation has removed disposal from the feasible set for defined product groups and made disposition a disclosed compliance artefact (Ominyi & Anichukwueze, 2022a; Okojie, Filani, et al., 2023). **Pattern 3: the decisive levers sit outside the function that owns the cost,** with fit and content quality in merchandising, defect rates in supplier quality, fraud exposure in risk, and policy terms in marketing, while the cost lands in operations, which explains both systematic over-tightening and the failure of return-reason data to reach the functions that could act on it (Akin-Oluyomi & Akhigbe, 2023b; Ogundairo & Ayivi-Donkor, 2024a). **Pattern 4: the evidence base is asymmetric,** concentrating where modelling is tractable and thinning where cost concentrates, while practice has scaled interventions carrying almost no independent evaluation.

Strand	Maturity of research	Maturity of practice	Principal binding constraint
Prediction and propensity modelling	High, but offline-evaluated	Moderate to high	Absence of field experimentation
Inspection and grading automation	Low	Moderate, narrow scope	Soft-goods condition assessment
Network design and consolidation	High	High	Assumption drift from outsourced networks
Traceability and Digital Product Passport	Low	Emerging, regulation-driven	Item-level identifier persistence
Agentic automation and adjudication	Very low	Emerging, ahead of research	Governance, auditability, security
Policy design and segmentation	Moderate	High	Attribution across purchase and return
Value recovery and recommerce	Moderate	High	Residual-value measurement
Financial control and assurance	Low	Low	Cost visibility and audit readiness
Regulatory compliance and disclosure	Low	Low, deadline-driven	Item-level disposition tracking
Emerging-market reverse flows	Very low	High but undocumented	Absence of research access

4. Conceptual Framework

Classical models treat the returned item as a cost object and the problem as minimising recovery or disposal cost; closed-loop formulations improve on this by treating returns as a planned input. Neither represents the situation now facing e-commerce retailers, in which the objective is value recovery, the feasible set is legally bounded, the decisive causal levers sit upstream of the reverse flow, and performance is gated by data integration rather than decision quality. The Constrained Value-Recovery (CVR) model represents these four features explicitly, and is offered as an organising framework for future empirical work rather than a tested theory.

Layer 1: Antecedent determinants. Return volume and mix are largely determined before any return occurs, by content quality and dimensional accuracy, sizing information, supplier quality, packaging, delivery reliability and promise accuracy, and policy leniency. These are owned by merchandising, marketing, procurement, and logistics, not by returns operations (Akin-Oluyomi & Akhigbe, 2023b; Ogundairo & Ayivi-Donkor, 2023a).

Layer 2: Flow governance. Eligibility screening, fraud scoring, channel selection, and provisional routing determine the cost trajectory of the item. This is where prediction and policy differentiation are operationalised, and where automated decisions about individuals bring algorithmic accountability into scope (Akinleye & Adeyoyin, 2021; Annan, 2025a; Ominyi & Anichukwueze, 2024).

Layer 3: Physical processing and grading. Transport, consolidation, receipt, inspection, and grading convert an uncertain item into a classified asset with an estimable residual value. This layer holds the labour bottleneck, the automation frontier, and the principal source of variance in realised recovery (Akanbi & Sunday, 2025; Mayo et al., 2021).

Layer 4: Constrained disposition. The terminal decision allocates the graded item to a recovery channel, distinguished by a feasible set exogenously bounded by regulation and an outcome subject to mandatory disclosure (Abioye et al., 2023; Ominyi et al., 2024b).

Enabling substrate. All four layers are gated by item-level identity, event capture, data classification and lineage, model governance, and security. The substrate is a moderator rather than an antecedent: it does not generate value, but it bounds the performance attainable at every layer (Aliliele et al., 2024a; Okonkwo, Ahiaeke Patrick, et al., 2023).

Loop A, learning. Return-reason and grading data flow from Layers 3 and 4 back to Layer 1, informing content correction, sizing revision, supplier intervention, and assortment. In most organisations this loop is broken, the single most consequential structural failure identified here (Ogundairo & Ayivi-Donkor, 2024a; Filani et al., 2022).

Loop B, residual value. Realised recovery values feed back into pricing, sourcing, and policy design, because a credible resale channel raises the expected residual value of every unit sold (Tonoyan et al., 2023).

The framework yields six propositions that are testable with firm-level data.

- **P1.** Firms whose data substrate supports item-level disposition tracking achieve higher recovery rates than comparable firms lacking it, independent of the sophistication of their disposition rules.
- **P2.** The profit effect of policy tightening is non-monotonic and cohort-dependent, turning negative beyond the point at which suppressed returns accompany suppressed purchase frequency among high-value customers.
- **P3.** Where Loop A is instrumented and routed to merchandising, return rate declines through reduced fit and expectation-gap returns with no offsetting reduction in conversion.
- **P4.** The value of propensity modelling is realised only where the prediction is coupled to an experimentally evaluated intervention; offline predictive accuracy is uncorrelated with realised margin improvement.
- **P5.** Under a binding destruction prohibition, the shadow price of the constraint is greatest for categories combining low residual value with high resale-channel friction, and firms respond first by shifting Layer 1 sourcing rather than Layer 4 disposition.
- **P6.** In cash-on-delivery markets, refused-delivery volume dominates post-purchase return volume, and cost per reverse unit is determined principally by delivery attempt economics rather than processing cost.

The model is specified for consumer e-commerce returns in categories where resale is legally and commercially feasible. It does not extend to recalls, to categories where regulation forecloses resale entirely and the model degenerates to a compliance-and-disposal problem (Aneke & Adesemoye, 2025), or to industrial remanufacturing, where the antecedent layer has a different structure.

5. Discussion

5.1 Principal findings

The closed-loop framing remains correct but insufficient. It captures the integration of forward and reverse flows while omitting the legal bounding of the disposition set and the upstream location of causal levers. Prevailing taxonomies are inadequate in one further respect: constructed around the post-purchase return, they have no category for the refused delivery, which is the dominant reverse phenomenon in cash-on-delivery markets.

Capability has advanced substantially and unevenly. Prediction, robotics, and traceability infrastructure are deployable, whereas automated grading of soft goods, agentic adjudication, and digital twins of returns operations are not. Evidence quality lags capability, since almost all predictive work is evaluated offline and much applied work is conceptual rather than validated. The field can demonstrate that returns are predictable; it cannot yet demonstrate that prediction is profitable. Three movements characterise practice since 2022: retrenchment on policy leniency, consolidation of the physical network through third-party drop-off and freight linehaul, and the legitimisation of recommerce as a designed channel. All three are rational responses to cost pressure, but only the second is unambiguously supported by evidence. Meanwhile the dominant models assume conditions that fail across a growing share of global volume. The refused-delivery flow generates a return without a completed transaction, without payment-linked customer data, and with the outbound cost sunk, while lower labour costs invert the automation calculus, making manual processing and deeper refurbishment rational where high-wage markets would automate or liquidate.

5.2 Unresolved challenges

The policy-tightening paradox. Fees suppress return rates, but the net multi-year profit effect is unestablished. Retailers with the most generous policies have long observed that their highest-returning customers are also their highest-spending, so suppressing returns may suppress the purchasing that generated them, and almost no published work follows cohorts long enough to settle this.

The measurement problem. Return rate is the most-cited and least-useful metric, being largely determined by category mix. More decision-relevant metrics include fully loaded cost per return, recovery rate, time-to-resale, and return-adjusted contribution margin at SKU and customer level. Performance intelligence models from large-scale service delivery offer a template for the metric hierarchy returns management lacks (Adelanwa et al., 2023a), and multi-site performance frameworks show how operational margin can be decomposed to site and transaction level (Akin-Oluyomi & Akhigbe, 2023a).

Fraud detection and fairness. Systems that score accounts and deny returns introduce a false-positive problem with direct customer harm and regulatory exposure, yet the literature focuses on detection accuracy rather than the cost of errors or the fairness of outcomes.

Data fragmentation and compliance capability. The advances reviewed are gated by systems integration rather than model capability, as set out in Section 3.8, and disclosure obligations require item-level disposition tracking many firms cannot produce.

Return less refunds. A practice applied at very large scale has no independent evidence base on environmental outcomes, behavioural effects, or fraud interaction, and its environmental credentials depend on an unmeasured retention proportion.

Peak capacity, cross-border complexity, and automated governance. Returns volume peaks weeks after sales volume, coinciding with reduced staffing and heavy inventory, and predictive procurement planning models designed to sustain operational uptime have not been adapted (Okonkwo et al., 2024c). Customs, duty drawback, and VAT recovery frequently make cross-border recovery uneconomic, while adjudication by autonomous systems raises questions of auditability, appeal, and non-discrimination on which practice runs ahead of regulation. Real-time risk dashboards developed for hospital supply chains illustrate the monitoring capability returns operations lack (Filani et al., 2022).

5.3 Reconciling the findings

Two apparent contradictions dissolve under the CVR structure. The disagreement over whether lenient policies are profitable is largely an artefact of measurement boundary: studies observing only the return transaction find leniency costly, while studies observing the customer relationship find it valuable, and locating policy at Layer 1, where effects are jointly determined across purchase and return, implies that any single-transaction evaluation is misspecified. Similarly, studies reach opposite conclusions on the environmental question because they draw the system boundary differently, some counting reverse transport and others the disposition outcome; locating the effect at Layer 4 indicates that disposition outcome rather than reverse mileage is the decision-relevant quantity, which is also the position the regulation has taken.

6. Implications

6.1 Theoretical implications

Reclassifying disposition from an optimisation to a constrained optimisation problem is a change of object rather than a technical refinement: models retaining disposal in the feasible set are misspecified for affected jurisdictions from 2026, and the shadow price of the constraint becomes a quantity of theoretical interest. Identifying the data substrate as a moderator rather than an antecedent explains the persistent gap between demonstrated model performance and realised operational improvement, and generates a falsifiable prediction (P1) distinguishing the data-maturity account from the decision-quality account. The review also extends returns theory to the refused-delivery flow, which has different antecedents, cost structure, and fraud dynamics from the post-purchase return around which the field's constructs were built. A methodological implication follows: the most useful recent advances originated outside reverse logistics narrowly defined, so a field that reads only its own literature will keep rediscovering solved problems while missing the constraints that bind.

6.2 Managerial implications

Measure properly. Replace return rate with fully loaded cost per return, recovery rate, time-to-resale, and return-adjusted margin at SKU and customer level, made operational through

dashboards rather than periodic reporting (Tonoyan et al., 2024b; Sanni & Atima, 2021b). **Avoid.** Invest in content quality, dimensional and fit data, and sizing tools where fit dominates return reasons, and route return-reason data to merchandising and suppliers as a standing process treated as a managed change programme (Ogundairo & Ayivi-Donkor, 2024a). **Gatekeep intelligently.** Apply eligibility, fraud scoring, and routing at initiation, differentiate by customer value and risk, document the logic, and provide an appeal route, with verifiable workflows where multiple parties are involved (Sanni et al., 2024). **Process efficiently.** Convert parcels into freight through consolidation, automate inspection where variety and volume justify it, decide deliberately what to outsource, retain the data in all cases, and manage the workforce dimension explicitly (Falemi et al., 2023b). **Recover value and comply.** Build resale and refurbishment channels ahead of regulatory deadlines rather than in response to them, and build the item-level disposition tracking that both value recovery and disclosure require.

6.3 Policy implications

The effectiveness of the destruction prohibition depends on the quality of disposition data firms must produce, so a regime accepting aggregate estimates will be substantially weaker than one requiring item-level reconciliation, making enforcement a data-architecture question (Ominyi et al., 2024b; Bello et al., 2025). The returnless refund is a visible gap in the regulatory perimeter, transferring disposal responsibility to consumers without disclosure while producing outcomes the destruction framework was designed to prevent. And proportionality deserves attention, since costs marginal for large retailers are prohibitive for smaller sellers, where evidence on ESG adoption suggests undifferentiated obligations produce non-compliance rather than behaviour change (Akinleye, 2023; Efobi et al., 2022a).

7. Limitations

Six limitations bear on how these conclusions should be used. **Coverage:** English-language sources dominate, biasing toward North America, Europe, and Anglophone Africa, and the substantial Chinese-language literature on platform-mediated returns is unrepresented. **Practitioner statistics:** the empirical baseline in Section 3.2 depends on industry research produced by interested parties with undisclosed sample frames and inconsistent definitions, most visibly for fraud incidence and processing cost. **Evidence type:** much adjacent work consists of conceptual frameworks rather than validated implementations, which supports inference about mechanism but not effect size. **Review type:** as a semi-systematic review without a pre-registered protocol, the selection of adjacent literatures reflects judgement about which mechanisms are load-bearing, and no assessment of inter-rater reliability in coding was conducted. **Regulatory currency:** the compliance position depends on delegated and implementing acts that continue to develop. **Status of the framework:** the CVR model is an organising framework, not a tested theory; it has not been validated against firm-level data, its layers have not been operationalised as measurement instruments, and the relative weight of its paths is unknown.

8. Directions for Further Research

The propositions set out in Section 4 and the challenges in Section 5.2 imply an agenda organised around seven themes.

Theme	Priority questions	Suggested methods
Policy and profitability	What is the multi-year effect of return fees and window reduction on cohort lifetime value, by category and segment?	Field experiments; difference-in-differences on natural policy variation; cohort survival analysis
Returnless refunds	What proportion of items are used, donated, or discarded, and what is the true carbon and material outcome?	Consumer panels with validation; life-cycle assessment
Prediction with feedback	Do propensity interventions reduce returns without suppressing conversion?	Randomised field experiments; uplift rather than propensity modelling
Regulation as constraint	How should disposition models be reformulated when disposal is prohibited, and what is the shadow cost?	Constrained optimisation; policy-scenario simulation; compliance case studies
Emerging markets	What are the structure, cost, and fraud dynamics of refused-delivery flows in cash-on-delivery markets?	Platform-partnered empirical studies; process mapping; comparative cases
Fraud and fairness	What is the cost of false positives, and how should detection be evaluated beyond accuracy?	Cost-sensitive evaluation; fairness auditing; customer-response experiments
Digital Product Passport	Can DPP data measurably improve authentication, grading consistency, and disposition routing?	Design-science research; pilot implementation; controlled grading studies

Three cross-cutting recommendations follow. The field needs far more field experimentation and fewer offline model comparisons on convenience datasets; cost accounting for returns needs standardisation, since the inability to compare cost-per-return figures across studies impedes cumulative knowledge; and closer partnerships with platforms and logistics providers are necessary, because the data required to answer the most important questions is held privately and is not obtainable by survey.

9. Conclusion

E-commerce returns are no longer a marginal operational cost. At an estimated 19.3 percent of online sales in the United States in 2025, within a total approaching USD 850 billion, they are a first-order determinant of retail profitability and, increasingly, of regulatory standing.

The field is at an inflection point defined by three simultaneous shifts. Technologically, prediction, vision, robotics, and generative systems have made intelligent returns management feasible rather than aspirational, though the binding constraint is data integration and governance rather than model capability. Commercially, the industry has retreated from unconditional free returns toward segmented, fee-bearing, and algorithmically differentiated policies, and has legitimised the secondary market as a designed channel. Legally, the European Union has converted disposition from a private commercial decision into a regulated and publicly disclosed one.

The literature has not kept pace evenly. Optimisation models continue to assume disposal options regulation has removed, prediction papers continue to evaluate offline what only experiment can settle, returnless refunds have scaled to hundreds of millions of transactions without independent evaluation, and the reverse-flow dynamics of the fastest-growing markets remain almost entirely undocumented. The central reframing recommended here is to stop treating returns as a leakage to be minimised and to start treating them as a designed flow to be optimised for value recovery within regulatory constraints, as formalised in the framework developed above. That change alters the objective function, the metrics, which capabilities are strategic, and what the research agenda should prioritise.

References

- Abetoh, N. F., & Atakpa, M. I. (2024). Audit analytics in healthcare financial oversight: Leveraging data science to strengthen accountability in multilateral grant ecosystems. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, 10(6), 2710-2747. <https://doi.org/10.32628/CSEIT2410791>
- Abioye, R. F., Okojie, J. S., Filani, O. M., Ike, P. N., Idu, J. O. O., Nnabueze, S. B., Okojokwu-Idu, J. O., & Ihwughwavwe, S. I. (2023). Automated ESG reporting in energy projects using blockchain-driven smart compliance management systems. *International Journal of Multidisciplinary Evolutionary Research*, 4(2), 120-129. <https://doi.org/10.54660/IJMER.2023.4.2.120-129>
- Adegbite, M. P., Adebayo, A., & Ahmed, M. O. (2022). A security architecture model for IT and OT convergence in regulated energy networks: Design principles and governance alignment. *International Journal of Computer Science and Mathematical Theory*, 8(2), 81-132. <https://doi.org/10.56201/ijcsmt.v8.no2.2022.pg81.132>
- Adelanwa, A., Basnet, A., & Anene, U. N. (2023a). Data driven digital transformation models for lifecycle performance management in infrastructure delivery. *International Journal of Advanced Multidisciplinary Research and Studies*, 3(6), 2646-2662. <https://doi.org/10.62225/2583049X.2023.3.6.5968>
- Adesuyi, M. O., Walawalkar, G., & Kalu, A. (2022). Predictive budgeting models using operational and market signals. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, 8(5), 818-837. <https://doi.org/10.32628/IJSRCSEIT>
- Adesuyi, M. O., Kalu, A., & Walawalkar, G. (2023). Data-led cost governance in technology-intensive enterprises. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, 9(3), 877-896. <https://doi.org/10.32628/IJSRCSEIT>
- Adesuyi, M. O., Akomolafe, O., Olaogun, B. O., Ndukwe, V. U., & Sakyi, J. K. (2023). Global interoperability model for distributed ledger-based cross-border payment systems. *International Journal of Multidisciplinary Research and Growth Evaluation*, 4(6), 1291-1300. <https://doi.org/10.54660/IJMRGE.2023.4.6.1291-1300>
- Adesuyi, M. O., Akomolafe, O., Olaogun, B. O., Ndukwe, V. U., & Sakyi, J. K. (2025a). AI-enabled fraud detection ecosystem model for securing international payment channels. *International Journal of Advanced Multidisciplinary Research and Studies*, 5(6), 866-882. <https://doi.org/10.62225/2583049X.2025.5.6.5284>
- Agu, M. U., Akomolafe, O., & Bello, A. (2023a). A comparative review of SOX compliance frameworks in cross-border financial auditing. *International Journal of Advanced Multidisciplinary Research and Studies*, 3(6), 2297-2306. <https://doi.org/10.62225/2583049X.2023.3.6.5362>
- Agu, M. U., Akomolafe, O., & Bello, A. (2023b). A review of integrated data management systems for enhancing financial forecasting accuracy. *International Journal of Advanced Multidisciplinary Research and Studies*, 3(6), 2335-2344.
- Agu, M. U., Akomolafe, O., & Bello, A. (2025). Advances in predictive financial risk assessment using Python-based forecasting systems. *International Journal of Computer Science and Mathematical Theory*, 11(11), 131-148. <https://doi.org/10.56201/ijcsmt.vol.11.no11.2025.pg131.148>

- Ahiaeke Patrick, M. C., Okonkwo, C. S., Mayo, W., & Okeke, O. T. (2021). Model for data driven vendor evaluation and bid selection using geospatial intelligence. *Shodhshauryam, International Scientific Refereed Research Journal*, 4(4), 426-443. <https://doi.org/10.32628/SHISRRJ214461>
- Ahmed, M. O., Adegbite, M. P., & Adebayo, A. (2021). Zero trust architecture for operational technology in North American critical infrastructure: A framework for implementation and resilience optimization. *International Journal of Engineering and Modern Technology*, 7(1), 66-113. <https://doi.org/10.56201/ijemt.vol.7.no1.2021.pg66.113>
- Akanbi, O., & Sunday, E. A. (2024). An integrated path-planning and slotting optimization model for AMR-enabled high-density warehousing. *International Journal of Advanced Multidisciplinary Research and Studies*, 4(6), 3226-3243. <https://doi.org/10.62225/2583049X.2024.4.6.6181>
- Akanbi, O., Ganiu, O. S., & Sunday, E. A. (2025). A multi-agent AI framework for swarm intelligence in autonomous mobile robot (AMR) fleet coordination. *International Journal of Scientific Research in Humanities and Social Sciences*, 2(1), 81-109.
- Akanbi, O., & Sunday, E. A. (2025). A systematic review of AI-driven autonomous mobile robots (AMR) in scalable micro-fulfillment centers. *International Journal of Advanced Multidisciplinary Research and Studies*, 5(6), 2363-2379. <https://doi.org/10.62225/2583049X.2025.5.6.6182>
- Akhigbe, R., Falemi, A., & Akin-Oluyomi, O. T. (2023). A conceptual model for improving customer experience using workforce behavior and real-time operational data. *International Journal of Multidisciplinary Research and Growth Evaluation*, 4(6), 1322-1338. <https://doi.org/10.54660/ijmrge.2023.4.6.1322-1338>
- Akin-Oluyomi, O. T., Okoruwa, P. O., Babatope, O. M., & Akokodaripon, D. A. (2023). Evaluating supplier sustainability metrics through data-driven procurement and supply chain frameworks. *International Journal of Advanced Multidisciplinary Research and Studies*, 3(6), 2213-2223.
- Akin-Oluyomi, O. T., Atima, M. E., & Akinleye, O. K. (2023a). Green procurement strategies for balancing cost efficiency with long-term environmental responsibility. *International Journal of Advanced Multidisciplinary Research and Studies*, 3(6), 2183-2193.
- Akin-Oluyomi, O. T., & Akhigbe, R. (2023a). An advanced framework for improving multi-site operational efficiency using data-driven performance indicators. *International Journal of Advanced Multidisciplinary Research and Studies*, 3(1), 1763-1781. <https://doi.org/10.62225/2583049X.2023.3.1.5343>
- Akin-Oluyomi, O. T., & Akhigbe, R. (2023b). A conceptual supply chain leadership model for aligning logistics decisions with enterprise strategy. *International Journal of Advanced Multidisciplinary Research and Studies*, 3(1), 1725-1744. <https://doi.org/10.62225/2583049X.2023.3.1.5340>
- Akin-Oluyomi, O. T., & Akhigbe, R. (2023c). A proposed supply chain analytics framework for improving forecasting accuracy and reducing bottlenecks. *International Journal of Advanced Multidisciplinary Research and Studies*, 3(1), 1686-1703. <https://doi.org/10.62225/2583049X.2023.3.1.5338>
- Akin-Oluyomi, O. T., Atima, M. E., & Akinleye, O. K. (2024). Cross-border supplier relationship management frameworks for pharmaceutical and global construction sectors. *International Journal of Multidisciplinary Research and Growth Evaluation*, 5(6), 1709-1718.

- Akinlade, O. F., Filani, O. M., & Nwachukwu, P. S. (2024). Automation and digital twins framework reducing procurement errors and turnaround time. *International Journal of Scientific Research in Humanities and Social Sciences*, 1(1), 197-216.
- Akinleye, O. K., & Adeyoyin, O. (2021). Process automation framework for enhancing procurement efficiency and transparency. *Shodhshauryam, International Scientific Refereed Research Journal*, 4(4), 356-387.
- Akinleye, O. K., & Adeyoyin, O. (2022a). A negotiation optimization model for reducing procurement costs in manufacturing firms. *Shodhshauryam, International Scientific Refereed Research Journal*, 5(5), 398-435. <https://doi.org/10.32628/SHISRRJ225891>
- Akinleye, O. K., Okoruwa, P. O., Babatope, O. M., & Akokodaripon, D. A. (2023). Leveraging big data and business intelligence for optimization of manufacturing sector procurement. *International Journal of Advanced Multidisciplinary Research and Studies*, 3(6), 2164-2172.
- Akinleye, O. K. (2023). Framework for quantitative evaluation of ESG adoption within SME supply chains in emerging economies. *International Journal of Advanced Multidisciplinary Research and Studies*, 3(6), 2317-2334.
- Akinleye, O. K. (2024). A sustainable procurement and resilience framework for post-pandemic pharmaceutical operations. *International Journal of Advanced Multidisciplinary Research and Studies*, 4(1), 1602-1621.
- Akinola, A. S., Adesanya, O. S., Okafor, C. M., & Dako, O. F. (2024). Value-chain automation in beverage logistics: Throughput, capacity, and cost avoidance via queueing models. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, 10(4), 1112-1132.
- Akokodaripon, D. A., Akinleye, O. K., Okoruwa, P. O., & Babatope, O. M. (2023). Procurement cost optimization strategies: Comparative analyses across UK, Nigeria, and emerging economies. *International Journal of Advanced Multidisciplinary Research and Studies*, 3(6), 2224-2234.
- Akomolafe, O., Olaogun, B. O., Adesuyi, M. O., Ndukwe, V. U., & Sakyi, J. K. (2022). Smart contract automation model for supplier payment systems and performance benchmarking. *International Journal of Multidisciplinary Research and Growth Evaluation*, 3(6), 827-836. <https://doi.org/10.54660/IJMRGE.2022.3.6.827-836>
- Akomolafe, O., Agu, M. U., & Bello, A. (2023a). A conceptual model for implementing risk-based auditing in strategic financial management. *International Journal of Advanced Multidisciplinary Research and Studies*, 3(6), 2274-2286. <https://doi.org/10.62225/2583049X.2023.3.6.5359>
- Akomolafe, O., Agu, M. U., & Bello, A. (2023b). A quantitative conceptual model for assessing compliance risk in emerging economies. *International Journal of Advanced Multidisciplinary Research and Studies*, 3(6), 2287-2296. <https://doi.org/10.62225/2583049X.2023.3.6.5360>
- Akomolafe, O., Olaogun, B. O., Adesuyi, M. O., Ndukwe, V. U., & Sakyi, J. K. (2024a). Scalable blockchain payment gateway architecture model for enterprise-grade adoption. *International Journal of Advanced Multidisciplinary Research and Studies*, 4(1), 1552-1568. <https://doi.org/10.62225/2583049X.2024.4.1.5280>
- Akomolafe, O., Olaogun, B. O., Adesuyi, M. O., Ndukwe, V. U., & Sakyi, J. K. (2024b). Smart contract-based dispute resolution model for international supplier payments. *International*

- Journal of Advanced Multidisciplinary Research and Studies*, 4(1), 1582-1601.
<https://doi.org/10.62225/2583049X.2024.4.1.5282>
- Akomolafe, O., Agu, M. U., & Bello, A. (2025). A conceptual model for advancing risk governance through data-driven compliance analytics in financial institutions. *Journal of Accounting and Financial Management*, 11(11), 211-228.
<https://doi.org/10.56201/jafm.vol.11.no11.2025.pg211.228>
- Aliliele, C., Eboh, E. E., & Oluwo, K. (2024). Advances in variance analytics for cost control in manufacturing and industrial enterprises. *International Journal of Advanced Multidisciplinary Research and Studies*, 4(6), 3163-3185.
<https://doi.org/10.62225/2583049X.2024.4.6.6012>
- Aliliele, C., Mbonu, I. S., & Iwuanyanwu, U. (2024a). A conceptual framework for enterprise data sensitivity classification and regulatory traceability mechanisms. *International Journal of Advanced Multidisciplinary Research and Studies*, 4(6), 3103-3124.
<https://doi.org/10.62225/2583049X.2024.4.6.5991>
- Aliliele, C., Mbonu, I. S., Uzoka, E., & Iwuanyanwu, U. (2025b). Advances in data lakehouse governance architectures for enterprise data loss prevention and compliance assurance. *Shodhshauryam, International Scientific Refereed Research Journal*, 8(4), 171-213.
<https://doi.org/10.32628/SHISRRJ258474>
- Ambali, K. B., Eyetsemitan, R. A., Oyeleye, A. O., & Fadayomi, O. (2021). Lean Six Sigma for small enterprises: A systematic review and Lite-DMAIC adaptation framework for resource-constrained organizations. *Iconic Research and Engineering Journals*, 5(5), 562-583. <https://doi.org/10.64388/IREV5I5-1716957>
- Aneke, O. B., & Adesemoye, A. C. (2021). Reframing trade and import compliance: A conceptual model for risk-based interdiction of illicit medical products. *International Journal of Scientific Research in Science and Technology*, 8(6), 1226-1248.
- Aneke, O. B., Sydney, E., & Adesemoye, A. C. (2023). Data integrity and governance in regulated life sciences operations: A review of failures, controls, and remediation strategies. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, 9(10), 538-568.
- Aneke, O. B., & Adesemoye, A. C. (2025). Advances in cold chain integrity and good distribution practice for temperature-sensitive pharmaceuticals. *International Journal of Health and Pharmaceutical Research*, 10(3), 99-137.
- Anene, U. N., & Clement, T. (2022). A resilient logistics framework for humanitarian supply chains: Integrating predictive analytics, IoT, and localized distribution to strengthen emergency response systems. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, 8(5), 398-424.
- Anene, U. N., & Clement, T. (2024). Localized supply chain solutions for sustainable community development: A strategic model for economic revitalization and regional resilience. *International Journal of Scientific Research in Science and Technology*, 11(5).
- Anichukwueze, C. C., Osuji, V. C., & Oguntegbe, E. E. (2021). Blockchain-based architectures for tamper-proof regulatory recordkeeping and real-time audit readiness. *International Journal of Multidisciplinary Research and Growth Evaluation*, 2(6), 485-504.
- Annan, A. O. (2024). Algorithmic accountability and trade secret protection in artificial intelligence. *Shodhshauryam, International Scientific Refereed Research Journal*, 7(5), 315-347.

- Annan, A. O. (2025a). Automated decision-making and anti-discrimination compliance under U.S. law. *International Journal of Advanced Multidisciplinary Research and Studies*, 5(2), 2522-2540.
- Appriss Retail, & Deloitte. (2024). *Consumer returns in the retail industry 2024*. Appriss Retail.
- Arumosoye, O. M., & Obriki, O. D. (2021). Organizational learning-based conceptual maturity model for continuous safety performance improvement. *International Journal of Multidisciplinary Research and Growth Evaluation*, 2(1), 970-980. <https://doi.org/10.54660/IJMRGE.2021.2.1.970-980>
- Atakpa, M. I. (2021). A review of predictive analytics models for anti-money laundering detection in commercial banking systems. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, 7(2), 778-804. <https://doi.org/10.32628/CSEIT2064813>
- Atakpa, M. I., & Abetoh, N. F. (2022). A systematic review of machine learning advances in financial fraud detection for banking systems. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, 8(2), 771-801. <https://doi.org/10.32628/CSEIT23906220>
- Atakpa, M. I., & Fobellah, A. N. (2023). Anomaly detection in financial time-series data: A conceptual model for healthcare and banking applications. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, 9(2), 967-997. <https://doi.org/10.32628/CSEIT2342441>
- Atima, M. E., Sanni, J. O., & Attah, A. (2022). Predictive audience segmentation models resolving targeting inefficiencies in regulated professional service enterprises. *Shodhshauryam, International Scientific Refereed Research Journal*, 5(1), 271-303. <https://doi.org/10.32628/SHISRRJ247134>
- Badmus, O., Jooda, D., Ozowara, D. E., & Anunagba, C. O. (2022b). A systematic review of MuleSoft ESB integration patterns in multi-cloud Salesforce architectures. *Gyanshauryam, International Scientific Refereed Research Journal*, 5(3), 462-481.
- Badmus, O., Jooda, D., & Anunagba, C. O. (2024). A privacy-by-design framework for role-based security architecture in Salesforce environments handling sensitive personal data. *International Journal of Advanced Multidisciplinary Research and Studies*, 4(6), 3244-3254. <https://doi.org/10.62225/2583049X.2024.4.6.6243>
- Badmus, O., Dosunmu, A. A., & Anunagba, C. O. (2025). A governance framework for AI-assisted CRM workflows: Agentforce deployment, risk management, and organizational readiness in enterprise Salesforce environments. *International Journal of Scientific Research in Humanities and Social Sciences*, 2(1), 59-80.
- Basnet, A., Oghenemaiga, E., & Anene, U. N. (2021). Audience segmentation and forecasting models for enhancing targeted digital marketing effectiveness. *Shodhshauryam, International Scientific Refereed Research Journal*, 4(5), 279-305.
- Basnet, A., Oghenemaiga, E., & Anene, U. N. (2024). Attribution, revenue, and yield optimization models using Google Ad Manager reporting and forecasting tools. *International Journal of Advanced Multidisciplinary Research and Studies*, 4(6). <https://doi.org/10.62225/2583049X.2024.4.6.5667>
- Bello, A., Akomolafe, O., & Agu, M. U. (2023). A conceptual framework for data-driven procurement risk management in multinational enterprises. *International Journal of Advanced Multidisciplinary Research and Studies*, 3(6), 2307-2316. <https://doi.org/10.62225/2583049X.2023.3.6.5363>

- Bello, A. D., Elebe, O., Hammed, N. I., Omoegun, G. O., & Fadayomi, O. (2024). A cybersecurity risk management and regulatory compliance framework for financial institutions. *Iconic Research and Engineering Journals*. <https://www.irejournals.com/paper-details/1713553>
- Bello, A. D., Elebe, O., Hammed, N. I., Okoruwa, P. O., Fadayomi, O., & Omoegun, G. O. (2025). An advanced regulatory technology framework for improving financial transparency and fraud reporting accuracy. *International Journal of Advanced Multidisciplinary Research and Studies*, 5(6).
- Bola-Sadipe, D., Aliliele, C., & Odihi, F. (2023). Conceptual model for automated financial consolidation and transparency in multinational corporations. *Gyanshauryam, International Scientific Refereed Research Journal*, 6(6), 414-455. <https://doi.org/10.32628/GISRRJ236645>
- Dada, T., Isiekwu, C. P., & Oluwo, K. (2021a). Advances in multinational cash flow consolidation and FX risk control using tiered treasury architecture. *Iconic Research and Engineering Journals*, 4(11), 601-620. <https://doi.org/10.64388/IREV4111-1714351>
- Dada, T., Isiekwu, C. P., & Oluwo, K. (2021b). Designing CRM-based sales forecasting models for multichannel lending institutions. *Iconic Research and Engineering Journals*, 5(3), 451-466. <https://doi.org/10.64388/IREV5I3-1714352>
- Dosunmu, A. A., & Ogundele, P. O. (2021). Incident response and digital forensics strategies for rapid cyber attack containment. *Gyanshauryam, International Scientific Refereed Research Journal*, 4(4), 239-258.
- Dosunmu, A. A., & Ogundele, P. O. (2022). Threat intelligence integration frameworks supporting proactive enterprise cybersecurity decision making. *Gyanshauryam, International Scientific Refereed Research Journal*, 5(3), 397-416.
- Dosunmu, A. A., & Ogundele, P. O. (2023). Cyber threat actor analysis models for strategic enterprise security planning. *Shodhshauryam, International Scientific Refereed Research Journal*, 6(5), 513-531.
- Dosunmu, A. A., & Ogundele, P. O. (2024a). Breach and attack simulation frameworks for continuous validation of enterprise security controls. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, 10(3), 1100-1119.
- Dosunmu, A. A., & Ogundele, P. O. (2024b). Cyber risk quantification models for prioritizing enterprise security investment decisions. *International Journal of Multidisciplinary Research and Growth Evaluation*, 5(6), 1777-1785. <https://doi.org/10.54660/IJMRGE.2024.5.6.1777-1785>
- Dosunmu, A. A., & Ogundele, P. O. (2024c). Enterprise scale continuous security validation models for regulated digital infrastructures. *International Journal of Scientific Research in Humanities and Social Sciences*, 1(2), 929-945.
- Dosunmu, A. A., & Ogundele, P. O. (2025c). Security orchestration and automation models for accelerating incident detection and response. *Computer Science and IT Research Journal*, 6(11), 878-894. <https://doi.org/10.51594/csitrj.v6i11.2163>
- Ebhojie, O., Dogbatsey, E. A., & Oyeleye, A. O. (2023a). Audit liaison, corrective action planning, and control compliance in multinational organisations: A systematic literature review. *International Journal of Advanced Multidisciplinary Research and Studies*, 3(6), 2839-2850. <https://doi.org/10.62225/2583049X.2023.3.6.6200>
- Eboh, E. E., & Aliliele, C. (2024). AI-driven data analytics framework for risk assessment and detection of venture capital and private equity investment fraud in U.S. capital markets.

- International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, 10(6), 2624-2665. <https://doi.org/10.32628/CSEIT2410787>
- Edivri, J., & Oteri, O. (2022). Predictive capacity planning and resource utilization forecasting models for multi-program and multi-stakeholder IT portfolios. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, 8(4), 826-845.
- Edivri, J., & Oteri, O. (2024). A conceptual KPI-driven decision and optimization framework for IT service delivery, portfolio performance, and adoption. *Gyanshauryam, International Scientific Refereed Research Journal*, 7(1), 167-187. <https://doi.org/10.32628/GISRRJ246643>
- Efobi, O. Z., Akinleye, O. K., & Fasawe, O. (2021). Framework for data-driven operations management and performance improvement in educational institutions. *Gyanshauryam, International Scientific Refereed Research Journal*, 4(6), 127-158.
- Efobi, O. Z., Akinleye, O. K., & Fasawe, O. (2022a). Conceptual framework for sustainable procurement practices in local manufacturing enterprises in Africa. *Gyanshauryam, International Scientific Refereed Research Journal*, 5(6), 248-266.
- Efobi, O. Z., Akinleye, O. K., & Fasawe, O. (2022b). Conceptual model for data-driven lean supply chain optimization in manufacturing and retail operations. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, 8(2), 703-734. <https://doi.org/10.32628/CSEIT2541335>
- Efobi, O. Z., Akinleye, O. K., & Fasawe, O. (2023). Conceptual framework for developing a resilience index for post-pandemic supply chains. *Shodhshauryam, International Scientific Refereed Research Journal*, 6(2), 421-432.
- Ekun, K., & Muriel, A. (2024). Online lead time quotation under contingency. In A. Brown Greer, C. Contardo, & J.-M. Frayret (Eds.), *Proceedings of the IISE Annual Conference & Expo 2024*. https://doi.org/10.21872/2024IISE_6090
- Ekwunife, D. I., Precious, O. T., Rasul, O. A., Akinlade, O. F., Nwokoro, T. O., & Ikpe, V. I. (2024). Using blockchain technology to maximize supply chain and logistics management in North America. *International Journal of Science and Research Archive*, 12(2), 854-863.
- Elebe, O., Hammed, N. I., Omoegun, G. O., Fadayomi, O., & Bello, A. D. (2023). An advanced machine learning model for detecting synthetic identity fraud in e-commerce platforms. ResearchGate.
- European Union. (2024). Regulation (EU) 2024/1781 of the European Parliament and of the Council of 13 June 2024 establishing a framework for the setting of ecodesign requirements for sustainable products. *Official Journal of the European Union*, L 2024/1781.
- European Union. (2025). Directive amending Directive 2008/98/EC on waste, as regards extended producer responsibility for textiles. *Official Journal of the European Union*.
- Eyetsemitan, R. A., Oyeleye, A. O., Ambali, K. B., & Fadayomi, O. (2022). Standard operating procedures as strategic assets in small business operations: A systematic review and implementation framework. *Gyanshauryam, International Scientific Refereed Research Journal*, 5(2), 438-465. <https://doi.org/10.32628/GISRRJ225356>
- Eyetsemitan, R. A., Oyeleye, A. O., Ambali, K. B., & Fadayomi, O. (2024b). Data-driven process optimization in micro-enterprises: A conceptual framework for funnel analysis and bottleneck identification. *International Journal of Multidisciplinary Research and Growth Evaluation*, 5(6), 1950-1968. <https://doi.org/10.54660/IJMRGE.2024.5.6.1950-1968>

- Eyetsemitan, R. A., Ambali, K. B., Oyeleye, A. O., & Fadayomi, O. (2025). An integrated lean-digital framework for scaling small business operations: Synthesizing SOP design, automation, compliance, and change management. *International Journal of Multidisciplinary Research and Growth Evaluation*, 6(6), 1341-1360. <https://doi.org/10.54660/IJMRGE.2025.6.6.1341-1360>
- Eze, F. I., Anene, U. N., & Akinleye, O. K. (2023). Pharmaceutical supply chain governance, environmental risk management, and sustainable access to essential medicines in emerging economies: The PSCG-ERM framework. *International Journal of Health and Pharmaceutical Research*, 8(4), 192-241. <https://doi.org/10.56201/ijhpr.v8.no4.2023.pg192.241>
- Ezeugwa, E. C., Oluokun, O. A., & Ogunnowo, E. (2023a). Lean Six Sigma based model for process optimization in manufacturing systems. *International Journal of Advanced Multidisciplinary Research and Studies*, 3(4), 1268-1285. <https://doi.org/10.62225/2583049X.2023.3.4.4882>
- Fadayomi, O., Bello, A. D., Elebe, O., Hammed, N. I., & Omoegun, G. O. (2024). An adaptive fraud risk scoring model for real-time transaction monitoring at scale. *IIARD International Journal of Banking and Finance Research*, 10(10), 212-230.
- Falemi, A., Akhigbe, R., & Akin-Oluyomi, O. T. (2023b). A supply chain workforce optimization framework for addressing staffing volatility during rapid expansion cycles. *International Journal of Advanced Multidisciplinary Research and Studies*, 3(1), 1745-1762. <https://doi.org/10.62225/2583049X.2023.3.1.5342>
- Falemi, A., Akhigbe, R., & Akin-Oluyomi, O. T. (2024). A conceptual enterprise risk management model that integrates HR strategy with operational analytics. *International Journal of Multidisciplinary Research and Growth Evaluation*, 5(6), 1730-1753. <https://doi.org/10.54660/ijmrge.2024.5.6.1730-1753>
- Falemi, A., Akhigbe, R., & Akin-Oluyomi, O. T. (2025). A proposed operational growth framework linking leadership effectiveness with measurable business outcomes. *International Journal of Multidisciplinary Research and Growth Evaluation*, 6(6), 1081-1102. <https://doi.org/10.54660/ijmrge.2025.6.6.1081-1102>
- Filani, O. M., Nnabueze, S. B., Ike, P. N., & Wedraogo, L. (2022). Real-time risk assessment dashboards using machine learning in hospital supply chain management systems. *International Journal of Multidisciplinary Evolutionary Research*, 3(1), 65-76. <https://doi.org/10.54660/IJMER.2022.3.1.65-76>
- Guide, V. D. R., & Van Wassenhove, L. N. (2009). The evolution of closed-loop supply chain research. *Operations Research*, 57(1), 10-18.
- Ike, P. N., Ogbuefi, E., Nnabueze, S. B., Olatunde-Thorpe, J., Aifuwa, S. E., Oshoba, T. O., & Akokodaripon, D. (2022). Lean supply chain practices improving operational efficiency, reducing waste, and enhancing organizational competitiveness globally. *Journal of Frontiers in Multidisciplinary Research*, 3(2), 182-192. <https://doi.org/10.54660/IJFMR.2022.3.2.182-192>
- Ike, P. N., Okojie, J. S., Nnabueze, S. B., Idu, J. O. O., Filani, O. M., & Ihwughwawwe, S. I. (2025). Digital twin-driven environmental compliance models for sustainable procurement in oil, gas, and utilities. *International Journal of Advanced Multidisciplinary Research and Studies*, 5(5), 562-576.

- Isiekwu, C. P., Oluwo, K., & Dada, T. (2021). A conceptual model for CFO-led strategic finance in joint venture and cross-border partnerships. *Iconic Research and Engineering Journals*, 4(7), 383-400. <https://doi.org/10.64388/IREV417-1714350>
- Jimoh, H. O., & Ahmed, M. O. (2024). Analyzing Network Time Protocol (NTP) based amplification DDoS attack and its mitigation techniques. *Journal of Digital Innovations and Contemporary Research in Science, Engineering and Technology*, 12(2), 17-24. <https://doi.org/10.22624/AIMS/DIGITAL/V11N2P2x>
- Jones, B. C., & Ominyi, M. (2022b). Toward a conceptual framework for agricultural export promotion under the African Continental Free Trade Area. *IIARD Journal of Business and African Economy*, 8(1), 88-118. <https://doi.org/10.56201/jbae.v8.no1.2022.pg88.118>
- Jones, B. C., & Ominyi, M. (2024a). Applications of artificial intelligence in customs administration and trade facilitation: A review. *World Journal of Innovation and Modern Technology*, 8(6), 181-217. <https://doi.org/10.56201/wjimt.v8.no6.2024.pg181.217>
- Jones, B. C., & Ominyi, M. (2024b). A conceptual framework for harmonizing digital trade regulations in cross-border e-commerce between the United States and Nigeria. *International Journal of Economics and Financial Management*, 9(9), 337-364. <https://doi.org/10.56201/ijefm.v9.no9.2024.pg337.364>
- Kumuyi, O., Akeju, B., Uzoka, E., & Ozowara, D. E. (2023). Framework for blockchain-based cross-border data exchange and regulatory transparency. *International Journal of Multidisciplinary Futuristic Development*, 4(1), 99-113.
- Ladapo, O. O., Jooda, D., Dosunmu, A. A., & Abolaji, T. O. (2024). Keeping humans in the loop: Human-centered automated annotation with generative AI. *International Journal of Multidisciplinary Futuristic Development*, 5(1), 81-95. <https://doi.org/10.54660/IJMFD.2024.5.1.81-95>
- Lamidi, O. B. A. (2023). Comprehensive evaluation model for improving carbon accounting accuracy in corporate sustainability programs. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, 10(1), 825-853. <https://doi.org/10.32628/IJSRCSEIT>
- Lawal, O. A., & Oduleye, T. E. (2021a). A conceptual decision model for capital allocation using financial analytics. *Gyanshauryam, International Scientific Refereed Research Journal*, 4(2), 269-295.
- Lawal, O. A., & Oduleye, T. E. (2021b). Aligning financial planning analytics with corporate strategy: A conceptual integration model. *Shodhshauryam, International Scientific Refereed Research Journal*, 4(3), 319-346.
- Lawal, O. A., & Oduleye, T. E. (2023a). A review of decision analytics models for sustainable profitability in technology firms. *Gyanshauryam, International Scientific Refereed Research Journal*, 6(6), 455-475.
- Lawal, O. A., & Oduleye, T. E. (2023b). Behavioral financial analytics: A conceptual model for explaining enterprise performance. *International Journal of Advanced Multidisciplinary Research and Studies*, 3(6), 2590-2604.
- Mayo, W., Ogbale, J. I., Okoruwa, P. O., & Babatope, O. M. (2021). Designing an AI-predictive maintenance model for e-commerce systems using machine learning and cloud analytics. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, 7(5), 416-440. <https://doi.org/10.32628/IJSRCSEIT>
- Mbonu, I. S., Aliliele, C., Iwuanyanwu, U., & Uzoka, E. (2021a). A conceptual framework for risk based business intelligence architecture in financial technology platforms. *International*

- Journal of Multidisciplinary Research and Growth Evaluation*, 2(6), 731-746.
<https://doi.org/10.54660/IJMRGE.2021.2.6.731-746>
- Mbonu, I. S., Aliliele, C., Iwuanyanwu, U., & Uzoka, E. (2022). A conceptual framework for AI enabled IT general controls and SOX audit automation processes. *Gyanshauryam, International Scientific Refereed Research Journal*, 5(5), 384-414.
<https://doi.org/10.32628/GISRRJ2256239>
- Mbonu, I. S., Iwuanyanwu, U., Aliliele, C., & Uzoka, E. (2022a). A review of data protection impact assessment models in multi cloud financial infrastructure systems. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, 8(1), 589-623. <https://doi.org/10.32628/CSEIT25442>
- Mbonu, I. S., Iwuanyanwu, U., Aliliele, C., & Uzoka, E. (2022b). Advances in cloud identity and access governance optimization in large scale AWS enterprise environments. *Shodhshauryam, International Scientific Refereed Research Journal*, 5(3), 403-438.
<https://doi.org/10.32628/SHISRRJ225490>
- Medon, J. J., & Oduleye, T. E. (2022). A comprehensive financial reporting model for strengthening compliance and organizational accountability systems. *International Journal of Multidisciplinary Research and Growth Evaluation*, 3(6), 768-777.
- Medon, J. J., & Oduleye, T. E. (2023). Developing a financial planning model for sustainable profitability in dynamic business environments. *Shodhshauryam, International Scientific Refereed Research Journal*, 6(3), 418-447. <https://doi.org/10.32628/SHISRRJ236926>
- Medon, J. J., & Oduleye, T. E. (2024). An integrated predictive analytics model for enhancing strategic financial forecasting and decision accuracy. *Gyanshauryam, International Scientific Refereed Research Journal*, 7(3), 258-279.
<https://doi.org/10.32628/GISRRJ247322>
- National Retail Federation, & Happy Returns. (2025). *2025 retail returns landscape*. Washington, DC: National Retail Federation.
- Nnabueze, S. B., Ike, P. N., Olatunde-Thorpe, J., Aifuwa, S. E., Oshoba, T. O., Ogbuefi, E., & Akokodaripon, D. (2021). End-to-end visibility frameworks improving transparency, compliance, and traceability across complex global supply chain operations. *International Journal of Multidisciplinary Futuristic Development*, 2(2), 50-60.
<https://doi.org/10.54660/IJMFD.2021.2.2.50-60>
- Nwakamma, S., Ojukwu, J., & Oyesiji, S. O. (2024a). LLM-as-a-judge for automated model governance: A review of methods, biases, and release-gating practices. *World Journal of Innovation and Modern Technology*, 8(6), 185-216.
<https://doi.org/10.56201/wjimt.v8.no6.2024.pg185.216>
- Nwakamma, S., Ojukwu, J., & Oyesiji, S. O. (2024b). Securing agentic AI enterprise workflows against prompt injection, tool poisoning, memory manipulation, and excessive agency threats. *World Journal of Innovation and Modern Technology*, 8(6), 217-248.
<https://doi.org/10.56201/wjimt.v8.no6.2024.pg217.248>
- Obogo, S. F., Arumosoye, O. M., & Obriki, O. D. (2021). Advances in proactive hazard recognition and near miss reporting systems. *International Journal of Multidisciplinary Research and Growth Evaluation*, 2(6), 835-846.
<https://doi.org/10.54660/IJMRGE.2021.2.6.835-846>
- Obriki, O. D., & Arumosoye, O. M. (2022). Conceptual framework explaining recurrence mechanisms of unsafe behaviors in high-hazard worksites. *Shodhshauryam, International*

- Scientific Refereed Research Journal*, 5(3), 380-402.
<https://doi.org/10.32628/SHISRRJ225489>
- Obriki, O. D., Arumosoye, O. M., & Obogo, S. F. (2023). Advances in continuous hazard monitoring systems for workplace safety. *International Journal of Advanced Multidisciplinary Research and Studies*, 3(6), 2742-2759.
<https://doi.org/10.62225/2583049X.2023.3.6.6075>
- Obriki, O. D., & Arumosoye, O. M. (2023). Conceptual framework for proactive hazard identification using digital safety data streams. *Gyanshauryam, International Scientific Refereed Research Journal*, 6(3), 457-481. <https://doi.org/10.32628/GISRRJ236336>
- Oduleye, T. E., & Medon, J. J. (2021). A data-driven cost management model for improving strategic financial planning and performance evaluation. *International Journal of Multidisciplinary Research and Growth Evaluation*, 2(6), 524-537.
- Oduleye, T. E., & Medon, J. J. (2023b). A quantitative model for measuring the strategic impact of financial analysis on enterprise growth. *International Journal of Advanced Multidisciplinary Research and Studies*, 3(1), 1663-1672.
<https://doi.org/10.62225/2583049X.2023.3.1.5334>
- Ogbole, J. I., Okoruwa, P. O., Fadayomi, O., Abolaji, T. O., Edivri, J., & Akeju, B. (2021). Conceptual model for identity-centric zero trust architecture in enterprise security governance. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, 7(5), 393-415.
<https://doi.org/10.32628/IJSRCSEIT217562>
- Oghenemaiga, E., Basnet, A., & Anene, U. N. (2024). Predictive analytics applications for forecasting traffic patterns across owned and operated media platforms. *International Journal of Advanced Multidisciplinary Research and Studies*, 4(6).
<https://doi.org/10.62225/2583049X.2024.4.6.5668>
- Ogundairo, K. M., & Ayivi-Donkor, S. S. (2023a). Machine learning approaches to customer acquisition and retention: A framework for predictive lifecycle management. *IIARD International Journal of Economics and Business Management*, 9(10), 210-246.
<https://doi.org/10.56201/ijebm.v9.no10.2023.pg210.246>
- Ogundairo, K. M., & Ayivi-Donkor, S. S. (2024a). Bridging the "adoption gap": Why supply chain AI fails without product marketing principles. *International Journal of Marketing and Communication Studies*, 8(5), 169-205.
<https://doi.org/10.56201/ijmcs.v8.no5.2024.pg169.205>
- Ogundairo, K. M., & Ayivi-Donkor, S. S. (2024b). The vanishing interface: Why the coming era of autonomous agents demands a paradigm shift in product marketing architecture. *IIARD International Journal of Economics and Business Management*, 10(11), 350-385.
<https://doi.org/10.56201/ijebm.v10.no11.2024.pg350.385>
- Ogundairo, K. M. (2025). Hardening the autonomous value chain: Lean Six Sigma guardrails and multi-enterprise ETL architecture for agentic supply chain orchestration. *IIARD International Journal of Economics and Business Management*, 11(12), 441-478.
<https://doi.org/10.56201/ijebm.vol.11.no12.2025.pg441.478>
- Ogunwole, O., Okonkwo, C. S., Agbabiaka, J., Mayo, W., & Okeke, O. T. (2021). Supply chain resilience framework for critical infrastructure and gas processing plants. *Shodhshauryam, International Scientific Refereed Research Journal*, 4(4), 444-461.
<https://doi.org/10.32628/SHISRRJ214462>

- Okafor, C. M., Osuji, V. C., & Dako, O. F. (2021). Fintech-enabled transformation of transaction banking and digital lending as a catalyst for SME growth and financial inclusion. *International Journal of Multidisciplinary Research and Growth Evaluation*, 2(6), 485-504.
- Okafor, C. M., Farounbi, B. O., Adesanya, O. S., & Akinola, A. S. (2024). Controls for cross-border payments operations: Correspondent banking risk reduction via end-to-end monitoring. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, 10(4), 1050-1071.
- Okojie, J., Ike, P., Idu, J., Nnabueze, S. B., Filani, O., & Ihwughwawwe, S. (2023). Predictive analytics models for monitoring smart city emissions and infrastructure risk in urban ESG planning. *International Journal of Multidisciplinary Futuristic Development*, 4(1), 45-57. <https://doi.org/10.54660/IJMFD.2023.4.1.45-57>
- Okojie, J. S., Filani, O. M., Ike, P. N., Okojoku-Idu, J. O., Nnabueze, S. B., & Ihwughwawwe, S. I. (2023). Integrating AI with ESG metrics in smart infrastructure auditing for high-impact urban development projects. *International Journal of Multidisciplinary Futuristic Development*, 4(1), 32-44. <https://doi.org/10.54660/IJMFD.2023.4.1.32-44>
- Okonkwo, C. S., Ogunwole, O., Mayo, W., & Okeke, O. T. (2021). Framework for regulatory-compliant procurement in high-risk energy environments. *International Journal of Multidisciplinary Research and Growth Evaluation*, 2(6), 595-605. <https://doi.org/10.54660/IJMRGE.2021.2.6.595-605>
- Okonkwo, C. S., Mayo, W., & Okeke, O. T. (2023). Conceptual model for asset lifecycle management and inventory visibility. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, 10(1), 809-824. <https://doi.org/10.32628/CSEIT2391568>
- Okonkwo, C. S., Ahiaekwe Patrick, M. C., Okeke, O. T., & Mayo, W. (2023). Framework for integrating IT systems engineering with supply chain operations. *International Journal of Advanced Multidisciplinary Research and Studies*, 3(6), 2580-2589. <https://doi.org/10.62225/2583049X.2023.3.6.5500>
- Okonkwo, C. S., Agbabiaka, J., Mayo, W., & Okeke, O. T. (2024a). Conceptual framework for digital supply chain governance in energy and infrastructure sectors. *Gyanshauryam, International Scientific Refereed Research Journal*, 7(4), 335-356. <https://doi.org/10.32628/GISRRJ247423>
- Okonkwo, C. S., Agbabiaka, J., Mayo, W., & Okeke, O. T. (2024b). Framework for secure and scalable supply chain systems supporting national energy reliability. *International Journal of Advanced Multidisciplinary Research and Studies*, 4(6), 2816-2826. <https://doi.org/10.62225/2583049X.2024.4.6.5494>
- Okonkwo, C. S., Agbabiaka, J., Mayo, W., & Okeke, O. T. (2024c). Model for predictive procurement planning to sustain operational uptime. *International Journal of Scientific Research in Humanities and Social Sciences*, 1(2), 909-928. <https://doi.org/10.32628/IJSRSSH242772>
- Okonkwo, C. S., Agbabiaka, J., Mayo, W., & Okeke, O. T. (2024d). Review of advances in procurement strategy, ERP adoption, and logistics performance. *International Journal of Advanced Multidisciplinary Research and Studies*, 4(6), 2827-2835. <https://doi.org/10.62225/2583049X.2024.4.6.5495>
- Okonkwo, C. S., Agbabiaka, J., Mayo, W., & Okeke, O. T. (2024e). Review of digital supply chain models for cost control and operational continuity. *International Journal of Advanced*

- Multidisciplinary Research and Studies*, 4(6), 2836-2846.
<https://doi.org/10.62225/2583049X.2024.4.6.5496>
- Okonkwo, C. S., Agbabiaka, J., Mayo, W., & Okeke, O. T. (2024f). Supply chain automation framework using service management platforms. *Shodhshauryam, International Scientific Refereed Research Journal*, 7(2), 157-177. <https://doi.org/10.32628/SHISRRJ2472157>
- Okonkwo, C. S., Agbabiaka, J., Okeke, O. T., & Mayo, W. (2025). Framework for national-scale supply chain optimization through integrated IT and procurement systems. *Gulf Journal of Advance Business Research*, 3(12), 1610-1625. <https://doi.org/10.51594/gjabr.v3i12.189>
- Okoruwa, P. O., Babatope, O. M., Akokodaripon, D. A., & Akinleye, O. K. (2024). Developing integrated digital platforms for enhancing transparency in procurement and supply chain management. *International Journal of Multidisciplinary Research and Growth Evaluation*, 5(6), 1719-1729.
- Okoruwa, P. O., Fadayomi, O., Abolaji, T. O., Edivri, J., Ogbole, J. I., & Akeju, B. (2024). Enterprise cybersecurity trends and threat evolution, advances and emerging research directions. *Global Multidisciplinary Perspectives Journal*, 1(6), 194-204. <https://doi.org/10.54660/GMPJ.2024.1.6.194-204>
- Okoruwa, P. O., Babatope, O. M., Akokodaripon, D. A., & Akinleye, O. K. (2025). Digital procurement transformation approaches for strengthening efficiency in global supply chain management. *International Journal of Multidisciplinary Research and Growth Evaluation*, 6(5), 975-985.
- Olaogun, B. O., Adesuyi, M. O., Akomolafe, O., Ndukwe, V. U., & Sakyi, J. K. (2023). Regulatory compliance adaptation model for cross-border payment product redesign. *International Journal of Advanced Multidisciplinary Research and Studies*, 3(1), 1651-1662. <https://doi.org/10.62225/2583049X.2023.3.1.5279>
- Oluwo, K., Dada, T., & Isiekwu, C. P. (2024). Transforming insurance underwriting with machine learning: A review and application cases. *International Journal of Advanced Multidisciplinary Research and Studies*, 4(6), 3008-3019.
- Oluwo, K., Bola-Sadipe, D., & Aliliele, C. (2025). Conceptual framework for data analytics driven financial decision making in banking sector organizations. *Shodhshauryam, International Scientific Refereed Research Journal*, 8(5), 259-302. <https://doi.org/10.32628/SHISRRJ258529>
- Ominyi, M., & Anichukwueze, C. C. (2022a). A conceptual framework for harmonizing data protection compliance across GDPR, NDPR, and United States privacy regimes. *International Journal of Social Sciences and Management Research*, 8(5), 148-174. <https://doi.org/10.56201/ijssmr.v8.no5.2022.pg148.174>
- Ominyi, M., & Anichukwueze, C. C. (2024). Conceptualizing responsible AI governance structures for automated decision systems in regulated industries. *International Journal of Social Sciences and Management Research*, 10(11), 403-430. <https://doi.org/10.56201/ijssmr.v10.no11.2024.pg.403.430>
- Ominyi, M., Anichukwueze, C. C., & Uzougbo, N. S. (2024b). A systematic review of organizational readiness for the EU Artificial Intelligence Act in multinational enterprises. *World Journal of Innovation and Modern Technology*, 8(6), 185-203. <https://doi.org/10.56201/wjimt.v8.no6.2024.pg185.203>
- Ominyi, M., Anichukwueze, C. C., & Uzougbo, N. S. (2025a). A conceptual framework for multi-agent AI quality control in the review of regulated documents. *International Journal of*

- Social Sciences and Management Research*, 11(8), 534-557.
<https://doi.org/10.56201/ijssmr.vol.11no8.2025.pg534.557>
- Omoegun, G. O., Sunday, E. A., Essien, M. A., & Oluokun, O. A. (2023). Vibration-based condition monitoring of rotating machinery using LabVIEW. *International Journal of Scientific Research in Civil Engineering*, 7(6), 82-108.
- Osuji, V. C., Okafor, C. M., & Dako, O. F. (2021). Engineering high-throughput digital collections platforms for multibillion-dollar payment ecosystems. *Shodhshauryam, International Scientific Refereed Research Journal*, 4(4), 315-335. Environmental Remediation, Carbon Accounting, and Geospatial Risk Modeling
- Osuji, V. C., Dako, O. F., & Okafor, C. M. (2024). Orchestrating multi-vertical digital ecosystem platforms across housing, education, health, and mobility to drive shared prosperity. *International Journal of Scientific Research in Humanities and Social Sciences*, 1(1), 338-359.
- Oyeleye, A. O., Eyetsemitan, R. A., Ambali, K. B., & Fadayomi, O. (2022). Reducing client onboarding cycle time in small professional services firms: A Lean Six Sigma process redesign framework. *Gyanshauryam, International Scientific Refereed Research Journal*, 5(2), 467-498. <https://doi.org/10.32628/GISRRJ225357>
- Oyeleye, A. O., Dogbatsey, E. A., & Ebhojie, O. (2025). Embedding automated close controls in public sector ERP systems: A conceptual model for audit readiness and financial reporting quality. *Zenodo*. <https://doi.org/10.5281/zenodo.20097950> \\\[Originally numbered 2(1), 110-130; journal name not captured in source.\\\]
- Oyesiji, S. O., Nwakamma, S., & Ojukwu, J. (2025). Compressing recommender and ranking models for edge deployment: A survey. *International Journal of Engineering and Modern Technology*, 11(12), 205-237. <https://doi.org/10.56201/ijemt.vol.11.no12.2025.pg205.237>
- Oziri, S. T., Arowogbadamu, A. A. G., & Seyi-Lande, O. B. (2025). Transforming big data into strategy: Comprehensive frameworks for business optimization in telecommunications. *Gulf Journal of Engineering and Technology*, 1(5), 94-111.
- Ozowara, D. E., Adebayo, A., & Anunagba, C. O. (2025). Advanced conceptual model for strengthening audit quality using data analytics across financial institutions. *International Journal of Advanced Multidisciplinary Research and Studies*, 5(6), 2246-2268. <https://doi.org/10.62225/2583049X.2025.5.6.6050>
- Rogers, D. S., & Tibben-Lembke, R. S. (1999). *Going backwards: Reverse logistics trends and practices*. Reno, NV: Reverse Logistics Executive Council.
- Rukh, S., Seyi-Lande, O. B., & Oziri, S. (2023a). A model for advancing digital inclusion through business analytics and partnerships. *Gyanshauryam, International Scientific Refereed Research Journal*, 6(5), 661-700.
- Rukh, S., Oziri, S. T., & Seyi-Lande, O. B. (2023b). Framework for enhancing marketing strategy through predictive and prescriptive analytics. *Shodhshauryam, International Scientific Refereed Research Journal*, 6(4), 531-569.
- Rukh, S., Seyi-Lande, O. B., & Oziri, S. T. (2024). An integrated framework for AI and predictive analytics in supply chain management. *International Journal of Scientific Research in Humanities and Social Sciences*, 1(1), 451-491.
- Sakyi, J. K., Nnabueze, S. B., Filani, O. M., Okojie, J. S., & Okereke, M. (2022a). Customer service analytics as a strategic driver of revenue growth and sustainable business competitiveness. *Journal of Frontiers in Multidisciplinary Research*, 3(2), 109-123. <https://doi.org/10.54660/IJFMR.2022.3.2.109-123>

- Sanni, J. O., & Atima, M. E. (2021a). Analytics driven go to market frameworks addressing compliance sustainability complexity. *International Journal of Multidisciplinary Research and Growth Evaluation*, 2(6), 647-660.
- Sanni, J. O., & Atima, M. E. (2021b). Business intelligence dashboard frameworks resolving executive visibility gaps in strategic marketing governance. *International Journal of Multidisciplinary Research and Growth Evaluation*, 2(6), 633-646. <https://doi.org/10.54660/IJMRGE.2021.2.6.633-646>
- Sanni, J. O., Atima, M. E., & Attah, A. (2022). Systematic review of attribution modeling methods resolving bias in multi-touch journeys. *Shodhshauryam, International Scientific Refereed Research Journal*, 5(1), 304-334. <https://doi.org/10.32628/SHISRRJ247135>
- Sanni, J. O., Iwuanyanwu, U. A., Essien, M. A., Atima, M. E., & Attah, A. (2022). Adaptive control models for AI-driven marketing automation in financial compliance environments. *Shodhshauryam, International Scientific Refereed Research Journal*, 5(1), 243-270. <https://doi.org/10.32628/SHISRRJ247133>
- Sanni, J. O., Iwuanyanwu, U. A., Essien, M. A., & Attah, A. (2023). Lifecycle-aware marketing automation using federated learning for secure cross-organizational data management. *Gyanshauryam, International Scientific Refereed Research Journal*, 6(6), 337-364. <https://doi.org/10.32628/GISRRJ236642>
- Sanni, J. O., & Attah, A. (2023b). Artificial intelligence assisted content optimization models resolving digital conversion performance bottlenecks issues. *Gyanshauryam, International Scientific Refereed Research Journal*, 6(6), 303-336. <https://doi.org/10.32628/GISRRJ236641>
- Sanni, J. O., & Attah, A. (2023c). Market research frameworks addressing entry barriers within highly regulated industrial service sectors. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, 10(2), 904-930. <https://doi.org/10.32628/CSEIT2342439>
- Sanni, J. O., Iwuanyanwu, U. A., Essien, M. A., & Wedraogo, L. (2024). Integrating blockchain-enabled smart contracts for transparent and verifiable marketing workflows. *International Journal of Advanced Multidisciplinary Research and Studies*, 4(6), 2891-2906. <https://doi.org/10.62225/2583049X.2024.4.6.5646>
- Sanni, J. O., & Wedraogo, L. (2024). Data-centric funnel optimization frameworks resolving revenue leakage in high-value services. *International Journal of Advanced Multidisciplinary Research and Studies*, 4(6), 2859-2874. <https://doi.org/10.62225/2583049X.2024.4.6.5641>
- Sanni, J. O., Iwuanyanwu, U. A., & Essien, M. A. (2025). Problem-oriented process mining for auditable marketing automation lifecycle control. *International Journal of Advanced Multidisciplinary Research and Studies*, 5(6), 1933-1947. <https://doi.org/10.62225/2583049X.2025.5.6.5650>
- Seyi-Lande, O. B., Arowogbadamu, A. A. G., & Oziri, S. T. (2022). Cross-functional key performance indicator frameworks for driving organizational alignment and sustainable business growth. *International Journal of Multidisciplinary Futuristic Development*, 1(2), 1-18.
- Seyi-Lande, O. B., Arowogbadamu, A. A. G., & Oziri, S. T. (2024). Subscriber base expansion through strategic innovation and market penetration in competitive telecommunications landscapes. *International Journal of Multidisciplinary Futuristic Development*.

- Shah, R., Oziri, S. T., & Seyi-Lande, O. B. (2025). A framework for leveraging artificial intelligence in strategic business decision-making. *Gulf Journal of Advance Business Research*, 3(11), 1517-1558. Technical and Vocational Education, STEM Curriculum, and Workforce Readiness
- Shittu, H., & Nabil, M. (2023). Smart supply chain management with attribute-based encryption access control. In *2023 IEEE 13th Annual Computing and Communication Workshop and Conference (CCWC)* (pp. 198-204). IEEE. <https://doi.org/10.1109/CCWC57344.2023.10099268>
- Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, 104, 333-339.
- Sunday, E. A., & Omoegun, G. O. (2022). Smart fault detection in HVAC systems using sensor-based monitoring. *International Journal of Scientific Research in Science, Engineering and Technology*, 7(4), 380-403.
- Tonoyan, A., Dada, O., & Ayivi-Donkor, S. S. (2021a). Advances in demand forecasting: Machine learning algorithms for revenue projection and financial planning accuracy. *Gyanshauryam, International Scientific Refereed Research Journal*, 4(1), 282-317.
- Tonoyan, A., Dada, O., & Ayivi-Donkor, S. S. (2022a). Advances in geospatial analysis: Predictive analytics methods for store location selection and market entry return on investment. *International Journal of Marketing and Communication Studies*, 6(2), 78-105. <https://doi.org/10.56201/ijmcs.v6.no2.2022.pg78.105>
- Tonoyan, A., Dada, O., & Ayivi-Donkor, S. S. (2022b). Algorithmic process optimization and cost reduction: A review of simulation modeling and financial impact assessment. *Journal of Accounting and Financial Management*, 8(8), 139-169. <https://doi.org/10.56201/jafm.vol.8.no8.2022.p139.169>
- Tonoyan, A., Dada, O., & Ayivi-Donkor, S. S. (2022c). Conceptual model for predictive cost optimization: Machine learning applications in business transformation analysis. *International Journal of Economics and Business Management*, 8(6), 68-102. <https://doi.org/10.56201/ijebm.v8.no6.2022.pg68.102>
- Tonoyan, A., Dada, O., & Ayivi-Donkor, S. S. (2023). A conceptual framework for retail asset valuation: Integrating quantitative pricing and multi-unit financial performance prediction. *Journal of Accounting and Financial Management*, 9(12), 218-250. <https://doi.org/10.56201/jafm.v9.no12.2023.pg218.250>
- Tonoyan, A., Dada, O., & Ayivi-Donkor, S. S. (2024b). Real-time KPI tracking systems: A review of automated performance monitoring and data-driven decision making. *World Journal of Innovation and Modern Technology*, 8(6), 247-281. <https://doi.org/10.56201/wjimt.v8.no6.2024.pg247.281>
- Tonoyan, A., Dada, O., & Ayivi-Donkor, S. S. (2025). A conceptual model for real-time route optimization: Algorithmic pathways to delivery profitability and logistics cost reduction. *World Journal of Innovation and Modern Technology*, 9(12), 308-364. <https://doi.org/10.56201/wjimt.v9.no12.2025.pg308.364>
- Walawalkar, G., Kalu, A., Oduleye, T. E., & Adesuyi, M. O. (2025). Capital efficiency optimization models in high-velocity business environments. *International Journal of Advanced Multidisciplinary Research and Studies*, 5(6), 2029-2041.
- Walawalkar, G., Adesuyi, M. O., Kalu, A., & Oduleye, T. E. (2025). Executive financial dashboards for real-time strategic oversight. *International Journal of Advanced Multidisciplinary Research and Studies*, 5(6), 2042-2054.

- Wedraogo, L., & Sanni, J. O. (2024). Machine learning models addressing uncertainty in cross-channel campaign performance forecasting accuracy. *International Journal of Advanced Multidisciplinary Research and Studies*, 4(6), 2875-2890. <https://doi.org/10.62225/2583049X.2024.4.6.5648>
- Yusuf, M., Akintunde, A., Shittu, H., & Quadri, A. (2023). Radio frequency identification (RFID) based library management system. *International Journal of Technology and Systems*, 8(2), 21-35. <https://doi.org/10.47604/ijts.2041>