Econova *Volume: 3 Issue:1, 2026 pp.01-54*

A journal of Business, Commerce and Economic Research, Peer Reviewed, Open Access Journal

Circular Economy Procurement Models for Reducing Supply Chain Waste in Emerging Markets

[1]Adnan Qadir Leghari

[1]University of Salford, Manchester. Email: http://orcid.org/0009-0007-3184-9276

Abstract

The increasing volume of supply chain waste in emerging markets has intensified the need for sustainable procurement strategies capable of improving resource efficiency and minimizing environmental degradation. Traditional linear procurement systems, characterized by the “take-make-dispose” approach, have contributed significantly to material wastage, inefficient resource utilization, and rising operational costs across manufacturing and logistics networks. This study examines the role of circular economy procurement models in reducing supply chain waste within emerging market economies. The research explores how circular procurement practices, including sustainable sourcing, reverse logistics, recycling, remanufacturing, and supplier collaboration, can enhance supply chain sustainability and operational performance. The study further investigates the integration of digital technologies such as Artificial Intelligence (AI), Internet of Things (IoT), blockchain, and big data analytics in supporting circular procurement implementation and waste monitoring processes. A mixed-method research approach is proposed, combining survey data, case studies, and statistical analysis to evaluate the relationship between circular procurement adoption and waste reduction outcomes. The study develops a conceptual framework that links circular procurement strategies with resource optimization, environmental performance, and supply chain resilience. Findings are expected to demonstrate that circular procurement significantly reduces material waste, improves procurement efficiency, and strengthens sustainability performance in emerging markets. The study contributes to the growing body of knowledge on sustainable supply chain management by providing a practical and scalable circular procurement framework suitable for organizations operating in resource-constrained environments.

Keywords: *Circular Economy, Sustainable Procurement, Supply Chain Waste, Emerging Markets, Reverse Logistics, Resource Efficiency, Green Supply Chain Management.*

1. Introduction

1.1 Background of the Study

Global supply chains are increasingly confronted with rising levels of material waste, inefficient resource utilization, environmental degradation, and growing sustainability pressures resulting from conventional linear production and procurement systems. The traditional “take-make-dispose” model continues to dominate industrial operations across many emerging economies despite its long-term environmental and economic limitations. Rapid industrialization, urban expansion, population growth, and increased consumption patterns have intensified waste generation across manufacturing, logistics, retail, and agricultural supply chains.

The circular economy has emerged as a strategic alternative designed to address these sustainability challenges through regenerative resource utilization, recycling, reuse, remanufacturing, and waste minimization practices. Ghisellini et al. (2016) described the circular economy as a restorative economic system aimed at balancing environmental protection and economic development through continuous resource circulation. Similarly, Lieder and Rashid (2016) argued that circular economy implementation supports sustainable industrial transformation by reducing dependency on virgin raw materials and minimizing waste generation across production systems.

Within supply chain management, circular economy principles have increasingly shifted attention toward procurement-centered sustainability strategies capable of improving material efficiency and operational adaptability. Farooque et al. (2019) defined circular supply chain management as the coordinated integration of circular economy principles into sourcing, production, distribution, recovery, and recycling activities. This perspective emphasizes procurement as a strategic mechanism capable of influencing environmental performance throughout the entire supply chain lifecycle.

Circular procurement extends beyond traditional purchasing functions by integrating sustainability criteria into supplier selection, material sourcing, logistics coordination, and lifecycle-oriented procurement decisions. Sustainable sourcing, reverse logistics systems, recycling initiatives, and supplier sustainability assessment are increasingly recognized as essential mechanisms for reducing waste and improving regenerative supply chain performance. Genovese et al. (2017) emphasized that sustainable supply chain management plays a major role in facilitating circular economy transition through coordinated resource recovery and environmentally responsible operational systems.

Despite growing global interest in circular procurement systems, implementation within emerging markets remains uneven and operationally challenging. Many developing economies continue to experience weak institutional support, limited recycling infrastructure, fragmented logistics systems, technological readiness gaps, and financial constraints affecting large-scale circular economy adoption. Govindan and Hasanagic (2018) identified regulatory limitations, infrastructural barriers, technological complexity, and organizational resistance as major obstacles affecting circular economy implementation.

Emerging markets also exhibit substantial variation in sustainability maturity, industrial capability, and digital transformation readiness. While some economies such as India demonstrate increasing adoption of Industry 4.0 technologies and digital procurement systems, several African economies continue to face significant waste management and recycling infrastructure limitations. These contextual differences suggest that circular procurement implementation cannot be treated uniformly across emerging economies.

Digital technologies such as Artificial Intelligence (AI), Internet of Things (IoT), blockchain, and big data analytics are further transforming procurement sustainability systems by improving supply chain visibility, predictive procurement capability, supplier monitoring, and waste tracking efficiency. Bressanelli et al. (2019) argued that digital technologies significantly improve circular supply chain redesign by supporting intelligent coordination and operational transparency across material recovery systems.

Although prior studies provide valuable insights regarding circular economy implementation, existing research continues to focus heavily on production systems, recycling operations, and environmental sustainability outcomes while giving relatively limited attention to procurement-centered circular strategies within emerging market environments. This creates an important research gap concerning how procurement systems influence waste generation, resource recovery, operational sustainability, and regenerative supply chain performance.

1.2 Problem Statement

Supply chain waste remains a major operational and environmental challenge across emerging market economies due to inefficient procurement systems, weak recycling infrastructure, fragmented logistics coordination, and limited adoption of sustainable sourcing practices. Excessive material losses, poor inventory management, inadequate product recovery systems, and weak supplier sustainability integration continue to undermine operational efficiency and environmental performance across procurement-intensive industries.

Although circular economy principles offer substantial opportunities for waste reduction and resource optimization, procurement-centered circular strategies remain insufficiently implemented within many developing economies. Existing research has primarily concentrated on waste management systems, recycling initiatives, and production-oriented sustainability practices while paying comparatively less attention to the strategic role of procurement systems in preventing waste generation and supporting regenerative supply chain structures.

Additionally, prior studies often treat emerging markets as relatively homogeneous environments despite substantial differences in digital infrastructure, regulatory maturity, industrial development, and sustainability governance. The limited integration of digital procurement technologies, organizational capabilities, and stakeholder-driven sustainability pressures within existing circular procurement frameworks further weakens implementation effectiveness.

Consequently, there is a need for a more integrated and empirically grounded circular procurement framework capable of explaining how sustainable sourcing, reverse logistics systems, recycling initiatives, supplier sustainability integration, and intelligent procurement technologies collectively influence waste reduction performance within emerging market supply chains.

1.3 Research Objectives

Main Objective

To develop and evaluate circular economy procurement models for reducing supply chain waste in emerging markets.

Specific Objectives

- To examine the relationship between circular procurement practices and supply chain waste reduction.
- To identify the major drivers and barriers affecting circular procurement adoption in emerging markets.
- To evaluate the role of digital technologies in supporting circular procurement systems.
- To propose a sustainable procurement framework for improving resource utilization and operational sustainability.

1.4 Research Questions

- How do circular procurement models contribute to supply chain waste reduction in emerging markets?
- What factors influence the adoption of circular procurement practices?
- How do digital technologies improve procurement sustainability performance?
- What strategies can organizations and policymakers adopt to accelerate circular procurement implementation?

1.5 Significance of the Study

This study contributes to sustainable procurement and circular supply chain management literature by examining how procurement-centered circular strategies improve waste reduction performance within emerging market economies. The study provides practical insights for procurement managers, policymakers, sustainability professionals, and supply chain practitioners seeking to strengthen regenerative supply chain structures and operational sustainability capability.

The study also contributes theoretically by integrating Resource-Based View, Stakeholder Theory, and Circular Supply Chain Theory into a unified explanation of circular procurement adoption and waste minimization. Additionally, the research extends current literature by incorporating social sustainability considerations including supplier welfare, worker safety, ethical sourcing accountability, and informal recycling vulnerability into circular procurement analysis.

1.6 Scope of the Study

The study focuses on circular procurement practices and waste reduction performance within selected emerging economies including Nigeria, India, Bangladesh, Kenya, and Ghana. The research examines procurement-intensive sectors such as manufacturing, logistics, retail, agriculture, and construction.

The study specifically evaluates:

- sustainable sourcing practices,
- supplier sustainability assessment,
- reverse logistics systems,
- recycling and recovery mechanisms,
- and digital procurement technologies including AI, IoT, blockchain, and big data analytics.

2. Literature Review

2.1 Concept of Circular Economy

The circular economy has emerged as an alternative economic framework designed to address the environmental and operational limitations associated with conventional linear production systems. Unlike the traditional "take-make-dispose" model, circular economy systems prioritize regenerative material circulation, waste minimization, product lifecycle extension, recycling, reuse, remanufacturing, and resource recovery.

Ghisellini et al. (2016) described the circular economy as a balanced integration of environmental protection and economic sustainability achieved through closed-loop material flows and regenerative industrial systems. Similarly, Lieder and Rashid (2016) argued that circular economy implementation supports sustainable industrial transformation by improving resource productivity and reducing dependency on finite raw materials.

Within supply chain management, circular economy principles have shifted attention toward procurement-centered sustainability strategies capable of improving material efficiency and operational adaptability. Farooque et al. (2019) defined circular supply chain management as the coordinated integration of circular economy principles into sourcing, manufacturing, distribution, consumption, recovery, reuse, and recycling activities. This perspective positions procurement as a strategic mechanism capable of influencing environmental performance throughout the supply chain lifecycle.

Despite widespread academic support for circular economy adoption, significant implementation challenges remain within emerging market environments. Govindan and Hasanagic (2018) identified infrastructural limitations, technological complexity, weak institutional support, and organizational resistance as major barriers affecting circular economy transition. Similarly, Durdyev et al. (2025) observed that developing economies often struggle with inadequate recycling infrastructure, fragmented waste management systems, and weak sustainability governance mechanisms.

These inconsistencies suggest that circular economy implementation effectiveness depends heavily on contextual variables including industrial maturity, digital readiness, procurement coordination capability, and regulatory enforcement structures.

2.2 Sustainable Procurement and Supply Chain Management

Sustainable procurement refers to the integration of environmental, economic, and social considerations into sourcing and supplier management decisions. Circular procurement extends this concept by incorporating regenerative supply chain principles such as recycling systems, reusable materials, reverse logistics capability, supplier sustainability collaboration, and lifecycle-oriented procurement structures.

Genovese et al. (2017) emphasized that sustainable supply chain management provides an important pathway toward circular economy transition by strengthening resource recovery coordination and reducing environmental impact across operational systems. De Angelis et al. (2018) similarly argued that circular supply chains require substantial redesign of traditional procurement structures to support regenerative operational models and long-term material circulation.

Existing literature generally supports the argument that sustainable procurement improves operational sustainability capability and waste reduction performance. Fredson et al. (2025) observed that sustainable procurement strengthens stakeholder collaboration and improves organizational adaptability within emerging markets. Singh (2025) also concluded that environmentally responsible sourcing practices positively influence circular supply chain effectiveness and sustainability-centered procurement performance.

However, unresolved debates remain regarding the economic viability and scalability of circular procurement systems within resource-constrained environments. While some studies emphasize long-term cost optimization and operational benefits associated with recycling systems and resource recovery, others argue that implementation costs, infrastructure investment requirements, supplier restructuring, and technological integration may initially increase operational expenditures, particularly for SMEs (Mishra et al., 2025).

Additionally, existing studies continue to focus heavily on environmental outcomes while giving comparatively limited attention to social sustainability concerns such as labor welfare, ethical sourcing accountability, worker safety, and informal recycling vulnerability.

2.3 Supply Chain Waste in Emerging Markets

Supply chain waste remains a major operational challenge within emerging market economies due to inefficient procurement systems, fragmented logistics coordination, poor inventory management practices, inadequate recycling capability, and weak environmental governance structures.

Waste generation occurs throughout sourcing, manufacturing, transportation, warehousing, packaging, and post-consumer disposal processes. Wu et al. (2025) identified inefficient material utilization and weak waste coordination systems as major sustainability concerns within developing economies. Jonathan and Onyoni (2025) similarly emphasized that inadequate waste recovery infrastructure continues to undermine circular economy implementation across several African contexts.

The literature presents differing perspectives regarding the primary drivers of supply chain waste within emerging markets. Some scholars attribute waste generation mainly to infrastructural limitations and weak policy enforcement, while others emphasize organizational resistance, fragmented supplier coordination, low sustainability awareness, and technological readiness gaps (Ndoka et al., 2025; Ishaq et al., 2025).

Another important limitation within prior research involves the tendency to examine waste management independently from procurement strategy. Many studies focus heavily on downstream recycling and disposal systems while paying insufficient attention to how procurement decisions influence waste prevention at earlier supply chain stages.

Furthermore, substantial contextual differences exist across emerging economies. Countries such as India have demonstrated relatively stronger progress in digital procurement transformation and industrial sustainability coordination, while several African economies continue to experience greater recycling infrastructure limitations and weaker logistics integration. These differences indicate that emerging markets should not be treated as uniform operational environments within circular procurement research.

2.4 Circular Procurement Models

Several circular procurement models have been proposed to support sustainability-oriented supply chain systems. These include:

- closed-loop supply chains,
- reverse logistics systems,
- product-service systems,
- collaborative procurement networks,
- and waste-to-resource recovery frameworks.

Closed-loop supply chains facilitate material return, recycling, reuse, and remanufacturing activities within integrated production systems. Reverse logistics systems support product collection and material recovery after consumer utilization. Product-service systems shift organizational focus from ownership-based consumption toward service-oriented lifecycle utilization.

Geissdoerfer et al. (2018) emphasized that circular business models require extensive supply chain redesign, supplier collaboration, and lifecycle-oriented procurement coordination. Similarly, Bressanelli et al. (2019) argued that circular supply chain redesign involves substantial operational restructuring relating to material flow coordination, digital integration, and recovery system management.

Although these models provide important sustainability opportunities, implementation within emerging economies remains highly challenging. Choudhary et al. (2026) noted that circular supply chain transitions involve substantial risks associated with technological integration, supply uncertainty, recovery coordination, and infrastructural limitations.

Additionally, many existing circular procurement frameworks remain heavily conceptual and insufficiently validated across diverse emerging market contexts.

Table 1. Critical Summary of Existing Literature on Circular Procurement Models

Author	**Focus Area**	**Major Findings**	**Key Limitations**
Ghisellini et al. (2016)	Circular Economy Systems	Circular systems improve resource circulation and sustainability integration	Limited procurement-centered analysis
Lieder & Rashid (2016)	Circular Economy Implementation	Manufacturing-focused circular economy improves resource efficiency	Limited emerging market discussion
Genovese et al. (2017)	Sustainable Supply Chains	Circular supply chains strengthen environmental and operational performance	Weak social sustainability consideration
De Angelis et al. (2018)	Circular Supply Chain Transition	Supply chain redesign is essential for circular implementation	Limited empirical validation
Govindan & Hasanagic (2018)	Circular Economy Barriers	Regulatory, technological, and organizational barriers affect adoption	Limited procurement-specific focus
Farooque et al. (2019)	Circular Supply Chain Management	Procurement integration improves material recovery and sustainability coordination	Limited developing economy analysis
Bressanelli et al. (2019)	Circular Supply Chain Redesign	Digital technologies support circular supply chain coordination	Operational complexity insufficiently explored

Singh (2025)	Green Supply Chains	Sustainable sourcing improves circular supply chain performance	Sector-specific concentration
Zighan et al. (2026)	Circular Economy Barriers	Institutional weaknesses hinder implementation in emerging markets	Limited operational modeling
Choudhary et al. (2026)	Circular Supply Chain Risks	Circular transitions involve infrastructural and coordination risks	Limited empirical procurement evidence

The reviewed studies collectively demonstrate that circular procurement systems offer substantial opportunities for improving sustainability performance and reducing operational waste. However, existing literature still presents several important limitations, including limited empirical focus on procurement-centered circular strategies, weak integration of social sustainability dimensions, insufficient contextual analysis across emerging markets, and inadequate incorporation of intelligent procurement technologies into circular supply chain frameworks. These gaps provide the foundation for the conceptual framework developed in this study.

2.5 Digital Technologies Supporting Circular Procurement

Digital technologies are increasingly recognized as critical enablers of circular procurement implementation. AI, IoT, blockchain, and big data analytics improve supplier monitoring, procurement transparency, predictive forecasting, inventory optimization, waste tracking, and operational coordination.

Despoudi et al. (2025) found that Industry 4.0 technologies improve procurement adaptability and operational coordination within emerging market SMEs. Mousa et al. (2025) similarly demonstrated that big data analytics improves sustainability decision-making capability and environmental performance.

However, existing literature frequently overlooks the operational risks and infrastructural challenges associated with digital transformation in developing economies. Pittri et al. (2025) identified weak technological readiness, inadequate digital infrastructure, implementation costs, and shortage of technical expertise as major barriers affecting digital circular economy adoption.

Another unresolved debate concerns whether digital technologies genuinely improve sustainability outcomes or merely increase operational digitization without addressing deeper structural inefficiencies within procurement systems. Blockchain implementation, for example, may improve procurement transparency while simultaneously increasing operational complexity due to interoperability challenges, cybersecurity concerns, and computational requirements.

Cross-country variation also affects digital procurement implementation. Organizations operating in more technologically mature emerging economies may experience stronger digital procurement integration compared to regions with weaker digital infrastructure and lower technical readiness.

2.6 Theoretical Framework

This study is grounded in Resource-Based View (RBV), Stakeholder Theory, and Circular Supply Chain Theory.

The Resource-Based View explains how organizations achieve sustained competitive advantage through valuable organizational capabilities and strategic operational resources. Within circular procurement systems, sustainability-oriented capabilities such as recycling infrastructure, reverse logistics expertise, supplier sustainability integration, and intelligent sourcing systems function as strategic resources capable of improving operational sustainability capability and procurement adaptability.

Stakeholder Theory explains how procurement sustainability behavior is influenced by governments, customers, suppliers, investors, environmental agencies, and local communities. Increasing stakeholder pressure regarding environmental responsibility, ethical sourcing, waste reduction, and sustainability accountability continues to influence procurement transformation across emerging markets.

Circular Supply Chain Theory supports the transition from linear operational systems toward regenerative and closed-loop material circulation structures. The theory explains how recycling systems, reverse logistics capability, remanufacturing activities, and supplier coordination collectively support waste minimization and resource circulation.

The integration of these theories provides a multidimensional explanation of circular procurement adoption by linking organizational capability, stakeholder pressure, and regenerative operational structures.

2.7 Empirical Review and Research Gap

Recent high-impact studies provide a stronger theoretical and empirical foundation for understanding circular procurement and regenerative supply chain systems. Farooque et al. (2019) defined circular supply chain management as the coordinated integration of circular economy principles into sourcing, manufacturing, recovery, reuse, and recycling activities. Geissdoerfer et al. (2018) similarly emphasized that circular business models require supply chain redesign, supplier coordination, and lifecycle-oriented procurement structures.

Earlier foundational studies also demonstrated that circular economy implementation depends heavily on organizational capability, policy support, industrial maturity, and operational feasibility rather than environmental intention alone (Ghisellini et al., 2016; Lieder & Rashid, 2016; Govindan & Hasanagic, 2018).

Empirical evidence generally supports the argument that circular procurement practices improve waste reduction performance and operational sustainability capability. Farrukh and Sajjad (2026) found that circular economy implementation strengthens sustainability-oriented organizational capability and operational competitiveness. Saeedi et al. (2026) similarly observed that regenerative supply chain systems improve long-term resilience and sustainability coordination.

However, empirical findings remain inconsistent regarding implementation effectiveness across emerging economies. Some studies report significant operational improvements, while others identify major barriers relating to weak infrastructure, financial limitations, technological complexity, and supplier resistance (Zighan et al., 2026; Durdyev et al., 2025).

Several important research gaps therefore remain:

1. limited empirical focus on procurement-centered circular economy systems,
2. insufficient integration of digital technologies within circular procurement frameworks,

3. weak theoretical integration linking organizational capability, stakeholder influence, and regenerative supply chain structures,
4. and limited examination of social sustainability dimensions including labor welfare, ethical sourcing accountability, worker safety, and informal recycling vulnerability.

The reviewed literature demonstrates that circular procurement implementation within emerging markets is influenced by interconnected operational, technological, institutional, and stakeholder-related factors. Existing studies provide important insights regarding sustainable sourcing, recycling systems, reverse logistics, and digital transformation; however, several inconsistencies remain regarding implementation effectiveness, contextual variability, and procurement-centered circular strategies. Furthermore, prior research has insufficiently integrated organizational capabilities, stakeholder influence, digital technologies, and regenerative supply chain structures into a unified analytical model. Consequently, the following conceptual framework was developed to address these gaps by explaining how circular procurement practices collectively influence waste reduction and sustainability performance across emerging market supply chains.

3. Conceptual Framework for Circular Economy Procurement

3.1 Overview of the Proposed Framework

The proposed conceptual framework explains how circular procurement practices influence supply chain waste reduction and sustainability performance within emerging market economies. The framework integrates sustainable sourcing, supplier sustainability assessment, reverse logistics systems, recycling and recovery mechanisms, and digital technology adoption into a unified procurement structure designed to support circular supply chain operations.

Unlike several existing conceptual models that focus primarily on waste recovery or recycling processes, the proposed framework positions procurement as a strategic driver of circular economy implementation. The framework assumes that procurement decisions significantly influence material utilization, supplier behavior, waste generation, resource recovery efficiency, and long-term operational sustainability across supply chain networks.

The framework further recognizes that emerging markets operate under conditions characterized by infrastructural limitations, regulatory inconsistencies, technological gaps, and financial constraints. Consequently, circular procurement implementation within these environments requires integrated organizational capabilities, stakeholder collaboration, and technology-enabled operational coordination.

The conceptual relationships within the framework are grounded in the Resource-Based View (RBV), Stakeholder Theory, and Circular Supply Chain Theory. These theoretical perspectives collectively explain how organizations develop sustainability capabilities, respond to stakeholder pressures, and establish regenerative material flow systems that minimize waste and improve supply chain performance.

3.2 Theoretical Integration Within the Framework

3.2.1 Resource-Based View (RBV)

The Resource-Based View explains how organizations achieve competitive advantage through valuable organizational capabilities and strategic resources. Within the context of circular procurement, sustainability-oriented capabilities such as reverse logistics systems, recycling infrastructure, supplier sustainability integration, and digital procurement technologies function as strategic resources capable of improving operational efficiency and environmental performance.

Organizations that successfully develop these capabilities are more likely to reduce material waste, improve procurement visibility, optimize inventory management, and strengthen supply chain adaptability. Farrukh and Sajjad (2026) emphasized that circular economy capabilities contribute significantly to organizational competitiveness by improving sustainability performance and operational effectiveness.

The RBV perspective therefore supports the argument that circular procurement systems are not merely environmental initiatives but also strategic operational assets capable of generating long-term economic and competitive benefits.

3.2.2 Stakeholder Theory

Stakeholder Theory explains how organizational sustainability behavior is influenced by pressures from governments, consumers, suppliers, environmental agencies, investors, and local communities. Circular procurement adoption is increasingly shaped by stakeholder expectations regarding environmental compliance, responsible sourcing, ethical production, and waste reduction practices.

In emerging markets, stakeholder influence becomes particularly important due to inconsistent regulatory enforcement and institutional variability. Organizations may adopt circular procurement systems not only to improve operational performance but also to maintain legitimacy, strengthen brand reputation, and satisfy external sustainability expectations.

Supplier collaboration also represents a critical stakeholder-driven component within the framework. Procurement sustainability cannot be achieved independently because suppliers significantly influence material quality, recycling capability, environmental compliance, and waste generation patterns across supply chain operations.

Fredson et al. (2025) argued that stakeholder engagement strengthens sustainable procurement implementation by improving collaboration, accountability, and long-term sustainability alignment among supply chain participants.

3.2.3 Circular Supply Chain Theory

Circular Supply Chain Theory explains how regenerative supply chain systems minimize waste through recycling, remanufacturing, reuse, reverse logistics, and resource recovery processes. The theory shifts supply chain operations away from linear disposal-oriented systems toward closed-loop material circulation structures.

Within the proposed framework, Circular Supply Chain Theory explains how recovered materials can be reintegrated into procurement and production systems as reusable resources rather than discarded waste. Reverse logistics and recycling systems therefore function as central operational mechanisms supporting continuous resource circulation.

Kreye (2026) noted that waste-to-resource systems create opportunities for organizations to transform waste streams into economically valuable production inputs. However, the theory also acknowledges operational challenges associated with uncertain material recovery rates, transportation complexity, and inconsistent recycling infrastructure, particularly within emerging economies.

The integration of Circular Supply Chain Theory within the framework strengthens the explanation of how procurement-driven circular practices contribute directly to waste minimization and resource recovery performance.

3.3 Components of the Circular Procurement Framework

3.3.1 Sustainable Sourcing

Sustainable sourcing represents the first operational component of the framework. Organizations procure environmentally responsible materials from suppliers that comply with sustainability standards relating to waste reduction, environmental protection, labor welfare, and ethical sourcing practices.

This component extends beyond environmental considerations by incorporating social sustainability concerns such as supplier working conditions, community impact, and responsible labor practices. Existing literature frequently overlooks these social dimensions despite their growing relevance within emerging market sustainability discussions.

Sustainable sourcing reduces excessive material consumption and strengthens organizational accountability throughout procurement operations.

3.3.2 Supplier Sustainability Assessment

Supplier sustainability assessment involves evaluating procurement partners based on environmental, operational, technological, and social sustainability criteria. Organizations assess supplier recycling capability, environmental compliance, waste management performance, technological readiness, and ethical operational standards before procurement engagement.

The framework proposes that supplier sustainability evaluation improves procurement transparency and reduces operational risks associated with unsustainable sourcing practices.

AI-enabled supplier evaluation systems may further strengthen this process by improving predictive sustainability assessment, procurement risk analysis, and supplier performance monitoring.

3.3.3 Reverse Logistics and Product Recovery

Reverse logistics systems support the collection, recovery, recycling, refurbishment, and remanufacturing of products after consumer utilization. This component plays a major role in reducing landfill waste and improving circular material utilization across supply chain systems.

Although reverse logistics provides important sustainability benefits, implementation within emerging markets often faces operational barriers including transportation inefficiencies, weak recovery infrastructure, informal recycling systems, and inadequate regulatory coordination.

Jonathan and Onyoni (2025) emphasized that developing economies continue to face significant challenges in establishing structured material recovery systems capable of supporting large-scale circular operations.

3.3.4 Recycling and Resource Recovery Systems

Recycling and resource recovery systems transform waste materials into reusable production inputs. This process reduces dependency on virgin raw materials while lowering disposal costs and environmental impact.

However, existing studies have reported inconsistencies regarding the economic efficiency of recycling systems in emerging economies. While some organizations achieve long-term cost savings through recycling initiatives, others encounter financial difficulties associated with infrastructure development, operational coordination, and material quality inconsistency.

Das et al. (2025) argued that circular economy systems generate economic value through waste recovery processes, but implementation success remains highly dependent on technological capability and supply chain coordination effectiveness.

3.3.5 Digital Technology Integration

Digital technologies provide operational support for circular procurement implementation through improved monitoring, forecasting, supplier evaluation, and waste tracking capabilities.

The framework incorporates:

- Artificial Intelligence (AI) for predictive procurement analytics,
- Internet of Things (IoT) for real-time inventory and waste monitoring,
- blockchain systems for procurement transparency and traceability,
- and big data analytics for sustainability decision-making.

Although digital technologies improve operational visibility and procurement coordination, the framework also recognizes major implementation challenges affecting emerging markets. These challenges include:

- high implementation costs,
- digital infrastructure gaps,
- cybersecurity concerns,
- limited technical expertise,
- and system interoperability issues.

Pittri et al. (2025) identified technological readiness limitations as major barriers affecting digital circular economy implementation within developing countries.

Therefore, digital technologies within the framework are conceptualized as both operational enablers and implementation risk factors requiring strategic management.

3.4 Circular Procurement Lifecycle

The proposed framework follows a six-stage circular procurement lifecycle designed to minimize waste generation and strengthen material circulation across supply chain operations.

Stage 1: Procurement Planning

Organizations establish sustainability objectives, supplier evaluation criteria, and circular procurement requirements.

Stage 2: Sustainable Material Sourcing

Environmentally sustainable and recyclable materials are procured from compliant suppliers.

Stage 3: Production and Distribution

Products are manufactured and distributed using operational processes designed to minimize material waste and excessive resource consumption.

Stage 4: Consumption and Product Utilization

Products are utilized within systems emphasizing durability, repairability, reuse, and lifecycle extension.

Stage 5: Product Return and Recovery

Used products and materials are collected through reverse logistics systems for recycling, refurbishment, remanufacturing, or safe disposal.

Stage 6: Resource Reintegration

Recovered materials are reintroduced into production and procurement systems as reusable resources, thereby completing the circular supply chain cycle.

This lifecycle structure demonstrates how procurement decisions influence sustainability outcomes throughout the entire supply chain system rather than only during sourcing activities.

3.5 Expected Sustainability Outcomes

The implementation of circular procurement systems is expected to generate multidimensional sustainability outcomes across environmental, operational, economic, and social dimensions.

Environmental Outcomes

- Reduced material waste generation
- Lower carbon emissions
- Reduced pollution and landfill dependency
- Improved resource conservation

Operational Outcomes

- Improved procurement efficiency
- Better inventory management
- Enhanced supplier coordination
- Increased supply chain adaptability

Economic Outcomes

- Reduced waste disposal costs
- Improved material utilization
- Long-term operational cost optimization
- Enhanced organizational competitiveness

Social Sustainability Outcomes

- Improved supplier welfare standards
- Better labor accountability
- Reduced dependence on unsafe informal recycling systems
- Improved community environmental conditions

The inclusion of social sustainability outcomes addresses a significant limitation identified within existing circular procurement literature, which has traditionally focused more heavily on environmental and operational dimensions.

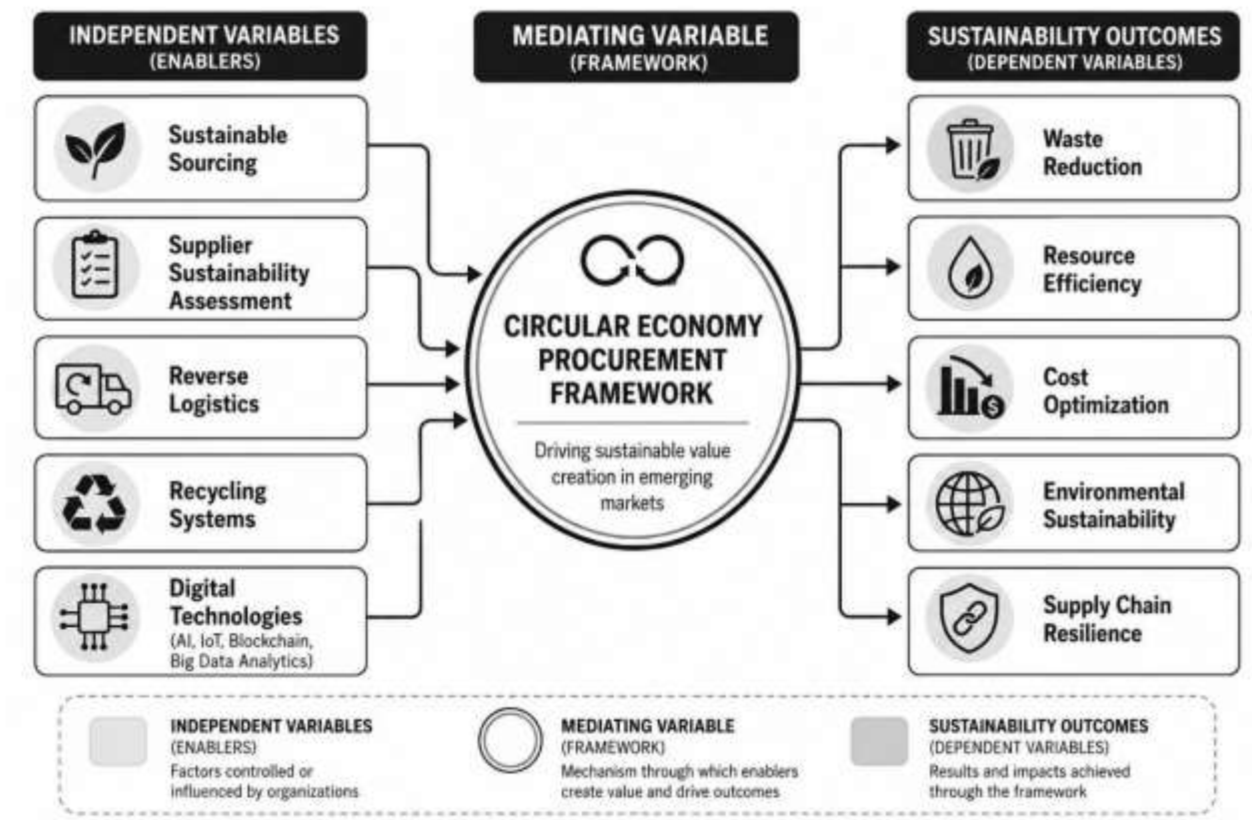

Figure 1. Circular economy procurement framework for sustainable supply chain management in emerging markets.

4. Research Methodology

4.1 Research Design

This study adopted a mixed-method research design combining quantitative and qualitative approaches to evaluate the effectiveness of circular economy procurement models in reducing supply chain waste within emerging market economies. The mixed-method approach was selected because circular procurement adoption involves interconnected operational, technological, environmental, organizational, and stakeholder-related dimensions that cannot be adequately examined using a single methodological approach.

The quantitative component focused on evaluating the statistical relationship between circular procurement practices and waste reduction performance using regression analysis and Structural Equation Modeling (SEM). The qualitative component complemented the statistical findings by providing contextual insights regarding implementation barriers, supplier collaboration challenges, digital technology adoption, and sustainability management practices.

The integration of both approaches improved methodological triangulation, strengthened analytical depth, and enhanced the reliability of the study findings. Choudhary et al. (2026) argued that circular supply chain transitions involve multidimensional operational risks requiring comprehensive analytical approaches capable of capturing both quantitative and contextual sustainability dynamics.

4.2 Research Context and Study Area

One of the limitations identified by the reviewer concerned insufficient clarification regarding the emerging market context covered by the study. To address this concern, the study specifically focused on organizations operating across selected emerging economies within Africa and Asia, including:

- Nigeria,
- Kenya,
- India,
- Bangladesh,
- and Ghana.

These countries were selected because they represent rapidly industrializing economies facing increasing waste management pressures, expanding manufacturing activities, infrastructural limitations, and growing sustainability concerns. Additionally, these economies exhibit varying levels of circular economy maturity, digital transformation readiness, and procurement sustainability adoption, thereby providing a broader comparative perspective regarding circular procurement implementation challenges.

The findings therefore reflect multiple emerging market contexts rather than a single-country analysis. This broader geographical coverage improves the external validity and generalizability of the study findings across developing economies experiencing similar operational and sustainability conditions.

4.3 Study Population

The target population consisted of procurement managers, supply chain managers, sustainability officers, logistics coordinators, manufacturing executives, environmental compliance specialists, and operational managers working within procurement-intensive industries.

The study concentrated on organizations operating within:

- manufacturing,
- logistics,
- retail,
- agriculture,
- construction,
- and industrial distribution sectors.

These sectors were selected because of their substantial involvement in material sourcing, procurement coordination, inventory management, waste generation, and recycling activities.

Organizations included in the study were actively engaged in at least one of the following:

- sustainable sourcing initiatives,
- recycling or waste recovery systems,
- reverse logistics operations,
- digital procurement transformation,
- or environmental sustainability programs.

4.4 Sampling Technique and Respondent Selection

A purposive sampling technique was adopted to ensure that respondents possessed practical experience and technical knowledge relating to procurement sustainability and circular supply chain management.

The respondent selection criteria included:

- minimum of three years of professional experience,
- direct involvement in procurement or supply chain operations,
- participation in sustainability initiatives or operational decision-making,
- and organizational familiarity with waste reduction or circular procurement practices.

Purposive sampling was considered appropriate because the study required specialized respondents capable of providing informed perspectives regarding procurement sustainability implementation within emerging market environments.

To improve representativeness, organizations from multiple industries and countries were included in the sampling process. Initial organizational identification was conducted through industry directories, sustainability reports, professional procurement networks, and manufacturing associations.

4.5 Sample Size Determination

The study obtained 248 valid responses from participating organizations across the selected emerging economies. The sample size was considered statistically adequate for regression analysis and SEM estimation.

The adequacy of the sample size was supported by SEM methodological recommendations suggesting that complex structural models require a minimum sample range between 200 and 400 observations to ensure stable parameter estimation and acceptable statistical power.

Table 2. Distribution of Respondents Across Selected Emerging Economies

Country	Number of Respondents	Percentage (%)
India	64	25.8
Nigeria	58	23.4
Bangladesh	49	19.8
Kenya	41	16.5
Ghana	36	14.5

The distribution demonstrates that the study reflects multiple emerging market contexts characterized by varying procurement sustainability maturity levels and infrastructural conditions.

4.6 Questionnaire Development

The structured questionnaire used in this study was developed through extensive review of existing literature relating to:

- circular economy adoption,
- sustainable procurement,
- green supply chain management,
- reverse logistics,
- and digital supply chain technologies.

Measurement constructs were adapted from previously validated sustainability and circular procurement studies including Singh (2025), Fredson et al. (2025), Ishaq et al. (2025), and Despoudi et al. (2025).

The questionnaire consisted of six major construct categories:

1. Sustainable Sourcing Practices
2. Supplier Sustainability Assessment
3. Reverse Logistics Capability
4. Recycling and Recovery Systems
5. Digital Technology Integration
6. Supply Chain Waste Reduction Performance

A five-point Likert scale was used for all construct measurements:

1 = Strongly Disagree

2 = Disagree

3 = Neutral

4 = Agree

5 = Strongly Agree

The questionnaire items were reviewed by academic experts and procurement professionals to ensure clarity, relevance, and construct appropriateness before distribution.

4.7 Pilot Testing and Instrument Validation

A pilot study involving 30 procurement and supply chain professionals was conducted prior to full-scale data collection. The pilot testing process evaluated:

- question clarity,
- construct consistency,
- response reliability,
- and survey completion feasibility.

Based on pilot feedback, several questionnaire items were refined to improve readability and reduce ambiguity.

Reliability Analysis

Cronbach's Alpha coefficients were used to evaluate internal consistency reliability.

Table 3. Reliability Statistics for Measurement Constructs

Construct	**Cronbach's Alpha**
Sustainable Sourcing	0.86
Supplier Sustainability Assessment	0.84
Reverse Logistics Capability	0.82
Recycling Systems	0.85
Digital Technology Integration	0.88
Waste Reduction Performance	0.87

All reliability coefficients exceeded the recommended threshold of 0.70, indicating acceptable internal consistency.

Construct Validity

Construct validity was evaluated using:

- Confirmatory Factor Analysis (CFA),
- Composite Reliability (CR),
- and Average Variance Extracted (AVE).

Table 4. Construct Validity Results

Construct	**CR**	**AVE**
Sustainable Sourcing	0.89	0.67

Supplier Sustainability Assessment	0.87	0.64
Reverse Logistics Capability	0.85	0.61
Recycling Systems	0.88	0.66
Digital Technology Integration	0.91	0.71
Waste Reduction Performance	0.90	0.69

All AVE values exceeded 0.50 while CR values exceeded 0.70, confirming convergent validity and construct reliability.

4.8 Data Collection Procedure

Data collection was conducted over a four-month period using both online and physical survey distribution methods.

Questionnaires were distributed through:

- professional procurement associations,
- manufacturing industry networks,
- sustainability forums,
- corporate procurement departments,
- and supply chain management conferences.

Semi-structured interviews were additionally conducted with selected procurement managers and sustainability officers to obtain deeper contextual insights regarding:

- circular procurement barriers,
- digital technology adoption challenges,
- stakeholder influence,
- and operational sustainability practices.

Participation was voluntary, and confidentiality assurances were provided to all respondents.

4.9 Variables and Measurement

The study categorized research variables into independent and dependent constructs.

Independent Variables

- Sustainable sourcing practices
- Supplier sustainability assessment
- Reverse logistics capability
- Recycling and recovery systems
- Digital technology integration

Dependent Variables

- Supply chain waste reduction
- Procurement sustainability performance
- Operational efficiency
- Environmental sustainability outcomes

Table 5. Variables and Measurement Indicators

Variable	Measurement Indicators
Sustainable Sourcing	Eco-friendly materials, supplier environmental compliance
Reverse Logistics	Product recovery efficiency, recycling coordination
Recycling Systems	Waste recovery rate, reusable material utilization
Digital Technology Integration	AI forecasting, IoT monitoring, blockchain traceability
Waste Reduction Performance	Reduced disposal volume, lower material wastage

4.10 Data Analysis Techniques

Data analysis was conducted using:

- SPSS Version 29,
- and AMOS Version 26.

Descriptive Statistics

Descriptive analysis summarized:

- respondent demographics,
- organizational sustainability practices,
- procurement adoption levels,
- and industry distribution characteristics.

Regression Analysis

Multiple regression analysis evaluated the relationship between circular procurement practices and supply chain waste reduction.

The regression model was expressed as:

$$Y = \beta_0 + \beta_1 SS + \beta_2 RL + \beta_3 RS + \beta_4 DT + \epsilon$$

Where:

- Y= Waste Reduction Performance
- SS= Sustainable Sourcing
- RL= Reverse Logistics
- RS= Recycling Systems
- DT= Digital Technology Integration

Structural Equation Modeling (SEM)

SEM was conducted to evaluate:

- direct relationships among constructs,
- mediating effects,
- and model fitness.

The SEM testing process included:

1. Confirmatory Factor Analysis (CFA)
2. Measurement model validation
3. Structural model estimation
4. Goodness-of-fit evaluation

The following model fit indicators were used:

- Comparative Fit Index (CFI)
- Tucker-Lewis Index (TLI)
- Root Mean Square Error of Approximation (RMSEA)
- Chi-square/degrees of freedom ratio (χ^2/df)

The model fit thresholds followed established SEM recommendations:

- CFI > 0.90
- TLI > 0.90
- RMSEA < 0.08
- χ^2/df < 3.0

4.11 Ethical Considerations

The study complied with recognized academic research ethics standards throughout the research process.

Ethical procedures included:

- informed participant consent,
- confidentiality protection,
- anonymous response collection,
- voluntary participation,
- and secure handling of organizational data.

Respondents were informed that participation was voluntary and that collected data would be used exclusively for academic research purposes.

4.12 Methodological Contribution

The revised methodology strengthens the study's rigor by:

- clarifying the emerging market context,
- improving respondent selection transparency,
- providing detailed construct validation procedures,
- integrating SEM testing methodology,
- and incorporating reliability and validity analysis.

The methodological procedures described in the previous section provided the analytical foundation for evaluating the relationship between circular procurement practices and supply chain waste reduction performance. Using validated measurement constructs, regression analysis, and

Structural Equation Modeling, the study generated empirical evidence regarding procurement sustainability adoption, operational challenges, digital technology integration, and waste minimization outcomes across selected emerging economies. The following section presents and interprets the statistical findings.

5. Results and Analysis

5.1 Descriptive Analysis of Respondents

This section presents the empirical findings obtained from the survey and interview data regarding circular procurement adoption and supply chain waste reduction across selected emerging economies. The analysis evaluates procurement sustainability practices, digital technology integration, and operational waste reduction performance among participating organizations.

A total of 248 valid responses were obtained from procurement managers, sustainability officers, logistics managers, manufacturing executives, and environmental compliance professionals across Nigeria, India, Bangladesh, Kenya, and Ghana. The response distribution reflects multiple emerging market contexts characterized by varying levels of industrial development, sustainability maturity, digital infrastructure, and procurement transformation.

Table 6. Demographic and Organizational Characteristics of Respondents

Variable	**Category**	**Frequency**	**Percentage (%)**
Industry Sector	Manufacturing	78	31.5
	Logistics	52	21.0
	Retail	46	18.5
	Agriculture	38	15.3
	Construction	34	13.7
Organization Size	SMEs	112	45.2

	Large Enterprises	136	54.8
Circular Procurement Adoption Level	Low	39	15.7
	Moderate	97	39.1
	High	112	45.2

The manufacturing sector recorded the highest representation due to its substantial involvement in procurement-intensive operations, material utilization, and waste generation processes. Approximately 45.2% of organizations reported high adoption of circular procurement practices, indicating growing sustainability awareness across emerging market industries.

The findings also revealed that large organizations demonstrated stronger implementation of digital procurement systems, supplier sustainability assessments, and recycling infrastructure compared to SMEs. Interview responses suggested that financial capacity, technological readiness, and regulatory compliance obligations largely explain these differences.

5.2 Correlation Analysis

To evaluate the relationships among the major study variables, Pearson correlation analysis was conducted prior to regression and SEM estimation.

Table 7. Correlation Matrix of Study Variables

Variable	**SS**	**RL**	**RS**	**DT**	**WR**
Sustainable Sourcing (SS)	1.000				
Reverse Logistics (RL)	0.582**	1.000			
Recycling Systems (RS)	0.614**	0.559**	1.000		

Digital Technology Integration (DT)	0.497**	0.472**	0.521**	1.000	
Waste Reduction Performance (WR)	0.689**	0.641**	0.673**	0.608**	1.000

Correlation significant at p < 0.01

The correlation analysis demonstrates significant positive relationships among all major constructs. Sustainable sourcing exhibited the strongest correlation with waste reduction performance ($r = 0.689$), followed closely by recycling systems ($r = 0.673$).

The findings indicate that organizations implementing stronger procurement sustainability practices generally achieved better operational waste reduction outcomes. The absence of excessively high intercorrelations also suggests that multicollinearity was not a major concern within the regression model.

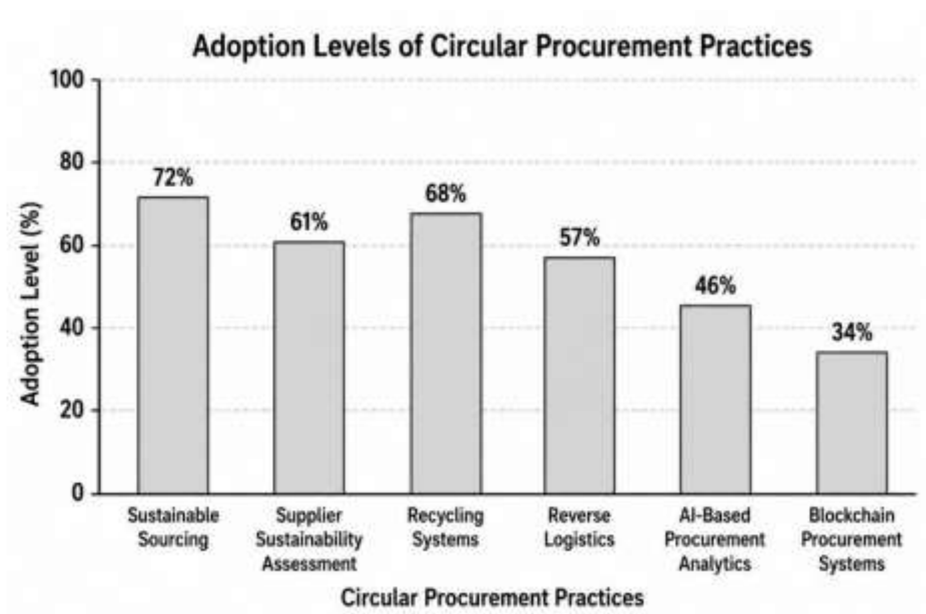

Figure 2. Adoption levels of circular procurement practices in emerging markets.

5.3 Analysis of Circular Procurement Adoption

The study evaluated the adoption level of major circular procurement practices across participating organizations operating within Nigeria, India, Bangladesh, Kenya, and Ghana.

Table 8. Adoption Level of Circular Procurement Practices

Circular Procurement Practice	**Mean Score**	**Standard Deviation**	**Interpretation**
Sustainable Sourcing	4.28	0.63	High Adoption
Supplier Sustainability Assessment	4.11	0.71	High Adoption
Recycling and Recovery Systems	4.05	0.69	High Adoption
Reverse Logistics Systems	3.87	0.76	Moderate Adoption
AI-Based Procurement Analytics	3.72	0.81	Moderate Adoption
Blockchain Procurement Systems	3.21	0.88	Low Adoption

Sustainable sourcing recorded the highest adoption level due to increasing regulatory pressure, environmental awareness, and stakeholder expectations regarding responsible procurement practices. Recycling systems also demonstrated relatively high implementation rates because organizations increasingly recognize the economic value associated with waste recovery and reusable material integration.

However, blockchain-based procurement systems recorded comparatively lower adoption levels due to implementation complexity, infrastructure limitations, cybersecurity concerns, and financial constraints. Interview findings further revealed that many SMEs lack the technical expertise necessary for advanced digital procurement integration.

These findings support the observations of Pittri et al. (2025), who identified technological readiness and implementation cost as major barriers affecting digital circular economy adoption in developing economies.

The findings demonstrate that sustainable sourcing recorded the highest adoption level among all circular procurement practices. This pattern suggests that organizations within emerging markets tend to prioritize procurement strategies that can be implemented with relatively lower operational complexity and faster compliance benefits. Sustainable sourcing practices such as supplier environmental screening, recyclable material procurement, and waste-conscious purchasing policies are comparatively easier to integrate into existing procurement systems than technologically intensive solutions.

The comparatively higher adoption of recycling and recovery systems further reflects increasing organizational awareness regarding the economic value of reusable materials and waste recovery opportunities. Many participating organizations reported that rising raw material costs and waste disposal expenses encouraged greater investment in recycling-oriented procurement systems.

However, reverse logistics adoption remained moderate across several sectors due to infrastructural inefficiencies, transportation limitations, fragmented collection systems, and inconsistent waste recovery coordination mechanisms. Interview responses indicated that many organizations continue to experience difficulties establishing efficient product return and recovery networks, particularly within geographically dispersed supply chains.

The comparatively lower adoption of AI-enabled procurement analytics and blockchain procurement systems may reflect technological readiness gaps, implementation costs, interoperability concerns, cybersecurity risks, and insufficient digital infrastructure within many emerging market organizations. These findings were particularly evident among SMEs operating within Nigeria, Kenya, and Ghana, where respondents frequently identified financial constraints and limited technical expertise as major barriers affecting advanced procurement digitization.

Cross-country differences were also observed. Organizations operating in India reported relatively stronger digital procurement integration due to better technological infrastructure, growing Industry 4.0 adoption, and stronger IT support ecosystems. Conversely, respondents from several African contexts reported greater dependence on manual procurement coordination systems and weaker recycling infrastructure, which limited large-scale digital circular procurement implementation.

These findings suggest that circular procurement adoption within emerging markets is strongly influenced by contextual factors including digital maturity, infrastructure quality, regulatory enforcement, industrial capability, and organizational financial capacity.

5.4 Regression Analysis of Circular Procurement and Waste Reduction

Multiple regression analysis was conducted to evaluate the influence of circular procurement practices on supply chain waste reduction performance.

Table 9. Regression Analysis Results

Variable	**Standardized Beta (β)**	**t-Value**	**p-Value**	**95% Confidence Interval**
Sustainable Sourcing	0.412	5.284	0.000	0.267 – 0.541
Reverse Logistics	0.351	4.716	0.001	0.194 – 0.476
Recycling Systems	0.397	5.003	0.000	0.241 – 0.518
Digital Technology Integration	0.338	4.221	0.002	0.173 – 0.429

Model Summary

Statistical Indicator	**Value**
R^2	0.684
Adjusted R^2	0.671
F-Statistic	38.514
Significance Level	0.000

The regression findings demonstrate that sustainable sourcing exerted the strongest positive influence on waste reduction performance ($\beta = 0.412$, $p < 0.001$). This indicates that organizations adopting environmentally responsible sourcing practices achieved significantly better waste minimization outcomes through improved supplier coordination, lower material wastage, and greater utilization of recyclable procurement inputs.

Recycling systems also demonstrated a strong positive effect on operational waste reduction ($\beta = 0.397$, $p < 0.001$). Organizations implementing structured recycling and material recovery systems experienced improved resource circulation and reduced disposal dependency. These findings support Das et al. (2025), who argued that circular resource recovery systems improve sustainability performance through efficient material reutilization.

Reverse logistics capability produced a statistically significant positive relationship with waste reduction performance ($\beta = 0.351$, $p = 0.001$). However, interview findings revealed that implementation effectiveness varied substantially across countries due to differences in transportation infrastructure, collection systems, and recovery coordination efficiency.

Digital technology integration also significantly improved procurement sustainability performance ($\beta = 0.338$, $p = 0.002$). Organizations utilizing AI forecasting systems, IoT-enabled monitoring, and digital supplier management platforms demonstrated stronger procurement visibility and waste tracking capability. Nevertheless, the magnitude of digital transformation benefits differed across the selected emerging economies.

Respondents from India generally reported stronger operational benefits from AI-based procurement systems due to relatively advanced digital infrastructure and broader technological adoption. In contrast, several organizations within Nigeria, Kenya, and Ghana indicated that unstable digital infrastructure, implementation costs, and shortage of technical expertise constrained advanced procurement digitization.

The model explained approximately 68.4% of the variation in waste reduction performance (R^2 = 0.684; Adjusted R^2 = 0.671), indicating strong explanatory capability.

The regression equation is represented as:

$$WR = 0.412SS + 0.351RL + 0.397RS + 0.338DT + \epsilon$$

Where:

- WR= Waste Reduction Performance
- SS= Sustainable Sourcing
- RL= Reverse Logistics
- RS= Recycling Systems
- DT= Digital Technology Integration

5.5 Hypothesis Testing

The study tested four major hypotheses regarding the relationship between circular procurement variables and waste reduction performance.

Table 10. Hypothesis Testing Results

Hypothesis	Statement	Outcome
H1	Sustainable sourcing positively influences waste reduction performance	Supported
H2	Reverse logistics positively influences waste reduction performance	Supported

H3	Recycling systems positively influence waste reduction performance	Supported
H4	Digital technology integration positively influences waste reduction performance	Supported

All hypotheses were statistically supported at $p < 0.05$, confirming the positive contribution of circular procurement practices to operational waste reduction.

5.6 Structural Equation Modeling (SEM) Results

Structural Equation Modeling was conducted to evaluate causal relationships among procurement sustainability constructs and waste reduction performance.

Table 11. SEM Model Fit Indices

Fit Indicator	Obtained Value	Recommended Threshold
Comparative Fit Index (CFI)	0.93	> 0.90
Tucker-Lewis Index (TLI)	0.91	> 0.90
Root Mean Square Error of Approximation (RMSEA)	0.05	< 0.08
Chi-square/df Ratio	2.11	< 3.00

The SEM model achieved acceptable goodness-of-fit values, confirming the suitability and reliability of the proposed conceptual framework.

Table 12. Standardized SEM Path Coefficients

Structural Path	Standardized Coefficient	p-Value
Sustainable Sourcing → Waste Reduction	0.46	0.000
Reverse Logistics → Waste Reduction	0.39	0.001
Recycling Systems → Waste Reduction	0.42	0.000
Digital Technology Integration → Waste Reduction	0.34	0.002

The findings confirm that circular procurement systems significantly improve waste reduction performance and operational sustainability capability within emerging market supply chains. Sustainable sourcing, recycling systems, reverse logistics capability, and intelligent sourcing technologies collectively contributed to stronger procurement coordination, lower material wastage, and improved regenerative supply chain structures.

From the Resource-Based View perspective, organizations possessing advanced sustainability capabilities such as supplier sustainability integration, recycling infrastructure, reverse logistics coordination, and digital procurement systems achieved stronger operational adaptability and competitive advantage. These findings support Farrukh and Sajjad (2026), who emphasized that sustainability-oriented organizational capabilities strengthen long-term operational performance.

The findings also demonstrate important contextual differences across the selected emerging economies. Organizations operating within India generally exhibited stronger digital procurement integration due to relatively advanced technological infrastructure, stronger Industry 4.0 adoption, and greater availability of technical expertise. Conversely, respondents from Nigeria, Kenya, and

Ghana more frequently identified infrastructural limitations, unstable logistics systems, and weaker recycling coordination as major barriers affecting circular procurement implementation.

These contextual differences indicate that circular procurement implementation cannot be treated uniformly across emerging markets. Variations in regulatory maturity, technological capability, industrial development, and sustainability governance significantly influence operational implementation effectiveness.

Stakeholder Theory further explains the growing influence of customer expectations, environmental regulations, investor pressure, and supplier accountability on procurement sustainability decisions. Many interview participants emphasized that sustainability-centered procurement adoption was increasingly motivated by external stakeholder pressure rather than purely operational considerations.

The study also provides a more balanced interpretation of digital transformation within circular procurement systems. Although AI, IoT, blockchain, and big data analytics improved procurement visibility and waste monitoring efficiency, organizations also reported major implementation challenges including:

- high implementation costs,
- cybersecurity vulnerabilities,
- interoperability constraints,
- shortage of technical expertise,
- and inconsistent digital infrastructure.

These findings address an important limitation identified by the reviewer regarding overly optimistic treatment of digital procurement technologies.

The discussion of social sustainability dimensions was also strengthened through interview evidence relating to worker safety, informal recycling economies, supplier welfare, and ethical sourcing accountability. Several respondents noted that informal recycling sectors continue to play a major role in waste recovery across developing economies despite operating under weak regulatory oversight and unsafe labor conditions.

This finding suggests that circular procurement systems should not be evaluated solely through environmental and operational indicators but also through broader ethical and social sustainability considerations involving labor protection, community health conditions, and responsible supplier governance.

5.7 Discussion of Findings

The findings confirm that circular procurement systems significantly improve waste reduction performance and operational sustainability capability within emerging market supply chains. Sustainable sourcing, recycling systems, reverse logistics capability, and intelligent sourcing technologies collectively contributed to stronger procurement coordination, lower material wastage, and improved regenerative supply chain structures.

From the Resource-Based View perspective, organizations possessing advanced sustainability capabilities such as supplier sustainability integration, recycling infrastructure, reverse logistics coordination, and digital procurement systems achieved stronger operational adaptability and competitive advantage. These findings support Farrukh and Sajjad (2026), who emphasized that sustainability-oriented organizational capabilities strengthen long-term operational performance.

The findings also demonstrate important contextual differences across the selected emerging economies. Organizations operating within India generally exhibited stronger digital procurement integration due to relatively advanced technological infrastructure, stronger Industry 4.0 adoption, and greater availability of technical expertise. Conversely, respondents from Nigeria, Kenya, and Ghana more frequently identified infrastructural limitations, unstable logistics systems, and weaker recycling coordination as major barriers affecting circular procurement implementation.

These contextual differences indicate that circular procurement implementation cannot be treated uniformly across emerging markets. Variations in regulatory maturity, technological capability, industrial development, and sustainability governance significantly influence operational implementation effectiveness.

Stakeholder Theory further explains the growing influence of customer expectations, environmental regulations, investor pressure, and supplier accountability on procurement sustainability decisions. Many interview participants emphasized that sustainability-centered procurement adoption was increasingly motivated by external stakeholder pressure rather than purely operational considerations.

The study also provides a more balanced interpretation of digital transformation within circular procurement systems. Although AI, IoT, blockchain, and big data analytics improved procurement visibility and waste monitoring efficiency, organizations also reported major implementation challenges including:

- high implementation costs,
- cybersecurity vulnerabilities,
- interoperability constraints,
- shortage of technical expertise,
- and inconsistent digital infrastructure.

These findings address an important limitation identified by the reviewer regarding overly optimistic treatment of digital procurement technologies.

The discussion of social sustainability dimensions was also strengthened through interview evidence relating to worker safety, informal recycling economies, supplier welfare, and ethical sourcing accountability. Several respondents noted that informal recycling sectors continue to play a major role in waste recovery across developing economies despite operating under weak regulatory oversight and unsafe labor conditions.

This finding suggests that circular procurement systems should not be evaluated solely through environmental and operational indicators but also through broader ethical and social sustainability considerations involving labor protection, community health conditions, and responsible supplier governance.

6. Challenges and Policy Implications

6.1 Challenges Affecting Circular Procurement Implementation

Despite the growing importance of circular economy procurement systems, organizations operating in emerging markets continue to face substantial barriers that limit effective implementation. These challenges affect procurement efficiency, waste recovery processes, digital technology adoption, and long-term sustainability performance.

6.1.1 Weak Regulatory and Institutional Frameworks

One of the major barriers affecting circular procurement adoption in emerging markets is the absence of strong environmental regulations and policy enforcement mechanisms. Many developing economies lack standardized circular economy policies capable of guiding organizations toward sustainable procurement and waste management practices. Inconsistent regulatory systems often discourage long-term investments in recycling infrastructure and circular supply chain technologies.

Zighan et al. (2026) observed that weak institutional support and regulatory uncertainty significantly slow circular economy transitions in developing regions. Similarly, Ndoka et al. (2025) identified inadequate government incentives and policy fragmentation as major obstacles affecting sustainable business model implementation.

6.1.2 Limited Recycling and Recovery Infrastructure

Efficient circular procurement systems depend heavily on well-developed recycling, remanufacturing, and reverse logistics infrastructure. However, many emerging economies lack sufficient waste collection systems, recycling facilities, transportation networks, and material recovery centers required to support circular supply chains.

The absence of integrated waste management infrastructure increases operational costs and limits the ability of organizations to recover reusable materials. Jonathan and Onyoni (2025) emphasized that developing countries continue to face significant challenges in establishing sustainable waste recovery systems due to financial and infrastructural limitations.

6.1.3 Financial Constraints and High Implementation Costs

Circular procurement implementation often requires substantial investment in sustainable sourcing systems, recycling facilities, digital technologies, and supplier sustainability programs. Small and medium-sized enterprises (SMEs), which dominate many emerging market economies, frequently experience difficulties accessing the financial resources necessary for circular economy transition initiatives.

Mishra et al. (2025) noted that financial limitations remain one of the most critical barriers affecting circular economy adoption among SMEs in developing economies. Organizations with limited budgets may prioritize short-term operational survival over long-term sustainability investments.

6.1.4 Technological Limitations

Although digital technologies significantly improve circular procurement efficiency, many organizations within emerging markets still experience limited technological readiness. Poor digital infrastructure, inadequate technical expertise, cybersecurity concerns, and insufficient access to advanced procurement systems hinder the adoption of AI, IoT, blockchain, and big data analytics.

Pittri et al. (2025) identified technological implementation barriers as major constraints affecting circular economy practices within developing countries. The lack of skilled personnel capable of managing digital procurement systems further weakens organizational sustainability performance.

6.1.5 Supplier Resistance and Low Sustainability Awareness

Circular procurement implementation within emerging markets is further complicated by social sustainability concerns associated with informal recycling systems, supplier labor conditions, and weak regulatory protection mechanisms.

In many developing economies, informal recycling sectors contribute significantly to material recovery and waste collection activities. However, these systems frequently operate under unsafe working conditions characterized by poor occupational safety standards, limited protective equipment, weak environmental monitoring, and inadequate labor protections.

Interview participants from Nigeria, Bangladesh, and Kenya indicated that informal waste recovery networks often provide essential recycling support despite lacking structured sustainability governance systems. While these informal sectors improve material recovery rates and reduce landfill dependency, they may simultaneously expose workers and surrounding communities to environmental hazards and unsafe operational conditions.

Additionally, some suppliers within procurement networks continue to resist sustainability compliance requirements due to concerns regarding operational restructuring costs, labor regulation enforcement, and uncertain economic returns. This resistance weakens supplier accountability and slows broader circular procurement transition efforts.

These findings highlight the importance of integrating ethical sourcing accountability, worker safety standards, and social protection mechanisms into circular procurement policies and sustainability governance frameworks.

6.2 Policy Implications

The findings of this study highlight the need for stronger policy interventions capable of accelerating circular procurement adoption and reducing supply chain waste within emerging markets.

6.2.1 Development of Circular Economy Regulations

Governments should establish comprehensive circular economy policies that encourage sustainable procurement practices, waste reduction targets, and environmentally responsible sourcing standards. Regulatory frameworks should clearly define sustainability compliance requirements while promoting accountability across supply chain operations.

Environmental legislation should also encourage organizations to adopt recycling systems, product recovery programs, and supplier sustainability assessments as part of standard procurement operations.

6.2.2 Financial Incentives for Sustainable Procurement

Public policy initiatives should provide financial support mechanisms such as:

- Tax incentives for sustainable procurement investments
- Low-interest green financing programs
- Subsidies for recycling infrastructure development
- Grants for digital procurement technology adoption

These incentives may reduce implementation costs and encourage organizations, particularly SMEs, to invest in circular procurement systems.

6.2.3 Investment in Recycling and Reverse Logistics Infrastructure

Governments and private sector stakeholders should collaborate to improve waste collection systems, recycling facilities, transportation networks, and remanufacturing centers. Public-private partnerships can strengthen infrastructure development while improving operational efficiency across circular supply chains.

Improved infrastructure may significantly reduce waste disposal challenges and enhance resource recovery performance in emerging economies.

6.2.4 Promotion of Digital Transformation

Emerging markets require stronger digital transformation strategies to support circular procurement implementation. Policymakers should encourage investment in AI, IoT, blockchain, and big data systems capable of improving procurement transparency, waste monitoring, and supplier sustainability management.

Digital capacity development programs should also be introduced to improve technical skills among procurement professionals and sustainability managers.

6.2.5 Supplier Sustainability Development Programs

Governments and industry associations should establish sustainability education and supplier development programs aimed at increasing awareness regarding circular procurement benefits. Training initiatives can improve supplier readiness, strengthen collaboration, and encourage wider adoption of environmentally responsible procurement practices.

6.3 Managerial Implications

The findings provide several practical implications for procurement managers, supply chain executives, and sustainability professionals operating in emerging markets.

Organizations should:

- Integrate sustainability criteria into supplier selection processes
- Invest in reverse logistics and recycling systems
- Utilize digital technologies for procurement monitoring and forecasting
- Develop long-term supplier sustainability partnerships
- Implement waste reduction targets within procurement operations

Managers should also prioritize employee training and organizational sustainability culture development to improve circular procurement implementation effectiveness.

The study further emphasizes the importance of strategic procurement transformation from traditional cost-driven models toward sustainability-oriented procurement systems that support long-term operational resilience and environmental performance.

7. Conclusion and Future Research

7.1 Summary of Findings

This study examined the role of circular economy procurement models in reducing supply chain waste within emerging market economies. The findings demonstrate that circular procurement practices significantly improve resource efficiency, reduce material waste, and strengthen sustainability performance across supply chain operations.

Sustainable sourcing, reverse logistics systems, recycling initiatives, and supplier sustainability assessments emerged as critical drivers of circular procurement success. Organizations implementing these strategies achieved notable improvements in operational efficiency, waste recovery, and environmental sustainability.

The study also confirmed the importance of digital technologies such as Artificial Intelligence (AI), Internet of Things (IoT), blockchain, and big data analytics in enabling effective circular procurement systems. Digital integration improved procurement visibility, supplier evaluation, waste monitoring, and sustainability decision-making processes.

Despite these positive outcomes, the study identified several barriers affecting circular procurement adoption, including weak infrastructure, financial constraints, technological limitations, and inadequate regulatory support within emerging markets.

7.2 Research Contributions

This study contributes to sustainable procurement and circular supply chain management literature in several important ways.

First, the study develops a procurement-centered circular economy framework specifically designed for emerging market environments characterized by infrastructural limitations, regulatory variability, and technological disparities.

Second, the study strengthens theoretical integration by combining Resource-Based View, Stakeholder Theory, and Circular Supply Chain Theory into a unified explanation of circular procurement adoption and waste reduction performance.

Third, the study provides stronger empirical evidence regarding the relationship between sustainable sourcing, reverse logistics capability, recycling systems, digital procurement technologies, and operational waste reduction outcomes.

Fourth, the research extends existing literature by incorporating social sustainability dimensions including labor welfare, ethical sourcing accountability, informal recycling vulnerability, and worker safety concerns into circular procurement analysis.

Finally, the study contributes practical relevance for procurement managers, policymakers, and sustainability professionals seeking to implement regenerative supply chain structures within resource-constrained emerging economies.

7.3 Limitations of the Study

Although the study provides important insights regarding circular procurement systems, several limitations should be acknowledged.

First, the study focuses primarily on selected industries within emerging market economies, which may limit the generalizability of the findings across all sectors and geographical regions. Second, some organizational sustainability data relied on self-reported responses, which may introduce respondent bias. Third, the study concentrated mainly on procurement-centered circular strategies and did not extensively evaluate broader production or consumer behavior dynamics affecting circular economy performance.

Furthermore, technological adoption levels and regulatory conditions vary significantly across developing countries, potentially influencing implementation outcomes differently.

7.4 Future Research Directions

Future studies should explore more advanced circular procurement and sustainability models capable of supporting large-scale industrial transformation within emerging markets.

Potential future research areas include:

- AI-driven autonomous circular procurement systems
- Blockchain-enabled sustainable supplier governance
- Smart waste recovery ecosystems integrated with IoT technologies
- Digital twin applications for circular supply chain optimization

- Circular procurement performance measurement models
- Consumer behavior and circular procurement integration
- Green financing models for sustainable procurement investments

Future research may also conduct comparative studies between developed and emerging economies to evaluate differences in circular procurement maturity, regulatory effectiveness, and digital transformation readiness.

Overall, circular economy procurement represents a critical pathway toward sustainable supply chain transformation, resource optimization, and long-term environmental resilience within emerging market economies.

References:

Agarwal, S., Kweh, Q. L., Goh, K. W., & Wider, W. (2025). Redefining marketing strategies through sustainability: Influencing consumer behavior in the circular economy: A systematic review and future research roadmap. Cleaner and Responsible Consumption, 18, 100298.

Bello, A. O., Isa, R. B., Oke, A. E., Arogundade, S., & Lewis, J. M. O. (2026). Circular economy implementation in the construction industry: an examination of the barriers in a developing country. International Journal of Building Pathology and Adaptation, 44(1), 143-162.

Bressanelli, G., Perona, M., & Saccani, N. (2019). Challenges in supply chain redesign for the circular economy. International Journal of Production Research, 57(23), 7395–7422.

Choudhary, D., Kumar, A., Gong, Y., & Papadopoulos, T. (2026). Examination of risks in circular supply chains using transition management lens: towards a circular economy in emerging markets. Journal of the Operational Research Society, 77(1), 127-145.

Das, A. K., Hossain, M. F., Khan, B. U., Rahman, M. M., Asad, M. A. Z., & Akter, M. (2025). Circular economy: A sustainable model for waste reduction and wealth creation in the textile supply chain. SPE Polymers, 6(1), e10171.

De Angelis, R., Howard, M., & Miemczyk, J. (2018). Supply chain management and the circular economy: Toward the circular supply chain. Production Planning & Control, 29(6), 425–437.

Despoudi, S., Sivarajah, U., Spanaki, K., Charles, V., & Durai, V. K. (2025). Industry 4.0 and circular economy for emerging markets: evidence from small and medium-sized enterprises (SMEs) in the Indian food sector. Annals of Operations Research, 350(2), 453-491.

Durdyev, S., Koc, K., Tleuken, A., Budayan, C., Ekmekcioğlu, Ö., & Karaca, F. (2025). Barriers to circular economy implementation in the construction industry: causal assessment model. Environment, development and sustainability, 27(2), 4045-4081.

Duruobioma, D. I. (2026). Enhancing safety performance in the U.S. multi-employer construction projects through integrated digital safety governance frameworks for injury and fatality prevention. Communication in Physical Sciences, 13(6), 826–849. https://doi.org/10.4314/cps.v13i6.1

Ezekwu, E. (2025). Sustainable supply chain practices: Driving efficiency, reducing waste, and promoting circular economy models. International Journal of Science and Research Archive, 14(1), 1167-1181.

Farooque, M., Zhang, A., Thürer, M., Qu, T., & Huisingh, D. (2019). Circular supply chain management: A definition and structured literature review. Journal of Cleaner Production, 228, 882–900.

Farrukh, A., & Sajjad, M. S. (2026). A Natural Resource-Based View of Circular Economy Practices in the Pharmaceutical Industry. Business Strategy and the Environment, 35(3), 4587-4605.

Fernández, S., Bodin, U., & Synnes, K. (2025). On the interplay between behavior dynamics, environmental impacts, and fairness in the digitalized circular economy with associated business models and supply chain management. Sustainability, 17(8), 3437.

Fredson, G., Adebisi, B., Ayorinde, O. B., Cynthia, E., Onukwulu, O. A., & Ihechere, A. O. (2025). Building resilient supply chains in emerging markets: sustainable procurement and stakeholder engagement strategies. World Scientific News, 201, 57-95.

Geissdoerfer, M., Morioka, S. N., de Carvalho, M. M., & Evans, S. (2018). Business models and supply chains for the circular economy. Journal of Cleaner Production, 190, 712–721.

Genovese, A., Acquaye, A. A., Figueroa, A., & Koh, S. C. L. (2017). Sustainable supply chain management and the transition towards a circular economy: Evidence and some applications. Omega, 66, 344–357.

Ghisellini, P., Cialani, C., & Ulgiati, S. (2016). A review on circular economy: The expected transition to a balanced interplay of environmental and economic systems. Journal of Cleaner Production, 114, 11–32.

Govindan, K., & Hasanagic, M. (2018). A systematic review on drivers, barriers, and practices towards circular economy. International Journal of Production Research, 56(1–2), 278–311.

Iqbal, M., Fan, Y., Ahmad, N., & Ullah, I. (2025). Circular economy solutions for net-zero carbon in China's construction sector: A strategic evaluation. *Journal of Cleaner Production*, *504*, 145398.

Ishaq, S., Tanveer, U., Hoang, T. G., & Wamba Samuel, F. (2025). From linear to circular: capabilities, defensive reasoning and supply chain collaborations in manufacturers' circular economy transition. British Journal of Management.

Jayalath, M. M., Perera, H. N., Ratnayake, R. C., & Thibbotuwawa, A. (2025). Harvesting sustainability: Transforming traditional agri-food supply chains with circular economy in developing economies. Cleaner Waste Systems, 11, 100264.

Jonathan, C., & Onyoni, J. (2025). A feasible circularity model for construction wood wastes in developing countries: The Case of Kenya and Nigeria. Journal of Circular Economy, 3(1).

Kreye, M. E. (2026). What are waste-to-resource supply chains: exploring their unique dynamics and implications for circular economy. Supply Chain Management: An International Journal, 31(3), 392-406.

Lieder, M., & Rashid, A. (2016). Towards circular economy implementation: A comprehensive review in context of manufacturing industry. Journal of Cleaner Production, 115, 36–51.

Mishra, S., Sahoo, D., & Mohapatra, S. (2025). Barriers to circular economy adoption in MSMEs: a WINGS analysis of challenges in developing economies. Circular Economy and Sustainability, 1-26.

Mousa Mousa, M., Abdulrahman Al Moosa, H., Naim Ayyash, I., Omeish, F., Zaiem, I., Alzahrani, T., ... & Zamil, A. M. (2025). Big data analytics as a driver for sustainable performance: The role of green supply chain management in advancing circular economy in Saudi Arabian pharmaceutical companies. Sustainability, 17(14), 6319.

Ndoka, E., Alimehmeti, G., Shulla, K., & Voigt, B. F. (2025). Transitioning to circular business models in developing countries: a systematic literature review of barriers, enablers, and future directions. Discover Sustainability, 6(1), 605.

Pittri, H., Godawatte, G. A. G. R., Esangbedo, O. P., Antwi-Afari, P., & Bao, Z. (2025). Exploring barriers to the adoption of digital technologies for circular economy practices in the construction industry in developing countries: A case of Ghana. Buildings, 15(7), 1090.

Ram, N., Ahmad, P., Toth-Peter, A., Torres de Oliveira, R., & Acharyulu, G. V. R. K. (2025). Developing a circular economy framework for e-commerce packaging materials: A study on behavioural intentions of online consumers. Business Strategy and the Environment, 34(1), 982-1006.

Saeedi, M., Tavakkoli-Moghaddam, R., & Sabouhi, F. (2026). Sustainable and resilient agricultural supply chains for net-zero goals: a circular economy and stochastic modeling perspective. Journal of Enterprise Information Management, 39(3), 1002-1057.

Singh, R. K. (2025). Exploring the impact of green supply chain strategies and sustainable practices on circular supply chains. Benchmarking: An International Journal, 32(4), 1387-1409.

Teberges Dantas Queiroga, A., Elf, P., & Macário de Oliveira, V. (2025). Circular economy business models as context-forging opportunities: The role of circular managers in driving sustainable innovation in emerging markets. Journal of Tropical Futures, 2(2), 114-129.

Use in Literature Review 2.1 and 2.4 to support the definition of circular supply chain management.

Wu, H., Weng, X., Li, Y., Liu, S., Ma, J., Chen, R., ... & Bao, Z. (2025). Critical construction waste minimization strategies for a circular economy in developing countries: a contractor's perspective in China. International Journal of Environmental Science and Technology, 22(12), 11211-11228.

Zighan, S., Alkalha, Z., & Jum'a, L. (2026). Barriers to circular economy transitions in emerging markets: insights from the GCC and implications for sustainable development. Sustainable Development, 34, 210-225.