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Determinants of circular supply chain implementation in a resource-constrained country: Evidence from Liberia's mineral water industry

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Background: Mineral water companies face growing environmental challenges and resource depletion, yet circular supply chain (CSC) adoption remains uneven. In developing economies, structural resource scarcity limits firms' ability to build capabilities using conventional models, creating a gap in understanding how circular practices emerge under constraints.

Objectives: This study examined how internal organisational factors influence CSC implementation in Liberia's mineral water sector, and how government policy moderates this relationship, focusing on firms operating under resource scarcity.

Method: A quantitative approach surveyed 306 respondents from three mineral water companies. Data were collected from supply chain personnel and analysed using partial least squares structural equation modelling to examine the effects of managerial commitment, operational process capability, resource allocation discipline and government policy on CSC adoption.

Results: Managerial commitment, operational process capability and disciplined resource allocation significantly influenced CSC implementation. Government policy strengthened the link between internal capabilities and implementation, enhancing adoption when aligned with firm capacities.

Conclusion: Internal organisational factors are critical drivers of CSC implementation under scarcity, and supportive policy frameworks amplify their effect. Scarcity can act as a generative condition that reshapes resource prioritisation and allocation for sustainable operations.

Contribution: The study extends the resource-based view by demonstrating how firms develop circular capabilities under persistent scarcity. It offers empirical evidence on internal mechanisms and policy interactions that enable CSC implementation in developing economies, providing insights for managers and policymakers seeking to enhance sustainability in resource-constrained contexts.

Keywords: circular supply chain; resource scarcity; organisational capabilities; government policy; mineral water sector; sustainability.

Introduction

As businesses confront increasing environmental pressures, material depletion and sustainability-related operational risks, circular supply chain management (CSCM) has emerged as a central strategy for enabling sustainable production and consumption transitions (Cano et al. 2025). Circular supply chain management promotes practices such as recycling, remanufacturing, reverse logistics and material recovery to minimise waste and extend resource lifecycles within supply chains (Hamid et al. 2026). Recent studies emphasise that CSCM contributes not only to environmental sustainability but also to operational resilience, competitive advantage and resource efficiency, particularly in industries facing ecological and economic uncertainty (Agyabeng-Mensah, Baah & Afum 2025; Zhu et al. 2026). Despite growing attention, CSCM implementation remains uneven across firms and regions, especially in developing economies characterised by institutional weaknesses and structural resource constraints (Kirchherr et al. 2023; Ndoka, Alimehmeti & Shulla 2025). Existing explanations often focus on barriers such as inadequate infrastructure, financial constraints and technological deficiencies (Pellegrino et al. 2026).

However, these accounts largely identify obstacles without adequately explaining how firms develop circular capabilities under persistent scarcity. As a result, CSCM theory remains limited in explaining capability formation when resource stability cannot be assumed.

This gap exposes a key assumption of the Resource-Based View (RBV), namely that firms require stable and sufficient resources to build valuable, rare, inimitable and non-substitutable (VRIN) capabilities for sustained competitive advantage (Barney 1991; Peteraf 1993). Classical RBV conceptualises capability development in contexts where firms access financial, technological and operational resources that enable accumulation and deployment. However, recent scholarship questions this assumption in structurally constrained environments where scarcity is systemic rather than temporary (Shen & Chen 2025). Taddei et al. (2024) argue that theoretical advances often arise when empirical realities challenge dominant assumptions. In many developing economies, firms face persistent infrastructural instability, limited technology diffusion and restricted financial access, making resource sufficiency problematic (Aryee & Kanda 2024; Petropoulos et al. 2026). In such contexts, firms may build capabilities not through abundance, but through adaptation, recombination and prioritisation of scarce resources.

Liberia's mineral water sector offers a useful context because scarcity is structural rather than episodic. Firms operate under weak recycling systems, unstable supply chains, limited technological support, and weak environmental governance, yet still display varying levels of CSCM implementation. This variation suggests that some firms develop circular capabilities despite severe constraints, while others struggle under similar conditions. Evidence indicates that firms in developing economies increasingly rely on adaptive capabilities and resource recombination strategies to overcome institutional and operational deficiencies (Aryee & Kanda 2024). Thus, the sector is appropriate for examining capability formation where RBV assumptions do not hold. Structural scarcity may therefore reshape how firms evaluate, coordinate, and deploy strategic resources for sustainability objectives.

Building on scarcity-oriented and dynamic capability perspectives, this study argues that structural scarcity alters mechanisms through which CSCM capabilities emerge (Li et al. 2025). Scarcity not only reduces resource availability but also changes how organisations prioritise and utilise strategic resources. Under constrained conditions, firms rely on managerial commitment (MC), process adaptability, selective orchestration and disciplined resource allocation to support circular practices such as recycling, reverse logistics and material recovery (Farooque et al. 2022; Shen & Chen 2025). Scarcity can also stimulate innovation and resilience by encouraging recombination of existing resources and redesign of operational routines (Alam & Ullah 2025; Yordanova & Shotarov 2026).

Unlike prior CSCM studies that consider broad organisational and institutional drivers, this study focuses on MC, operational process capability (OPC) and resource allocation discipline (RAD) as key internal mechanisms of capability recombination under scarcity. Managerial commitment reflects strategic prioritisation; OPC reflects process redesign with limited resources; and RAD reflects structured orchestration of scarce resources. These variables align with a scarcity-oriented reinterpretation of RBV and jointly explain internal capability formation. External factors such as technological readiness, stakeholder pressure and collaboration were not prioritised as they are less reflective of internally generated adaptation under severe constraints.

Using data from 306 respondents across three mineral water companies in Liberia, the study employs Partial Least Squares Structural Equation Modelling (PLS-SEM) to test these relationships. It extends RBV by proposing a scarcity-oriented view of capability formation and advances CSCM literature by explaining how firms transform structural scarcity into a catalyst for circular capability development in resource-constrained contexts.

Research purpose

The purpose of this study was to examine how internal factors influence the implementation of CSCM in Liberia's mineral water sector, particularly within contexts characterised by structural resource scarcity.

Study objectives

The study objectives were:

- To examine the influence of internal factors on the implementation of Circular Supply Chain (CSC) in the mineral water sector in Liberia.
- To assess the moderating role of government policy on the relationship between internal factors and CSC implementation in resource-constrained environments.
- To provide recommendations for managers and policymakers on strengthening internal capabilities and developing a supportive policy framework to enhance (CSC) implementation in Liberia's mineral water industry.

Literature review

This section synthesises existing research on CSC, internal organisational capabilities and the influence of government policy. It examines how key organisational factors, including MC, OPC and RAD, contribute to the implementation of CSC practices. The review also identifies theoretical and empirical gaps in the existing literature, particularly regarding CSC adoption in resource-constrained environments. It therefore provides the conceptual foundation for the development of the study's hypotheses and conceptual framework.

Internal organisational factors and circular supply chain management

The implementation of CSC has attracted increasing scholarly attention as organisations seek to address environmental sustainability and resource efficiency challenges. Circular supply chain encompasses practices such as recycling, remanufacturing, material reuse and reverse logistics, all

aimed at extending resource lifecycles and minimising waste (Geissdoerfer et al. 2017; Govindan et al. 2020). These practices are widely recognised as critical mechanisms for reducing environmental impact while maintaining economic performance (Agyabeng-Mensah et al. 2025). Despite its growing relevance, the adoption of CSC remains uneven across firms and contexts, particularly in resource-constrained environments where infrastructural and institutional limitations persist (Kirchherr et al. 2023; Shourkaei, Taylor & Dyck 2024).

Traditional explanations for this variation often emphasise external constraints such as inadequate infrastructure, financial limitations and technological gaps (Bressanelli et al. 2018; Kirchherr et al. 2023).

However, such perspectives tend to focus primarily on barriers to adoption rather than explaining how firms develop capabilities under conditions of scarcity (Hyvärinen, Keskinen & Levänen 2020). As a result, recent scholarship has increasingly shifted attention toward internal organisational factors as primary drivers of CSC implementation, particularly in developing economy contexts where firms must rely more heavily on internally generated capabilities (Aryee & Kanda 2024).

Drawing on the RBV, firms are understood to achieve competitive advantage through the development and deployment of valuable internal capabilities (Barney 1991; Peteraf 1993). However, the classical RBV assumes relative resource sufficiency, which is often unrealistic in developing economies characterised by persistent structural constraints (Bromiley & Rau 2016). In response, recent studies propose a scarcity-oriented extension of RBV, arguing that firms can develop capabilities through the recombination and strategic use of limited resources rather than through accumulation (Randall 2021).

Within this perspective, internal organisational mechanisms become central to CSC implementation. Firms operating in resource-constrained environments actively reinterpret, recombine and repurpose scarce resources to create circular capabilities such as reverse logistics systems and material recovery processes (Farooque et al. 2022). These processes demonstrate that scarcity can function as a generative condition, stimulating innovation, flexibility and strategic problem-solving rather than merely constraining organisational performance (Williams et al. 2021).

While many previous studies broadly identify organisational capabilities as important for CSC adoption, there is limited consensus regarding which specific internal mechanisms are most critical under conditions of structural scarcity. Some scholars emphasise technological capability and digital integration as primary enablers (Bressanelli et al. 2018), whereas others argue that leadership orientation and organisational flexibility are more decisive in developing economy contexts where advanced infrastructure is absent (Aryee & Kanda 2024). Similarly, Govindan et al. (2020) highlight supply chain collaboration as central to CSC implementation, while Shen and Chen (2025) contend that internally driven resource orchestration is more important in environments characterised by institutional instability. These contrasting findings suggest that CSC capability development is context-dependent rather than universally determined by a fixed set of factors.

Empirical evidence from recent studies further supports this argument by demonstrating that CSC implementation is strongly influenced by internal organisational factors, particularly MC, OPC, and RAD (Montag 2023). These findings reinforce the view that CSC adoption is fundamentally an internally driven process, especially in contexts where external support mechanisms are weak or inconsistent, and where firms must rely on internal capability orchestration to achieve sustainability outcomes.

Managerial commitment and circular supply chain implementation

Managerial commitment is widely recognised as a critical determinant of sustainability initiatives and CSC adoption. It reflects the extent to which top management prioritises, supports and integrates circular practices into organisational strategy and operations (Agyabeng-Mensah et al. 2025; Govindan et al. 2020). Empirical studies consistently show that leadership support is a key enabler of environmental and supply chain innovations, as it provides strategic direction and legitimacy for sustainability initiatives within organisations (Farooque et al. 2022).

In the context of resource scarcity, MC plays a transformative role by reframing constraints as opportunities for innovation rather than barriers to performance (Williams et al. 2021). As noted in recent studies, committed managers encourage employees to view residual resources as valuable inputs rather than waste, thereby fostering a culture of circular thinking and continuous improvement (Kirchherr et al. 2023; Montag 2023). This strategic orientation enables firms to identify new value creation pathways and implement circular practices despite limited financial and technological resources (Shen & Chen 2025).

From an RBV perspective, MC can be conceptualised as a higher-order organisational capability that shapes the development and deployment of other firm resources (Barney 1991; Peteraf 1993). It influences strategic decision-making, resource prioritisation and organisational learning processes, all of which are essential for CSC implementation (Bromiley & Rau 2016; Randall 2021).

Furthermore, empirical findings indicate that firms with strong MC are significantly more likely to adopt circular practices such as recycling, reverse logistics and sustainable resource utilisation, as leadership support reduces resistance to change and facilitates cross-functional coordination (Alam & Ullah 2025; Farooque et al. 2022).

Recent literature also highlights that MC enhances organisational resilience and adaptability in uncertain and resource-constrained environments. By promoting long-term sustainability goals and fostering innovation, committed leadership enables firms to navigate the operational and strategic complexities associated with CSC transitions (Aryee & Kanda 2024).

Operational process capability and circular supply chain implementation

Operational process capability refers to a firm's ability to design, adapt and manage processes that support CSC activities. It encompasses process flexibility, efficiency and the integration of circular practices into routine operations (Farooque et al. 2022; Govindan et al. 2020). Existing literature recognises operational capability as a critical organisational competence that enables firms to translate sustainability-oriented strategies into practical supply chain activities (Agyabeng-Mensah et al. 2025; Li et al. 2025).

The literature further emphasises that operational capability is a key enabler of CSC, as it facilitates the implementation of circular practices such as recycling, remanufacturing and reverse logistics systems (Bressanelli et al. 2018; Kirchherr et al. 2023). In resource-constrained environments, firms are often required to redesign existing supply chain routines to accommodate circular practices, including decentralised recovery systems and material reuse processes (Pellegrino et al. 2026; Shen & Chen 2025). These adaptive processes allow organisations to optimise resource utilisation and minimise waste despite infrastructural and technological limitations, which are common barriers in developing economy contexts (Hyvärinen et al. 2020).

From a theoretical standpoint, OPC aligns with dynamic capability theory, which emphasises the ability of firms to reconfigure resources and processes in response to changing environmental conditions (Eisenhardt & Martin 2000; Teece 2018). Within the CSC context, this capability involves the continuous adaptation and reconfiguration of supply chain processes to support circular flows of materials, including reuse, recycling and closed-loop systems (Farooque et al. 2022; Govindan et al. 2020; Massari, Nacchiero & Giannoccaro 2023).

Empirical evidence further suggests that firms with strong operational capabilities are better positioned to manage the complexities associated with CSCs, including product returns, material recovery and coordination among supply chain partners (Bimpizas-Pinis, Calzolari & Genovese 2022; Montag 2023). These capabilities enhance supply chain integration, improve process efficiency and support the effective implementation of CSC practices. Moreover, such capabilities are particularly important in developing economies, where firms must rely on internal innovation and process flexibility to compensate for weak infrastructure and limited external support systems (Alam & Ullah 2025; Aryee & Kanda 2024).

Resource allocation discipline and circular supply chain implementation

Resource allocation discipline refers to the strategic prioritisation and efficient utilisation of limited resources to achieve organisational objectives. It is especially critical in resource-constrained environments, where firms must make deliberate decisions regarding the allocation of financial, material and human resources in order to maintain operational efficiency and competitiveness (Osei et al. 2023). Existing literature emphasises that effective resource allocation is a fundamental managerial function that directly influences organisational performance and the successful implementation of strategic initiatives, including sustainability-oriented practices (Barney 1991; Peteraf 1993).

The literature further identifies RAD as a key mechanism through which firms convert scarcity into capability. By concentrating limited resources on high-impact initiatives, organisations are able to maximise the value derived from constrained inputs and support the implementation of CSC practices (Shen & Chen 2025). This perspective is consistent with emerging scholarship on scarcity-oriented capability development, which suggests that firms can achieve efficiency and innovation through resource recombination and prioritisation rather than resource abundance (Yordanova & Shotarov 2026).

Within the RBV framework, RAD represents an organisational capability that enhances the efficiency and effectiveness of resource utilisation. It enables firms to balance competing priorities and strategically invest in circular initiatives such as recycling systems, waste reduction programmes and sustainable production processes (Dey et al. 2022; Farooque et al. 2022; Govindan et al. 2020). By directing resources toward sustainability-focused activities, firms can improve both environmental and operational performance outcomes (Agyabeng-Mensah et al. 2025).

Empirical findings from recent studies further demonstrate that disciplined resource allocation is a significant predictor of CSC implementation, highlighting its importance in enabling firms to adopt and sustain CSC practices (Alam & Ullah 2025; Montag 2023). In addition, RAD contributes to organisational resilience by enabling firms to adapt to changing environmental conditions and resource constraints, particularly in uncertain and resource-limited contexts (Aryee & Kanda 2024; Duchek 2020).

Government policy and circular supply chain management

Government policy plays a critical role in shaping the institutional environment within which firms operate and significantly influences the adoption of CSC practices (Kalmykova, Sadagopan & Rosado 2018; Schöggl, Stumpf & Baumgartner 2020). Policies such as environmental regulations, recycling standards and extended producer

responsibility (EPR) frameworks provide formal guidelines and economic incentives that encourage firms to implement CSC practices (Govindan et al. 2020; Kirchherr et al. 2023). These regulatory instruments are widely recognised as essential mechanisms for promoting sustainable production and consumption patterns across industries (Borgia, Zavalloni & Viaggi 2025).

In the context of Liberia, government policy on environmental sustainability and natural resource management is primarily guided by the Environmental Protection Agency Act (EPA Act of 2003, amended 2019), the National Environmental Policy (Government of Liberia, 2002) and sector-specific frameworks governing forestry, mining, agriculture, and waste management. The Environmental Protection Agency of Liberia (EPA) serves as the lead regulatory body responsible for enforcing environmental compliance, conducting environmental impact assessments (EIAs) and coordinating national responses to environmental degradation and climate change. In addition, Liberia's participation in international climate commitments, including the Paris Agreement, has reinforced national efforts toward low-carbon development and green growth strategies. Sectoral policies such as the (Food and Agriculture Organisation of the United Nations Legal Office Database [FAOLEX] 2026), the Liberia Extractive Industries Transparency Initiative (LEITI) and waste management regulations under local authorities reflect ongoing attempts to promote sustainable resource extraction, transparency and environmental accountability.

However, despite these policy frameworks, enforcement capacity remains limited because of institutional weaknesses, inadequate funding and technical constraints, which often result in a gap between policy formulation and implementation. Green initiatives, including community reforestation programs, plastic waste reduction campaigns and emerging circular economy awareness efforts, are still in early stages of development and largely dependent on donor and development partner support. This policy environment, therefore, presents a mixed institutional context where regulatory intent toward sustainability exists, but practical enforcement and operationalisation remain constrained, thereby making organisational internal capabilities even more critical for driving CSC adoption in Liberia.

Institutional theory suggests that firms respond to regulatory pressures in order to achieve legitimacy, comply with societal expectations, and maintain their competitive positioning within the market (Juráček, Jurík & Makyšová 2025; Kalmykova et al. 2018). In this context, coercive pressures arising from government regulations often compel organisations to adopt environmentally sustainable practices, including CSC (Farooque et al. 2022; Schöggl et al. 2020). However, the effectiveness of government policy in promoting CSC is not uniform and depends largely on the alignment between policy frameworks and organisational capabilities, as well as the broader institutional context in which firms operate (Petropoulos et al. 2026).

Empirical evidence from recent studies indicates that while government policy can provide institutional stability and operational guidance, its impact on CSC implementation is often contingent on contextual factors such as regulatory quality, enforcement mechanisms and firm-level readiness (Zhu et al. 2026). In some cases, policy frameworks facilitate circular practices by reducing uncertainty, legitimising sustainability initiatives and providing incentives for innovation (Adomako & Tran 2026; Govindan et al. 2020). Conversely, rigid or poorly aligned policies may impose compliance burdens that limit organisational flexibility, increase operational costs and hinder innovation, particularly in resource-constrained environments (Farooque et al. 2022).

This dual role of government policy highlights the need for context-sensitive regulatory frameworks that support rather than constrain organisational capabilities. Scholars argue that effective policy design should emphasise flexibility, alignment with firm-level realities and the provision of enabling conditions that foster innovation and capability development (Schöggl et al. 2020). Such an approach is particularly important in developing economies, where institutional weaknesses and resource constraints may otherwise limit the effectiveness of policy interventions in promoting CSC adoption.

Moderating role of government policy

Beyond its direct influence, government policy plays a moderating role in the relationship between internal organisational factors and CSC implementation. It shapes how effectively internal capabilities – such as MC, OPC and RAD – translate into actual CSC practices (Farooque et al. 2022; Govindan et al. 2020; Hernandez Marquina et al. 2024). Existing studies emphasise that the interaction between firm-level capabilities and institutional frameworks is critical in determining sustainability outcomes (Bari, Chimhundu & Chan 2024; Kirchherr et al. 2023; Schöggl et al. 2020).

Empirical evidence suggests that government policy provides the institutional framework necessary for internal mechanisms to operate effectively by reducing uncertainty, establishing regulatory clarity and creating structured operational pathways for firms (Duchek 2020; Wieland & Durach 2021). Policy instruments such as recycling regulations, environmental standards and reverse logistics mandates have been shown to enable firms to experiment with circular practices and sustain capability development over time (Bari et al. 2024). These mechanisms enhance the effectiveness of internal organisational factors by aligning firm-level initiatives with broader institutional expectations.

However, empirical findings also reveal that government policy may exert a negative moderating effect under certain conditions, particularly when regulatory frameworks are

rigid or poorly aligned with firm-level realities (Ortega Perals et al. 2025). Excessive regulatory pressure can increase compliance costs, reduce operational flexibility and limit the ability of firms to innovate and adapt their processes to support CSC implementation (Petropoulos et al. 2026). This suggests that policy interventions must be carefully designed to avoid constraining organisational adaptability, especially in resource-constrained environments.

From a theoretical perspective, these findings extend institutional theory by highlighting the contingent and non-linear nature of policy influence on organisational behaviour. While traditional institutional theory emphasises the role of coercive pressures in driving organisational conformity (Aghajani, Memari & Sankaran 2026), recent scholarship suggests that the effectiveness of such pressures depends on their alignment with internal capabilities and contextual conditions (Schöggl et al. 2020; Shen & Chen 2025). Rather than uniformly promoting sustainability adoption, government policy interacts with internal organisational factors in complex ways, either enhancing or constraining CSC implementation depending on the degree of contextual alignment and institutional support.

Circular supply chain implementation

Circular supply chain implementation involves integrating circular economy principles into supply chain activities to reduce waste, extend product lifecycles and improve resource efficiency (Hamid et al. 2026). Unlike linear 'take–make–dispose' models, CSCs emphasise closed-loop systems where materials and products are reused, remanufactured, or recycled (Cano et al. 2025). This transition requires firms to redesign supply chain structures, processes and inter-organisational relationships to support circular material and information flows (Bimpizas-Pinis et al. 2022).

Circular supply chain operational practices include reverse logistics, product life extension, recycling, remanufacturing and waste recovery (Bari et al. 2025; Cano et al. 2025; Hamid et al. 2026). These practices allow firms to recover value from end-of-life products, reduce dependency on virgin resources, and enhance economic and environmental performance (Geissdoerfer et al. 2017; Kirchherr et al. 2023). Empirical studies indicate that CSC adoption improves resource efficiency, reduces material costs and strengthens competitive advantage (Agyabeng-Mensah et al. 2025; Govindan et al. 2020).

Theoretically, CSC implementation is explained through the RBV and dynamic capability theory. Resource-Based View posits that superior performance derives from valuable, rare and inimitable resources and capabilities, such as process innovation, supply chain integration and sustainability-oriented leadership (Barney 1991). Dynamic capability theory highlights the firm's ability to reconfigure resources and adapt processes in response to environmental changes, essential for managing CSCs (Eisenhardt & Martin 2000; Teece 2018).

Implementation challenges are pronounced in developing economies, where financial, infrastructural, regulatory and technical constraints exist (Hyvärinen et al. 2020; Ndoka et al. 2025). Successful CSC relies on internal capabilities, including MC, operational flexibility and effective resource allocation (Aryee & Kanda 2024; Shen & Chen 2025). Moreover, implementation is a continuous process requiring collaboration across the supply chain to enable learning, resource coordination and joint problem-solving (Yan et al. 2023). Finally, CSC adoption is context-dependent, with variations across industries and regions driven by institutional environments, resource availability and technological capabilities (Kirchherr et al. 2023; Shen & Chen 2025). In resource-constrained settings, firms adopt adaptive and innovative strategies to implement circular practices, leveraging internal capabilities to overcome structural limitations (Randall 2021).

Theoretical framework

Circular supply chain has become a key tactic for businesses seeking to improve sustainability through waste reduction, resource lifespan extension and increased production and distribution efficiency (Rashid & Rasheed 2025). These approaches are widely recognised as central to achieving sustainable production and consumption systems across industries (Shourkaei et al. 2024). Circular supply chain emphasises strategies such as recycling, remanufacturing, material reuse and closed-loop logistics intended to reduce environmental impact while preserving economic performance (Hamid et al. 2026; Sarstedt et al. 2022). Despite the growing popularity of CSC in both academic and professional circles, a significant knowledge gap remains regarding how businesses implement circular practices, particularly in resource-constrained environments (Pellegrino et al. 2026; Shourkaei et al. 2024). As Stern (2000:421) notes, 'a general theory lies far in the distance', highlighting the lack of a comprehensive framework capable of guiding sustainability-oriented operational decisions. Similarly, Kalmykova et al. (2018) argue that sustainability integration into strategic and operational decision-making remains fragmented and often lacks clear procedures or causal explanations.

Many existing studies implicitly assume that firms operate in environments characterised by stable resource availability, predictable supply chains and adequate technological and financial infrastructure (Agyabeng-Mensah et al. 2025; Osei et al. 2023; Petropoulos et al. 2026; Shourkaei et al. 2024; Yan et al. 2023). These assumptions reflect studies conducted largely in developed economy contexts where institutional support systems and infrastructure are well established (Bressanelli et al. 2018; Kirchherr et al. 2023). However, this assumption does not hold in many emerging economies, including Liberia, where resource scarcity is structural rather than incidental (Aryee & Kanda 2024). Limited access to raw materials, inadequate infrastructure, restricted financial and technological resources, and unstable supply chain flows are common constraints affecting firms in such contexts (Petropoulos et al. 2026; Yan et al. 2023). These conditions raise an important theoretical question: how can firms develop circular capabilities in contexts where resource

abundance is absent if the traditional RBV assumes that competitive advantage arises from the possession of valuable, rare, and inimitable resources (Barney 1991; Peteraf 1993)? This puzzle forms the theoretical foundation of this study.

Previous research has occasionally applied stakeholder theory and institutional theory to explain CSC adoption (Choudhary et al. 2022; Taddei et al. 2024). Stakeholder theory emphasises social and normative pressures, suggesting that firms adopt circular practices to meet expectations from investors, customers, regulators and society (Mahajan et al. 2023; Sarstedt et al. 2022; Schöggl et al. 2020). Institutional theory focuses on how organisations conform to external norms, regulations and rules to achieve legitimacy within their operating environments (Kalmykova et al. 2018). While these perspectives explain external pressures and compliance motivations, they provide limited insight into how firms internally transform constrained resources into circular capabilities (Farooque et al. 2022; Kirchherr et al. 2023).

To address these limitations, this study adopts the RBV as its primary analytical lens but adapts it to contexts of structural scarcity. Classical RBV suggests that firms achieve sustained competitive advantage by acquiring and deploying resources that are VRIN (Barney 1991; Peteraf 1993). This perspective assumes relatively stable access to strategic assets from which capabilities can be systematically developed (Bromiley & Rau 2016). However, these assumptions rarely hold in resource-constrained environments where scarcity of capital, materials, technology and infrastructure persists (Hyvärinen et al. 2020). Under such conditions, capabilities cannot emerge solely through resource accumulation, challenging traditional RBV logic (Randall 2021; Shen & Chen 2025).

Recent research proposes a scarcity-oriented reinterpretation of RBV that views scarcity as a catalyst for capability development rather than merely a constraint (Randall 2021). Firms operating in constrained environments actively reinterpret, reuse and recombine limited resources to develop strategic capabilities (Shen & Chen 2025; Williams et al. 2021). Through such recombination processes, organisations can develop circular capabilities, including reverse logistics, material recovery and sustainable resource flows, even without abundant inputs (Farooque et al. 2022; Pellegrino et al. 2026). This perspective shifts the analytical focus from resource possession to resource transformation and recombination, thereby extending RBV beyond its conventional boundaries.

Building on this scarcity-oriented RBV framework, this study identifies three internal mechanisms that enable firms to transform structural resource scarcity into effective CSC practices: MC, OPC and RAD. Managerial commitment reframes the strategic value of residual resources and encourages employees to view scarcity as a strategic opportunity (Kirchherr et al. 2023; Montag 2023). Operational process capability enables firms to redesign supply chain routines that support flexible reverse logistics and adaptive recycling practices (Pellegrino et al. 2026). Resource allocation discipline ensures that limited financial, material and human resources are directed toward initiatives with the greatest sustainability impact (Alam & Ullah 2025; Bromiley & Rau 2016).

Hypotheses development

Although studies generally report positive links between internal capabilities and CSC implementation, the strength and consistency of these relationships remain contested. Managerial commitment may be insufficient where institutional support is weak (Hyvärinen et al. 2020), while operational flexibility can improve efficiency but increase costs and coordination complexity (Petropoulos et al. 2026). Disciplined resource allocation may enhance sustainability but also suppress experimentation and innovation (Williams et al. 2021). These inconsistencies suggest that internal mechanisms do not operate in a linear way and may depend on contextual factors such as scarcity intensity and institutional alignment:

H1: Internal organisational mechanisms triggered by resource scarcity positively influence CSCM implementation.

H2: Government policy positively moderates the relationship between internal scarcity-triggered factors and CSC implementation, such that the relationship is stronger under higher policy support.

Conceptual framework

The conceptual framework explains how MC, OPC and RAD (independent variables) influence the implementation of CSC practices (dependent variable) in mineral water companies operating under resource constraints. Grounded in the RBV, the framework suggests that firms can develop strategic capabilities through the efficient utilisation and recombination of limited resources. These internal organisational factors enable firms to adopt CSC practices such as recycling, reverse logistics and material recovery. Government policy acts as a moderating variable that can strengthen or weaken the relationship between the internal factors and CSC implementation (see Figure 1).

Research methods and design

Study design

This study adopted a quantitative research design to examine the factors influencing the implementation of

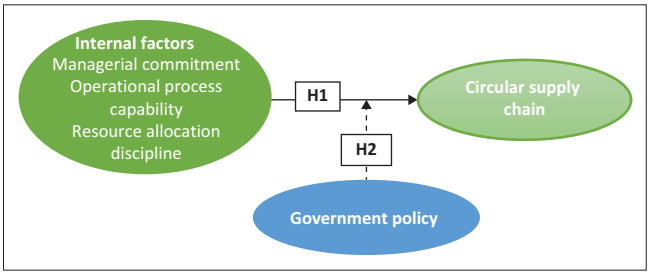


FIGURE 1: Conceptual framework.

CSC in Liberia's mineral water sector. Quantitative designs are commonly used in supply chain management research to test theoretically derived relationships and allow generalisation across organisational settings (Flynn, Albrecht & Scott 2018; Hair & Alamer 2022). The study was grounded in the scarcity-oriented RBV and examined the influence of internal organisational factors: MC, OPC and RAD on CSC implementation, with government policy acting as a moderating variable. A survey research design was employed to systematically collect standardised data from organisational decision-makers and enable empirical testing of relationships among the study constructs.

Setting

The study was conducted within Liberia's mineral water manufacturing sector, which relies heavily on plastic packaging and faces increasing pressure to adopt environmentally sustainable practices. This sector provides an appropriate context for examining CSC practices because of the significant waste management challenges associated with plastic packaging and the growing regulatory emphasis on environmental sustainability. In addition, firms in this industry operate under resource-constrained conditions, including limited recycling infrastructure and weak regulatory enforcement mechanisms, making it suitable for analysing scarcity-driven CSC initiatives.

Study population and sampling strategy

The study population consisted of employees involved in supply chain and operational decision-making within legally registered mineral water manufacturing firms in Liberia. Three major mineral water firms with established production and distribution systems were purposively selected for the study. Respondents were drawn from managerial and operational roles, including environmental compliance officers, production supervisors, procurement managers and logistics managers and the general employees, as these individuals possess the relevant knowledge required to provide information on CSCM practices (Campbell et al. 2020).

A total of 316 questionnaires were distributed using purposive sampling, ensuring that respondents had both strategic and operational insight as well as practical exposure to daily organisational processes and sustainability practices. This approach allowed the study to capture a comprehensive perspective on the factors influencing CSC implementation across different levels of the organisations.

Although purposive sampling may introduce selection bias, several measures were implemented to minimise this limitation and improve data credibility. Respondents were selected from multiple departments and hierarchical levels to ensure diverse perspectives and reduce overrepresentation of a single functional group.

The inclusion of managerial and operational employees minimised elite-response bias by capturing both strategic and practical dimensions of CSC implementation. Participating firms also shared similar operational characteristics and environmental constraints, reducing contextual variability. In addition, anonymity, voluntary participation and standardised questionnaire administration were applied to minimise social desirability bias and response distortion, thereby improving data reliability despite the non-probability sampling approach.

Data collection

Data were collected using a structured questionnaire comprising reflective multi-item scales established in supply chain management and circular economy studies (Farrokhi, Gatti & Bahrini 2026). The questionnaire items were further adapted from established literature on CSCM, sustainability capability, environmental management and the RBV, particularly the works of Barney (1991), Peteraf (1993), Geissdoerfer et al. (2017), Bressanelli et al. (2018), Govindan et al. (2020), Schöggl et al. (2020), Farooque et al. (2022) and Kirchherr et al. (2023). The instrument incorporated measurement items relating to MC, OPC, RAD, government policy and CSC implementation. The questionnaire was contextualised to reflect the operational realities of mineral water manufacturing firms in Liberia and aligned with the theoretical assumptions of the scarcity-oriented RBV adopted in this study. For methodological transparency and construct validity purposes, the complete questionnaire instrument has been included in Appendix 1.

To improve contextual relevance and construct validity, the original scales were adapted to reflect Liberia's mineral water sector, including weak recycling infrastructure and limited technological capacity.

Questionnaire items were reworded using locally familiar terminology. The instrument was reviewed by academic experts and practitioners, and pilot feedback led to minor wording revisions and removal of ambiguous items before final administration.

The questionnaire measured three key constructs: internal organisational factors, government policy and CSC implementation. Internal organisational factors were operationalised through MC, OPC and RAD. Government policy captured perceptions regarding the strength and enforcement of environmental regulations and recycling policies. Circular supply chain implementation was measured through indicators related to reverse logistics, recycling integration and material recovery.

All items were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The instrument was pre-tested with academic experts and industry practitioners to ensure clarity, relevance and contextual appropriateness. To minimise potential

common method variance (CMV), procedural remedies such as collecting responses from multiple organisational roles were applied (Sturman et al. 2025). Data were collected directly from respondents through questionnaire distribution within the selected firms.

Questionnaires were administered through face-to-face distribution within selected mineral water firms.

Printed copies were hand-delivered during working hours with management approval, allowing clarification of study objectives and questionnaire items. Follow-up visits and verbal reminders improved response rates, while incomplete or unreturned questionnaires after repeated follow-ups were excluded to ensure data quality and consistency.

Data analysis

Completed questionnaires were screened for completeness, consistency and missing values before analysis. The data were then coded and entered into statistical software for analysis. The study employed PLS-SEM using SmartPLS version 4.0.1.9 to test the proposed relationships.

Data analysis followed a two-stage approach recommended for PLS-SEM studies (Hair & Alamer 2022). Firstly, the measurement model was evaluated to assess reliability and validity using composite reliability, average variance extracted (AVE), and the heterotrait–monotrait (HTMT) ratio. Secondly, the structural model was assessed by estimating path coefficients and their statistical significance using bootstrapping procedures. The moderating effect of government policy on the relationship between internal organisational factors and CSC implementation was also tested.

Ethical considerations

Ethical approval for this study was obtained from the University of KwaZulu-Natal Humanities and Social Sciences Research Ethics Committee (Ref: HSSREC/00006542/2023). Permission to conduct the study was obtained from the management of the three selected mineral water companies. All participants provided written informed consent, and their confidentiality and anonymity were strictly maintained throughout the research process to ensure compliance with recognised ethical research standards.

Results

This section presents the empirical findings of the study, beginning with the assessment of the measurement model and followed by the structural model evaluation. The analysis examines the reliability, validity and predictive power of the constructs, as well as the hypothesised relationships between internal organisational factors, government policy and CSC implementation. Additionally, considerations of unobserved heterogeneity and endogeneity are addressed to ensure the robustness and credibility of the results.

Measurement model

The measurement model was assessed for indicator reliability, internal consistency, convergent validity and discriminant validity following PLS-SEM guidelines (Hair et al. 2021). All constructs: CSC, Government Policy (GP) and Internal Factors (IF) were reflective and evaluated using outer loadings, Cronbach's alpha, composite reliability (ρc, ρa), AVE and HTMT (Henseler & Schuberth 2020; Sarstedt et al. 2019). Outer loadings ranged from 0.928 to 0.979, AVE values from 0.901 to 0.928 and reliability statistics from 0.972 to 0.985, indicating strong indicator reliability, convergent validity and internal consistency (see Table 1). Heterotrait–monotrait values were all below 0.85, confirming discriminant validity. Some outer model VIF values were high because of reflective item correlations, but inner model VIF (1.314) showed no multicollinearity, supporting the model's suitability for structural analysis (Hair & Alamer 2022; Sarstedt et al. 2019).

Although reliability and validity indicators were exceptionally high, this does not necessarily imply redundancy. The strong values reflect the focused constructs and conceptual alignment of organisational capability indicators within a relatively homogeneous industry. Heterotrait–monotrait values remained below 0.85, confirming discriminant validity, while expert review and pilot testing minimised duplication and ambiguity among items.

Structural model

The structural model was evaluated for multicollinearity, explanatory power, predictive relevance, path significance, moderating effects and overall fit (Dash & Paul 2021; Hair et al. 2021). Variance inflation factor values for all paths,

TABLE 1: Measurement model assessment.

Constructs	Item code	Loadings	Cronbach's alpha	CR	AVE
Internal Factors	IF	-	0.974	0.981	0.928
	MC	0.958	-	-	-
	OPC	0.969	-	-	-
	RAD	0.961	-	-	-
Circular Supply Chain	CSC	-	0.972	0.978	0.901
	CSC1	0.977	-	-	-
	CSC2	0.938	-	-	-
	CSC3	0.930	-	-	-
	CSC4	0.971	-	-	-
	CSC5	0.928	-	-	-
Government Policy	GP	-	0.981	0.985	0.928
	GP1	0.933	-	-	-
	GP2	0.970	-	-	-
	GP3	0.957	-	-	-
	GP4	0.977	-	-	-
	GP5	0.979	-	-	-

CR, composite reliability; AVE, average variance extracted.

including the moderating effect of Government Policy × Internal Factors (1.314), were within acceptable limits, indicating no critical multicollinearity. Slightly higher VIFs for direct paths from GP and IF reflect their conceptual relatedness but do not compromise the validity of structural estimates (Farooque et al. 2022; Govindan et al. 2020). Overall, the model demonstrates robust reliability, validity and suitability for hypothesis testing and structural analysis.

The coefficient of determination (R^2) for CSC indicates the model's explanatory power and the proportion of variance explained by the predictor variables (Hair & Alamer 2022). R^2 values of 0.250, 0.500 and 0.750 are commonly interpreted as weak, moderate and substantial, respectively (Hair et al. 2021). The observed variance in CSC demonstrates moderate-to-substantial predictive power, suggesting that internal organisational factors, government policy and their interaction collectively account for a meaningful proportion of CSC implementation. This finding aligns with prior research showing that organisational capabilities and institutional conditions significantly influence supply chain and sustainability outcomes (Govindan et al. 2020).

Predictive relevance was assessed using the Stone–Geisser Q^2 criterion via blindfolding procedures, where Q^2 values above 0 indicate predictive usefulness, and values of 0.25 and 0.50 suggest medium and large predictive accuracy, respectively (Hair et al. 2021; Sarstedt et al. 2019). The positive Q^2 values observed for CSC confirm that the model has adequate out-of-sample predictive capability, demonstrating both explanatory and predictive power in similar contexts (Hair & Alamer 2022).

Structural model results reveal that internal organisational factors have a positive and statistically significant effect on CSC implementation (β = 0.709, t = 2.822, p = 0.005), with the 95% confidence interval (0.227, 1.217) excluding zero (see Figure 2 and Table 2). This supports the view that MC, OPC and disciplined resource allocation are key drivers of CSC practices in resource-constrained environments, consistent with the RBV (Agyabeng-Mensah et al. 2025; Barney 1991; Shen & Chen 2025).

The moderating effect of government policy on the relationship between internal factors and CSC implementation is significant but negative (β = −0.064, t = 5.818, p < 0.001), with confidence intervals (−0.086, −0.043) excluding zero. This suggests that while supportive policies can guide firms, overly rigid or misaligned regulatory frameworks may limit organisational flexibility and reduce the effectiveness of internal capabilities (Hyvärinen et al. 2020; Schöggl et al. 2020). This finding highlights the contingent and sometimes restrictive role of institutional pressures in sustainability transitions (Kirchherr et al. 2023).

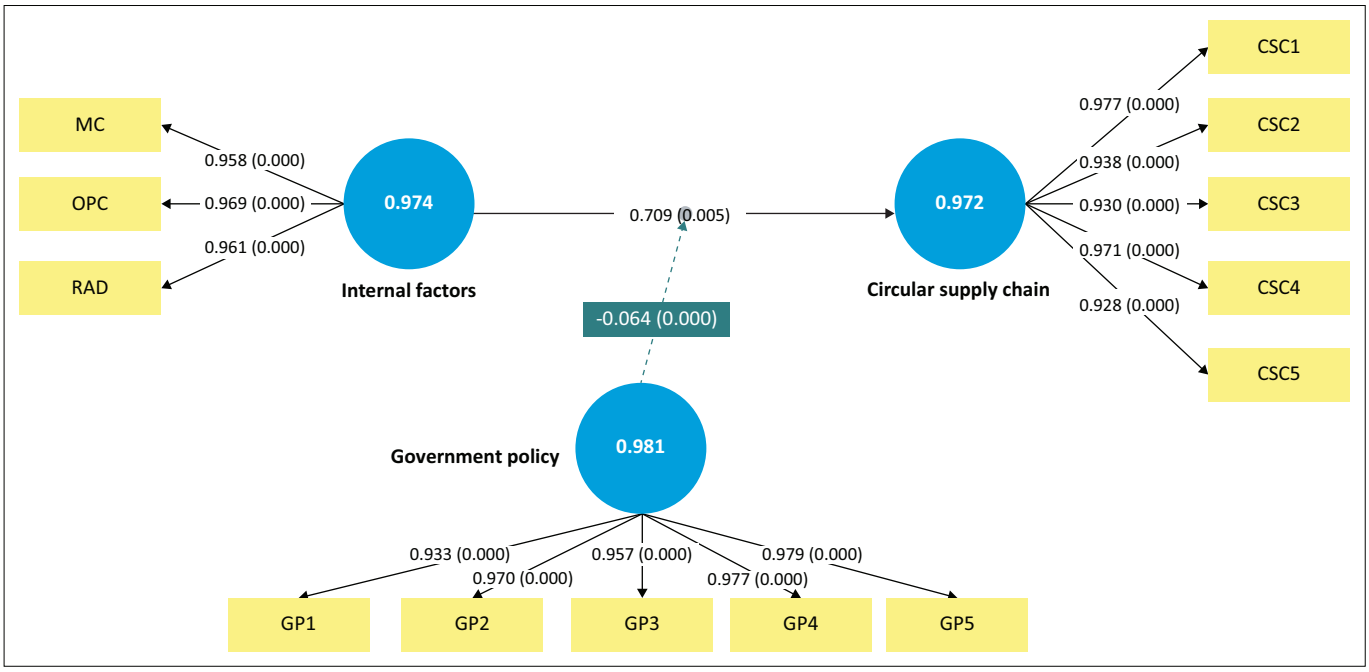


FIGURE 2: Structure model results of internal factors, government policy and circular supply chain.

TABLE 2: Structural model assessment.

No	Path	Type	Std beta	Std error	t	p	95% CI LL	95 CI UL	Significance	Remarks
H1	Internal Factors -> Circular Supply Chain	Direct	0.709	0.251	2.822	0.005	0.232	1.224	Yes	Hypothesis supported: Internal factors significantly and positively influence CSC implementation.
H2	Government Policy × Internal Factors -> CSC	Indirect	-0.064	0.011	5.818	0.000	-0.084	-0.041	Yes	Hypothesis supported: Government policy negatively moderates the relationship between internal factors and CSC implementation.

CI, confidence interval; LL, Lower Limit of the 95% Confidence Interval; UL, Upper Limit of the 95% Confidence Interval; CSC, circular supply chain.
***, p < 0.001; **, p < 0.01.

Model fit was evaluated using the Standardised Root Mean Square Residual (SRMR), d_ULS and d_G. An SRMR value below 0.08 indicates a good fit (Hair & Alamer 2022; Henseler & Schuberth 2020), and the obtained SRMR of 0.048, along with acceptable d_ULS and d_G values, confirms that the model fits the observed data well.

These results provide robust empirical support for the proposed model, demonstrating that internal organisational capabilities are central to CSC implementation, while government policy exerts a complex, contingent influence on CSC outcomes in resource-constrained settings.

Unobserved heterogeneity and endogeneity considerations

Unobserved heterogeneity refers to systematic differences in structural relationships across latent subpopulations that cannot be captured by observable variables, which can bias parameter estimates and mislead theoretical conclusions (Ringle et al. 2023; Sarstedt et al. 2022). In this study, latent class solutions and finite mixture approaches such as FIMIX-PLS were not estimated. However, several diagnostics suggest that unobserved heterogeneity is unlikely to affect the results. Bootstrapping based on 10 000 subsamples produced stable path coefficients with narrow confidence intervals, and the direction, magnitude and significance of structural paths remained consistent across percentile and bias-corrected intervals, providing indirect evidence of model stability (Hair & Alamer 2022; Sarstedt et al. 2019). The sampled firms operate in a relatively homogeneous context, facing similar resource constraints, regulatory environments and supply chain challenges, further reducing the likelihood of distinct latent subpopulations (Hyvärinen et al. 2020).

Prior research supports the view that contextual homogeneity mitigates significant unobserved heterogeneity in structural models (Sarstedt et al. 2022).

Endogeneity, which arises when explanatory variables correlate with the error term, was addressed through theoretical model specification and statistical diagnostics (Eckert & Hohberger 2023). The causal ordering of constructs was grounded in established theory, with internal organisational factors and government policy conceptualised as antecedents of CSCM implementation, consistent with prior research (Farooque et al. 2022; Govindan et al. 2020). Inner model collinearity diagnostics indicated a low variance inflation factor (VIF = 1.314) for the interaction term, suggesting multicollinearity and shared variance among predictors were not a concern (Hair & Alamer 2022; Sarstedt et al. 2019). Empirically, the non-significant direct effect of government policy combined with a significant moderating effect suggests that policy influence operates primarily through interaction effects, reducing the risk of omitted-variable bias. These findings align with previous studies highlighting the contingent and moderating role of institutional factors in shaping organisational outcomes (Kirchherr et al. 2023; Schöggl et al. 2020).

Although advanced techniques such as the Gaussian copula approach or instrumental variable methods can further address endogeneity (Abreu-Ledón et al. 2026; Eckert & Hohberger 2023), they were not applied in this study. Nevertheless, the robustness of bootstrapped estimates, theoretically grounded model specification, and absence of critical collinearity issues indicate that endogeneity is unlikely to threaten the validity of the findings. Future research could adopt these advanced diagnostics to strengthen causal inference and enhance robustness in similar supply chain research contexts.

Discussion

Summary of findings

This study examined how internal organisational factors and government policy interact to influence CSC implementation under resource scarcity. The results show that internal organisational factors – including MC, OPC and disciplined resource allocation – strongly drive CSC adoption, consistent with prior studies emphasising the centrality of internal capabilities in resource-constrained settings (Agyabeng-Mensah et al. 2025; Farooque et al. 2022; Govindan et al. 2020). Firms rely on internal mechanisms and resource recombination to implement circular practices when external support is limited (Randall 2021; Shen & Chen 2025).

Conversely, government policy may exert a negative moderating effect on the relationship between internal organisational capabilities and CSC implementation, suggesting that overly rigid or misaligned regulatory frameworks may reduce the effectiveness of internal capabilities by constraining organisational flexibility (Hyvärinen et al. 2020; Kirchherr et al. 2023; Schöggl et al. 2020).

The moderating effect of government policy on the relationship between internal factors and CSC implementation is significant but negative ($\beta = -0.064$, $t = 5.818$, $p < 0.001$), with confidence intervals (−0.086, −0.043) excluding zero. This suggests that while supportive policies can guide firms, overly rigid or misaligned regulatory frameworks may reduce organisational flexibility and weaken the effectiveness of internal capabilities (Hyvärinen et al. 2020; Schöggl et al. 2020).

This finding contrasts with studies from developed economies where environmental regulations positively strengthen sustainability transitions by encouraging compliance and innovation (Bari et al. 2024; Govindan et al. 2020). However, Liberia presents different institutional realities characterised by weak enforcement consistency, limited infrastructural support, fragmented recycling systems and administrative rigidities.

Under such conditions, regulatory requirements may increase operational pressure without corresponding institutional support. Firms may therefore divert scarce resources toward short-term compliance rather than long-term circular capability development, explaining why government policy weakened rather than strengthened the relationship between internal capabilities and CSC implementation.

The negative moderating effect may also reflect implementation inconsistencies within Liberia's environmental governance framework. Although environmental policies formally encourage sustainability practices, firms often experience uncertainty regarding enforcement standards, limited technical guidance and overlapping compliance procedures. These institutional inefficiencies may reduce managerial flexibility and discourage experimentation with adaptive circular solutions. In resource-constrained environments, where firms already operate with limited financial and technological capacity, additional regulatory rigidity may unintentionally suppress innovation and organisational responsiveness.

From a theoretical perspective, this finding extends institutional theory by showing that coercive regulatory pressures do not always enhance sustainability performance. While institutional theory often assumes that stronger regulation accelerates sustainability transitions, restrictive policy environments may instead create institutional tension that disrupts how firms deploy internal capabilities. The findings also differ from studies reporting uniformly positive relationships between policy enforcement and sustainability adoption, suggesting that institutional effectiveness is highly context dependent. The results therefore reinforce contingency perspectives within sustainability research, which argue that policy effectiveness depends not only on regulation itself but also on its alignment with organisational realities, infrastructural conditions and firm-level adaptive capacity.

Accordingly, MC, OPC and RAD become less effective when organisational discretion is constrained by rigid compliance requirements or poorly aligned policy instruments. This introduces an important boundary condition to the RBV, indicating that internal capabilities are contingent on the institutional environment in which they are applied.

Practically, restrictive policy environments may unintentionally slow sustainability transitions by limiting organisational learning, reducing responsiveness to local conditions, and constraining firms' ability to leverage internal capabilities effectively. Therefore, policy effectiveness in CSC implementation depends not only on enforcement strength but also on flexibility, contextual alignment and the ability to support organisational adaptability.

Theoretical contributions

This study advances CSCM and RBV theory in resource-constrained environments. Firstly, it extends RBV by showing that capabilities can emerge not only from resource accumulation but also through the creative recombination of scarce resources, positioning scarcity as a generative condition that stimulates innovation (Randall 2021). Secondly, it identifies three micro-level mechanisms – MC, OPC and RAD – that explain how firms develop circular capabilities under constraint (Farooque et al. 2022; Govindan et al. 2020). Thirdly, the study clarifies the contingent role of government policy: while regulations can stabilise the environment, misaligned or overly rigid policies may restrict organisational flexibility, highlighting the limits of institutional influence (Hyvärinen et al. 2020; Kirchherr et al. 2023). The research integrates internal and external factors into a scarcity-oriented RBV framework, providing a theoretically and empirically grounded explanation of CSCM adoption in constrained settings.

Implications for theory

The findings challenge abundance-based assumptions in RBV and traditional institutional theory, showing that competitive advantage and sustainability outcomes can emerge from capability recombination rather than resource accumulation (Barney 1991; Bromiley & Rau 2016). Internal organisational dynamics drive CSC implementation under structural scarcity, while government policy is effective only when aligned with firm-level capabilities (Aryee & Kanda 2024). This highlights the importance of contingency-based approaches to sustainability adoption, where institutional pressures must be contextually aligned to enhance, rather than constrain, organisational performance (Wieland & Durach 2021).

Implications for practice

The findings of this study offer several practical implications for managers, organisational decision-makers and policymakers operating in resource-constrained environments. For managers and supply chain practitioners, the results show that CSC implementation depends largely on strengthening internal organisational capabilities rather than relying on external support. Managers should institutionalise circularity by embedding sustainability targets into organisational strategy, performance appraisal systems, and operational routines. Particular emphasis should be placed on MC through leadership-driven sustainability agendas that communicate clear circular goals across organisational levels. Firms should also redesign supply chain processes to support reverse logistics, material recovery, and waste minimisation practices, even where infrastructure is limited. In addition, organisations should develop flexible operational structures that support adaptive reuse of materials, local sourcing of secondary inputs, and collaboration with informal recycling networks. Resource allocation discipline should prioritise high-impact circular initiatives such as waste reduction technologies and efficiency improvements.

For organisational decision-makers, especially in public enterprises and large firms, the findings suggest establishing

internal coordination units or sustainability task teams to oversee CSC integration. These units should coordinate collaboration between procurement, production and logistics functions to support closed-loop material flows. Decision-makers should also invest in employee capacity-building programmes focused on recycling standards, product life extension and reverse logistics management. Performance measurement systems should further incorporate circularity indicators such as waste reduction rates, resource recovery efficiency, and the use of recycled inputs.

For policymakers, the findings highlight the need for more enabling and context-sensitive regulatory frameworks. Instead of rigid compliance-based regulations, governments should adopt flexible policy instruments that encourage innovation and gradual transition toward circular practices. This includes fiscal incentives such as tax reductions or import duty exemptions for recycling technologies, as well as public–private partnerships to strengthen reverse logistics infrastructure. Policymakers should also strengthen institutional capacity within environmental agencies while avoiding excessive administrative burdens that discourage innovation. Overall, effective CSC implementation in resource-constrained environments requires both strong internal organisational capabilities and supportive, flexible policy frameworks.

Limitations and future research

The cross-sectional design limits insights into dynamic capability development, suggesting the need for longitudinal studies to capture evolving circular maturity. High intercorrelations between constructs indicate a need for finer measurement of internal factors and alternative policy typologies to enhance construct clarity.

The focus on a single industry and country limits generalizability, warranting multi-country and multi-industry comparative research. The study relied on self-reported perceptual data; respondent bias and subjective interpretation cannot be excluded. Although procedural remedies reduced common method bias, future studies should incorporate objective operational, environmental, observational, or archival data to improve measurement accuracy and reduce perceptual bias. Future studies should also integrate objective performance data or mixed methods to reduce perceptual bias and consider behavioural and cognitive perspectives to explore managerial decision-making in circular adoption.

Conclusion

This study demonstrates that CSC implementation in resource-constrained contexts is primarily driven by internal organisational mechanisms, with government policy acting as a contextual moderator that can enable or constrain capability deployment. Findings challenge the assumption that institutional pressure alone drives sustainability adoption, emphasising that internal capability recombination under scarcity is central to circular transformation. Theoretically, the study extends resource-based and dynamic capability perspectives by showing that scarcity can stimulate innovation, and advances institutional theory by highlighting the contingent role of policy. Practically, the results underscore the importance of strengthening internal capacities and designing flexible regulatory frameworks to support sustainable supply chain transitions in resource-limited settings.

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Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

CRediT authorship contribution

Samuel M. Nyema: Conceptualisation, Data curation, Formal analysis, Investigation, Methodology, Project administration, Software, Visualisation, Writing – original draft. Thokozani P. Mbhele: Funding acquisition, Resources, Supervision, Validation, Writing- review & editing. All authors reviewed the article, contributed to the discussion of results, approved the final version for submission and publication, and take responsibility for the integrity of its findings.

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Data availability

The data that support the findings of this study are available from the corresponding author, Samuel Monday Nyema,

upon reasonable request. The data are not publicly available because of privacy and confidentiality considerations related to the respondents who participated in the study.

Disclaimer

The views and opinions expressed in this article are those of the authors and are the product of independent academic research. They do not necessarily reflect the official policy or position of any affiliated institution, organisation or that of the publisher. The authors are solely responsible for the content, results and interpretations presented in this study.

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Appendix starts on the next page →

Appendix 1

Research questionnaire

Title of study

Determinants of Circular Supply Chain Implementation in a Resource-Constrained Country: Evidence from Liberia's Mineral Water Industry

Dear Respondent,

You are kindly requested to participate in this academic study examining the determinants of CSC implementation in Liberia's mineral water industry. The purpose of this study is to understand how internal organisational factors and government policy influence the adoption of circular supply chain practices in resource-constrained environments.

Your responses will be treated with strict confidentiality and anonymity and will be used solely for academic purposes. There are no right or wrong answers; therefore, kindly provide honest responses based on your organisational experience.

Please tick (✓) the option that best represents your opinion.

Response scale

Scale	Description
1	Strongly Disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly Agree

Section A

Demographic information

Please tick (✓) the appropriate option.

Gender

☐ Male
☐ Female

Age group

☐ 18–25 years
☐ 26–35 years
☐ 36–45 years
☐ 46 years and above

Highest educational qualification

☐ High School Certificate
☐ Diploma
☐ Bachelor's Degree
☐ Master's Degree
☐ Other (Specify) _____

Department

☐ Procurement
☐ Production
☐ Logistics/Distribution
☐ Environmental/Sustainability
☐ Administration
☐ Other (Specify) _____

Position level

☐ Managerial
☐ Supervisory
☐ Operational Staff

Years of work experience

☐ Less than 1 year
☐ 1–5 years
☐ 6–10 years
☐ Above 10 years

Section B

Internal organisational factors

TABLE 1-A1: Managerial commitment (MC).

Code	Statements	1	2	3	4	5
MC1	Top management prioritises environmental sustainability in organisational decision-making.					
MC2	Management actively supports circular supply chain initiatives within the organisation.					
MC3	Leadership allocates adequate support and attention toward sustainability programmes.					
MC4	Managers encourage employee participation in recycling and waste reduction activities.					
MC5	Management communicates clear circular economy and sustainability goals to employees.					

TABLE 2-A1: Operational Process Capability (OPC).

Code	Statements	1	2	3	4	5
OPC1	The organisation has operational processes that support recycling and material reuse.					
OPC2	Production processes can be adapted to support circular supply chain activities.					
OPC3	Reverse logistics activities are effectively integrated into operational systems.					
OPC4	Employees possess the technical capability required to support circular operations.					
OPC5	Existing operational systems support efficient waste management and material recovery.					

TABLE 3-A1: Resource Allocation Discipline (RAD).

Code	Statements	1	2	3	4	5
RAD1	The organisation strategically prioritises resources for sustainability initiatives.					
RAD2	Financial resources are efficiently allocated toward circular supply chain activities.					
RAD3	Limited organisational resources are effectively utilised to support environmental objectives.					
RAD4	Sustainability investments focus on areas with the greatest operational impact.					
RAD5	Human and material resources are coordinated effectively to support circular practices.					

Section C

TABLE 4-A1: Government Policy (GP).

Code	Statements	1	2	3	4	5
GP1	Government environmental regulations encourage firms to adopt circular supply chain practices.					
GP2	Existing recycling and waste management policies support sustainability efforts in the industry.					
GP3	Government agencies provide adequate environmental compliance guidance to firms.					
GP4	Environmental regulations are effectively enforced within the mineral water industry.					
GP5	Current government policies create a supportive environment for CSC implementation.					

Section D

TABLE 5-A1: Circular Supply Chain Implementation (CSC).

Code	Statements	1	2	3	4	5
CSC1	The organisation actively engages in recycling activities within supply chain operations.					
CSC2	Reverse logistics practices are implemented for product or material recovery.					
CSC3	Recovered or recycled materials are reused within production or operational processes.					
CSC4	Waste reduction practices are integrated into supply chain activities.					
CSC5	Circular economy principles are incorporated into the organisation's supply chain strategy.					