

Sustainability versus Regenerative Supply Chain Management: A PRISMA-based Systematic Review of Theoretical Evolution and Conceptual Boundaries (2010-2025)

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Abstract

Supply chain management has shifted from a focus on cost efficiency toward sustainability and, more recently, regeneration. Yet the boundaries between sustainable supply chain management, the circular economy, and regenerative supply chains remain unclear. This study conducts a systematic review following PRISMA 2020, covering literature from 2010–2025 across four databases. From 255 initial records, only nine studies met the inclusion criteria. Findings show that sustainability and the circular economy (CE) are well-developed, grounded in frameworks such as Stakeholder Theory, the Resource-Based View (RBV), and Network Theory, supported by measurable indicators. In contrast, regenerative supply chain management (RSCM) lacks clear definition, frameworks, and metrics. Current discussions are mostly normative, emphasizing ecosystem restoration, community well-being, and net-positive outcomes. The study concludes that RSCM requires new frameworks and indicators, including biodiversity gains, soil carbon sequestration, and social equity indices. Integrating regenerative principles into policies and strategies, particularly within ASEAN and Thailand, can help shift supply chains from minimizing harm to creating verifiable net-positive impacts.

Keywords: Sustainability, Regenerative Supply Chain, Circular Economy, PRISMA, Systematic Review

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Introduction

Over the past decades, supply chain management (SCM) has progressively expanded its remit from a narrow concern with cost, speed, and reliability toward broader environmental and social responsibilities. This evolution has been propelled by global imperatives such as the UN Sustainable Development Goals, the Paris Agreement, and escalating expectations around corporate ESG reporting. Within this trajectory, sustainability-oriented approaches have become mainstream in both scholarship and practice. More recently, however, interest has turned to regenerative approaches that aspire not merely to reduce harm but to produce net-positive impacts—restoring ecological and social systems and enhancing the very resources upon which supply chains depend. Yet, despite this growing attention, the conceptual boundaries that distinguish sustainability, circular economy, and regeneration in SCM remain insufficiently articulated, posing challenges for theory development, managerial action, and policy alignment.

The theoretical grounding of Sustainable Supply Chain Management (SSCM) has matured considerably, synthesizing multi-level drivers and calling for deeper theoretical substantiation (Brandenburg & Gruchmann, 2019). Foundational frameworks often rely on Stakeholder Theory and the Resource-Based View (RBV) to explain how and why firms embed sustainability in their inter-organizational processes (Kim & Lee, 2011). Beyond the firm level, Network Theory has been employed to analyze governance and interdependencies across supply networks, framing SSCM as a collective network-level endeavor (McLoughlin, Hines, Nudurupati, & Lascelles, 2015). While these theories provide robust explanations for why and how firms adopt sustainability, they primarily focus on harm reduction and efficiency within existing paradigms (Molamohamadi, Ismail, Leman, & Norzima, 2014), setting the stage for the later emergence of Circular Economy (CE) and regenerative models.

In parallel, the circular economy (CE) has gained prominence as a design logic aimed at closing loops, slowing flows, and narrowing resource use, thereby operationalizing environmental objectives through product-service systems, reverse logistics, remanufacturing, and material recirculation. Recent work has articulated circular models for sustainable supply chain management and explored tensions and complementarities between CE and sustainable development (Muradin, 2022). Conceptual models have connected circular supply chains with CE performance, extending strategy-to-operations linkages and signaling measurement avenues (Shaharudin & Mokhtar, 2022). Methodological advances have

proposed techniques for designing and managing global supply chain operations under CE criteria, including decision support for network configuration and strategy evaluation (Aldas-Salazar et al., 2023). Simulation-based analyses of (reverse) supply chains in circular product-service systems further illustrate operational trade-offs and dynamic effects inherent in CE transitions (Wu, 2023). These developments have sharpened operational toolkits and metrics, yet they predominantly aim at harm reduction and efficiency restoration, not the net-positive aspirations of regeneration.

A third vein of work has interrogated the intersection of digital transformation and sustainability in SCM—mapping how technologies such as IoT, blockchain, and advanced analytics may enhance visibility, traceability, and decision quality to support sustainability outcomes (Stroumpoulis & Kopanaki, 2022). While digital enablers can strengthen execution of sustainability and CE strategies, their theoretical integration has largely focused on improving performance within existing paradigms rather than reconceiving value creation toward restorative ends. In short, the literature has refined how to do sustainability better, but it has not yet clarified what it means to do regeneration at all within supply chains.

This conceptual ambiguity matters. Without a clear theoretical definition and boundary conditions for regenerative SCM, organizations struggle to formulate strategies that move beyond compliance and incremental efficiency to restoration, renewal, and capacity-building of social-ecological systems. Measurement is likewise constrained: widely used metrics target footprint reduction (e.g., emissions, waste, water) and circularity proxies (e.g., recirculation rates), while regenerative metrics—such as ecosystem function enhancement, biodiversity gains, soil carbon sequestration, community capability building, or net-positive social equity outcomes—remain under-specified for supply chains. The absence of middle-range theory hinders cumulative knowledge and comparable empirical testing, and it blurs the policy conversation where governments and coalitions (e.g., ASEAN initiatives on sustainable logistics and circular economy) are searching for levers that can credibly catalyze net-positive transitions in production and trade.

This study addresses these gaps by conducting a PRISMA-guided systematic review of literature published between 2010 and 2025 across multiple databases. We map how sustainability-focused studies have consolidated theoretical foundations; how circular economy work has provided operational models and methods; and where, if at all, regenerative ideas have surfaced in supply chain scholarship. The synthesis confirms that

while sustainability and CE are theoretically and methodologically articulated, regenerative SCM is not yet established as a distinct construct: explicit definitions are scarce, boundary criteria are ambiguous, and regenerative-specific models, metrics, and empirical validations are largely absent (Brandenburg & Gruchmann, 2019; McLoughlin et al., 2015; Kim & Lee, 2011; Molamohamadi et al., 2014; Stroumpoulis & Kopanaki, 2022; Muradin, 2022; Shaharudin & Mokhtar, 2022; Aldas-Salazar et al., 2023; Wu, 2023).

Building on these insights, we position regeneration not as a semantic extension of sustainability or a sub-case of circularity, but as a paradigmatic shift that reorients value creation: from maintenance to enhancement, from harm-reduction to benefit-creation, from efficiency to effectiveness in restoring system health, and from compliance to innovation grounded in socio-ecological outcomes. Conceptually, this requires clarifying (i) ontological foundations—what constitutes a regenerative supply chain and which system boundaries (temporal, spatial, ecological, social) matter; (ii) epistemological approaches—how regenerative outcomes can be known and credibly measured; and (iii) methodological frameworks—what research designs (e.g., longitudinal field studies, intervention experiments, comparative case series, systems simulation) can detect and attribute regeneration. Practically, it invites SCM to expand from enterprise-centric performance to system-centric performance, integrating landscape-level restoration, community capability building, and intergenerational equity into procurement, sourcing, network design, and last-mile strategies.

For policy and managerial audiences—particularly in emerging economies and regional production hubs—the distinction is consequential. In the ASEAN context, logistics and manufacturing corridors (e.g., automotive, agri-food, electronics) are under pressure to decarbonize, reduce waste, and increase resilience while advancing inclusive development. Translating regeneration into supply chain mandates could guide incentives (e.g., blended finance for restorative procurement), de-risk innovation (e.g., pilots on regenerative agriculture sourcing and material recirculation with biodiversity co-benefits), and align metrics (e.g., supply-base biodiversity baselines, community well-being indices) with trade and industrial policy. For Thailand’s sustainability and logistics agenda, articulating what counts as regenerative would help firms and public agencies move beyond circularity alone, orienting roadmaps toward net-positive ecosystem and social outcomes that are auditable and investment-grade.

Accordingly, the aims of this review are threefold. First, to map the theoretical evolution of sustainability and circular economy approaches in SCM, identifying their dominant foundations (stakeholder theory, RBV, institutional and network perspectives) and the operational toolkits that have emerged (Brandenburg & Gruchmann, 2019; McLoughlin et al., 2015; Kim & Lee, 2011; Molamohamadi et al., 2014; Stroumpoulis & Kopanaki, 2022; Muradin, 2022; Shaharudin & Mokhtar, 2022; Aldas-Salazar et al., 2023; Wu, 2023). Second, to clarify the conceptual boundaries of regeneration vis-à-vis sustainability and CE, specifying where existing constructs suffice and where new constructs and metrics are needed. Third, to propose an agenda for theory building and empirical inquiry that enables credible identification, measurement, and governance of regenerative supply chains in diverse sectoral and regional contexts. By consolidating disparate strands and surfacing boundary criteria, the review seeks to provide both scholars and decision-makers with a clearer foundation for advancing SCM from sustainability maintenance toward regenerative enhancement.

To directly address the research objective of clarifying conceptual boundaries, Table 1 provides a detailed comparative framework. The benefit of this framework is to operationalize the distinctions between these paradigms, serving as a 'Boundary Criteria Checklist' that compares sustainability, circular, and regenerative approaches across six key dimensions.

Table 1 Comparative Conceptual Dimensions of Supply Chain Paradigms

Dimension	Sustainability SCM (Harm Reduction)	Circular SCM (Loop Closing)	Regenerative SCM (Net- Positive Enhancement)
Core Objective / Goal	Do less harm; reduce environmental and social footprint ⁴	Resource efficiency: design for reuse, recycle, and close-the-loop systems ⁵	Do more good; restore, renew, and enhance socio-ecological systems ⁶
Primary Logic	Compliance & Efficiency (Meeting standards, minimizing waste)	Industrial Ecology & Decoupling (Slowing/closing resource loops)	Restoration & Co- evolution (Creating conditions for systems to thrive)
Theoretical Anchors	Stakeholder Theory, Resource-Based View (RBV), Institutional Theory ⁷	Industrial Ecology, Systems Thinking, Network Theory ⁸	Socio-Ecological Systems Theory, Resilience Theory, Ecological Economics ⁹

Table 1 Comparative Conceptual Dimensions of Supply Chain Paradigms (Continued)

Dimension	Sustainability SCM (Harm Reduction)	Circular SCM (Loop Closing)	Regenerative SCM (Net- Positive Enhancement)
Core Performance Metrics	Carbon footprint reduction, waste minimization, compliance rates ¹⁰	Recycling/reuse rates, reverse logistics efficiency, circularity indicators ¹¹	Net biodiversity gain, soil carbon sequestration, community well-being indices ¹²
Temporal Focus	Short-to-mid term (Annual reporting, project-based)	Mid-term (Product lifecycle, asset depreciation cycles)	Long-term & Intergenerational (Multi- decade ecological and social health)
System Boundary	Firm & Linear Supply Chain (Focal firm, Tier 1 suppliers)	Product Lifecycle & Reverse Networks (Inter- firm loops, product-as- service)	Socio-Ecological System (Ecosystem, watershed, community, landscape- level)

Note: The table highlights the conceptual distinctions among sustainability, circular, and regenerative supply chain management paradigms. Sustainability focuses on minimizing harm and complying with standards, circular supply chains emphasize closing material loops and resource efficiency, and regenerative supply chains aim at net-positive system enhancement through ecological and social restoration.

Methods

Protocol and Registration

This systematic review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines (Page et al., 2021), ensuring methodological transparency and rigor. The protocol was developed a priori, specifying the research questions, inclusion/exclusion criteria, and analytic approach.

Search Strategy

A comprehensive literature search was carried out across four databases: SciSpace (200 initial records), Google Scholar (20 records), PubMed (35 records), and additional sources obtained through backward and forward citation searches. The search covered the period from January 2010 to December 2025. Search terms included combinations of: (“sustainability” OR “sustainable”) AND “supply chain management,” “regenerative” AND “supply chain,” and (“sustainability” OR “regenerative”) AND “supply chain management.”

Eligibility Criteria

Studies were included if they met the following conditions: (i) published between 2010–2025; (ii) written in English; (iii) peer-reviewed journal articles, conference papers, or book chapters; and (iv) contained theoretical or conceptual contributions related to supply chain management with a focus on sustainability and/or regenerative approaches. Excluded were grey literature, dissertations, technical reports, non-English publications, and studies lacking theoretical or conceptual content. These inclusion and exclusion criteria, along with their rationales, are summarized in Table .

Table 2 Eligibility Criteria

Criteria	Specification / Rationale
Inclusion Criteria	
1. Publication Period	2010–2025 (Rationale: To capture the theoretical evolution from the establishment of SSCM to the emergence of RSCM.)
2. Language	English (Rationale: To ensure precise interpretation and maintain consistency in the analysis.)
3. Document Type	Peer-reviewed academic literature (Journal articles, conference papers, book chapters) (Rationale: To guarantee academic rigor and the reliability of synthesized concepts.)
4. Content Scope	Must contain theoretical or conceptual contributions (Rationale: Aligns with the primary objective of analyzing 'conceptual boundaries,' thus filtering out empirical or technical studies lacking theoretical grounding.)
Exclusion Criteria	
1. Document Type	Grey literature, dissertations, technical reports (Rationale: Lack of a formal peer-review process.)
2. Content Scope (Primary)	Non-Supply Chain focus (Rationale: To focus only on articles where SCM is the primary unit of analysis.)
3. Content Scope (Depth)	Insufficient theoretical depth or non-conceptual (Rationale: Descriptive or report-style articles without theoretical linkages were excluded.)
4. Content Scope (Regen.)	No regenerative content (Rationale: Applied specifically to the 'Regenerative' keyword search to isolate true RSCM concepts.)

Study Selection Process

The selection process was conducted independently by two researchers to mitigate selection bias. In the first stage (title and abstract screening, n=210), any discrepancies regarding

inclusion were discussed until a consensus was reached. A similar consensus-based approach was applied in the second stage (full-text assessment, n=40). Ultimately, 9 studies satisfied all inclusion criteria and were included in the final analysis. Figure 1 presents the PRISMA 2020 flow diagram detailing this process.

Data Extraction

Data were extracted using a standardized template capturing study characteristics (author, year, publication type), theoretical frameworks employed, methodological orientation, and key findings. Extracted data were organized into comparative tables to facilitate synthesis and thematic analysis.

Risk of Bias Assessment

Risk of bias was evaluated using the Risk of Bias in Non-randomized Studies—of Interventions (ROBINS-I) tool, with adaptations to account for the conceptual and theoretical nature of the included studies. Specifically, three domains were emphasized:

- 1) Study selection bias – whether the inclusion of sources reflected comprehensive coverage of the sustainability–regeneration literature.
- 2) Theoretical framing bias – whether the authors transparently justified their choice of frameworks (e.g., stakeholder theory, RBV, resilience).
- 3) Outcome interpretation bias – whether conclusions were proportionate to the evidence provided.

Other ROBINS-I domains (e.g., intervention classification, deviations from intended interventions) were not directly applicable to conceptual papers and were excluded from the assessment. Ratings were assigned as low, moderate, or serious risk based on transparency and methodological rigor. This adapted use of ROBINS-I aligns with recent practices in conceptual systematic reviews where theoretical contributions, rather than empirical intervention effects, are the unit of assessment.

Results

Study Selection

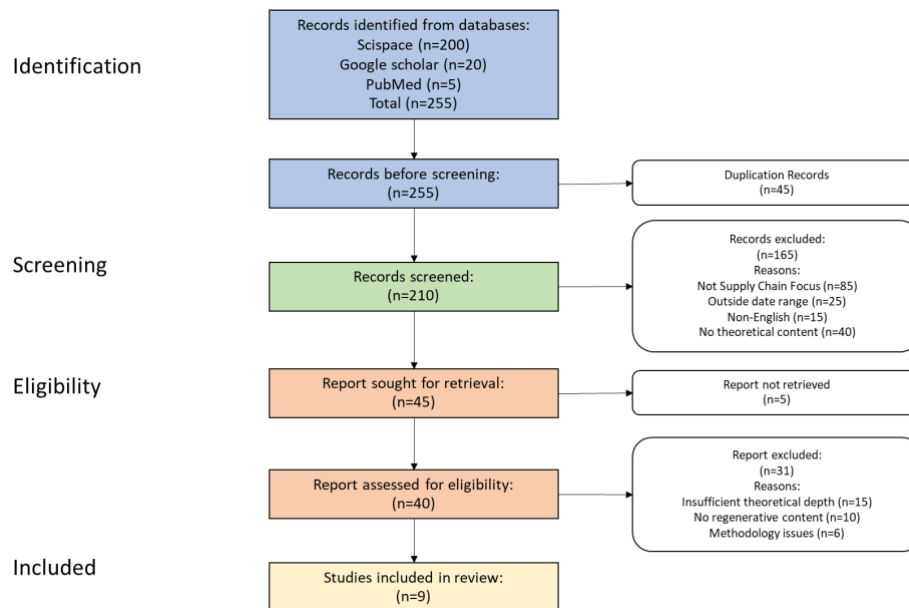


Figure 1 The PRISMA 2020 flow diagram

The PRISMA 2020 flow diagram (Figure 1) illustrates the study selection process. A total of 255 records were identified through database searches and citation tracking. After removing 45 duplicates, 210 records remained for title and abstract screening. Of these, 170 were excluded for not meeting the inclusion criteria. Forty reports were retrieved for full-text assessment, with 31 subsequently excluded due to lack of theoretical focus, non-English language, or inaccessible full texts. Ultimately, nine studies were included in the final analysis.

Study Characteristics

The included studies, published between 2011 and 2023, are summarized in Table 1. Most studies appeared after 2015 ($n = 7$), signaling increasing attention to sustainability and circular economy themes in supply chain research. The distribution by study type was as follows: conceptual frameworks ($n = 3$), literature reviews ($n = 2$), methodological proposal ($n = 1$), simulation study ($n = 1$), empirical study ($n = 1$), and conceptual discussion ($n = 1$). Collectively, these studies demonstrate a progression from early sustainability frameworks to circular economy integration and, more recently, exploratory connections with digital transformation. The characteristics of the nine included studies are summarized in Table .

Table 3 Data Extraction Template for Included Studies in the Systematic Review

Author(s), Year	Study Type	Theoretical Framework(s)	Methodology / Approach	Key Findings	Notes
Kim & Lee (2011)	Conceptual study	Stakeholder Theory, RBV	Conceptual model	Determinants of integrating sustainability into SCM	Early foundation of SSCM
Molamoham adi et al. (2014)	Conceptual framework	Three pillars of sustainability	Framework development	Linked SCM structures with environmental, social, and economic pillars	Integration emphasis
McLoughlin et al. (2015)	Conceptual framework	Network Theory	Theoretical synthesis	Defined SSCM processes grounded in network theory	Governance perspective
Brandenburg & Gruchmann (2019)	Literature review / Framework	Multi- theoretical (Stakeholder, RBV)	Synthesis and conceptual model	Comprehensive SSCM framework, call for stronger theory	Key SSCM reference
Stroumpoulis & Kopanaki (2022)	Literature review	Digital transformation + SSCM	Theoretical review	Link between digital tech and SSCM outcomes	Technology- sustainability nexus
Muradin (2022)	Conceptual model	Circular Economy	Conceptual analysis	Examined tensions/compl ementarities between CE and sustainability	Bridging concepts
Shaharudin & Mokhtar (2022)	Conceptual model	Circular Economy	Model development	Linked circular supply chains with CE performance	Applied to CE practices

Table 3 Data Extraction Template for Included Studies in the Systematic Review (Continued)

Author(s), Year	Study Type	Theoretical Framework(s)	Methodology / Approach	Key Findings	Notes
Aldas-Salazar et al. (2023)	Methodolo gical proposal	Circular Economy	Decision- support methodology	Strategy design for CE-oriented supply chains	Operationaliza tion focus
Wu (2023)	Simulation study	Circular Economy	Simulation- based modeling	Analysis of (reverse) supply chains in CE- based systems	Empirical computational

Note: Table 3 provides extracted metadata from the nine included studies, covering publication details, theoretical anchors, methodological approaches, and key contributions. The template highlights the dominance of sustainability and circular economy frameworks and the relative absence of regenerative supply chain theorization.

Theoretical Evolution

Analysis revealed three dominant streams of theoretical development:

1) Sustainability-focused studies (2011–2019) Foundational works applied stakeholder theory, resource-based view (RBV), and network theory to SCM. Kim and Lee (2011) emphasized determinants of sustainability integration, Molamohamadi et al. (2014) linked supply chain structures with the three sustainability pillars, and McLoughlin et al. (2015) framed key SSCM processes within network theory. Brandenburg and Gruchmann (2019) later synthesized these perspectives into a comprehensive conceptual framework and called for stronger theoretical substantiation.

2) Circular economy integration (2022–2023) Recent scholarship has increasingly emphasized circularity as a design logic for supply chains. Muradin (2022) highlighted complementarities and tensions between CE and sustainability, while Shaharudin and Mokhtar (2022) developed conceptual models linking circular supply chains with CE performance. Aldas-Salazar et al. (2023) advanced methodological proposals for CE-oriented supply chain strategies, and Wu (2023) used simulation-based modeling to analyze reverse supply chains in CE-based product–service systems.

3) Digital transformation integration (2022) Stroumpoulis and Kopanaki (2022) extended SSCM perspectives by integrating digital technologies, emphasizing blockchain, IoT,

and big data as enablers of sustainability outcomes. Although not regenerative in orientation, this signals an expansion of theoretical anchors beyond traditional sustainability frameworks.

Conceptual Boundaries Analysis

Despite emerging interest, none of the included studies explicitly defined or theorized regenerative supply chain management as a distinct paradigm. Regenerative elements were present in four studies but largely embedded within circular economy discourse, often as aspirational notions of restoration or net-positive outcomes. Three boundary issues were identified:

- 1) Lack of definition – No operational definition of regenerative SCM was proposed.
- 2) Boundary ambiguity – Sustainability, circular economy, and regenerative concepts were often conflated.
- 3) Theoretical underdevelopment – Regenerative SCM lacks middle-range theory and remains largely normative.

Risk of Bias Assessment

The adapted ROBINS-I assessment (Figure 2) indicated that most included studies exhibited moderate risk of bias ($n = 8$), primarily due to limited methodological transparency and selective use of frameworks. One study demonstrated serious risk of bias, arising from insufficient justification of theoretical claims. Nevertheless, overall methodological quality was acceptable for conceptual and theoretical contributions.



Figure 2 ROBINS-I Risk of Bias Assessment for included studies

Synthesis of Findings

The synthesis reveals a clear trajectory of theoretical evolution:

2010–2015: Early foundations of SSCM grounded in sustainability frameworks.

2015–2020: Consolidation of sustainability theories (stakeholder, RBV, network).

2020–2025: Integration of circular economy and digital transformation themes.

The review confirms that while sustainability and circular economy are relatively well-developed, regenerative SCM remains underdefined. The findings underscore a critical opportunity for theory building, boundary clarification, and development of regenerative-specific metrics and empirical validations.

Discussion

Principal Findings

This systematic review was guided by three aims: (1) to map the theoretical evolution of sustainability and circular economy (CE) approaches in SCM, (2) to clarify the conceptual boundaries of regeneration vis-vis sustainability and CE, and (3) to propose a research agenda for regenerative SCM. The findings address these aims by revealing a clear theoretical gap.

The review confirms that while sustainability-focused studies (Aim 1) have matured through established theories (e.g., Stakeholder Theory, RBV), and CE approaches have provided operational models, regenerative SCM (Aim 2) remains conceptually underdeveloped. Addressing Aim 3, the analysis identifies a significant boundary problem—the absence of a clear definition, framework, and regenerative-specific metrics—which forms the basis of the proposed research agenda.

Implications for Theory

This review suggests that moving from sustainability and circularity to regeneration requires a paradigmatic reorientation. Theoretical progression can be understood as a continuum:

- **Sustainability** emphasizes *harm reduction* and efficiency gains.
- **Circular economy** emphasizes *resource loops* and systemic efficiency.
- **Regeneration** requires *net-positive outcomes*, shifting the locus of value creation from minimizing footprints to enhancing socio-ecological systems.

Future theoretical development should address three critical areas:

- 1) **Ontological foundations** — What constitutes a regenerative supply chain? Which boundaries (ecological, social, intergenerational) define its scope?
- 2) **Epistemological approaches** — How can regenerative outcomes be credibly identified, measured, and validated?
- 3) **Methodological frameworks** — What research designs (e.g., longitudinal case studies, comparative experiments, systems modeling) are best suited to capture regenerative processes?

Furthermore, this call for regenerative-specific frameworks in SCM aligns with the emerging discourse in regenerative economics. This broader economic perspective argues for shifting economic models from extractive (harm-based) to restorative (net-positive), emphasizing qualitative development over quantitative growth. Future RSCM theory-building should therefore integrate principles from ecological and regenerative economics to provide a robust theoretical anchor for net-positive value creation.

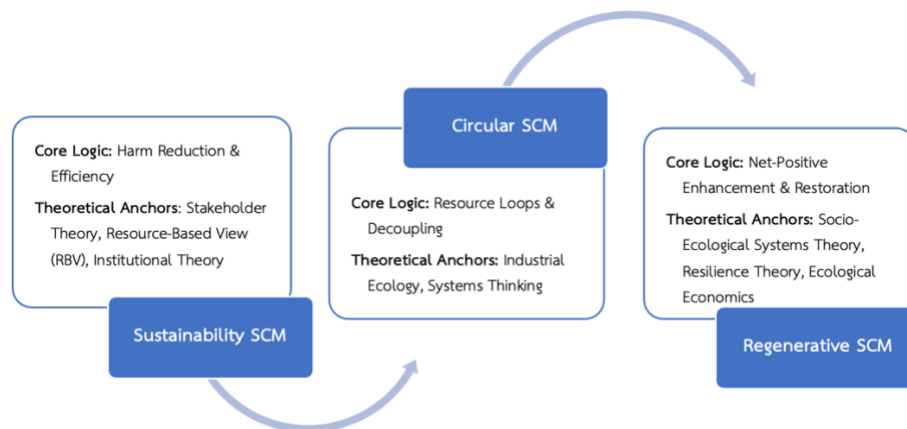


Figure 3 A Visual Synthesis of the SCM Paradigmatic Continuum

Practical and Policy Implications

The lack of regenerative theory has direct consequences for practice. Organizations aiming to transition toward regenerative models face ambiguity in designing strategies, selecting metrics, and aligning with stakeholder expectations. Policy frameworks at global and regional levels—such as the UN SDGs, EU Green Deal, and ASEAN circular economy initiatives—are beginning to demand beyond-sustainability outcomes. Yet without theoretical clarity, firms risk adopting fragmented or symbolic practices.

In emerging economies, including Thailand, the distinction is particularly critical. Logistics and industrial clusters such as the Eastern Economic Corridor (EEC) are under pressure to decarbonize and create inclusive growth. A regenerative SCM perspective could support policy alignment by guiding:

- Incentives for restorative procurement and sourcing (e.g., regenerative agriculture, biodiversity-friendly materials).
- Development of net-positive performance indicators for ecosystems and communities.
- Design of public–private partnerships that promote resilience, equity, and long-term system health.

Equity and Inclusivity Considerations

Current sustainability and circular economy models often emphasize efficiency and compliance, which can privilege large firms while sidelining small, localized actors. A regenerative supply chain paradigm must foreground equity and inclusivity, ensuring that SMEs and marginalized communities share in the benefits of system enhancement. Recent supply chain scholarship has begun to recognize this imperative. For instance, inclusive purchasing capabilities have been linked to more resilient supply chains that embed social inclusion criteria (Silva, 2022). Furthermore, operations and supply chain research is increasingly interrogating justice-oriented frameworks, advocating for public policy regimes that enable diversity, equity, and inclusion (DEI)-anchored practices across supply networks (Bodrožić & Gold, 2025; Matthews, 2025). These insights underscore the necessity for regenerative SCM to adopt metrics that extend beyond ecological outcomes to include DEI indicators, fair transitions in policy mechanisms, and responsive governance structures that do not perpetuate inequalities.

Paradigm Shift and Research Agenda

Collectively, the findings call for a paradigm shift in SCM research: from maintaining system stability to actively regenerating socio-ecological capacity. This requires:

- Development of conceptual models that distinguish regeneration from sustainability and circularity (as proposed in this review)
- Creation of regenerative-specific performance metrics, including biodiversity gains, soil health, and community empowerment indices.

- Empirical validation through longitudinal studies, cross-sector comparisons, and simulation modeling.

By consolidating sustainability, circular economy, and regenerative strands into a continuum framework, this review provides a foundation for advancing SCM theory and informing policy makers. Future research should not only test regenerative principles but also explore how they can be scaled across industries and geographies to achieve genuine net-positive outcomes.

Conclusions

Key Takeaways:

- **Theoretical:** This review maps the SCM paradigmatic continuum, clarifying the conceptual boundaries between 'harm reduction' (Sustainability), 'loop closing' (Circular), and 'net-positive enhancement' (Regenerative), establishing RSCM as a distinct, undefined paradigm.
- **Practical:** For practitioners, the review highlights that current metrics are insufficient for regeneration. New indicators (e.g., biodiversity gains, soil carbon, community well-being) are required to move strategy beyond incremental circularity.
- **Policy:** For policymakers (e.g., in ASEAN and Thailand's EEC), a regenerative framework is crucial for guiding investment and aligning industrial policy with auditable, net-positive ecological and social outcomes.

This PRISMA-based systematic review analyzed the theoretical evolution and conceptual boundaries of sustainability, circular, and regenerative supply chain management (SCM) between 2010 and 2025. The findings demonstrate that while sustainability frameworks have matured significantly, and circular economy approaches have provided concrete operational models, regenerative SCM remains conceptually underdeveloped. No explicit definitions, theoretical frameworks, or empirical validations have yet established regeneration as a distinct paradigm in the SCM field.

Theoretical Contribution

The review advances scholarly understanding by positioning sustainability, circular, and regenerative approaches along a continuum of paradigmatic development. This framework clarifies boundary ambiguities and identifies key theoretical anchors: sustainability (stakeholder theory, RBV, institutional theory), circular economy (industrial ecology, systems thinking), and regeneration

(socio-ecological systems, resilience, ecological economics). By articulating this continuum, the study provides a conceptual foundation for future regenerative SCM theory building.

Practical and Policy Contribution

For practitioners and policymakers, the review highlights the risks of conflating sustainability and circularity with regeneration. Without clear distinctions, organizations face difficulties in strategy design, performance measurement, and policy alignment. In contexts such as Thailand's Eastern Economic Corridor and broader ASEAN logistics development, a regenerative orientation could guide investment in restorative procurement, biodiversity-positive operations, and inclusive community outcomes. These insights underscore the necessity for new metrics, tools, and governance mechanisms that capture net-positive impacts.

Limitations

This review is subject to several limitations. First, the database coverage was restricted to four main sources, potentially omitting recent or regionally published studies. Second, only English-language publications were included, which may bias findings toward Western-centric perspectives. Third, the focus on theoretical and conceptual contributions excluded practice-oriented or technical studies that could offer valuable insights into regenerative principles.

Future Research Directions

Building on these limitations, future research should:

- 1) Develop clear operational definitions and theoretical frameworks for regenerative SCM.
- 2) Create regenerative-specific metrics, including biodiversity, soil health, and community well-being indicators.
- 3) Conduct empirical validations through case studies, longitudinal analyses, and intervention-based research.
- 4) Explore regional adaptations, particularly in emerging economies, where regenerative approaches could align economic competitiveness with ecological restoration and social equity.

To synthesize the contributions of this review, Table 4 summarizes the theoretical, practical, and policy implications alongside future research opportunities. This matrix highlights how the study

advances scholarly understanding, guides organizational practice, and informs policy frameworks, while setting an agenda for regenerative SCM research.

Table 4 Contribution Matrix of the Systematic Review on Sustainability, Circular, and Regenerative SCM

Dimension	Key Contributions	Future Research Opportunities
Theoretical	- Clarifies conceptual boundaries between sustainability, circular economy, and regenerative SCM. - Positions SCM paradigms on a continuum from harm reduction → resource loops → net-positive regeneration. - Identifies theoretical anchors (Stakeholder Theory, RBV, Network Theory, Industrial Ecology, Socio-Ecological Systems).	- Develop explicit definitions and frameworks for regenerative SCM. - Establish middle-range theory and ontological/epistemological foundations. - Expand theoretical integration with resilience and ecological economics.
Practical	- Provides insights for firms to distinguish sustainability and circular practices from regenerative strategies. - Highlights the absence of regenerative-specific metrics, creating awareness among practitioners.	- Develop regenerative performance metrics (e.g., biodiversity gains, soil carbon, community equity). - Conduct longitudinal case studies to validate regenerative business practices.
Policy	- Identifies the gap between policy ambition (e.g., SDGs, ASEAN circular economy initiatives) and current SCM frameworks. - Suggests that regenerative SCM can serve as a policy framework for inclusive, net-positive supply chains.	- Design public–private partnerships to support regenerative transitions. - Develop policy instruments and incentives aligned with regenerative SCM outcomes.
Research Agenda	- Provides a consolidated evidence base from 2010–2025. - Establishes regenerative SCM as an emerging but underdeveloped paradigm requiring urgent scholarly attention.	- Expand database and language coverage. - Use intervention-based methods, simulation modeling, and comparative studies across industries and regions.

Note: Table 4 synthesizes the contributions of this systematic review across theoretical, practical, and policy

dimensions, while outlining future research opportunities to advance regenerative supply chain management as a distinct paradigm.

In conclusion, this review represents the first PRISMA-based systematic mapping that distinguishes regenerative supply chain management as a nascent but distinct paradigm, rather than merely a rhetorical extension of sustainability or circularity (Oyefusi, 2022).

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