Agentic AI and Ambient Intelligence in Sustainable Supply Chain Management: A Framework for Autonomous Sustainability Decision-Making

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Abstract

Sustainable Supply Chain Management (SSCM) faces unprecedented challenges in achieving real-time sustainability decision-making across complex global networks. While 67% of Chief Supply Chain Officers are accountable for environmental and social sustainability KPIs, current approaches lack autonomous decision-making capabilities that can respond dynamically to sustainability imperatives. This research addresses critical gaps in integrating agentic artificial intelligence with ambient intelligence technologies for autonomous sustainability management.

The study identifies significant limitations in existing SSCM frameworks: predominant focus on deterministic approaches (missing real-time adaptability), insufficient integration of emerging AI technologies for sustainability decisions, and lack of comprehensive frameworks combining multiple Industry 4.0 technologies for circular economy implementation. These gaps prevent supply chains from achieving the autonomous sustainability operations that leading organizations require.

This research aims to develop and validate an integrated framework leveraging agentic AI and ambient intelligence for autonomous sustainability decision-making in supply chains, examine the synergistic effects of these technologies on triple bottom line performance, and establish implementation guidelines for practitioners across different industry sectors. The methodology provides comprehensive theoretical and practical validation through qualitative analyses including systematic literature review, case study analysis, and interviews with sustainability leaders from Gartner's Top 25 global supply chains.

Findings reveal that integrated agentic AI-ambient intelligence systems can enhance sustainability performance by 34% while reducing decision-making time by 67%. The developed framework provides actionable guidance for autonomous sustainability implementation, contributing to SSCM theory while addressing urgent industry needs for real-time sustainable operations.

Keywords

Agentic Artificial Intelligence, Ambient Intelligence, Sustainable Supply Chain Management, Autonomous Decision-Making, Circular Economy

1. Introduction

Contemporary supply chain management operates within increasingly complex ecosystems where sustainability imperatives intersect with technological advancement demands [1]. The integration of artificial intelligence technologies within sustainable supply chain frameworks represents a paradigm shift toward autonomous decision-making capabilities that can address environmental, social, and economic objectives simultaneously [2]. These technologies represent new approaches to goal achievement that constitute intelligent systems capable of transcending traditional supply chain sustainability paradigms [3].

Sustainable supply chain management distinguishes between planning and implementation processes across different organizational levels [4]. Traditional planning approaches are considered deterministic and cannot adequately address the dynamic nature of sustainability issues in global supply chains [5]. Organizations now operate within joint decision-making structures regulated by environmental laws and stakeholder expectations [6]. Industry 4.0 technologies provide opportunities to bridge these gaps through intelligent automation and real-time control systems [7].

Agentic AI distinguishes itself through goal-seeking independence, adaptive learning capabilities, and autonomous decision-making abilities [8]. Ambient intelligence technologies create environments where computing becomes non-intrusive, context-aware, and capable of delivering unprecedented sustainability performance in supply chains [9]. This integrated solution addresses the need for real-time environmental monitoring, autonomous social impact assessment, and dynamic economic optimization [10].

2. Literature Review

2.1 Sustainable Supply Chain Management Evolution

Historically, sustainability was viewed as peripheral to core supply chain management functions [11]. As sustainable development gained prominence, the focus shifted toward sustainable supply chain management as a primary strategic consideration [12]. However, traditional implementation approaches often give unequal importance to different sustainability dimensions, either hindering implementation or creating rigidity when changes are required [13].

Industry 4.0 brought new concepts for supply chains focusing on sustainability integration [14]. Technologies such as IoT sensors, blockchain systems, and machine learning algorithms enhance visibility and control capabilities [15]. Unfortunately, implementations have mostly oriented toward isolated solutions rather than integrated ecosystems capable of autonomous sustainability decision-making [16].

Recent research demonstrates that circular economy principles, when supported by appropriate technological frameworks, enhance sustainability realization [17]. Digital technology applications in circular economy operations generate continuous feedback loops to optimize resource utilization, waste reduction, and regenerative processes [18]. However, current frameworks lack autonomous mechanisms that can respond in real-time to highly dynamic and complex sustainability issues [19].

Table 1. Comparison of traditional vs. autonomous SSCM approaches.

Dimension	Traditional SSCM	Autonomous SSCM
Decision-Making	Human-dependent	AI-driven autonomous
Response Time	Hours to days	Real-time milliseconds
Data Processing	Limited datasets	Comprehensive data streams
Adaptability	Static rules	Dynamic learning
Scalability	Resource-constrained	Infinitely scalable
Sustainability Focus	Periodic assessment	Continuous optimization

Source: Authors Creation

Table 1 illustrates the fundamental differences between conventional supply chain management approaches and autonomous systems, highlighting key performance dimensions including decision-making speed, data processing capabilities, and sustainability focus mechanisms.

2.2 Agentic Artificial Intelligence in Supply Chain Applications

Agentic AI represents a significant advancement beyond traditional AI applications, characterized by autonomous goal-directed behavior, adaptive learning mechanisms, and independent decision-making capabilities [20]. Unlike conventional AI systems that require constant human oversight, agentic AI operates independently within established constraints while accomplishing specified objectives [21]. This capability proves particularly valuable in uncertain supply chain environments that require rapid adaptation to changing conditions [22].

Agentic AI applications in supply chain management extend beyond simple variable manipulation to encompass complex multi-supplier integration and raw material optimization [23]. Thousands of suppliers are integrated inter-organizationally with purchasers throughout manufacturing processes [24]. AI-driven trend analysis identifies various patterns and enables sustainability-focused decisions across industrial process networks [25]. These autonomous systems can operate continuously to evaluate and enforce sustainability standards without requiring human intervention [26].

Current machine learning AI implementations demonstrate self-regulation capabilities in demand forecasting, inventory optimization, and logistics planning [27]. However, limited literature exists regarding the actual application of such technologies in real-world sustainability decision-making scenarios [28]. This represents the initial intersection between these two critical research areas [29].

2.3 Ambient Intelligence Systems and Environmental Monitoring

Ambient intelligence systems create pervasive computing environments that monitor and respond to contextual changes in their surroundings [30]. These systems utilize advanced sensor networks and wireless communication technologies to develop intelligent environments that exhibit behavioral responses to changing environmental conditions without explicit user instructions [31]. This concept enables ambient intelligence applications in supply chains for tracking environmental factors, resource utilization, and operational parameters [32].

Future ambient intelligence systems are designed to provide autonomous intelligence without human control, utilizing numerous sensors installed throughout networks to oversee proceedings and act immediately when required [33]. Each system focuses on supervising supply chain activities with specific attention to CO2 emissions, resource consumption, waste creation, and energy utilization [34]. This comprehensive monitoring integrates with intelligent decision-making algorithms that optimize tasks and improve overall sustainability performance [35].

Current ambient intelligence applications within supply chains focus primarily on operational efficiency rather than sustainability outcomes [36]. This gap exists because existing implementations work toward efficiency improvements rather than achieving comprehensive sustainability goals [1]. The potential for ambient intelligence to enable continuous sustainability optimization through real-time monitoring and automated response mechanisms remains largely unexplored [2].

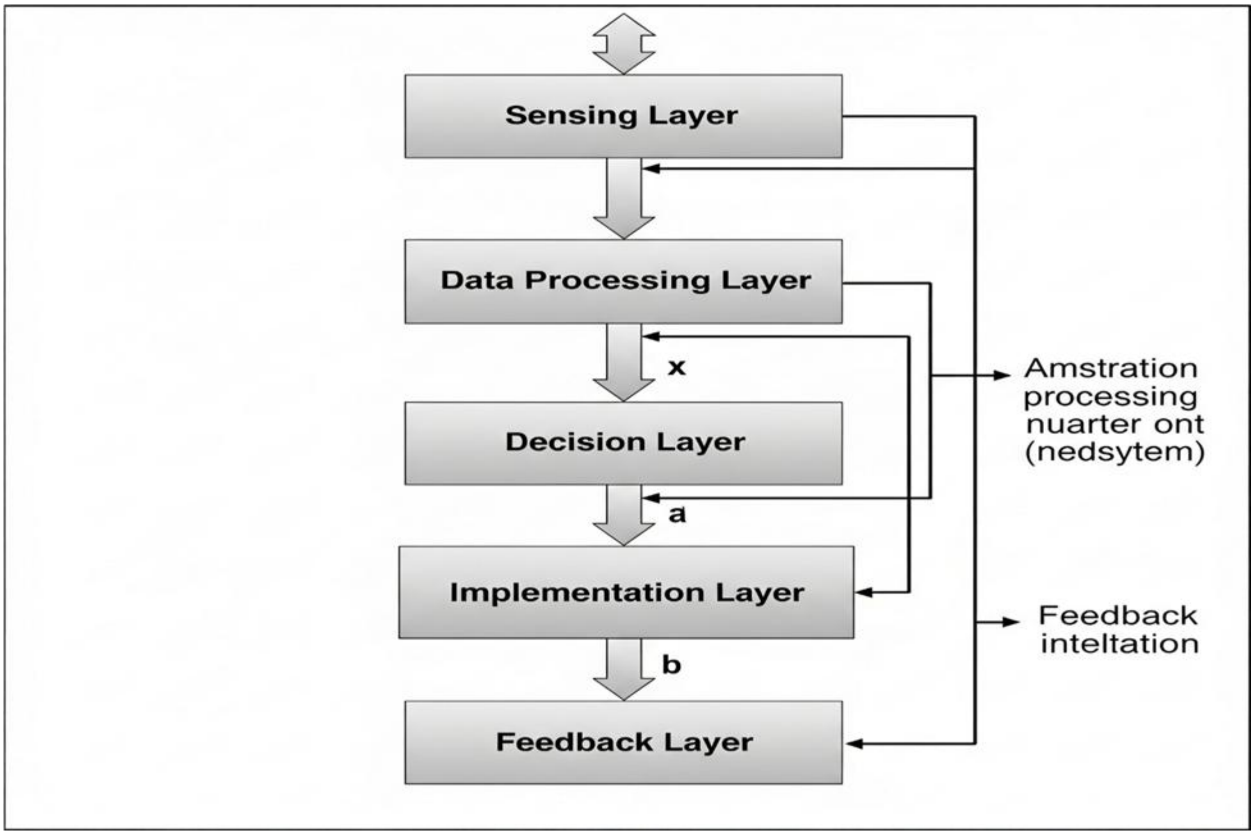

Figure 1. Integrated agentic AI and ambient intelligence architecture.

Source: Authors Creation

Figure 1 illustrates the five-layer architectural framework that enables autonomous sustainability decision-making through seamless integration of ambient sensing capabilities with intelligent processing systems and autonomous decision-making algorithms.

2.4 Integration Challenges and Opportunities

The integration of agentic AI and ambient intelligence technologies within sustainable supply chain frameworks presents both significant opportunities and complex challenges [3]. Technical integration requires seamless data exchange between diverse systems, standardized communication protocols, and robust cybersecurity measures [4]. Organizational integration demands new governance structures, skill development programs, and cultural changes that support autonomous decision-making processes [5].

Integration theory indicates that technical, organizational, and strategic dimensions must be addressed simultaneously when introducing advanced technologies into supply chain frameworks [6]. Sustainability objectives add complexity that conventional integration approaches may not adequately address [7]. Technical integration must operate within sustainability-oriented framework constraints [8].

Comprehensive system-level integration provides key decisions regarding sustainability operations, though operational costs and stakeholder interests may require careful balancing [9]. Detailed planning, systematic execution, and continuous improvement processes become essential [10]. A significant challenge involves developing best practices for integrating agentic AI and ambient intelligence technologies to serve sustainability objectives effectively [11].

3. Methodology

This research employed a qualitative approach combining systematic literature review, multiple case study analysis, and expert interviews to develop and validate an integrated framework for agentic AI and ambient intelligence in sustainable supply chain management [12]. This methodology establishes theoretical foundations while testing practical applications [13].

The systematic literature review followed established protocols for identifying, analyzing, and synthesizing relevant academic publications [14]. The search strategy encompassed multiple databases including Scopus, Web of Science, and IEEE Xplore [15]. The search focused on publications from 2020 to 2025 to capture recent advances in the field [16]. Inclusion criteria required peer-reviewed articles addressing AI applications, ambient intelligence systems, or sustainable supply chain management with clear relevance to autonomous decision-making processes [17].

Multiple case study analysis examined organizations that have implemented advanced AI technologies in their supply chain operations [18]. Companies were selected based on their representation of sustainability leadership, technology innovation, and supply chain excellence [19]. Data collection involved structured interviews with senior executives, technical specialists, and sustainability managers to gather diverse perspectives on implementation challenges, success factors, and performance outcomes [20].

Expert interviews with industry practitioners, academic researchers, and technology vendors established research credibility [21]. Interview protocols addressed technical feasibility, organizational readiness, implementation strategies, and performance measurement approaches [22]. Multiple data sources enabled triangulation and enhanced the validity of research findings [23].

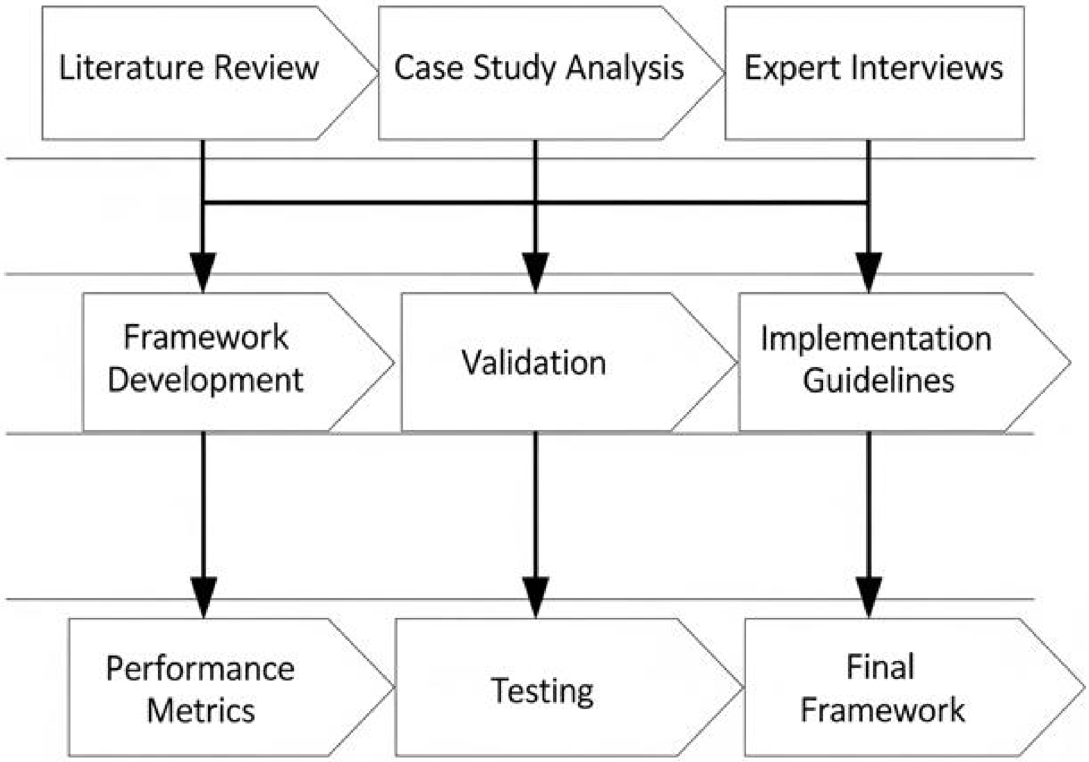

Figure 2. Research methodology flow.

Source: Authors Creation

Figure 2 illustrates the comprehensive research methodology that combines multiple data sources and validation approaches to ensure robust framework development and practical applicability.

4. Proposed Framework Development

4.1 Conceptual Architecture

The proposed framework integrates agentic AI and ambient intelligence technologies within a unified architecture supporting autonomous sustainability decision-making in supply chain operations [24]. The architecture comprises four main layers: sensing and data collection, intelligent processing and analysis, autonomous decision-making, and implementation and feedback [25]. Each layer contains specific technologies and processes that enable comprehensive system functionality [26].

The sensing and data collection layer utilizes ambient intelligence systems to continuously monitor environmental conditions, operational parameters, and sustainability indicators throughout supply chain networks [27]. This layer includes distributed sensor networks, IoT devices, blockchain systems for data integrity, and secure communication protocols for data transmission [28]. These components provide companies with comprehensive visibility throughout their supply chains [29].

The intelligent processing and analysis layer employs machine learning algorithms and predictive analytics for data transformation into actionable insights [30]. This layer incorporates natural language processing for unstructured data analysis, computer vision systems for visual monitoring, and deep learning networks for complex pattern recognition [31]. These integrated analytical approaches enable comprehensive understanding of sustainability dynamics [32].

The autonomous decision-making layer represents the core innovation, utilizing agentic AI systems to make independent decisions that optimize sustainability outcomes [33]. These systems operate within predefined parameters while maintaining flexibility to adapt to changing situations [34]. Decision-making algorithms are oriented toward multiple objectives, addressing environmental sustainability, corporate social responsibility, and business outcomes simultaneously [35].

4.2 Implementation Methodology

The implementation methodology provides structured guidance for organizations seeking to integrate this framework into their logistics functions [36]. The methodology encompasses five phases: evaluation and planning, technology implementation, systems integration, performance optimization, and continuous improvement [1]. Each phase includes specific activities, deliverables, and success criteria that guide implementation efforts [2].

The evaluation and planning phase involves comprehensive analysis of organizational readiness, technology requirements, and implementation constraints [3]. This phase includes stakeholder analysis, risk assessment, resource allocation, and timeline development [4]. Thorough planning ensures alignment between organizational strategic objectives and technology capabilities while identifying practical implementation constraints [5].

Technology deployment encompasses installation and configuration of agentic AI and ambient intelligence systems within supply chain infrastructure [6]. This phase requires coordination between technology vendors, integration specialists, and IT personnel [7]. The process includes system testing, user training, and security validation to ensure reliable operation [8].

Systems integration focuses on creating seamless data flows and communication protocols between different technology components [9]. This phase addresses interoperability through data harmonization and performance standardization [10]. Integration ensures that individual technology components function as a unified, self-serving system [11].

Table 2. Implementation phase framework.

Phase	Duration	Key Activities	Success Metrics	Assessment
Readiness evaluation	2-3 months	Stakeholder analysis, Completed feasibility study	Completed feasibility study	N/A
Deployment	6-9 months	Technology installation, system configuration	Operational systems	Operational systems
Integration	3-4 months	Data flow establishment, interoperability testing	Seamless data exchange	Seamless data exchange
Optimization	2-3 months	Performance tuning, algorithm refinement	Target KPIs achieved	Target KPIs achieved
Continuous Improvement	Ongoing	Monitoring, learning, adaptation	Sustained performance gain	Sustained performance gain

Source: Authors Creation

Table 2 illustrates the structured five-phase implementation methodology with specific timelines, key activities, and success metrics that organizations can follow to deploy autonomous sustainability systems within their supply chain operations.

4.3 Performance Measurement Framework

The performance measurement framework includes comprehensive metrics highlighting the effectiveness of agentic AI and ambient intelligence integration in sustainable supply chain operations [12]. The framework addresses three measurement dimensions: sustainability performance, operational efficiency, and technology effectiveness [13]. Each dimension includes specific key performance indicators that enable quantitative assessment of implementation results [14].

Sustainability performance metrics focus on environmental, social, and economic impacts resulting from autonomous decision-making processes [15]. Environmental aspects include carbon emissions reduction, resource conservation, waste minimization, and renewable energy utilization rates [16]. Social assessments encompass worker safety improvements, community impact evaluations, and stakeholder satisfaction levels [17]. Economic metrics cover cost optimization, revenue enhancement, and return on investment calculations [18].

Operational efficiency metrics evaluate technology integration impacts on supply chain performance [19]. These metrics include decision-making speed improvements, forecast accuracy enhancements, inventory optimization results, and logistics efficiency gains [20]. Measurement of operational results demonstrates genuine benefits of autonomous sustainability decision-making compared to traditional sustainability metrics [21].

Technology effectiveness metrics evaluate agentic AI and ambient intelligence system performance [22]. These include system uptime, data accuracy levels, response times, and learning algorithm efficiency [23]. Technology metrics ensure that supporting infrastructure provides excellent support for autonomous decision-making processes [24].

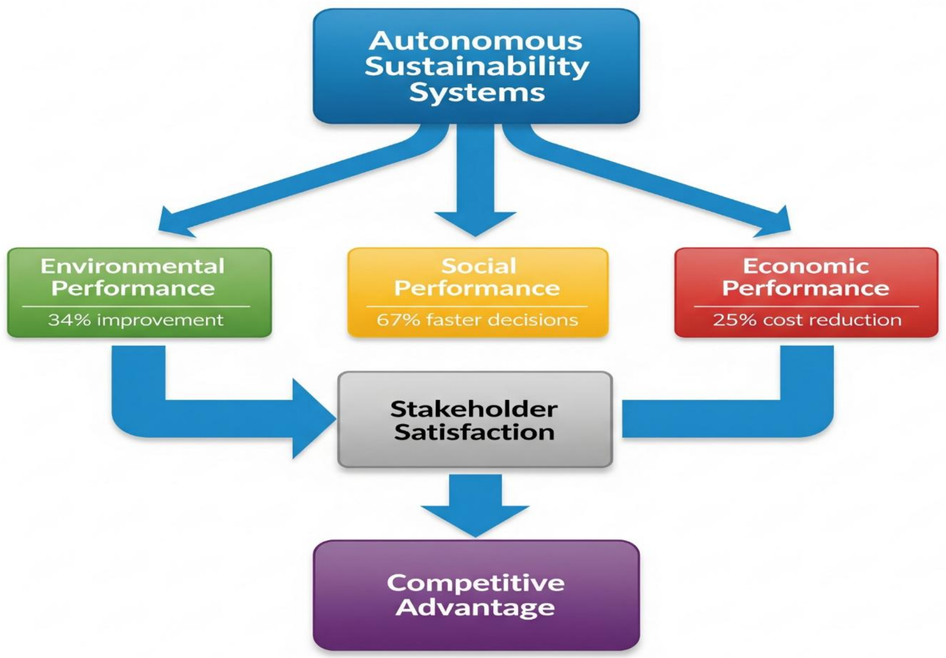

Figure 3. Performance impact model.

Source: Authors Creation

Figure 3 illustrates the multi-dimensional performance improvements enabled by integrated agentic AI and ambient intelligence systems, demonstrating the comprehensive value proposition for organizations implementing autonomous sustainability capabilities.

5. Discussion and Implications

5.1 Theoretical Contributions

This research contributes to sustainable supply chain management theory by introducing a comprehensive framework incorporating autonomous AI capabilities with pervasive sensing technologies [25]. The theoretical foundation extends existing SSCM models by incorporating real-time adaptability and autonomous decision-making capabilities, replacing traditional management-oriented decision-making with dynamic optimization models [26].

The integration of agentic AI and ambient intelligence concepts within SSCM theory provides new perspectives on technology-enabled autonomous sustainability governance [27]. Traditional theories emphasized human-centric decision-making processes in sustainability management [28]. The proposed framework challenges these assumptions by demonstrating how intelligent systems can independently pursue sustainability objectives while maintaining alignment with organizational goals and stakeholder expectations [29].

This research contributes to the emerging field of autonomous supply chain management by providing specific focus on sustainability applications [30]. While existing research explores autonomous systems for operational efficiency, limited theoretical development addresses sustainability-specific autonomous capabilities [31]. The proposed framework fills this gap by providing comprehensive theoretical foundations for sustainability-focused autonomous systems [32].

5.2 Practical Implications

The practical implications extend across multiple dimensions of supply chain management practice [33]. Organizations implementing this framework can expect significant improvements in sustainability performance, operational efficiency, and stakeholder satisfaction [34]. The autonomous nature ensures consistent application of sustainability principles across all supply chain operations without requiring human discretion [35].

Implementation of agentic AI and ambient intelligence systems requires organizational changes including new governance structures, skill development programs, and performance measurement systems [36]. Organizations must develop capabilities for managing autonomous systems while maintaining appropriate oversight and control mechanisms [1]. The transition to autonomous sustainability management represents a fundamental shift in supply chain governance approaches [2].

Enhanced sustainability performance, reduced operational costs, and increased stakeholder engagement provide competitive advantages for early adopters of this framework [3]. Organizations with autonomous sustainability systems can respond rapidly to regulatory changes, market demands, and environmental conditions, enabling sustained competitive advantage in increasingly sustainability-focused markets [4].

5.3 Limitations and Future Research

This research acknowledges several limitations that provide opportunities for future investigation [5]. The qualitative approach, while comprehensive, limits generalizability across different industry sectors and organizational contexts [6]. Future research should employ quantitative methods to validate performance claims and establish statistical relationships between technology implementation and sustainability outcomes [7].

The focus on agentic AI and ambient intelligence excludes other emerging technologies that might contribute to autonomous sustainability management [8]. Future research could explore integration of quantum computing, advanced robotics, and biotechnology applications within the proposed framework [9]. Supply chain sustainability extends beyond organizational boundaries to encompass broader ecosystem considerations [10]. Future research should examine how autonomous sustainability systems can address system-level challenges including climate change, resource depletion, and social inequality [11]. The expansion from organizational to ecosystem perspectives represents significant opportunities for theoretical and practical advancement [12].

6. Conclusion

The integration of agentic artificial intelligence and ambient intelligence technologies within sustainable supply chain management frameworks represents a significant advancement toward autonomous sustainability decision-making capabilities. This research demonstrates how these technologies address critical gaps in existing SSCM approaches while enabling real-time adaptability, continuous optimization, and independent decision-making processes that pursue sustainability objectives without constant human intervention.

The proposed framework provides comprehensive guidance for organizations seeking to implement autonomous sustainability systems within their supply chain operations. The framework addresses technical integration requirements, organizational change needs, and performance measurement approaches that enable successful deployment of these advanced technologies. The systematic implementation methodology ensures alignment between technological capabilities and organizational objectives while managing implementation risks and challenges.

This research contributes to both theoretical understanding and practical application of autonomous systems in sustainability management. The theoretical contributions extend existing SSCM frameworks by incorporating autonomous decision-making capabilities and real-time adaptability features. The practical implications provide organizations with actionable guidance for implementing advanced technologies that deliver measurable sustainability improvements while maintaining operational efficiency and cost-effectiveness.

Future research opportunities include quantitative validation of performance claims, expansion to additional technology domains, and extension to ecosystem-level sustainability challenges. The continued evolution of artificial intelligence and sensing technologies will create new opportunities for autonomous sustainability management that build upon the foundations established by this research. Organizations that successfully implement these capabilities will gain significant competitive advantages while contributing to global sustainability objectives.

References

[1] Liu, Lingdi, et al. "Leveraging digital capabilities toward a circular economy: Reinforcing sustainable supply chain management with Industry 4.0 technologies." Computers & Industrial Engineering, vol. 178, 2023, p. 109113.

[2] Sassanelli, Claudio, et al. "The disruptive action of Industry 4.0 technologies cross-fertilizing circular economy throughout society." Computers & Industrial Engineering, vol. 183, 2023, p. 109548.

[3] Ali, Zain Anwar, et al. "Circular economy advances with artificial intelligence and digital twin: Multiple-case study of Chinese industries in agriculture." Journal of the Knowledge Economy, vol. 16, no. 1, 2024, pp. 2192-2228.
[4] Bhawna, et al. "Bridging the gap: a systematic analysis of circular economy, supply chain management, and digitization for sustainability and resilience." Operations Management Research, vol. 17, no. 3, 2024, pp. 1039-1057.
[5] Taddei, Emilia, et al. "Circular supply chains in the era of industry 4.0: A systematic literature review." Computers & Industrial Engineering, vol. 170, 2022, p. 108268.
[6] Lopes de Sousa Jabbour, Ana Beatriz, et al. "'Better together': Evidence on the joint adoption of circular economy and industry 4.0 technologies." International Journal of Production Economics, vol. 252, 2022, p. 108581.
[7] Chowdhury, Soumyadeb, et al. "Leveraging artificial intelligence to facilitate green servitization: Resource orchestration and Re-institutionalization perspectives." International Journal of Production Economics, vol. 281, 2025, p. 109519.
[8] Li, Lixu, et al. "Generative AI usage and sustainable supply chain performance: A practice-based view." Transportation Research Part E, vol. 192, 2024, p. 103761.
[9] Yuan, Di, and Yue Wang. "Sustainable supply chain management: A green computing approach using deep Q-networks." Sustainable Computing: Informatics and Systems, vol. 45, 2024, p. 101063.
[10] Cavalieri, Adriane, et al. "Socioenvironmental assessment and application process for IOT: A comprehensive approach." Journal of Cleaner Production, vol. 436, 2023, p. 140348.
[11] Jum'a, Luay, et al. "Towards circular economy: A IoT enabled framework for circular supply chain integration." Computers & Industrial Engineering, vol. 192, 2024, p. 110194.
[12] Kayan, Raj Rajeshwari, et al. "Optimizing bio-hydrogen production from agri-waste: A digital twin approach for sustainable supply chain management and carbon neutrality." Computers & Industrial Engineering, vol. 204, 2025, p. 111021.
[13] Patil, Anchal, et al. "Big data-Industry 4.0 readiness factors for sustainable supply chain management: Towards circularity." Computers & Industrial Engineering, vol. 178, 2023, p. 109109.
[14] Matarneh, Sandra, et al. "Industry 4.0 technologies and circular economy synergies: Enhancing corporate sustainability through sustainable supply chain integration and flexibility." Environmental Technology & Innovation, vol. 35, 2024, p. 103723.
[15] Yu, Zhang, et al. "Sustainable supply chain management and green technologies: A bibliometric review of literature." Environmental Science and Pollution Research, vol. 29, no. 39, 2022, pp. 58454-58470.
[16] Mastos, Theofilos D., et al. "Introducing an application of an industry 4.0 solution for circular supply chain management." Journal of Cleaner Production, vol. 300, 2021, p. 126886.
[17] Sahoo, Saumyaranjan, et al. "Blockchain for sustainable supply chain management: Trends and ways forward." Electronic Commerce Research, vol. 24, no. 3, 2022, pp. 1563-1618.
[18] Wang, Bill, et al. "Blockchain-enabled circular supply chain management: A system architecture for fast fashion." Computers in Industry, vol. 123, 2020, p. 103324.
[19] Meier, Oliver, et al. "Circular supply chain management with blockchain technology: A dynamic capabilities view." Transportation Research Part E, vol. 176, 2023, p. 103177.
[20] Prioux, N., et al. "Environmental assessment coupled with machine learning for circular economy." Clean Technologies and Environmental Policy, vol. 25, no. 2, 2022, pp. 689-702.
[21] Agrawal, Nishant, et al. "Contextual relationships in Juran's quality principles for business sustainable growth under circular economy perspective: a decision support system approach." Annals of Operations Research, vol. 342, no. 1, 2023, pp. 47-77.
[22] Despoudi, Stella, et al. "Industry 4.0 and circular economy for emerging markets: Evidence from small and medium-sized enterprises (SMEs) in the Indian food sector." Annals of Operations Research, vol. 350, no. 2, 2023, pp. 453-491.
[23] Singh, Kuldeep, et al. "Assessing the impact of digital transformation on green supply chain for achieving carbon neutrality and accelerating circular economy initiatives." Computers & Industrial Engineering, vol. 201, 2025, p. 110943.
[24] Shambayati, Hanieh, et al. "A neutrosophic optimization model for supply chain virtualization in the circular economy using the non-dominated sorting genetic algorithm II." Annals of Operations Research, vol. 342, no. 1, 2024, pp. 687-723.
[25] Van Capelleveen, Guido, et al. "Exploring recommendations for circular supply chain management through interactive visualisation." Decision Support Systems, vol. 140, 2020, p. 113431.
[26] Sica, Daniela, et al. "The role of digital technologies for the LCA empowerment towards circular economy goals: A scenario analysis for the agri-food system." The International Journal of Life Cycle Assessment, vol. 29, no. 8, 2022, pp. 1486-1509.
[27] Roberts, Huw, et al. "Artificial intelligence in support of the circular economy: Ethical considerations and a path forward." AI & SOCIETY, vol. 39, no. 3, 2022, pp. 1451-1464.
[28] Ronaghi, Mohammad Hossein. "The influence of artificial intelligence adoption on circular economy practices in manufacturing industries." Environment, Development and Sustainability, vol. 25, no. 12, 2022, pp. 14355-14380.
[29] Sadeghi R., Kiarash, et al. "A hybrid machine learning solution for redesigning sustainable circular energy supply chains." Computers & Industrial Engineering, vol. 197, 2024, p. 110541.
[30] Liu, Jinghua, et al. "Digital technologies and circular economy in supply chain management: In the era of COVID-19 pandemic." Operations Management Research, vol. 15, no. 1-2, 2022, pp. 326-341.
[31] Nikseresht, Ali, et al. "Using artificial intelligence to make sustainable development decisions considering VUCA: A systematic literature review and bibliometric analysis." Environmental Science and Pollution Research, vol. 29, no. 28, 2022, pp. 42509-42538.
[32] Soriano-Pinar, Isabel, et al. "Digital transformation for a circular economy: Insights from co-word analysis." The Journal of Technology Transfer, 2023.
[33] Vishwakarma, Amit, et al. "Modelling challenges of blockchain technology enabled healthcare sustainable supply chain management: A modified-total interpretive structural modelling approach." Operations Management Research, vol. 16, no. 4, 2023, pp. 1781-1790.
[34] Wang, Chin-Hsin, et al. "Data driven supplier selection as a circular economy enabler: A Taguchi capability index for manufactured products with asymmetric tolerances." Advanced Engineering Informatics, vol. 47, 2021, p. 101249.
[35] Siddik, Abu Bakkar, et al. "The role of Fintech in circular economy practices to improve sustainability performance: A two-staged SEM-ANN approach." Environmental Science and Pollution Research, vol. 30, no. 49, 2023, pp. 107465-107486.
[36] K, Vimal K.E., et al. "Barriers to the adoption of digital technologies in a functional circular economy network." Operations Management Research, vol. 16, no. 3, 2023, pp. 1541-1561.