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TOE Framework Perspectives on Sustainability Practice Implementation: A Systematic Review

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Abstract
This study aims to systematically review the factors influencing the implementation of sustainability practices through the lens of the Technology–Organization–Environment (TOE) framework. Using a Systematic Literature Review (SLR) approach guided by PRISMA procedures, 65 peer-reviewed articles were initially identified from the Scopus database, and 13 studies met the final inclusion criteria because they explicitly examined sustainability practices supported by technological, organizational, and environmental determinants. The included studies span various sustainability contexts, including green supply chain management, environmental management systems, green innovation, circular economy transitions, blockchain-enabled sustainable food and pharmaceutical supply chains, agricultural traceability, e-waste urban mining, and social sustainability in MSMEs. The reviewed studies employed diverse analytical techniques such as PLS-SEM, fsQCA, panel regression, Best–Worst Method, Grey-DEMATEL, and qualitative case studies, with sample sizes ranging from 8 experts to 495 organizational respondents. The findings of this review indicate that technological factors – such as digital readiness, perceived benefits, compatibility, and blockchain/AI capability – play a central role in driving sustainability implementation. Organizational determinants, including top management support, resource readiness, and internal sustainability commitment, function as essential enablers. Meanwhile, environmental forces such as regulatory pressure, institutional norms, market competition, and customer expectations strongly influence adoption decisions. Overall, this SLR demonstrates that sustainability implementation is not shaped by a single determinant but rather by configurational interactions among technology, organizational capabilities, and environmental pressures. These results offer theoretical insights for advancing sustainability adoption models and practical implications for organizations and policymakers striving to accelerate sustainability transformation.
Keywords: *Technology–Organization–Environment (TOE), sustainability, technology adoption, environmental performance, systematic literature review.*

Introduction

Sustainability practice implementation has become a strategic priority for organizations across sectors, driven by increasing regulatory pressure, stakeholder expectations, environmental degradation, and the global commitment to achieving the Sustainable Development Goals (SDGs). To address these challenges, organizations increasingly rely on digital, environmental, and process innovations whose adoption dynamics can be systematically evaluated using the Technology–Organization–Environment (TOE) framework. TOE has been widely used to explain organizational

adoption of technologies such as blockchain, artificial intelligence, environmental management systems, and circular economy enablers that support sustainability outcomes. However, despite the growing body of research linking technology adoption with sustainability performance, existing studies remain fragmented across sectors and frequently analyze isolated factors rather than integrated configurations that drive successful sustainability implementation.

State of the art indicates that most prior research examines sustainability adoption from single-theory perspectives or focuses on specific technologies within narrow industry contexts, thereby limiting cross-sector generalization. Additionally, empirical findings show inconsistency regarding which technological, organizational, and environmental factors exert the strongest influence on sustainability adoption, and how these factors interact across different sustainability domains such as green supply chain management, green innovation, environmental performance, circular economy, and social sustainability. This fragmentation highlights a critical research gap: there is no comprehensive synthesis that consolidates TOE-based determinants of sustainability practice implementation across multiple sectors and technologies.

Based on this gap, the scientific novelty of the present article lies in integrating and comparing TOE-driven sustainability adoption evidence from diverse industries—including manufacturing, agriculture, seafood, pharmaceuticals, e-waste, and remanufacturing—to produce a cross-sectoral understanding of how sustainability practices are implemented. This review also contributes by identifying methodological patterns, dominant determinants, and configurational interactions among TOE elements that have not been systematically reported before.

Accordingly, this review investigates: How technological, organizational, and environmental factors influence sustainability practice implementation across sectors, and whether empirical findings demonstrate consistent support for these influences.

Therefore, the objective of this systematic literature review is to synthesize empirical and conceptual findings from TOE-based sustainability studies to identify key drivers, barriers, and interaction patterns that shape sustainability practice implementation across industries.

Method

This study uses a Systematic Literature Review (SLR) approach to identify, evaluate, and synthesize empirical and conceptual evidence on implementing sustainability practices through the Technology–Organization–Environment (TOE) framework. The review follows the PRISMA 2020 protocol, including stages for identification, screening, eligibility, and inclusion to ensure transparency and repeatability. To minimize methodological bias and clarify measurement boundaries, clear inclusion and exclusion criteria were applied, defining sustainability practices as organizational efforts that directly target environmental, social, or circular economy results. Studies that only focused on technology adoption without a sustainability goal were excluded, and TOE constructs were considered only when empirically measured or analytically applied. Data extraction was performed using a structured matrix that

captured key study features and TOE dimensions, ensuring a well-defined and scientifically rigorous analytical scope.

Table 1. Inclusion & Exclusion Criteria

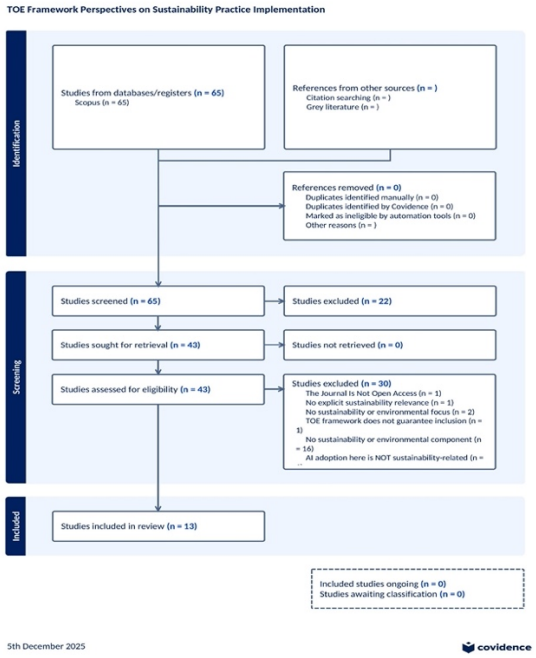
Inclusion Criteria	
• Publication Period	• Article published within a defined recent time frame (2020-2025)
• Publication type	• Peer-reviewed journal articles. • Studies conducted in any sector (public, private, SMEs, industry, supply chain, healthcare, education, etc.).
• Context/Sector	
• Type of study	• Empirical studies (qualitative, quantitative, or mixed methods). Systematic reviews, literature reviews, or conceptual papers directly related to sustainability and technology adoption.
• Theoretical relevance	• Studies that explicitly use the Technology–Organization–Environment (TOE) Framework. Studies that use other adoption theories (e.g., TAM, UTAUT, DOI, TAM-TOE) but whose factors can be mapped into the TOE dimensions.
• Topic relevance	• Studies that examine sustainability practices, environmental practices, green innovation, environmental management, climate-related initiatives, or green supply chain management. Studies that examine sustainability practices, environmental practices, green innovation, environmental management, climate-related initiatives, or green supply chain management.
Exclusion Criteria	
• Irrelevant topic	• Studies unrelated to sustainability, environmental practices, or green initiatives. Studies focusing on general technology adoption without a sustainability component.
• Not aligned with TOE Framework	• Studies that do not examine factors related to technology, organization, or environment. Studies that cannot be mapped to TOE dimensions. • Editorials, commentaries, opinion pieces, letters, book reviews, white papers.

• Non-research publications • Insufficient data • Duplicates • Language exclusion • Publication period exclusion	Theses, dissertations, textbooks, reports, or non–peer-reviewed documents. • Studies that only describe technologies without analyzing drivers, barriers, or implementation factors. Conceptual discussions with no connection to adoption factors • Duplicate records across multiple databases (only one version retained). • Articles not written in English. • Studies published outside the selected time range.

Source: Author (2025)

The subjects of this review are peer-reviewed journal articles indexed in Scopus. The objects are studies that explicitly discuss technology-enabled sustainability practices and incorporate TOE constructs. The final sample comprises 13 articles selected from an initial pool of 65 publications. These articles represent various industries including manufacturing, agriculture, seafood, pharmaceuticals, e-waste, remanufacturing, and MSMEs.

Figure 1. Research Method



Source: Author (2025)

In this SLR, operational definitions are derived from the TOE framework:

- Technology dimension includes perceived benefits, digital readiness, compatibility, complexity, blockchain transparency, artificial intelligence capability, and technological innovation.
- Organization dimension includes top management support, organizational readiness, resource availability, sustainability commitment, workflow adaptability, employee motivation, and business ethics.
- Environment dimension includes regulatory pressure, institutional forces (coercive, normative, mimetic), market competition, customer demand, and sustainability certification requirements.

These variables are extracted from each study and coded into a standardized matrix.

Data were collected using structured screening and extraction forms in Covidence. Instruments included:

1. An inclusion–exclusion checklist,
2. A structured extraction matrix for TOE variables, sustainability outcomes, sample characteristics, and study design, and
3. Quality assessment indicators to ensure methodological rigor.

Data were analyzed using narrative synthesis, thematic coding, and cross-study comparison to identify patterns, similarities, and differences across studies. Descriptive statistics were used to categorize study designs, sample sizes, countries, and sustainability contexts. TOE constructs were synthesized using tabular matrices, configuration mapping, and frequency analysis to determine dominant determinants of sustainability implementation.

As an SLR, this study does not test statistical hypotheses. Instead, it evaluates conceptual propositions, specifically:

1. Technological readiness influences sustainability practice implementation
2. Organizational support and capability moderate adoption outcomes; and
3. Environmental pressures shape sustainability adoption behavior. These propositions are evaluated through evidence aggregation and cross-study synthesis.

Results and Discussion

Study Characteristics

Following the PRISMA screening process, 13 out of 65 initially identified studies met the inclusion criteria because they explicitly examined *sustainability practice implementation* using the **Technology–Organization–Environment (TOE)** framework. These studies span multiple sustainability domains, including green supply chain management, environmental management systems (EMAS), green innovation, circular economy transitions, sustainable food and pharmaceutical supply chains, blockchain-based agriculture traceability, e-waste urban mining technologies, and social sustainability in MSMEs.

Methodological approaches across included studies vary substantially. Quantitative approaches (PLS-SEM, SEM, fsQCA, regression) dominate, involving sample sizes between **8 and 495 participants**, while qualitative case studies and mixed-

method decision-making models (BWM, Grey-DEMATEL) complement the dataset by providing rich contextual insights.

Technology Dimension (T) Findings

Across all studies, technological factors emerge as the strongest drivers of sustainability adoption. Key recurring determinants include:

- Technology readiness (AI capability, blockchain maturity, digitalization readiness)
- Perceived benefits (transparency, traceability, cost reduction, accuracy, environmental monitoring)
- Compatibility and complexity of the adopted systems
- Innovation characteristics (relative advantage, data quality, IoT integration)

Blockchain-based studies demonstrate that high traceability and transparent information flows significantly enhance responsible sourcing and reduce environmental risk. Digital transformation studies affirm that technological maturity is critical for transitioning toward circularity, smart CE, and green innovation.

Organization Dimension (O) Findings

Organizational factors serve as internal enablers that fundamentally influence the adoption of sustainability-oriented technologies. Consistent findings include:

- Top management support as the most influential organizational determinant
- Organizational readiness, referring to skills, infrastructure, and environmental commitment
- Resource availability, including financial, digital, and human resources
- Organizational culture, wherein resistance to change is a major barrier

Studies on EMAS, GSCM, and Quality 4.0 show that organizational support magnifies environmental performance benefits and strengthens sustainable change management. MSME studies highlight employee motivation and business ethics as internal mediators that link technology readiness to sustainability.

Environment Dimension (E) Findings

Environmental determinants constitute external pressures that strongly shape sustainability implementation. Frequently observed factors include:

- Regulatory pressure (environmental laws, mandatory reporting, government incentives)
- Institutional pressure (coercive, normative, and mimetic forces)
- Market competition and customer expectations
- Industry sustainability norms and standards

Studies in heavy-polluting industries show that environmental regulation and social concern strongly influence green innovation. Supply chain studies (seafood, agriculture, pharma) highlight that institutional trust and governance requirements make blockchain adoption essential for ensuring sustainability compliance.

Configurational Interaction of TOE Factors

A major insight from this SLR is that sustainability implementation is not driven by single isolated factors. Instead, findings—especially from fsQCA studies—reveal that different configurations of technological, organizational, and environmental conditions can produce high sustainability outcomes. For example:

- *Digital readiness* + *strong regulatory support* → high green innovation
- *Organizational commitment* + *resource readiness* → successful EMAS adoption
- *Blockchain capability* + *institutional pressure* → enhanced sustainable sourcing

This confirms that the TOE framework functions as an interdependent system rather than independent constructs.

Sectoral Differences in TOE Influence

The influence of TOE dimensions varies across industries:

- Manufacturing: organizational and technological factors play the dominant role.
- Supply chains (seafood, pharma, agriculture): environmental and institutional pressures are strongest.
- Circular economy and remanufacturing: technological sophistication (AI, ML, digital tools) is critical.
- MSMEs: organizational culture and management support outweigh technological barriers.

These variations highlight the need for sector-specific sustainability implementation strategies.

Theoretical Implications

This SLR advances sustainability adoption theory by demonstrating that:

1. TOE is a robust lens for explaining sustainability implementation.
2. Sustainability outcomes are shaped by configurational interplay, not linear causation.
3. Hybrid theoretical models (TOE + SDT, TOE + TPB, TOE + Institutional Theory) offer deeper explanatory power.
4. Digital technologies (blockchain, AI, IoT) function as *sustainability enablers*, expanding TOE's technological dimension.

"*What technological, organizational, and environmental determinants influence sustainability practice implementation across sectors?*"

Sustainability implementation across industries is driven by:

- Technological determinants: readiness, compatibility, perceived benefits, innovation maturity.
- Organizational determinants: management support, resource capacity, employee readiness, sustainability commitment.
- Environmental determinants: regulatory pressure, institutional norms, customer demand, competitive dynamics.

These determinants interact to shape adoption behaviors. No single factor guarantees success; rather, the synergy of TOE elements determines the effectiveness of sustainability practices.

Conclusion

This systematic review concludes that the implementation of sustainability practices across diverse industries is fundamentally shaped by the configurational interaction of technological, organizational, and environmental determinants as conceptualized in the TOE framework. Rather than functioning as isolated predictors, TOE elements collectively form enabling or constraining conditions that determine the success of sustainability-driven technological adoption. Technological readiness and perceived benefits consistently emerge as the most influential enablers, while organizational support and resource preparedness strengthen the internal capacity to adopt sustainability innovations. Environmental forces—particularly regulatory pressure and institutional expectations—serve as external catalysts that reinforce the urgency and legitimacy of sustainability implementation.

These findings directly address the research objective by demonstrating that sustainability practices can only be effectively implemented when organizations align their technological capabilities, organizational readiness, and environmental demands. The review further implies that sustainability outcomes are contingent on strategic alignment within and across these three dimensions. Theoretically, the review expands the application of the TOE framework into sustainability domains such as green supply chains, circular economy transitions, environmental management systems, and sustainable digitalization. Practically, it highlights the need for policymakers to strengthen regulatory frameworks and for managers to build technological competencies and sustainability-oriented cultures.

Building on the results of this systematic literature review, the study offers clear and relevant recommendations for future research. These recommendations emphasize the importance of exploring underexamined sustainability contexts, sector-specific dynamics, and advanced methodological approaches to better understand how technological readiness, organizational capabilities, and environmental pressures jointly influence sustainability practice implementation. This forward-looking perspective demonstrates the researcher's comprehensive understanding of the reviewed literature and the theoretical foundations underpinning the TOE framework.

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