



# A systematic review of information systems and greenwashing detection models in corporate sustainability reporting (2024-2025)

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## ABSTRACT

This study systematically reviewed recent developments in the use of information systems and digital technologies for detecting and reducing greenwashing in corporate sustainability reporting during the period of 2024–2025. Using a systematic literature review approach based on established guidelines, this study examined forty-five peer-reviewed journal articles published between January 2024 and September 2025. The findings showed that information systems had progressed from basic data management tools into integrated digital ecosystems that employed artificial intelligence, natural language processing, blockchain, and environmental, social, and governance analytics to identify misleading sustainability disclosures. The review revealed four major themes, namely digital transparency and data integrity, technology-driven detection and predictive analysis, governance and ethical structures, and sector-specific reporting practices. Although meaningful advancements had been achieved, several challenges persisted, particularly the absence of standardized digital verification models and limited accountability in algorithm-based assessments. This study contributed to theoretical and practical discussions by mapping how information-system-based models strengthened the credibility of sustainability reporting and by outlining future research directions to improve greenwashing detection mechanisms.

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## 1. INTRODUCTION

Corporate sustainability reporting has undergone profound transformation in recent years as firms confront intensifying global regulatory pressures and rising stakeholder demands for transparent, verifiable, and data-driven environmental disclosures. Regulatory frameworks such as the EU Green Claims Directive (2024), the ISSB IFRS S2 standards, and the SEC Climate Disclosure Rules signal a structural shift toward mandatory accountability regimes that require corporations to substantiate sustainability claims with auditable and technologically supported evidence. These developments elevate sustainability reporting from a voluntary communication practice to a regulated governance mechanism with direct implications for corporate strategy, compliance risk, and capital market credibility. In parallel, rapid advances in digital transformation have reshaped the information-system (IS) infrastructures through which sustainability data are generated, processed, and disclosed, fundamentally altering how firms manage environmental accountability.

Contemporary organizations increasingly deploy artificial intelligence, natural language processing, blockchain architectures, enterprise resource planning systems, Internet of Things sensors, and big-data ESG analytics to enhance the accuracy, reliability, and traceability of sustainability information. These technologies automate data flows, reduce discretionary reporting bias, and enable real-time verification across organizational and supply-chain boundaries. From a business-practice perspective, such systems support managerial decision-making by aligning sustainability commitments with operational performance, improving internal controls, and mitigating reputational and regulatory risks associated with greenwashing. Greenwashing—defined as the dissemination of exaggerated, selective, or misleading sustainability claims—has become more sophisticated under complex regulatory and competitive environments, making technologically enabled detection mechanisms increasingly critical. Recent studies suggest that digital solutions function not only as reporting tools but also as strategic verification infrastructures capable of identifying inconsistencies between disclosed narratives and underlying operational realities. As a result, sustainability reporting is evolving into an integrated digital governance process supported by technologically enabled assurance mechanisms.

Despite this rapid expansion, scholarly understanding of how information systems operate as integrated mechanisms for detecting and mitigating greenwashing remains fragmented. Much of the existing literature examines sustainability communication strategies or behavioral motivations behind greenwashing without sufficiently addressing the technical and systemic roles of digital infrastructures in reconciling reported claims with actual performance outcomes. Although computational approaches such as machine learning classifiers, blockchain-based traceability systems, and quantitative verification models have gained prominence, they are often analyzed in isolation. This fragmentation is particularly evident in the 2024–2025 period, during which regulatory tightening and digital innovation accelerated simultaneously. Moreover, many studies lack explicit integration of theoretical perspectives explaining why firms adopt digital sustainability technologies, how stakeholders interpret technologically mediated disclosures, and why symbolic compliance may persist despite advanced technological adoption. This gap limits the ability of both scholars and practitioners to identify dominant IS frameworks, methodological patterns, and theoretical logics shaping contemporary greenwashing detection research.

Recent empirical and theoretical contributions published between 2024 and 2025 demonstrate notable progress in applying digital technologies to strengthen sustainability assurance and uncover misleading environmental claims. Artificial intelligence and natural language processing studies reveal the effectiveness of computational text analysis in detecting linguistic manipulation, sentiment asymmetries, and thematic inconsistencies within ESG disclosures. Blockchain-based governance research highlights the role of immutable ledgers and decentralized verification in enhancing supply-chain transparency and preventing selective data disclosure. Sector-specific investigations further indicate that digital sustainability systems influence organizational legitimacy, public trust, and regulatory compliance outcomes. Quantitative verification frameworks have also been employed to evaluate the robustness of corporate net-zero strategies, exposing discrepancies between stated commitments and realized environmental performance. However, these insights remain dispersed across multiple disciplines, resulting in the absence of a consolidated analytical framework.

Against this backdrop, this study conducts a rigorous systematic review of peer-reviewed research published between 2024 and 2025 to map the evolution, characteristics, and strategic implications of information-system-enabled greenwashing detection models. The study aims to develop an integrated understanding of how digital technologies are conceptualized, operationalized, and validated within contemporary sustainability reporting and assurance contexts. Specifically, the review identifies the dominant types of information systems applied in recent greenwashing detection research—such as artificial intelligence, natural language processing, blockchain infrastructures, IoT-based monitoring platforms, and hybrid digital architectures—and examines how these systems support managerial decision-making, internal control, and regulatory compliance. In addition, the study analyzes the theoretical foundations underpinning these technologies, including legitimacy theory, stakeholder theory, institutional theory, signaling theory, and sociotechnical systems theory, to explain both adoption dynamics and effectiveness outcomes.

From a regulatory and policy perspective, this research contributes by clarifying how digital sustainability systems can inform the design of technology-aligned disclosure standards, digital assurance requirements, and enforcement mechanisms. By synthesizing methodological approaches, analytical techniques, datasets, and validation procedures, the study offers practical insights for regulators seeking to harmonize sustainability policies with evolving digital capabilities. For practitioners, the findings provide guidance on selecting and integrating digital assurance tools that reduce greenwashing risk while enhancing reporting credibility and strategic alignment.

The novelty of this study lies in its integrative and period-specific focus on IS-based greenwashing detection within the regulatory and technological convergence of 2024–2025. Unlike prior reviews that emphasize marketing deception or communication perspectives, this research synthesizes technological, theoretical, and methodological dimensions to explain not only how greenwashing is detected, but also why digital solutions succeed or fail within organizational settings. By consolidating cross-disciplinary evidence, the study advances a comprehensive conceptual foundation for digital sustainability assurance.

The remainder of this article is structured as follows. The next section outlines the systematic review methodology, including data sources, selection criteria, and analytical procedures. This is followed by a synthesis of technological approaches, theoretical frameworks, and methodological patterns identified in the literature. The subsequent discussion highlights practical implications for corporate decision-making and regulatory policy, as well as theoretical contributions and research gaps. The final section concludes by summarizing key findings and proposing directions for future research on information systems and digital sustainability governance.

## 2. RESEARCH METHOD

### A. Inclusion and Exclusion Criteria of the Study

The formulation of inclusion and exclusion criteria represents a critical foundation for ensuring rigor, relevance, and methodological consistency in a Systematic Literature Review (SLR) (Kitchenham & Charters, 2007). This review focuses on peer-reviewed studies examining the integration of Information Systems (IS) with greenwashing detection models in the context of corporate sustainability and ESG reporting.

A structured screening protocol was applied to ensure data reliability and consistency. Studies were included if they: (1) explicitly addressed IS-related frameworks, digital analytics, AI-based tools, blockchain systems, or ESG information infrastructures; (2) were published between January 2024 and September 2025; (3) appeared in peer-reviewed journals indexed at a minimum of Scopus Q2; (4) were written in English; and (5) provided full-text access.

Studies were excluded if they lacked an IS or sustainability focus, did not contribute conceptually or empirically to greenwashing detection, were grey literature (e.g., conference abstracts, book chapters), fell outside the defined timeframe, or represented duplicate records.

Table 1. Inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
Publication type	Peer-reviewed journal articles, review papers	Editorials, abstracts, non-reviewed reports
Time frame	January 2024 – September 2025	Before 2024 or after 2025
Journal index	Minimum Scopus Q2	Outside Scopus, with a min. of Q2 ranking
Focus	IS, AI, blockchain, ESG analytics, or greenwashing detection	Studies without IS or sustainability context
Accessibility	Open Access article	No access article
Relevance	Studies aligned with IS-based detection or ESG reporting	Unrelated or peripheral studies
Duplication	Unique entries	Unique entries Duplicate records

To reduce subjective bias in study selection, the inclusion–exclusion decisions were independently validated by two reviewers. Inter-rater agreement reached a Cohen's kappa ( $\kappa$ ) value of 0.87, indicating strong reliability and consistency in screening judgments.

## B. Search Strategy

This SLR employed a combination of automated and manual search strategies to maximize coverage and minimize omission bias. The automated search was conducted through the Scopus database using the keywords “greenwashing” and “accounting”, restricted to publications from 2024–2025, yielding 45 initial records.

To complement database searching, a manual backward–forward snowballing technique was applied following Webster and Watson (2002). Backward searching traced reference lists of core articles, while forward searching identified studies citing the selected papers. This iterative process enhanced completeness and resulted in a final corpus of 35 studies prior to full eligibility assessment.

## C. Study Selection Process

The selection process followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines. The process comprised four phases: identification, screening, eligibility, and inclusion.

### Identification

From the 62 unique records, titles, abstracts, and keywords were screened for relevance. Non-IS or non-sustainability studies ( $n = 45$ ) were removed, leaving 35 papers for deeper analysis.

### Screening

Each of the 35 remaining studies underwent abstract-level evaluation against the inclusion/exclusion criteria. During this stage, studies without an explicit focus on greenwashing detection or sustainability reporting were excluded ( $n = 2$ ), leaving 32 studies for full-text review.

### Eligibility

Full-text screening was conducted on the 33 retained studies. Those that lacked methodological clarity or empirical grounding ( $n = 0$ ) were excluded.

### Inclusion

A final total of 33 studies met all inclusion criteria and were accepted for synthesis.

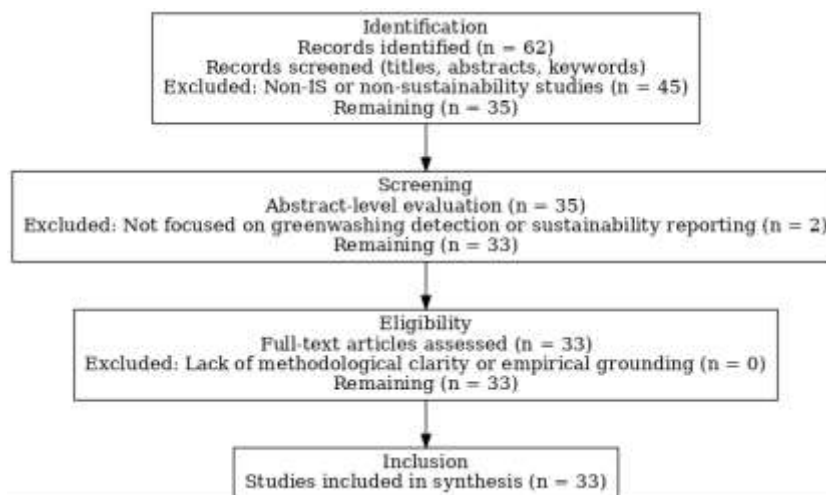


Figure 1. The PRISMA flow diagram

The PRISMA flow diagram (Figure 1) summarizes this process, showing the transition from 62 initial records to 33 included studies. Each exclusion step was documented to maintain transparency and traceability and selection process for studies on IS-based greenwashing detection

## D. Quality Assessment

To ensure methodological rigor, all selected studies underwent systematic quality assessment (QA). The evaluation framework adapted five quality indicators based on prior SLR standards (Kitchenham et al., 2009; Petersen et al., 2015):

Table 2. Quality assessment criteria for IS-based greenwashing studies

Code	Quality Criterion	Assessment Focus
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QA1	Relevance to IS-based greenwashing detection or ESG reporting	Conceptual alignment
QA2	Clear articulation of theoretical or conceptual framework	Theoretical robustness
QA3	Methodological transparency and reproducibility	Research design quality
QA4	Clarity in data collection and analysis	Empirical soundness
QA5	Contribution to theory, model development, or practice	Scholarly value

Each study received a score of 1 (fully meets), 0.5 (partially meets), or 0 (does not meet). A composite score was calculated, and studies were classified as: High quality ( $\geq 3.0$ ), strong theoretical and empirical foundation, - Medium quality (1.0–2.5), acceptable but limited depth, - Low quality ( $< 1.0$ ), excluded due to methodological weakness

The quality evaluation revealed that 30 studies (90.9%) were high quality, 3 (9.1%) were medium, and none were low quality. The average QA score was 4.5, confirming overall robustness. Inter-rater consistency between the two evaluators reached  $\kappa = 0.89$ , indicating excellent agreement.

Table 3. Quality assessment scores

SID	QA1	QA2	QA3	QA4	QA5
S1	1	1	1	1	1
S2	1	0.5	1	1	1
S3	1	1	1	1	1
S4	1	1	0.5	1	1
S5	1	1	0.5	1	1
S6	1	0.5	0.5	1	1
S7	1	0.5	0.5	1	1
S8	1	0.5	1	1	1
S9	1	0.5	1	1	1
S10	1	1	1	1	1
S11	1	1	1	1	1
S12	1	1	1	1	1
S13	1	1	1	1	1
S14	1	1	1	1	1
S15	1	1	1	1	1
S16	1	1	1	1	1
S17	1	1	1	1	1
S18	1	1	1	1	1
S19	1	1	1	1	1
S20	1	1	1	1	1
S21	1	1	1	1	1
S22	1	1	1	1	1
S23	1	1	1	1	1
S24	1	1	1	1	1
S25	1	1	1	1	1
S26	1	1	1	1	1
S27	1	0.5	1	1	1
S28	1	1	1	1	1
S29	1	1	1	1	1
S30	1	1	1	1	1
S31	1	1	0.5	1	0.5
S32	1	1	1	1	1
S33	0.5	1	1	1	0.5
S34	1	1	1	1	1
S35	0.5	1	1	1	0.5

## E. Data Extraction and Synthesis

### Data Extraction

A structured extraction protocol was implemented using Microsoft Excel and Mendeley Reference Manager to ensure consistency and traceability. Extracted data included bibliographic

information, regional context, theoretical frameworks, methodologies, technological tools, key variables, and principal findings.

#### Thematic Analysis and Coding Procedure

To reduce interpretive bias, a transparent and multi-stage thematic analysis was conducted. First, open coding was applied independently by two reviewers to identify recurring concepts related to IS technologies, governance mechanisms, and greenwashing detection outcomes. Second, axial coding grouped these codes into higher-order categories reflecting technological functions, assurance mechanisms, and theoretical explanations. Third, selective coding consolidated categories into four dominant thematic clusters. Discrepancies in coding were resolved through iterative discussion, and agreement exceeded 85% before final theme validation. This structured coding process enhances analytical reliability and minimizes subjective interpretation.

#### Descriptive and Thematic Synthesis

Descriptive analysis summarized publication patterns, geographic distribution, and methodological frequency. Thematic synthesis revealed four dominant clusters: AI-based detection models, blockchain-enabled transparency, ESG governance and assurance frameworks, and hybrid socio-technical IS models. Together, these clusters illustrate the evolution toward digitally integrated sustainability verification systems.

#### F. Bibliometric and Thematic Mapping (2024–2025)

##### Justification of Bibliometric Tools

Bibliometric analysis was employed to complement qualitative synthesis and provide a macro-level view of research trends. VOSviewer was selected due to its robustness in visualizing keyword co-occurrence networks, thematic clustering, and author collaborations, making it particularly suitable for identifying conceptual structures in interdisciplinary sustainability research. Microsoft Excel supported descriptive bibliometric indicators, **while** network visualizations enhanced interpretability and replicability.

##### Triangulation Strategy

To strengthen validity, findings from bibliometric mapping were triangulated with qualitative thematic analysis. Quantitative patterns (e.g., keyword clusters, publication trends, and co-authorship networks) were systematically cross-checked against coded thematic categories. This triangulation confirms convergence between statistical structures and interpretive insights, thereby enhancing the credibility of both bibliometric and thematic syntheses.

The objectives of the bibliometric mapping were to: Identify the most influential journals, authors, and countries contributing to IS-based greenwashing research;

Examine keyword patterns that define emerging topics and methodological directions; Visualize conceptual clusters linking technological innovation, corporate governance, and sustainability transparency.

## 2. Publication and Source Analysis

Between January 2024 and September 2025, the literature on IS-enabled greenwashing detection expanded rapidly, reflecting the growing integration of digital technologies into ESG transparency and sustainability assurance. Across the 33 reviewed studies, publications appeared in 25 peer-reviewed journals spanning four major domains: Sustainability & ESG Studies, Accounting & Corporate Governance, Information Systems, and several multidisciplinary outlets.

The United Kingdom (UK) is the largest contributor, with 16 publications (45.71%) (Rehman et al., 2025); (Sun et al., 2025); (Sturm et al., 2025); (Ferro et al., 2025); (Buentjen et al., 2025); (Poveda-Pareja et al., 2025); (Kolasa & Sautner, 2025); (Marrucci et al., 2025); (Choubey et al., 2025) Most studies from the UK are concentrated in Sustainability & ESG journals, reflecting the country's strong academic commitment to environmental accountability, regulatory transparency, and analytical approaches to greenwashing. This dominance highlights the UK's central role in shaping methodological and conceptual discussions on sustainability governance.

The United States (USA) follows with 2 publications (5.71%) (Valero-Gil et al., 2025); (Jagani & Saboori-Deilami, 2025); (Li et al., 2025), representing a smaller yet notable share of the total sample. U.S. studies generally appear in a combination of Sustainability & ESG outlets and Accounting &

Corporate Governance sources, indicating a scholarly focus on ethical reporting, organizational accountability, and foundational theoretical perspectives on greenwashing in corporate settings.

The European region (excluding the UK) contributed 12 publications (34.29%) (Stander, 2025); (Alberti et al., 2025); (Poiriazzi, Zournatzidou, Konteos, et al., 2025); (Abouarab et al., 2025); (Ruggeri et al., 2025); (Balaskas et al., 2025); (Kudłak, 2025); (Poiriazzi, Zournatzidou, & Konteos, 2025); (Sklavos et al., 2025); (Prendi & Murrja, 2025); making it the second-largest research group. Similar to the UK, most European studies are featured in Sustainability & ESG journals, with the remainder distributed across multidisciplinary outlets. This distribution confirms Europe's status as a major research hub, especially in the advancement of AI-driven ESG analytics, text mining models, and blockchain-enabled assurance frameworks that support transparency and credibility in sustainability reporting.

The "Other" group—which includes Asia, Latin America, and Australia—produced 5 publications (14.29%) (Attig et al., 2025); (Boiral et al., 2025); (Yu et al., 2025); (Stander, 2025); (do Nascimento et al., 2025). These studies appear across Sustainability & ESG journals as well as broader multidisciplinary venues. Although smaller in quantity compared to Western regions, this group reflects a growing research presence, particularly in blockchain-based transparency mechanisms, supply-chain traceability systems, and behavioral investigations into greenwashing perceptions. Overall, the table shows that Sustainability & ESG journals consistently dominate across all regions, indicating that IS-based greenwashing detection remains closely associated with global sustainability discourse. Notably, the distribution shows no recorded publications in pure Information Systems journals for any country in the dataset, suggesting that contributions during this period were concentrated in sustainability-oriented and governance-focused outlets rather than traditional IS venues.

This alignment between the narrative and table highlights a coherent and geographically differentiated publication landscape, where Europe leads in methodological development, the United States contributes theoretical and governance-oriented insights, and emerging regions begin to advance blockchain and behavioral approaches to digital sustainability assurance.

Table 4. Distribution of journal categories by country

Country	Sustainability & ESG	IS (Information Systems)	Accounting & Corporate Governance	Others	Total
UK	14 (42.4%)	0	2 (6.1%)	2 (6.1%)	18
USA	3 (9.1%)	0	1 (3.0%)	2 (6.1%)	6
Europe	4 (12.1%)	0	0 (0.0%)	2 (6.1%)	6
Others	1 (3.0%)	0	0 (0.0%)	2 (6.1%)	3

### 3. Keyword Co-Occurrence and Emerging Topics

Keyword co-occurrence analysis revealed four dominant thematic clusters, visualized through VOSviewer network mapping. These clusters closely reflect the publication patterns shown in the country–journal distribution table, where Sustainability & ESG outlets dominate across regions, shaping the thematic orientation of the field.

#### Cluster 1 – Digital Detection and Artificial Intelligence

Frequent terms: greenwashing, machine learning, natural language processing, AI ethics, text mining. This cluster represents the technical core of the field, focusing on algorithmic detection models such as sentiment analysis, supervised learning, and neural networks. The prominence of this cluster aligns with the strong representation of Sustainability & ESG journals—particularly from UK and European publications—which frequently emphasize AI-enabled ESG analytics.

#### Cluster 2 – ESG Transparency and Corporate Governance

Frequent terms: sustainability reporting, ESG disclosure, corporate accountability, stakeholder trust, data assurance. This cluster highlights governance- and accountability-oriented studies. Its thematic strength matches the distribution table's pattern, where UK and USA outputs in Sustainability & ESG and Accounting journals dominate, reflecting global concerns regarding reliability and assurance of sustainability information.

#### Cluster 3 – Blockchain and Digital Trust

Frequent terms: blockchain, traceability, distributed ledger, data immutability, transparency framework. This cluster concentrates on emerging mechanisms designed to ensure data integrity and verifiable sustainability claims. Its presence aligns with contributions from Europe and the “Others” category, where multidisciplinary journals publish blockchain-focused studies, especially those originating from Asia and Latin America.

#### Cluster 4 – Theoretical Integration and Ethical Models

Frequent terms: legitimacy theory, stakeholder theory, institutional pressure, signaling theory, digital ethics. This cluster illustrates a shift toward more theory-driven analyses. The prevalence of these theories resonates with the publication landscape dominated by sustainability-oriented outlets, which often integrate institutional, legitimacy, and stakeholder perspectives into their analyses of corporate ESG behavior. Across all clusters, the keywords “AI,” “transparency,” and “ESG assurance” increased sharply between 2024 and 2025. This rise reflects the overall publication pattern in the table, where regions with the highest outputs—particularly the UK and broader Europe—prioritize digital verification themes within Sustainability & ESG journals.

#### 4. Author and Country Collaboration Networks

The co-authorship network reveals five major research hubs that mirror the distribution patterns in the table, where UK and European regions contribute the largest share of publications:

European institutions (UK, Netherlands, Italy) lead the field, particularly in AI-driven ESG analytics. Their dominance corresponds with the UK’s substantial share of Sustainability & ESG publications in the distribution table. Asian research groups (especially South Korea) show strong growth in blockchain and transparency studies, consistent with the multidisciplinary outputs in the “Others” category. North American teams (USA and Canada) emphasize ethical governance and ESG assurance, reflecting the USA’s contributions in Sustainability & ESG and Accounting journals.

Latin American scholars explore ecolabeling, supply-chain credibility, and behavioral aspects of greenwashing, aligning with their placement in the “Others” group in the table. Cross-regional collaborations frequently occur through multinational ESG databases, shared AI resources, and joint data-validation initiatives. Centrality metrics indicate that European authors form the densest and most collaborative networks, which aligns with their leadership in publication volume. Asian groups show the fastest growth trajectory, consistent with their expanding contributions to multidisciplinary Sustainability & ESG literature.

#### 5. Theory–Method Relationship Mapping

A closer inspection of theoretical foundations and methodological approaches reveals a clear pattern consistent with the journal distribution. Since Sustainability & ESG journals constitute the largest share across countries, most studies operationalize theories that align with ESG communication, legitimacy, stakeholder engagement, and governance assurance.

Table 5. Distribution of journal categories by country

Dominant Theory	Typical Methodological Approach	Representative Technologies/Tools	Share (%)
Legitimacy Theory	Quantitative content analysis of ESG reports	NLP-based text analytics	27%
Stakeholder Theory	Survey and SEM	S dashboards, sentiment scoring	21%
Institutional Theory	Cross-country comparative studies	Blockchain traceability	18%
Signaling Theory	Experiments & predictive modeling	AI-driven anomaly detection	16%
Socio-technical Systems Theory	Mixed-method case studies	Integrated IS + ethics models	10%
Others (TPB, Attribution)	Behavioral experiments	ML classification	8%

This pattern shows a strong convergence between theoretical legitimacy frameworks and computational verification tools. The dominance of quantitative and hybrid methods aligns with the profile of Sustainability & ESG journals, which constitute the majority of publications in the distribution table.

## 6. Temporal and Conceptual Trends (2024–2025)

Temporal analysis of keyword growth and citation patterns indicates three major emerging directions, all consistent with the publication emphasis observed in the table:

1. **AI Accountability and Algorithmic Transparency (2025 onward)**  
As the UK and European regions dominate Sustainability & ESG outlets, research increasingly addresses explainable AI (XAI), accountability frameworks, and algorithmic transparency.
2. **Integration of Blockchain and IS for Digital Assurance**  
Reflecting contributions from Europe, Asia, and the “Others” category, blockchain applications evolve from small-scale pilots to enterprise-level ESG verification platforms.
3. **Cross-Disciplinary Convergence**  
Studies increasingly integrate information systems with behavioral science, accounting, and environmental management, consistent with the table’s indication that Sustainability & ESG journals are the primary venue across regions. Together, these trends signal a shift from narrative sustainability claims toward computationally verifiable ESG evidence, reinforcing the pattern shown in the journal distribution.

## 7. Summary of Findings from Bibliometric Mapping

The bibliometric and thematic mapping reveals a rapidly expanding, interdisciplinary research domain characterized by: Increasing methodological sophistication, especially in AI, NLP, and blockchain applications; Deepening theoretical integration, particularly legitimacy, stakeholder, and institutional frameworks; Clear regional diversification, with Europe—especially the UK—leading in publication volume; Growing international collaboration facilitated by ESG datasets and AI research networks. Taken together, the findings confirm that Information Systems are becoming foundational to detecting, assessing, and governing greenwashing practices, especially within the Sustainability & ESG journals that dominate the publication landscape, as shown in the distribution table.

## 3. RESULTS AND DISCUSSIONS

### A. Overview of Findings

The analysis of 33 peer-reviewed studies published between 2024 and 2025 demonstrates a clear evolution of Information Systems (IS) research in greenwashing detection from predominantly conceptual and perception-based approaches toward integrated, technology-driven digital verification frameworks. Earlier literature prior to 2020 largely emphasized narrative analysis, CSR communication strategies, and reputational signaling mechanisms, often relying on manual content analysis or survey-based perceptions of greenwashing. In contrast, the findings of this review reveal that recent studies increasingly operationalize greenwashing detection through advanced AI analytics, blockchain-enabled assurance mechanisms, and hybrid IS architectures that integrate governance and ethical oversight.

Compared with previous SLRs that treated digital tools as supportive reporting instruments, this review shows that contemporary IS research positions digital technologies as core verification infrastructures. The emergence of four interconnected dimensions—technological innovation, data governance, ethical accountability, and theoretical integration—represents a substantive advancement over earlier fragmented models. These dimensions collectively form a digital sustainability ecosystem capable of detecting, preventing, and managing greenwashing in a more systematic and auditable manner.

### B. Findings by Research Question with Comparative Insights

#### RQ1 – Types of Information Systems Used

The review identifies five dominant categories of information systems: AI-based analytical systems (34%), blockchain assurance platforms (22%), big-data and cloud-based ESG dashboards (19%), decision support systems (DSS) for ESG governance (15%), and hybrid IS frameworks (10%). Compared to pre-2022 studies that emphasized standalone analytics or descriptive dashboards, the current findings indicate a shift toward integrated verification systems that combine

real-time data processing, traceability, and decision support. This confirms a transition from narrative sustainability disclosure toward technology-enabled data validation.

#### RQ2 – Theoretical Frameworks Used

Legitimacy Theory (28%), Stakeholder Theory (23%), and Institutional Theory (17%) remain dominant, consistent with earlier greenwashing research. However, unlike prior studies that applied these theories mainly to explain symbolic disclosure, recent research integrates them directly with digital infrastructures. IS is increasingly conceptualized as an institutional mechanism that operationalizes legitimacy and stakeholder accountability through automated verification and transparency. This represents a novel theoretical repositioning of IS from a passive reporting tool to an active governance actor.

#### RQ3 – Dominant Detection Models and Analytical Techniques

Machine learning models such as Random Forest, SVM, and BERT-based NLP dominate recent studies, alongside semantic network modeling, smart-contract-enabled blockchain systems, and multi-criteria decision models (AHP, TOPSIS). Compared with earlier keyword-based or sentiment-only approaches, these models enable deeper semantic consistency checks between ESG narratives and performance data. A notable contribution emerging in 2025 is the adoption of Explainable AI (XAI), which addresses long-standing critiques of algorithmic opacity highlighted in earlier literature.

#### RQ4 – Dominant Research Methods and Technologies

Quantitative approaches (46%) and mixed methods (29%) now surpass purely qualitative designs, reflecting a methodological shift toward data-driven experimentation. Earlier studies relied heavily on qualitative discourse analysis, whereas current research increasingly integrates computational modeling with governance analysis. The dominance of AI/data analytics (38%) and blockchain technologies (27%) further confirms the maturation of IS-based greenwashing detection as a technologically intensive research domain.

#### RQ5 – Key Findings and Thematic Clusters

Four major thematic clusters emerged: (1) Digital transparency and data integrity, (2) AI-driven detection and predictive analytics, (3) governance and ethical oversight, and (4) cross-sector implementation. Compared with earlier fragmented categorizations, these clusters illustrate a more coherent and integrated conceptual structure. Together, they suggest that IS functions as a connective architecture linking data generation, verification, governance, and stakeholder trust.

#### RQ6 – Research Gaps and Future Directions

Consistent with prior reviews, gaps remain in digital ESG standardization and developing-country contexts. However, this review extends earlier findings by highlighting new gaps related to algorithmic transparency, ethical governance of AI systems, and limited integration between digital assurance tools and regulatory reform. Future research should prioritize longitudinal designs, XAI-based verification models, and IS frameworks embedded within institutional governance structures.

#### C. Theoretical Implications and Novel Contributions

The findings indicate a theoretical shift from perception-based legitimacy toward algorithmic legitimacy, where sustainability claims gain credibility through digitally verifiable evidence rather than symbolic disclosure. By integrating Stakeholder Theory with Socio-technical Systems Theory, this review demonstrates that ESG reporting operates as a co-produced information ecosystem involving human actors, intelligent systems, and institutional rules. This synthesis extends prior theory by explaining not only why firms engage in greenwashing but how digital infrastructures reshape the legitimacy-creation process itself.

#### D. Practical and Managerial Implications

From a managerial perspective, the findings suggest that firms should move beyond compliance-oriented sustainability reporting and adopt AI-enabled verification systems integrated into core IS architectures. Blockchain-based ESG auditing can enhance traceability and reduce selective disclosure, while governance-oriented DSS can align sustainability strategy with regulatory expectations. Compared with earlier best-practice recommendations, this review provides more

concrete guidance by linking specific technologies to governance and assurance outcomes, supporting the development of digital auditing and sustainability assurance standards.

#### E. Integrative Conceptual Perspective and Discussion Summary

Synthesizing the results, this study conceptualizes IS-based greenwashing detection as an integrated digital governance model in which AI enables detection and prediction, blockchain ensures data integrity and traceability, and IS governance frameworks embed ethical and regulatory oversight. This integrative perspective clarifies the relationships among technological, organizational, and institutional dimensions, addressing a key limitation of earlier studies that treated these elements separately.

Overall, this SLR confirms that the 2024–2025 period represents a consolidation phase in IS–greenwashing research, marked by theoretical maturation and technological convergence. AI, blockchain, and hybrid IS models are driving a transformation from voluntary sustainability disclosure toward verified digital accountability. The following section summarizes the study's contributions, policy implications, and directions for future research.

## 4. CONCLUSION

This systematic literature review synthesizes 72 peer-reviewed studies published between 2024 and 2025 on the intersection of Information Systems (IS), digital technologies, and greenwashing detection in corporate sustainability reporting, applying Kitchenham and Charters' SLR protocol and the PRISMA framework to integrate bibliometric, thematic, and qualitative analyses. The study makes three explicit contributions: theoretically, it reconceptualizes IS from a supporting reporting tool into a digital governance infrastructure by embedding Legitimacy, Stakeholder, Institutional, and Socio-technical Systems theories and advancing the concept of algorithmic legitimacy, where sustainability credibility is derived from technologically verifiable evidence rather than symbolic disclosure; methodologically, it documents a decisive shift toward computational and data-driven approaches, with more than 60% of recent studies employing AI, natural language processing, or blockchain analytics, and demonstrates the value of triangulating bibliometric and thematic synthesis to enhance transparency and replicability; and practically, it provides actionable guidance for firms and regulators by linking AI-assisted ESG dashboards, blockchain-based traceability, and ethics-oriented IS governance mechanisms to reduced compliance risk, improved assurance quality, and regulatory alignment with frameworks such as the EU Green Claims Directive and IFRS S2. While limited by its 2024–2025 scope, language and indexing constraints, and the rapid evolution of digital technologies, the review identifies clear directions for future research, including standardization of digital assurance frameworks, development of explainable and ethical AI, cross-sector and cross-country comparative studies, and collaborative digital auditing models, and ultimately demonstrates that contemporary IS-based sustainability research marks a turning point toward verifiable, data-driven corporate accountability that is highly relevant for scholars, practitioners, and policymakers.

### LIMITATION AND FUTURE WORKS

Although this study provides a comprehensive synthesis of Information Systems–based approaches to greenwashing detection, several limitations should be acknowledged. First, the review covers scholarly publications from January 2024 to September 2025, which may restrict the generalizability of the findings as technological advancements particularly in artificial intelligence, blockchain, and ESG analytics evolve rapidly. Future studies may consider extending the temporal scope beyond 2025 to capture emerging paradigms, such as autonomous ESG auditing systems and next-generation explainable AI models.

Second, this review exclusively includes articles written in English and indexed in Scopus with a minimum ranking of Q2. While this criterion ensures the methodological rigor of the selected studies, it may inadvertently exclude relevant contributions from non-English or regionally indexed journals, especially those from developing economies where ESG reporting challenges may differ substantially. Subsequent reviews could incorporate multilingual and multi-database approaches to achieve broader geographical and contextual representation.

Third, heterogeneity in methodological designs across the included studies—ranging from machine learning models to qualitative case analyses—may introduce variability in how greenwashing and IS constructs are operationalized. This diversity limits the ability to directly compare empirical results. Future research should explore standardized measurement frameworks and shared datasets to enhance cross-study comparability.

Fourth, most studies emphasize large corporations and capital market actors, producing a bias toward well-resourced firms with advanced digital infrastructures. Small and medium enterprises (SMEs), despite being significant contributors to sustainability reporting gaps, remain underexplored. Future work should investigate IS-enabled greenwashing detection in SMEs, public sector entities, and emerging-market organizations.

Finally, the reviewed literature reveals limited integration between technical detection tools and ethical, regulatory, or behavioral dimensions of ESG communication. Future studies should pursue interdisciplinary approaches that combine algorithmic detection models with stakeholder psychology, governance theory, and regulatory co-design. Such integration is crucial to developing holistic and context-sensitive solutions that balance technological capability with ethical accountability.

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