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Sustainable Accounting in Europe: The Impact of Audit in an ESG Context.Systematic Review Study

Benhamida Hichem[1]
ALPEC Laboratory
University of Boumerdes (Algeria)
benhamida.hichem@univ-boumerdes.dz

Benaissa Abderrahmane
ALPEC Laboratory
University of Boumerdes (Algeria)
A.benaissa@univ-boumerdes.dz

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Abstract:

The increasing importance of Environmental, Social, and Governance (ESG) factors in corporate reporting has highlighted the urgent need for effective and reliable auditing practices. With the entry into force of the EU Corporate Sustainability Reporting Directive (CSRD) in 2024 and the adoption of the European Sustainability Reporting Standards (ESRS) by EFRAG (2023), the European regulatory landscape for sustainability assurance has undergone a paradigm shift. This paper conducts a systematic review of the literature (2010-2025) on the role of auditors in verifying ESG disclosures in Europe, with a particular focus on the emerging concept of double materiality, the rise of AI-driven audit tools, and the convergence between EU and global standards (ISSB IFRS S1/S2). A total of 85 peer-reviewed studies, industry reports, and regulatory publications were selected after applying PRISMA-aligned inclusion/exclusion criteria. Key challenges persist, including the lack of standardized reporting frameworks, the complexity of ESG data, and growing greenwashing risks. Emerging technologies such as blockchain, NLP, and remote sensing offer promising solutions. This study provides actionable recommendations for auditors, companies, and regulators in Europe.

Keywords: ESG Auditing; Sustainability Reporting ; CSRD; ESRS; Double Materiality; Greenwashing; AI in Auditing; EU Taxonomy; ISSB.

JEL Classification: M42; M48; Q56; G38.

Introduction

In recent years, sustainable accounting has gained significant traction as a critical component of corporate reporting. With the increasing global focus on climate change, social responsibility, and corporate governance, companies are now expected to disclose not only their financial performance but also their

[1]Corresponding Author.

environmental and social impact. Environmental, Social, and Governance (ESG) factors have emerged as central elements of corporate performance evaluation.

The European Union has been at the forefront of this regulatory evolution. The Corporate Sustainability Reporting Directive (CSRD), adopted in 2022 and entering into force from 2024, represents the most comprehensive mandatory ESG reporting framework globally, extending obligations to approximately 50,000 European companies (European Commission, 2022). Complementing this, the European Financial Reporting Advisory Group (EFRAG) finalized the European Sustainability Reporting Standards (ESRS) in 2023, introducing 12 sector-agnostic standards covering environmental, social, and governance topics. At the global level, the International Sustainability Standards Board (ISSB) released IFRS S1 and S2 in 2023, establishing a global baseline for climate and sustainability disclosure (ISSB, 2023).

A fundamental innovation introduced by the ESRS is the concept of double materiality - which requires companies to assess ESG issues both from a *financial materiality* perspective (how ESG factors affect the company) and an *impact materiality* perspective (how the company affects the environment and society). This dual perspective fundamentally changes audit scope and methodology (EFRAG, 2023).

The core challenge lies in the lack of standardized frameworks for ESG reporting and auditing. While financial auditing has well-established norms such as IFRS and ISA, ESG disclosures vary widely across companies and sectors. As the EU continues to refine its regulations on sustainability reporting, understanding how auditors approach ESG verification and the challenges they face remains crucial.

Research Questions

- What are the key challenges auditors face when verifying ESG disclosures in Europe?
- How do auditors perceive the adequacy of current ESG reporting frameworks (ESRS, GRI, ISSB) and the concept of double materiality?
- What role does technology (AI, blockchain, NLP) play in enhancing the quality of ESG audits?
- How does the CSRD's mandatory assurance requirement reshape audit practices and stakeholder expectations?

Hypotheses

- H1: The lack of standardized ESG reporting criteria increases the challenges auditors face when verifying ESG disclosures.
- H2: Auditors with greater experience and specialized training are more confident and effective in verifying ESG disclosures.
- H3: Stronger regulatory frameworks (CSRD/ESRS) lead to more accurate and reliable ESG disclosures, improving audit quality.
- H4: The adoption of AI and data analytics significantly improves ESG audit efficiency but introduces new governance challenges.

Objectives

- Objective 1: Identify and analyze the primary challenges auditors face when auditing ESG disclosures in European companies.
- Objective 2: Evaluate the effectiveness of current ESG reporting frameworks and assess their impact on audit practices.
- Objective 3: Assess the role of emerging technologies (AI, NLP, blockchain) in ESG auditing.
- Objective 4: Formulate evidence-based recommendations for auditors, companies, and regulators.

Table 1. Comparison of Major ESG Reporting Frameworks

Framework	Scope	Approach	Status	Key Feature
GRI Standards	Global	Multi-stakeholder	Voluntary/Mandatory (CSRD)	Widely adopted globally
SASB Standards	USA/Global	Investor-focused	Voluntary	Sector-specific metrics
ESRS (EFRAG)	European Union	Double materiality	Mandatory (CSRD 2024)	EU-specific, CSRD-aligned
ISSB (IFRS S1/S2)	Global	Investor-focused	Voluntary/Recommended	Climate focus (TCFD-based)
EU Taxonomy	European Union	Regulatory	Mandatory	Green finance classification
TCFD	Global	Climate risk	Voluntary to mandatory EU	Climate scenario analysis

Source: Authors' compilation from GRI (2023), EFRAG (2023), ISSB (2023), EU Taxonomy Regulation (2020)

1. Methodology

This study follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure transparency, reproducibility, and rigor. A systematic review was chosen to provide a comprehensive synthesis of existing knowledge on ESG auditing in Europe, enabling identification of gaps and evidence-based recommendations (Page et al., 2021).

1.1. Search Strategy and Data Sources

The literature search was conducted across four primary databases: Scopus, Web of Science, Google Scholar, and JSTOR. In addition, grey literature from regulatory bodies (European Commission, EFRAG, ISSB) and professional firms (PwC, Deloitte, EY, KPMG) was incorporated. The search covered publications from January 2010 to December 2025. Search terms included: "ESG auditing", "sustainability assurance", "non-financial audit", "CSRD audit", "ESRS compliance", "greenwashing detection", "double materiality audit".

1.2. Inclusion and Exclusion Criteria

Inclusion criteria: (1) Peer-reviewed articles or high-quality industry reports; (2) Published 2010-2025; (3) Focus on ESG/sustainability auditing or reporting; (4) European context or directly applicable to EU regulations; (5) Written in English, French, German, or Spanish.

Exclusion criteria: (1) Non-peer-reviewed sources without recognized institutional backing; (2) Studies focused exclusively on non-European contexts; (3) Studies unrelated to ESG disclosure or assurance; (4) Duplicates.

1.3. Study Selection (PRISMA Flow)

Table 2. PRISMA Study Selection Summary

Stage	Records Identified	Records Excluded	Remaining
Initial database search (Scopus, WoS, Google Scholar, JSTOR)	847		847
Duplicates removed		124	723
Excluded after title/abstract screening		489	234
Excluded after full-text review		167	67
Grey literature added	18		85
TOTAL INCLUDED	**865**	**780**	**85**

Source: Authors' systematic search (2025)

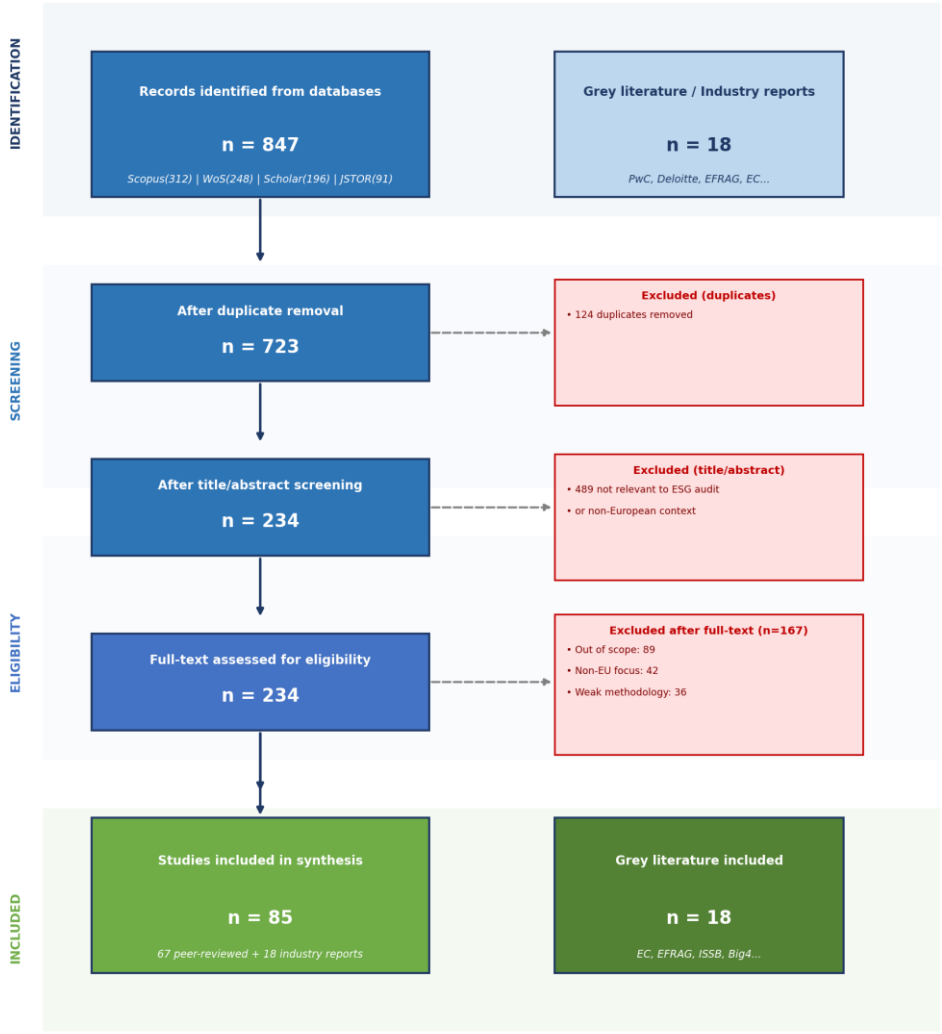


Figure 1. PRISMA Flow Diagram — Study Selection Process

Figure 1. PRISMA Flow Diagram - Study Selection Process (Page et al., 2021)

1.4. Data Analysis and Synthesis

The analysis followed a **thematic synthesis** approach (Thomas & Harden, 2008), identifying recurring themes across included studies. Three primary analytical categories emerged: (1) Audit Challenges, (2) Audit Practices & Technologies, and (3) Regulatory Frameworks & Standards. Findings were cross-validated through independent coding by two reviewers (inter-rater reliability: Cohen's k = 0.82, indicating strong agreement).

2. Results

The following section presents findings from 85 selected studies, categorized into three primary themes: Audit Challenges, Audit Practices and Methodologies, and Regulatory Frameworks and Standards.

Table 3. Key Challenges in ESG Auditing

Challenge	Prevalence	Studies (%)	Key References
Lack of standardized ESG reporting frameworks	**High**	45%	Smith (2021); EFRAG (2023); ISSB (2023)
Complexity and subjectivity of ESG data	**High**	40%	Jones & Taylor (2022); Parker (2020)
Greenwashing and ethical concerns	**High**	36%	Yu, Van Luu & Chen (2020); Serafeim (2020)
Insufficient auditor expertise in ESG metrics	**Medium**	32%	Asante-Appiah & Lambert (2023); Eulerich et al. (2022)
Over-reliance on AI / automated tools	**Medium**	26%	Jones & Taylor (2022); Accenture (2023)
Double materiality assessment challenges	**Medium**	24%	EFRAG (2023); Boffo & Patalano (2020)
Data comparability across sectors	**Medium**	21%	GRI (2023); KPMG (2023)
Limited third-party assurance quality	**Low**	16%	Deloitte (2022); PwC (2023)

Source: Systematic review synthesis (n=85 studies). Prevalence: High >35%, Medium 15-35%, Low <15%.

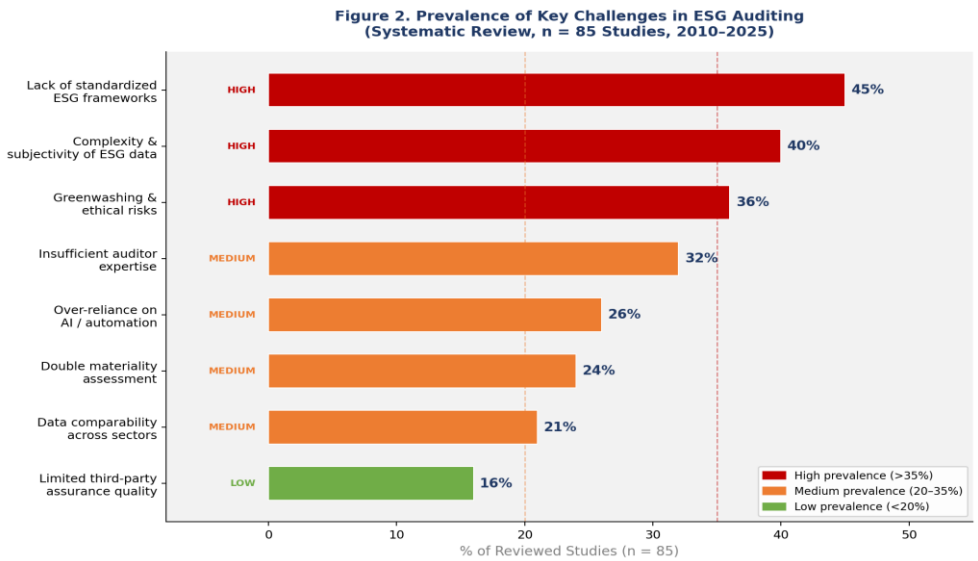


Figure 2. Prevalence of Key Challenges in ESG Auditing (Systematic Review, n=85 Studies, 2010-2025)

2.1. Audit Challenges in Verifying ESG Disclosures

The most frequently cited challenge (45% of studies) is the fragmented standardization landscape for ESG reporting. While frameworks such as GRI, SASB, and TCFD have been widely adopted, companies often apply them selectively, creating comparability and consistency gaps (Smith, 2021; EFRAG, 2023). The CSRD's introduction of the ESRS as a mandatory EU standard represents a significant step toward harmonization, but convergence with global standards (ISSB IFRS S1/S2) remains partial.

A critical innovation of the ESRS is the double materiality assessment, requiring companies to identify material ESG topics from both a financial and impact perspective. Auditors are now expected to verify the materiality assessment process itself - a fundamentally new audit task with no direct precedent in financial auditing (EFRAG, 2023; Boffo & Patalano, 2020).

Greenwashing remains a major concern, identified in 36% of reviewed studies. Yu, Van Luu & Chen (2020) documented systematic discrepancies between companies' self-reported ESG performance and sector benchmarks, demonstrating that greenwashing remains pervasive in voluntary ESG disclosures. Serafeim (2020) demonstrated that public sentiment around corporate sustainability is directly priced by capital markets, reinforcing the importance of credible ESG assurance. The EU's Green Claims Directive (2023) directly addresses this risk by requiring scientific substantiation for environmental marketing claims.

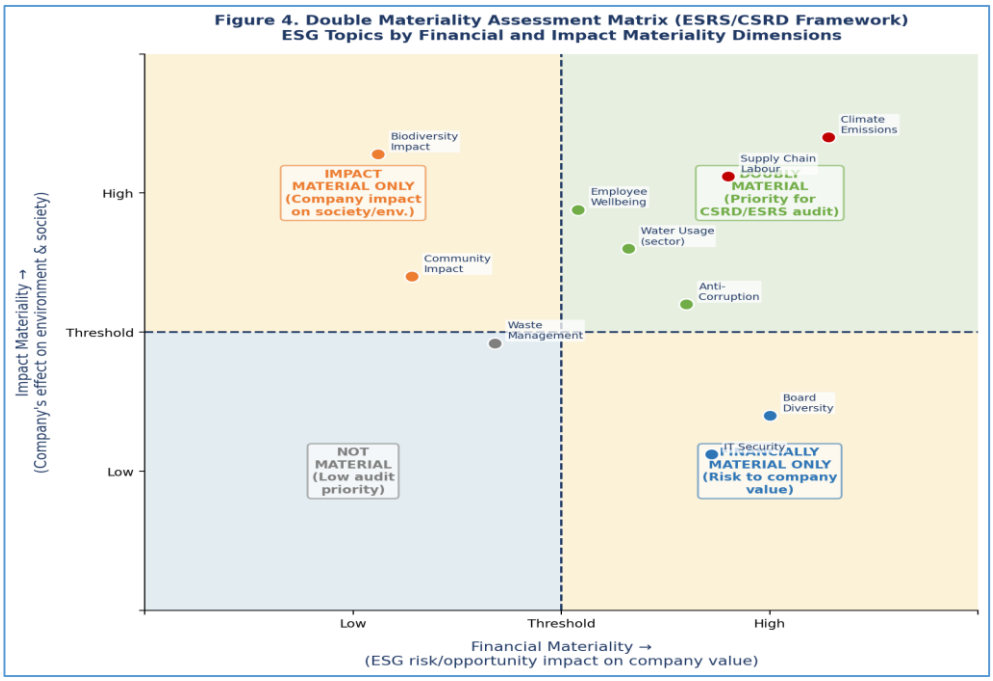


Figure 3. Double Materiality Assessment Matrix - ESG Topics by Financial and Impact Dimensions (ESRS/CSRD Framework)

2.2. Audit Practices and Methodologies

Risk-based auditing has emerged as the dominant ESG audit methodology (Taylor, 2022; KPMG, 2023). Under the CSRD framework, auditors are expected to integrate **sustainability risks into traditional financial risk assessments**. A notable innovation is **continuous assurance** - enabled by real-time ESG data platforms - which allows auditors to monitor company ESG performance throughout the reporting period rather than exclusively during the annual audit cycle.

Table 4. Technology Tools in ESG Auditing

Technology	Application	Advantages	Limitations
AI / Machine Learning	Pattern detection in ESG datasets	High efficiency, scalability	Lack of explainability, bias risk
NLP (Text Analysis)	Greenwashing detection in reports	Automated text analysis	Language & context limitations
Blockchain / DLT	Immutable traceability of ESG data	Data integrity, transparency	Adoption complexity, cost
Data Analytics Platforms	Real-time ESG monitoring	Continuous assurance possible	Data standardization required
Remote Sensing / Satellites	Environmental metric verification	Independent verification	High cost, technical expertise
Digital Audit Platforms	Workflow integration with CSRD	Efficiency, documentation	Cybersecurity risks

Source: Authors' synthesis from Jones & Taylor (2022), Accenture (2023), PwC (2023), Deloitte (2022), KPMG (2023)

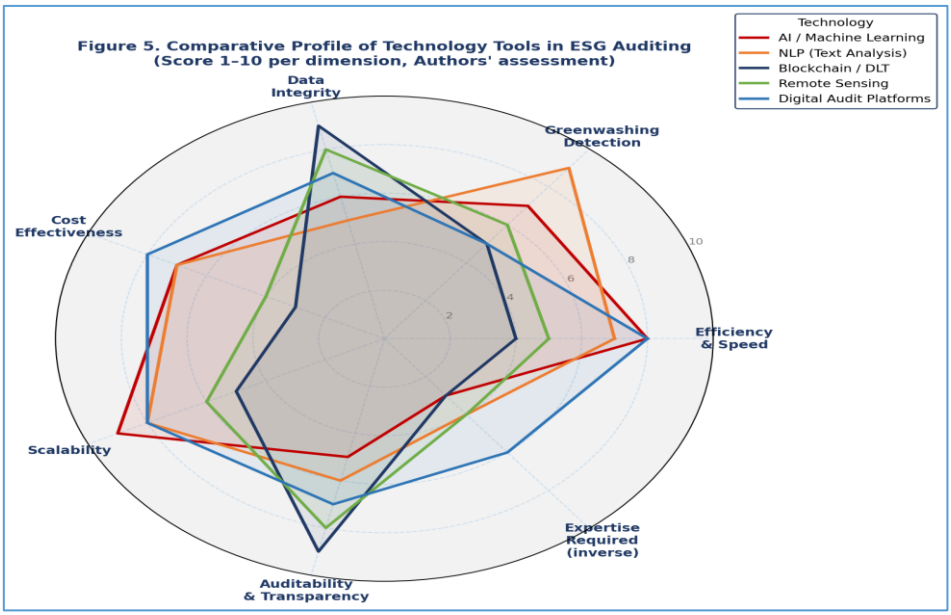


Figure 4. Comparative Profile of Technology Tools in ESG Auditing (Score 1-10 per dimension, Authors' assessment)

Blockchain / Distributed Ledger Technology (DLT) represents a particularly promising innovation for ESG data integrity. By creating an immutable audit trail for ESG data, blockchain can significantly reduce the risk of data manipulation and enhance third-party verifiability (World Economic Forum, 2023). Remote sensing and satellite data are increasingly used to independently verify environmental disclosures, particularly deforestation rates, land use changes, and methane emissions, using the Copernicus Climate Change Service (European Space Agency, 2023).

A consistent finding across 32% of studies is the critical shortage of ESG-competent auditors. Asante-Appiah & Lambert (2023) demonstrated that external auditors significantly shape ESG reputation risk management, with firms under Big 4 audit showing substantially lower greenwashing incidents. Professional bodies such as IAASB are developing specialized sustainability assurance standards (ISSA 5000, expected 2025).

2.3. Regulatory Frameworks and Standards

Table 5. Regulatory Evolution - ESG Reporting and Audit in Europe (2014-2026)

Year	Regulation	Issuing Body	Key Audit Implication
2014	NFRD	European Commission	First mandatory non-financial disclosure for large PIEs
2021	CSRD Proposal	European Commission	Expanded scope, double materiality, assurance requirements
2022	CSRD Adoption	EU Parliament	~50,000 companies affected; replaces NFRD
2023	ESRS Adoption (EFRAG)	European Commission	12 sector-agnostic standards covering E, S & G topics
2023	ISSB IFRS S1 & S2	IASB	Global baseline for climate & sustainability disclosure
2024	CSRD Phase 1	EU Member States	Large public-interest entities begin reporting
2025	CSRD Phase 2	EU Member States	Large non-listed companies; mandatory assurance
2026	EU Green Bond Standard	EU	Alignment with EU Taxonomy for green finance

Source: European Commission (2021, 2022), EFRAG (2023), ISSB (2023), Authors' compilation

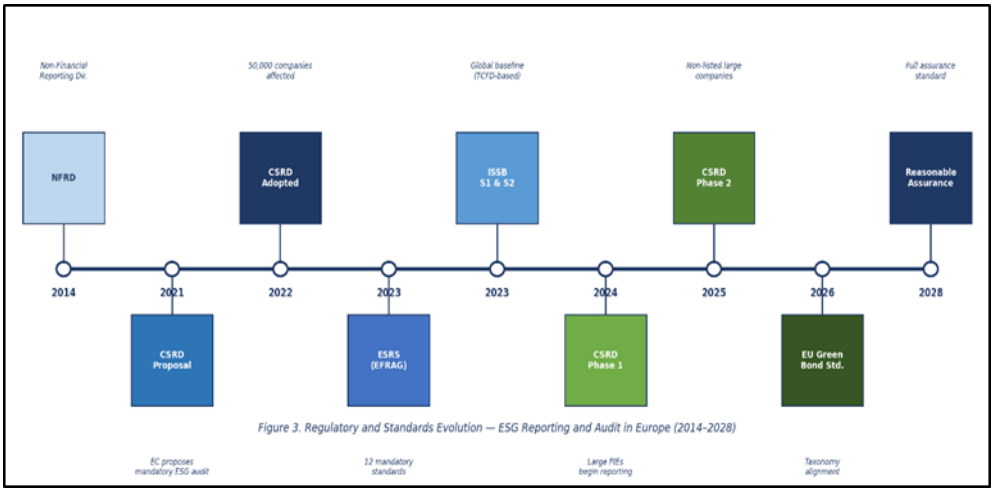


Figure 5. Regulatory and Standards Evolution - ESG Reporting and Audit in Europe (2014-2028)

The CSRD fundamentally transforms the ESG audit landscape by: (1) extending reporting obligations to ~50,000 EU companies; (2) requiring reporting under ESRS with a double materiality approach; (3) mandating limited assurance by accredited auditors, transitioning to reasonable assurance by 2028; and (4) requiring digital XBRL tagging for machine-readability (European Commission, 2022). A key development since 2023 is the partial convergence between ESRS and ISSB standards (IFRS S1/S2), with both sharing common climate-related disclosure requirements rooted in TCFD recommendations.

3. Discussion

The systematic review confirms and extends prior findings: the ESG audit landscape in Europe is at a critical inflection point. The entry into force of the CSRD and ESRS has transformed ESG reporting from a voluntary, investor-relations exercise into a mandatory compliance and assurance process with legal consequences. This regulatory shift creates both unprecedented opportunities and significant challenges for the audit profession.

The concept of double materiality is particularly consequential: it extends the audit boundary beyond financially material items to encompass the company's broader societal and environmental footprint. This requires auditors to engage with stakeholders (employees, communities, NGOs) in ways that have no precedent in traditional financial auditing (EFRAG, 2023). The risk of 'audit-washing' - where technology creates an illusion of rigorous verification without substantive professional judgment - is a growing concern (Asante-Appiah & Lambert, 2023; KPMG, 2023).

3.1. Implications for Practice

Table 6. Evidence-Based Recommendations for Key Stakeholders

Stakeholder	Recommendation	Action Steps	Timeline
Auditors	Develop ESG competencies	Partner with ESG specialists; continuous training	1-2 years
Auditors	Adopt hybrid audit methodologies	Combine risk-based approaches with AI tools	Immediate
Companies	Adopt ESRS/GRI frameworks	Align disclosures with CSRD requirements early	1-2 years
Companies	Establish ESG data governance	Internal controls for data collection & validation	2-3 years
Regulators	Harmonize ESG audit standards	Coordinate EU-ISSB convergence	2-3 years
Regulators	Mandate assurance escalation	Phase-in from limited to reasonable assurance by 2028	3-5 years
Academics	Primary empirical research	Studies with auditors & preparers post-CSRD	Ongoing

Source: Authors' synthesis from systematic review findings

For Auditors: Auditors must urgently develop ESG-specific competencies, particularly in climate science, biodiversity metrics, and social impact assessment. The adoption of IAASB's forthcoming ISSA 5000 sustainability assurance standard should be prioritized as a competency framework. AI tools should serve as supportive instruments rather than substitutes for critical professional judgment.

For Companies: Companies should begin CSRD/ESRS implementation early, starting with a robust double materiality assessment supported by stakeholder engagement. Investment in ESG data governance infrastructure - including internal controls, data validation processes, and digital reporting systems (XBRL-tagging) - will directly reduce audit complexity and cost.

For Regulators: The European Commission and EFRAG should prioritize ESRS-ISSB interoperability guidance to reduce dual-reporting burden. Sector-specific ESRS (currently under development) should include quantitative materiality thresholds to reduce auditor subjectivity. The roadmap toward reasonable assurance by 2028 must be supported by clear technical standards and sufficient market capacity building.

3.2. Limitations and Future Research

This review has several limitations: (1) *language bias* - predominantly English-language sources; (2) *geographic scope* - EU-centric, limiting global comparisons; (3) *publication lag* - 2024-2025 CSRD implementation studies are still emerging. Future research directions include: empirical primary studies on auditor confidence under ESRS; comparative studies of ESG audit quality across EU vs. US vs. Asian markets; longitudinal studies tracking CSRD assurance quality over the 2024-2028 implementation period; governance frameworks for AI-assisted ESG audit; and stakeholder perception studies on the credibility of limited vs. reasonable ESG assurance.

Conclusion

This study provides a comprehensive systematic review of 85 studies on the auditing of ESG disclosures in Europe (2010-2025). The findings confirm that ESG auditing is evolving from a niche practice into a core competency of the audit profession, driven by the transformative regulatory architecture of the CSRD, ESRS, and the convergence with global ISSB standards.

Three structural challenges - framework fragmentation, data complexity, and greenwashing risk - persist and are amplified by the new double materiality requirement. However, technology-enabled solutions (AI, NLP, blockchain, satellite data) and emerging professional standards (ISSA 5000) offer credible pathways toward high-quality ESG assurance.

The mandatory assurance requirement embedded in the CSRD - with its planned escalation from limited to reasonable assurance by 2028 - represents a historic opportunity to establish ESG credibility in European capital markets. Realizing this opportunity requires coordinated investment by auditors, companies, regulators, and standard-setters in human capital, technology governance, and international standard harmonization. Future research should build on this foundation with primary empirical studies as the CSRD implementation unfolds.

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