

THE APPLICATION OF ARTIFICIAL INTELLIGENCE IN AUDITING SUSTAINABILITY REPORTS: BETWEEN ETHICAL CHALLENGES AND EFFICIENCY

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Abstract. Artificial intelligence is increasingly embedded in the assurance of sustainability reports, promising efficiency gains yet raising acute ethical concerns. This study examines how AI can improve audit efficiency while preserving ethical integrity, and whether such use remains compliant with emerging assurance and reporting standards. Building on a three-pillar model: Ethics and Independence, Efficiency and Detection, and Governance and Compliance, we derive three hypotheses and evaluate them through a practitioner survey of auditors, accountants and senior managers, complemented by a targeted document analysis using LLM/NLP tools on ESG reports. Results indicate that explicit ethical safeguards (bias testing, transparency and independence protocols) are associated with higher stakeholder trust; moreover, AI-assisted review reduces time while maintaining or improving the detection of exaggeration/greenwashing; finally, aligning AI workflows with ISSA 5000, IFRS S1/S2, ESRS and GRI enhances traceability of evidence and perceived compliance. Accordingly, the study underscores the need for continuous professional training, clear ethical guidelines and governance-by-design for AI in sustainability assurance, and offers an integrated model that connects ethics, efficiency and standard-based compliance.

Keywords: AI auditing, sustainability report assurance, ethics and independence, efficiency, greenwashing, ISSA 5000.

JEL classification: M42; M41; M14; Q56; C45

Introduction

The transformation of sustainability reporting in recent years has created a dual pressure on assurance practices: on the one hand, standards and disclosure requirements have diversified and become increasingly detailed; on the other, the volume and heterogeneity of information have expanded rapidly. In this context, artificial intelligence promises a step-change in the efficiency of auditing sustainability reports, yet it simultaneously opens a substantial field of ethical questions regarding bias, transparency, and independence. Moreover, the emergence of a global normative

framework for the assurance of sustainability reporting, coupled with initiatives to converge reporting frameworks, calls for a repositioning of audit: from traditional procedures to assurance-by-design workflows in which AI generates not only results but also audit-ready, traceable, and reproducible evidence.

Accordingly, this article examines the application of artificial intelligence to the auditing of sustainability reports through two critical lenses, ethics and efficiency, anchored in a well-defined normative framework. First, we synthesize recent literature on ethical principles, bias control, and the perceived effects on independence to delineate the minimum conditions for public trust. Second, we map NLP/LLM applications for extracting, aligning, and verifying disclosures, including the detection of greenwashing and exaggeration, to highlight tangible operational gains. In parallel, we integrate assurance standards and reporting frameworks into a coherent process design so that the proposed hypotheses can be tested rigorously on indicators of time, accuracy, coverage, and evidence quality. Thus, our contribution is a conceptual model that connects ethics, efficiency, and compliance within an AI-assisted audit architecture capable of supporting both the practical utility and the social legitimacy of sustainability assurance.

Literature Review

Recent scholarship delineates three complementary axes regarding the use of artificial intelligence in the assurance of sustainability reports. First, on the **ethics and independence dimension**, studies show that the social validity of AI-assisted audit depends on explicit principles, bias control, and transparency about how models operate. Syntheses and conceptual works highlight both architectures for ethical auditing of AI and limits in stakeholder involvement and external reporting (Laine, 2024; Schiff, 2024; Lehner et al., 2022). In the same vein, research on bias and professional dilemmas indicates that explanation mechanisms and fairness testing are essential for trust (Murikah et al., 2024; Fülöp et al., 2023; Huriye, 2023). Moreover, experimental evidence suggests that certain uses of AI can mitigate the perceived effect of independence conflicts on firms' liability, thereby strengthening the credibility of professional judgements (Libby & Witz, 2024).

Second, on the **efficiency and detection dimension**, applied NLP/LLM studies demonstrate the ability to extract, align, and verify disclosures from ESG reports, reducing review time and increasing the accuracy of non-compliance identification (Hillebrand et al., 2023; Zou et al., 2025). Concomitantly, scoring and automated classification approaches provide tools for flagging exaggeration and greenwashing, reinforcing the control of misstatement risk (Lagasio, 2024; Luo et al., 2025). In addition, evidence from the audit-risk domain indicates AI's potential to support risk-oriented procedures with measurable operational savings (Adamyk et al., 2023), while background literature explains the evolution of ideas and use cases (Omoteso, 2012).

Third, on the **normative framework and compliance dimension**, assurance standards and reporting frameworks set the requirements against which AI workflows must be designed. ISSA 5000 defines general requirements for sustainability assurance engagements, regardless of the reporting framework, guiding types of evidence, documentation, and assurance reporting. In parallel, IFRS S1/S2 structure investor-relevant disclosures, while ESRS expand the granularity of requirements at the European level, GRI remains the widely used reference for non-financial reporting. Applied literature on GRI–ESRS alignment and sectoral case studies shows how mappings and compliance checks can be built, useful for configuring rules and coverage indicators in AI systems (Matuszak et al., 2025). Furthermore, approaches linking AI to sustainable accounting underscore the need to balance innovation and responsibility in line with societal expectations (Areiqat & Jaber, 2025).

In what follows, we provide a focused synthesis of prior work and derive the hypotheses from the analyzed sources (2022–2025), organized along three axes: H1 - Ethical integrity and

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independence, H2 - Efficiency and detection quality, and H3 - Normative framework and compliance.

Table 1. Hypotheses, representative studies, and relevance

Hypothesis	Representative studies (year)	Relevant to the research
H1 Ethical integrity and independence	Laine (2024); Schiff (2024); Murikah (2024); Lehner et al. (2022); Libby & Witz (2024); Fülöp et al. (2023)	Ethical principles, bias testing, transparency/XAI, and independence-safe protocols are linked to higher stakeholder trust and credibility of professional judgement.
H2 Efficiency and detection quality	Hillebrand et al. (2023, sustain.AI); Zou et al. (2025, ESGReveal); Lagasio (2024); Luo et al. (2025); Adamyk et al. (2023)	LLM/NLP reduces review time and improves identification of non-compliance, exaggeration, and greenwashing versus manual review.
H3 Normative framework and compliance	ISSA 5000 (IAASB, 2024); IFRS S1/S2 (ISSB, 2023/24); ESRS (2023/24); GRI (rev. 2021, in force 2023); Matuszak et al. (2025); GRI–ESRS alignment (2023)	An assurance-by-design pipeline aligned to ISSA 5000 and mapped to IFRS S1/S2, ESRS, and GRI increases requirement coverage, traceability, and evidence quality.

Notes: XAI = Explainable AI; LLM = Large Language Model; ESG = Environmental, Social and Governance
 Source: Authors' elaboration based on the reviewed literature

Taken together, the evidence in Table 1 supports a three-pillar architecture that underpins our conceptual model: Ethics & Independence as the premise of trust, Efficiency & Detection as the driver of operational value, and Governance & Compliance as the anchor of professional legitimacy. We summarise this structure in Figure 1, which guides our empirical tests.

In sum, the literature converges on three directions: (i) conditions for **ethical integrity** and protection of independence to sustain trust; (ii) **operational gains** through NLP/LLM and earlier detection of misstatements; (iii) **alignment with standards** to ensure traceability, evidential sufficiency, and interoperability across frameworks. On this basis we derive the working hypotheses: H1 - ethical integrity and independence raise stakeholder trust; H2 - AI reduces review time and improves detection of non-compliance/greenwashing; H3 - an assurance-by-design pipeline aligned with ISSA 5000, IFRS S1/S2, ESRS, and GRI increases compliance and the quality of evidence.

Methodology

The study proceeds through a sequence that mirrors the practical reality of the project: a bibliometric analysis of the selected sources, the derivation of research directions and hypotheses; the administration of a questionnaire to practitioners, and, finally, the correlation of the results with the scientific hypotheses in order to develop the conceptual model. In this way, the approach links theoretical coherence with empirical verification in a compact format suitable for a short article.

First, the bibliometric analysis maps the field: we extract metadata (year and type of publication, outlet, keywords, and references to normative frameworks such as ISSA 5000, IFRS S1/S2, ESRS, GRI) and identify dominant themes (ethics/independence; efficiency/detection; governance/compliance). In parallel, we perform a brief thematic synthesis, grouping contributions along the three axes, highlighting trends (e.g., the transition from isolated NLP applications to LLMs mapped to GRI/ESRS requirements) and gaps (stakeholder involvement, evidence traceability, interoperability across frameworks). This stage directly yields the research directions and the hypotheses H1–H3:

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H1 (Ethics and Independence): explicit ethical measures and independence-safe protocols increase stakeholder trust;

H2 (Efficiency and Detection): AI-assisted review reduces time and improves detection of non-compliance/greenwashing;

H3 (Governance and Compliance): an assurance-by-design pipeline aligned with ISSA 5000, IFRS S1/S2, ESRS, and GRI increases requirement coverage and evidence quality.

Data were collected online via Google Forms during March - August 2025 from a sample of 77 practitioners (auditors, accountants, and managers). The questionnaire comprised Likert-scale items (1–5) grouped into three constructs aligned with hypotheses H1–H3. Second, the questionnaire targets auditors, accountants, and senior managers exposed to sustainability reporting. The instrument comprises three blocks of Likert-scale items (1–5), aligned with the hypotheses: (i) ethics and independence - perceptions of transparency/explain ability, bias testing, anti-conflict protocols; (ii) efficiency and detection - perceptions of time per file, perceived accuracy, and the ability to identify exaggeration/greenwashing; (iii) governance and compliance - perceptions of the usefulness of aligning to ISSA 5000, IFRS S1/S2, ESRS, and GRI for generating traceable evidence.

Third, we correlate the results with the scientific hypotheses through concise, transparent analyses. Finally, based on the results, we develop the conceptual model: we position Ethics and Independence as the premise of trust, Efficiency and Detection as the driver of operational value, and Governance and Compliance as the anchor of professional legitimacy - integrated into an assurance-by-design architecture with traceability and interoperability. The model specifies clear links among constructs and indicates outcome metrics (trust, time, precision/recall/F1, requirement coverage, evidence quality) that can be reported succinctly.

Throughout, we ensure ethical safeguards (informed consent, anonymization, appropriate data governance) and work exclusively with public documents for the documentary component. Limitations - such as self-reporting, convenience sampling, sectoral heterogeneity, or model error, are acknowledged explicitly and mitigated via clear indicators and full reporting of uncertainty. Thus, the methodology remains lean, realistic, and precisely aligned with the four steps you outlined: bibliometrics; derivation of directions and hypotheses; questionnaire; correlation; and, ultimately, the conceptual model.

Basic content

We analyzed 77 valid questionnaires completed by practitioners in the Republic of Moldova. The sample is dominated by certified auditors (50.8%), followed by professional accountants (14.3%) and public-sector auditors and audit trainees (12.7% each), with other roles having marginal shares. Organisationally, the market is predominantly fragmented: small firms (11–50 employees) 42.9% and micro-firms (1–10) 25.4% - 68.3% in total - with lower participation from public entities or internal audit departments. In terms of tooling, Excel/Power Query is used by 88.9% of respondents, while advanced solutions have limited penetration (DataSnipper 12.7%; CaseWare 11.1%; ACL/IDEA 6.3%; BI 4.8%) and enterprise/RPA platforms (each ~1.6%). This market and tooling profile suggests significant headroom for operational optimisation through AI.

Regarding the perceived potential of AI in financial audit in Moldova, 90.5% rate the impact as moderate (“supports processes, does not replace professional judgment”), while the “high” and “low” options are each selected by under 5%, and “no impact” is absent. Consistent with this, respondents prioritise automation for: detection of unusual transactions (88.9%), intelligent sample selection (76.2%), indicator analysis and report generation (60.3%), and, to a lesser extent, document verification (46.0%). At the same time, pronounced ethical and professional risks are flagged: unclear responsibility for decisions (87.3%), over-reliance on automated outputs (87.3%), and reduced professional skepticism (82.5%), along with model miscalibration (39.7%). Overall,

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this profile indicates conditional acceptance of AI: useful for efficiency, but legitimate only when coupled with visible ethical and governance safeguards.

Alignment with the hypotheses is clear. H2 (Efficiency and Detection) is supported by respondents' focus on high-volume, rule-governed tasks (anomalies, sampling, reporting) and by the current Excel-centric baseline, which signals operational gains for LLM/NLP solutions tailored to ESG. H1 (Ethical integrity and Independence) is reinforced by major concerns about responsibility, over-reliance, and maintaining skepticism - necessitating independence-safeguards, transparency/XAI, and integrated bias testing. Finally, H3 (Normative framework and Compliance) is underpinned by the open-ended recommendations: a national guideline, regulatory adaptation, phased pilots, and including algorithm testing in quality inspections - all oriented towards audit trail and documentation compatible with ISSA 5000, IFRS S1/S2, ESRS, and GRI.

Based on these findings, we propose an integrated conceptual model (Figure 1) with three pillars: Ethics and Independence as the foundation of trust (explicit ethical measures, XAI, bias testing, independence safeguards), Efficiency and Detection as the vector of operational value (LLM/NLP for extracting, aligning, and flagging deviations/greenwashing), and Governance and Compliance as the anchor of professional legitimacy (an assurance-by-design workflow mapped to ISSA 5000, IFRS S1/S2, ESRS, and GRI).

Figure 1 depicts the AI-3P model for AI-assisted assurance. H1 (Ethics & Independence) is posited to increase stakeholder trust; H2 (Efficiency & Detection) is expected to reduce review time and improve detection quality (F1). The impact of H2 on evidence quality and ESRS/GRI coverage is mediated by H3 (Governance & Compliance), which is anchored in ISSA 5000, IFRS S1/S2, ESRS, and GRI. The $H1 \times H2$ interaction moderates the $H2 \rightarrow$ Trust path, indicating that ethical safeguards condition the perceived benefits of efficiency gains. Rounded panels show implementation enablers (non-causal). Survey signals ($n = 77$; Moldova, March–August 2025) motivate the focus on anomaly detection (88.9%), sampling (76.2%), reporting (60.3%) and highlight risks (unclear responsibility 87.3%, over-reliance 87.3%, lower skepticism 82.5%), supporting an assurance-by-design approach with explicit audit trails.

The model links the hypotheses to operational indicators - per-file review time, precision/recall/F1, requirement coverage, and evidence quality - and outlines a pragmatic path from an “Excel-centric” workflow to auditable AI with traceability and clearly assigned responsibilities.

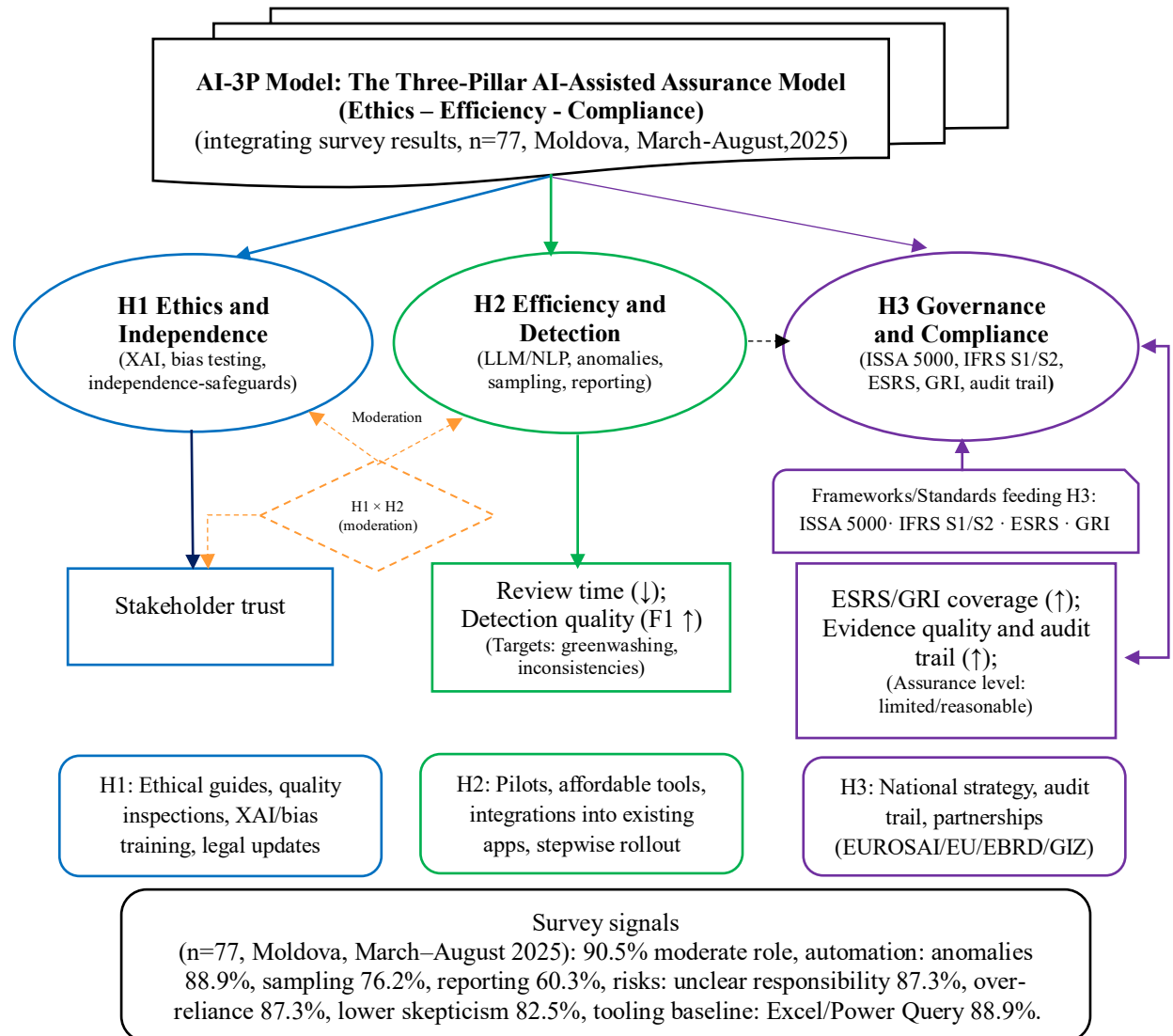


Figure 1. AI-3P: AI-Assisted Assurance in Three Pillars - Ethics, Efficiency, and Compliance.

Source: Authors' elaboration

Conclusions

This study advances an integrated view of AI-assisted sustainability assurance that is simultaneously ethically credible, operationally useful, and standards-aligned. Synthesizing recent literature and evidence from 77 practitioners, we find conditional acceptance of AI: respondents welcome automation where rules and volumes dominate (anomalies, sampling, reporting), yet they anchor legitimacy in explicit safeguards - bias testing, transparency/explain ability, and independence protocols. These insights substantiate our three-pillar AI-3P model. First, H1 is supported: ethics and independence function as the premise of trust. Second, H2 holds: AI can reduce review time while maintaining or improving detection quality (F1) for exaggeration/greenwashing. Third, H3 clarifies that governance-by-design, mapped to ISSA 5000, IFRS S1/S2, ESRS, and GRI, mediates efficiency gains into higher evidence quality and coverage through traceable audit trails. Moreover, the H1×H2 interaction indicates that efficiency benefits translate into trust only when ethical safeguards are visible.

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Practically, the model offers a pragmatic trajectory from today’s Excel-centric workflows to auditable AI with clear responsibilities, measurable indicators (per-file time, precision/recall/F1, requirement coverage, evidence quality), and documentation fit for assurance conclusions (limited/reasonable). Conceptually, it connects ethics, efficiency, and compliance into a single assurance-by-design architecture.

Limitations - self-reported data, a single-country convenience sample - invite pilot deployments that capture log-level audit trails, cross-country replications, and experiments measuring fairness and explain ability alongside assurance outcomes. Overall, the findings argue for targeted training, national guidance, and quality-inspection protocols that test both the results and the evidence generated by AI, thereby sustaining public trust while realizing efficiency at scale.

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