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Auditing in the Twin Transition Era

Between Professional Judgment, Sustainability Assurance, and Agentic AI – Challenges and Future Directions

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Abstract

This study investigates how the convergence between digital transformation and the sustainability transition – commonly referred to as the Twin Transition – is reshaping financial auditing in the context of emerging autonomous technologies such as Agentic AI. An exploratory qualitative approach is adopted, combining reflexive thematic analysis of the academic literature, evaluation of the regulatory framework (CSRD, ESRS, ISA), and synthesis of the relationships between the digital dimension, the sustainability dimension, and the auditor's professional judgment. Findings highlight that integrating Agentic AI, Blockchain (BT), Big Data Analytics (BDA), and Robotic Process Automation (RPA) into audit engagements can deliver substantial benefits, including continuous auditing, ESG data traceability, and operational efficiency. However, these developments also raise challenges such as algorithmic opacity, data bias, and the lack of adapted standards. The paper proposes a conceptual framework for integrated financial auditing, where professional judgment remains the central decision-making node, complemented by the predictive and adaptive capacities of emerging technologies. Finally, the study outlines avenues for future research on algorithmic auditing, standardization of sustainability assurance, and the development of hybrid auditor competencies, contributing to both the theoretical and practical foundations of auditing in the Twin Transition era.

Key words: *digital transformation; sustainability transition; Twin Transition; auditor; audit profession; professional judgment; Artificial Intelligence (AI); Agentic AI;*

JEL Classification: *M42, O14, O33, Q01, Q55, Q56*

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1. Introduction

The audit profession is undergoing one of the most profound transformations in its recent history, driven by the phenomenon known in the academic literature and European policy as the *Twin Transition* – the convergence of accelerated digital transformation and the sustainability transition (KPMG, 2024; EC, 2025).

More than a technological or regulatory shift, the Twin Transition represents *a systemic reconfiguration of economic and social paradigms*, with far-reaching implications of how organizations create value, report performance, and manage risks (Tiron-Tudor *et al.*, 2025a). These dynamics are further amplified in the context of Industry 6.0, where digital interconnectivity, sustainability imperatives, and intelligent automation converge into a data-driven model of production and governance (Bornet *et al.*, 2024; Deliu & Olariu, 2024; Tiron-Tudor & Deliu, 2024; Stoica & Ionescu-Feleagă, 2024; Deliu, 2025).

Within this new landscape, auditing can no longer be examined in isolation, but must be understood as part of an extended governance ecosystem oriented toward transparency, resilience, and responsibility to both environment and the society (Deliu, 2020, 2024, 2025; Tiron-Tudor *et al.*, 2025b).

The adoption of the Corporate Sustainability Reporting Directive (CSRD) and the European Sustainability Reporting Standards (ESRS), together with the rapid development of emerging technologies such as Artificial Intelligence (AI), the Internet of Things (IoT), Blockchain (BT), Robotic Process Automation (RPA), and Big Data Analytics (BDA), has prompted a fundamental redefinition of the audit function (Farcane & Deliu, 2020; Bornet *et al.*, 2024; PwC, 2024; EFRAG, 2025).

In this evolving context, the auditor is no longer merely a "validator" of financial information, but rather a *"guarantor" of the credibility of integrated reporting*, being responsible for assessing ESG (Environmental, Social, Governance) impacts and also for interpreting the decisions and implications of digital transformation (Deliu, 2024a).

This reconfiguration introduces a series of epistemological and ethical tensions. On the one hand, professional judgment (anchored in skepticism, discernment, and accumulated experience) remains the cornerstone of assurance engagements (Bogdan *et al.*, 2020; IFAC, 2022; Deliu, 2024b, 2025), particularly in safeguarding the public interest. On the other hand, autonomous algorithms and AI models, especially Agentic AI systems, introduce a new decision-making logic defined by speed, opacity, and adaptive, real-time predictive capabilities (McAfee & Brynjolfsson, 2017; Binns, 2018; Bornet *et al.*, 2024; Schreyer *et al.*, 2024; Abror *et al.*, 2025).

While conventional AI executes predefined instructions, Agentic AI adds operational autonomy: it can define its own objectives, adjust processes, and act proactively within data-driven contexts. This technological leap raises fundamental questions:

- *(RQ1): How can professional responsibility be maintained when decision-making is delegated to an algorithm?*
- *(RQ2): What expertise must auditors develop to effectively understand and evaluate autonomous models effectively?*
- *(RQ3): Is the ethics of auditing compatible with the decision-making autonomy of AI?*

In parallel, pressures related to climate change and social equity are expanding the notion of materiality from the financial sphere to *double materiality*, that is, reporting that considers both the impact on the entity and the entity's impact on the environment and society (EFRAG, 2024). This shift requires a holistic perspective and expanded competencies from financial auditors, who must be able to understand and validate qualitative, narrative, and complex information that cannot easily be quantified using traditional accounting indicators (Adams, 2020; Tiron-Tudor *et al.*, 2025b).

Against this backdrop, the present study investigates the interactions between professional judgment, sustainability, and Agentic AI in the reconfiguration of contemporary auditing. Its purpose is to outline a research agenda that can support the development of theoretical and methodological frameworks for financial auditing in the *Twin Transition* era. The main contributions of this article are:

- understanding the risks associated with delegating decisions to autonomous systems;
- redefining the professional competencies required of auditors in the Twin Transition era.

Rather than framing technology and professional judgment as opposing forces, the article advances the logic of constructive coexistence. The challenge is not whether auditors will be replaced by algorithms, but how

they can remain credible and relevant in an ecosystem where trust is grounded in digital transparency, sustainable accountability, and professional discernment.

The structure of the paper is as follows: The first section outlines the general context of the research, emphasizing the relevance of the Twin Transition phenomenon and the study's objectives. The second section examines the conceptual and normative foundations of the dual transition, highlighting the implications of digital and sustainability transformations for the auditing profession. The third section details the exploratory qualitative approach, the stages of the analytical process, and the methodological rationale. The fourth section presents the conceptual framework developed, which integrates the digital, sustainability, and professional dimensions into a new model of integrated financial auditing. The fifth section discusses emerging trends, theoretical and practical implications, as well as the ethical and epistemological challenges associated with this transformation. Finally, the last section synthesizes the conclusions and outlines directions for future research.

2. Background: Twin Transition – a new interpretive framework for the audit profession

The concept of *Twin Transition* refers to the intersection between digital transformation and the sustainability transition, two simultaneous and interdependent processes that are reshaping business models, value chains, and, consequently, auditing practices. According to the European Commission, this dual transition is essential for achieving the objectives of the European Green Deal and the EU's Digital Strategy (EC, 2025; ECEU, 2025).

From both an economic and professional perspective, the Twin Transition is not limited to the adoption of new technologies; it also requires the integration of environmental and social objectives into decision-making and reporting processes (Tiron-Tudor *et al.*, 2025a). For the auditing profession, this context redefines the auditor's role: moving from a compliance-focused verifier of financial statements to an arbiter of the credibility of integrated reporting, which encompasses both financial and non-financial indicators (KPMG, 2024; PwC, 2024).

2.1 Digital transformation: professional judgment vs. autonomous algorithms

Digital transformation in auditing involves the large-scale adoption of emerging technologies such as AI, BT, and BDA (Appelbaum *et al.*, 2017; Yoon *et al.*, 2021). These tools are fundamentally transforming audit methodology by:

– shifting from sample-based testing to full-population analysis of transactions;

– transitioning from retrospective audits to continuous auditing (Vasarhelyi *et al.*, 2018).

A significant technological breakthrough is represented by the rise of Agentic AI: autonomous systems capable not only of executing instructions, but also of defining objectives, planning actions, and dynamically adapting to changing contexts (Schreyer *et al.*, 2024). Unlike conventional AI, which responds to predefined inputs, Agentic AI has proactive capacities and can make decisions in complex and unstructured environments. Potential applications in auditing include:

– continuous monitoring of accounting transactions and the automatic initiation of investigations when anomalies are detected;

– dynamic adjustment of audit programs based on contextual changes (e.g., regulatory updates, macroeconomic fluctuations);

– aggregation and correlation of ESG data from diverse sources (internal reports, public databases, IoT sensors).

However, the integration of autonomous algorithms raises ethical, legal, and social challenges (Tiron-Tudor *et al.*, 2025a). Concerns include algorithmic opacity (the "black box" problem), systemic biases embedded in training data, and the lack of specific regulatory frameworks (Binns, 2018; Barredo-Arrieta *et al.*, 2020). These risks may undermine both reputational trust and legal accountability. In this context, professional judgment remains indispensable, particularly for:

- interpreting AI-generated outputs within the specific context of the audited entity (Deliu, 2024b);
- verifying the coherence and relevance of the underlying data (Deliu, 2025);
- ensuring compliance with ethical principles and auditing standards (ISA 200; IFAC, 2022).

Scholars stress that, despite technological progress, automation does not eliminate the need for professional judgment; instead, it transforms its very essence (Kokina & Davenport, 2017; Appelbaum & Nehmer, 2020; Deliu, 2024b). The auditor of the future must not only understand algorithmic logic but also acquire the ability to audit AI models themselves, beyond the financial data processed by such systems.

2.2 Sustainability transition: redefining professional competencies

The sustainability transition in auditing is driven by regulatory reforms and growing pressure from investors, regulators, and society for transparent disclosure of ESG performance. The adoption of the CSRD (EU 2022/2464) and the ESRS represents a decisive shift from voluntary reporting to a binding legal obligation to publish detailed information on environmental, social, and governance impacts (EFRAG, 2025).

These regulations institutionalize the principle of double materiality, requiring entities to disclose both how ESG factors influence financial performance (outside-in) and how organizational activities affect the environment and society (inside-out) (Adams, 2020). For auditors this entails:

- validating data that are often qualitative, narrative, and unstructured;
- ensuring the traceability and integrity of data sources;
- assessing the consistency between financial and ESG information.

Accordingly, auditors' professional competencies must be expanded (Deliu, 2024a,b; Tiron-Tudor *et al.*, 2025b) to encompass:

- technical expertise inf ESG standards and the EU taxonomy;
- advanced skills in analysing complex datasets, including the use of AI and BT for validation;
- understanding of climate-related risks and their financial implications;
- communication skills tailored to diverse stakeholder groups.

Thus, the Twin Transition not only reshapes the *scope* of the auditor's work but also redefines the *professional identity* itself, requiring a *hybrid profile* in which technological expertise, ESG competencies, and professional judgment coexist within an integrated framework.

3. Research methodology

This study adopts an *exploratory qualitative approach*, grounded in *a reflexive thematic analysis* of the academic literature and the recent regulatory framework, with the aim of identifying the interactions, synergies, and challenges arising from the convergence of digital transformation, sustainability, and the integration of emerging technologies – particularly Agentic AI – into financial auditing. Such a methodological choice is appropriate for fields in an early stage of theoretical and practical development, where empirical evidence remains scarce and knowledge depends primarily on conceptual analysis and expert interpretation (Saunders *et al.*, 2009; Creswell & Creswell, 2017).

The research process was structured into three main stages:

i. *Literature review* – a targeted analysis of academic studies published between 2015 and 2024, using the Web of Science, Scopus, and Google Scholar databases, alongside professional sources (ACCA, IFAC, EFRAG). Keywords included: "twin transition", "financial audit", "agentic AI", "ESG assurance", "sustainability reporting audit", and "AI in auditing".

ii. *Regulatory and professional framework analysis* – examination of European directives (CSRD, ESRS), international auditing standards (ISA), IFAC guidelines, and recommendations issued by professional bodies (CAFR, PCAOB, IAASB), in order to assess the implications of the Twin Transition for the auditor's role, tasks, and competencies.

iii. *Conceptual analysis and synthesis* – development of an integrative framework mapping cause-effect relationships and interdependencies between digital transformation, sustainability transition, and professional judgment, while simultaneously highlighting risks and opportunities.

The analysis was carried out using the method of thematic synthesis (Thomas & Harden, 2008), by coding the extracted information and grouping it into four main themes (**Table no. 1**).

Given the emergent nature of the field, this research combined a document-based review with the author's reflexive analysis (Schwandt, 1994; Denzin & Lincoln,

2008). Within this interpretive paradigm, the researcher's role extends beyond data collection and synthesis to the critical interpretation of meanings and connections, informed by professional expertise and contextual understanding of financial auditing.

Table no. 1. Themes and subthemes identified in the literature

Themes	Subthemes
Technology and Agentic AI in auditing	automation; algorithmic decision-making; continuous auditing; sustainability auditing – ESG indicator validation; double materiality
Role of professional judgment	professional skepticism; ethics; governance
Risks and challenges	algorithmic bias; AI opacity (black box problem); lack of adapted standards
Strategic opportunities	ESG traceability; operational efficiency; innovation in audit procedures

Source: author's projection

This methodological choice is justified by:

- *Complexity of the subject* – the interplay between auditing, technology, sustainability, and governance requires a flexible approach capable of capturing subtle nuances and multiple interdependencies;
- *Lack of a stable theoretical framework* – in the absence of consolidated theories, it is necessary to construct a conceptual model grounded in heterogeneous sources;
- *Need for depth* – the aim is not the statistical validation of hypotheses but rather the in-depth exploration of relationships and tensions among dimensions.

Through this reflexive approach, the study captures more than the explicit elements of literature and regulation, respectively it highlights the implicit meanings and emerging directions for research, thereby providing a solid foundation for drawing conclusions and developing a future research agenda.

4. Results: Conceptual framework – a new model of integrated financial auditing in the Twin Transition era

Recent literature emphasizes that digitalization and sustainability are not parallel trajectories but convergent processes, whose points of intersection are increasingly evident in ESG auditing (Asante-Appiah & Lambert, 2023; KPMG, 2024; PwC, 2024; Cheng & Li, 2025). Technologies such as BT can ensure the traceability of green certificates and supply chains, while Agentic AI systems enable the analysis of massive datasets on emissions, resource consumption, or organizational diversity, identifying patterns and correlations difficult to detect through traditional human analysis (Deliu, 2024a).

This integration transforms the Twin Transition from a macro-political concept into an *operational catalyst* for the emergence of an *integrated financial auditing model*, where technology becomes a strategic partner of professional judgment and sustainability consolidates its role as a central pillar of assurance.

The model in **Figure no. 1** illustrates the interdependence of the two dimensions of the Twin Transition and how they converge toward a professional core grounded in skepticism, discernment, and ethics.

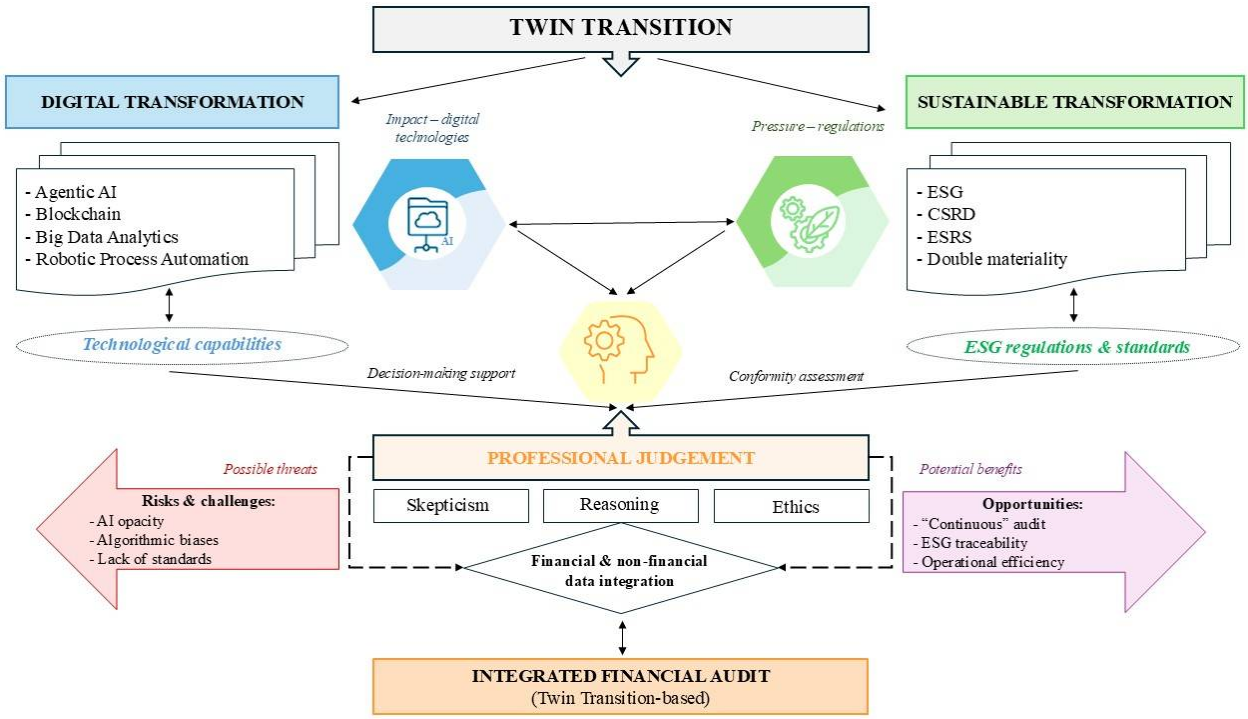
I. Digitalization dimension – technological capabilities and decision support

a. Technologies such as Agentic AI, BT, BDA, and RPA provide *advanced decision support*, enhancing auditors' ability to perform predictive analyses, detect anomalies in real time, and implement *continuous auditing*.

b. *Agentic AI* introduces an *additional layer of operational autonomy*, dynamically adjusting audit processes in response to contextual changes, thereby reducing reaction times and optimizing the prioritization of procedures.

c. This dimension directly improves *operational efficiency* through rapid *integration of multi-source data* (e.g., unstructured data, IoT), but also raises challenges of interpretability and control.

Figure no. 1. Conceptual framework - Model of integrated financial auditing in the Twin Transition era



Source: author's projection

II. Sustainability – normative pressure and compliance evaluation

a. Regulations such as CSRD, ESRS, and the EU taxonomy mandate detailed ESG reporting, in line with the principle of double materiality.

b. Auditors must verify not only the accuracy of financial data but also the coherence, traceability, and integrity of non-financial information, including qualitative and narrative data.

c. The dynamic nature of this regulatory framework demands continuous professional development, interdisciplinary competencies, and adaptation of audit methodologies.

III. Professional judgment – the integration node

a. Serves as the central pivot of the model, anchored in three pillars: skepticism, discernment, and ethics.

b. Mediates between algorithms and final audit decisions, filtering, interpreting, and validating information generated by both traditional sources and autonomous algorithms to ensure relevance and credibility.

c. Enables coherent integration of financial and non-financial data; yet, without robust professional judgment, the risk of accepting algorithmic biases or errors increases significantly.

d. Protects the public interest through critical evaluation of outcomes produced by digital technologies.

IV. Risks and challenges – potential threats

a. AI opacity (black box problem) – difficulty in explaining the logic behind algorithmic decisions.

b. Algorithmic bias and indirect discrimination – systemic errors embedded in training data or model design.

c. Absence of specific standards for auditing AI models and ESG disclosures, highlighting the need for AI auditing protocols and the extension of ISA standards into emerging domains.

V. Strategic opportunities – potential benefits

a. Continuous auditing and proactive monitoring.

b. ESG traceability through BT.

c. Operational efficiency and reduced reporting times.

The proposed framework demonstrates that an integrated financial audit model based on the Twin Transition is not simply an incremental adaptation, but a paradigm shift.

In the *short term*, adoption of this model requires: (i) investment in digital and ESG training for auditors; (ii) adaptation of auditing standards to new technological and reporting realities; (iii) development of methodologies for evaluating Agentic AI systems and BT infrastructures used in auditing.

In the *long term*, this framework can serve as a foundation for applied research on AI governance, the integration of double materiality into auditing, and the procedural design of continuous auditing.

5. Discussion: emerging trends, implications, and ethical-epistemological challenges in financial auditing

The findings confirm that the Twin Transition – the convergence of digital transformation and the sustainability transition – is not a marginal development for the auditing profession, but a *structural process* that profoundly reshapes audit methodologies, professional responsibilities, and the technological infrastructure of assurance. The rise of Agentic AI serves as a *catalyst* for this transition, introducing a level of decision-making autonomy unprecedented in the history of auditing, while at the same time increasing pressure on regulatory frameworks and professional ethics.

Within this context, the proposed conceptual framework demonstrates that transformation does not occur through isolated adjustments, but through a *network of interdependencies* between technological capabilities, normative requirements, and professional judgment, where risks and opportunities coexist in a dynamic balance.

5.1. Emerging trends in financial auditing and future research directions

The analysis of the proposed framework highlights five major trends that are shaping the evolution of financial auditing in the Twin Transition era (**Table no. 2**).

This analysis also identifies several future research directions (**Table no. 3**).

The evolution of financial auditing cannot be dissociated from the broader dynamics of digitalization and global sustainability objectives. In this context, the proposed directions are not only theoretical themes but also represent the practical agenda of the auditing profession for the coming decade.

Table no. 2. Emerging trends in financial auditing under the Twin Transition

Trend	Causes	Effects & implications
1. Integration of Agentic AI in audit processes	Agentic AI transforms auditing from a retrospective, periodic activity into a proactive and continuous process, capable of initiating procedures based on automatic detection of anomalies or contextual changes (e.g., legislative or market shifts).	– increase in operational efficiency; – reduction of response times, but also the emergence of dilemmas regarding decision-making opacity; – algorithmic bias; – attribution of responsibility in case of errors.
2. Expansion of sustainability auditing	Implementation of CSRD and ESRS expands the auditors' mandate beyond verifying financial statements to include ESG indicator validation and the application of double materiality (outside-in and inside-out).	– the need to acquire new competencies (climate impact analysis, social risk assessment, validation of qualitative data); – interdisciplinary collaboration with experts in environment, governance, and social sciences;

3. Recalibration of professional judgment	In an ecosystem dominated by autonomous technologies and sustainability reporting pressures, professional judgment becomes the primary safeguard for quality assurance and the critical filter for algorithmic output.	– auditors must combine professional skepticism with technical understanding of AI models, including notions of AI auditing and algorithmic interpretability.
4. Emergence of integrated audit ecosystems	The merging of financial, sustainability, and technological audits generates integrated platforms for data collection, analysis, and reporting.	– enhanced operational efficiency, but also increased complexity of governance, data security, and system interoperability.
5. Focus on traceability and digital transparency	BT and Distributed Ledger technologies are becoming foundational infrastructures for ensuring the integrity and traceability of both financial and non-financial data.	– strengthening public trust in integrated reporting, but also the necessity to audit these very digital infrastructures themselves.

Source: author's projection

Table no. 3. Future research directions

Research direction	Context
1. Algorithmic auditing and ethical responsibility	– investigation of responsibility-sharing models between the auditor and autonomous systems in cases of erroneous decisions.
2. Standardization of sustainability auditing	– development of unified methodological frameworks for ESG indicator validation, applicable across multiple industries and jurisdictions.
3. Competence mapping for the auditor of the future	– identification of the hybrid skill set (financial, technological, sustainability-related) required in an integrated audit environment.
4. AI interpretability methods applicable in auditing	– development of explainable AI (XAI) models to increase transparency in automated decision-making processes.
5. The impact of the Twin Transition on audit quality	– empirical studies measuring the effects of digital and sustainable transformation on audit effectiveness and trust.
6. Frameworks for continuous auditing	– research into operational models that combine real-time monitoring with reporting in line with international standards.

Source: author's projection

5.2. Theoretical and Practical Implications

5.2.1. Theoretical Implications: A Paradigm Shift in Auditing

From a theoretical perspective, the findings point to an ongoing paradigm shift. Whereas traditional financial auditing was anchored in a post-factum logic (i.e., the retrospective verification of accounting information for a closed period), the combined pressures of digitalization and sustainability are pushing the profession toward proactive and continuous auditing (continuous assurance) (Chan *et al.*, 2018). Therefore:

- Digital transformation alters the epistemological foundations of auditing: moving from sample-based testing to full-population, real-time data analysis (Vasarhelyi *et al.*, 2015).
- Agentic AI introduces a new dimension: the algorithm's ability to prioritize, sequence, and dynamically adjust audit procedures based on contextual data (Omoteso, 2012).
- Sustainability embeds the principle of double materiality, requiring the simultaneous evaluation of financial impacts on the entity and the entity's impacts on the environment and society (EFRAG, 2023).

From an epistemological standpoint, this context challenges traditional assurance models (Power, 2004). Thus, audit theory, historically grounded in objectivity, skepticism, and documentary verification, must now

integrate: concepts from data science and AI, principles from algorithmic ethics, and ESG governance frameworks and impact assessment methodologies.

This interdisciplinary integration lays the foundation for a unified conceptual framework in which financial and non-financial data are treated as inseparable components of the same validation process.

5.2.2. Practical Implications: Recalibrating the Auditor's Role

The results also reveal major practical shifts in auditing:

- *Expanding the competency set*

The modern auditor must combine accounting expertise with data analytics, ESG literacy, and AI knowledge (Tiron-Tudor *et al.*, 2025b). Traditional training must therefore be complemented with modules on BDA, ML, algorithm interpretability (Explainable AI – XAI), and ESG indicator validation. According to ACCA (2025), hybrid skills will be the key differentiator between relevant and marginalized auditors.

- *Adoption of integrated auditing*

The Twin Transition drives the convergence of financial, sustainability, and technological auditing, leading to the creation of integrated audit ecosystems. Within these ecosystems, digital platforms simultaneously manage financial, non-financial, and technical data flows, ensuring traceability and coherence.

- *Changing the auditor-client interaction model*

Auditing will no longer be an annual event but a continuous process of monitoring, dialogue, and feedback. Agentic AI can directly interact with client systems, issuing real-time alerts and recommending corrective actions before issues materialize.

5.3. Ethical and epistemological challenges. Gaps between technological and normative dynamics

This transformation raises pressing ethical challenges on three levels:

i. *Delegation of decision-making to algorithms* – Who bears responsibility for an audit conclusion or opinion generated (wholly or partly) by an autonomous algorithm? In the absence of clear regulation, accountability risks becoming fragmented (Martin, 2019).

ii. *Opacity of AI models* – Complex models such as Deep Neural Networks may deliver high performance but operate as "black boxes", limiting auditors' ability to validate algorithmic reasoning (Doshi-Velez & Kim, 2017).

iii. *Algorithmic bias* – Historical datasets often contain systemic biases which, once learned by AI, are perpetuated or amplified. In auditing, this could lead to discriminatory or erroneous conclusions with severe ethical and legal implications (Pizzi *et al.*, 2020).

A further key finding is the gap between the exponential pace of technological innovation (AI, BT, RPA) and the relatively slow adaptation of auditing standards and ESG regulations. *This asymmetry produces a regulatory vacuum*, in which practitioners adopt technological solutions before appropriate standards exist, potentially undermining consistency, comparability, and public trust in audit reports.

In conclusion, the future of financial auditing is not defined by a binary choice between professional judgment and autonomous algorithms, but by their *critical integration into a unified framework*. Professional judgment remains the ultimate interpretive filter, safeguarding public interest and ethical principles. Agentic AI serves as the engine of efficiency, processing vast datasets and uncovering patterns beyond human capability. The sustainability dimension introduces the moral and societal obligation to assess long-term impacts of economic activity, beyond short-term financial performance. Thus, the Twin Transition is not only reshaping auditing methods and tools but redefining its very mission: shifting from the verification of compliance to the assurance of trust in global corporate governance.

6. Conclusions

This study has shown that the Twin Transition constitutes a structural process that is fundamentally transforming the foundations of financial auditing. The introduction of Agentic AI amplifies this transformation, offering unprecedented opportunities in terms of efficiency and accuracy, while also raising complex challenges related to ethics, governance, and professional accountability.

On the one hand, digital transformation is shifting the logic of auditing from retrospective verification to continuous monitoring, based on exhaustive data analysis and adaptive algorithmic decision-making. On the other hand,

the sustainability transition, reinforced by the implementation of the CSRD and ESRS, extends the scope of auditing to the evaluation of ESG impacts and the application of the principle of double materiality, demanding new skill sets from auditors. Within this context, professional judgment remains an essential anchor of the audit process, but it must be recalibrated to include both the interpretation of algorithmic models and the evaluation of non-financial information. Agentic AI emerges as a strategic enabler, yet one that requires clear standards of transparency, auditability, and accountability.

This paper proposes an integrated conceptual framework that maps the interdependencies among three fundamental dimensions – professional judgment, sustainability, and autonomous algorithms – within the Twin Transition. The model clarifies the epistemological and ethical tensions between algorithmic autonomy and human responsibility, while also highlighting synergies and the potential for constructive coexistence between technology and professional judgment. It further suggests a research agenda centered on standardization, hybrid competencies, and AI interpretability.

The analysis also reveals important implications for both practice and public policy. Auditing professionals must rapidly adapt to an interdisciplinary skill profile, while their continuous education should include domains such as BDA, AI ethics, and ESG governance. For regulatory bodies, it is imperative that legislative developments keep pace with technological evolution by establishing standards that regulate both sustainability auditing and the auditing of algorithms.

Future research may explore longitudinal case studies, evaluate the real impact of autonomous technologies on audit quality, and test the applicability of the proposed framework across different contexts (jurisdictions, industries).

The central finding of this study is that financial auditing in the Twin Transition era cannot be understood as a simple adaptation of existing practices, but rather as a profound redefinition of the profession's mission – shifting from validating financial compliance to guaranteeing the credibility of integrated information within a complex, global, digital, and sustainability-oriented ecosystem.

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