# Blockchain Technology in Financial Accounting and ESG reporting: A review of current trends and future opportunities.

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*Abstract:*

*This study aims to investigate the utilisation of blockchain technology in the field of financial accounting and (ESG) reporting. The indicated research aim is achieved on the basis of bibliometric review of high-quality peer-reviewed journal articles from 2017 to 2024. This study connnects the latest research to analyze blockchain's role in advancing sustainable financial practices. The review examines blockchain's decentralized, tamper-resistant features and its application in addressing critical challenges, such as data manipulation and audit inefficiencies. Furthermore, the study evaluates its contributions to green finance, investment strategies, and climate-related disclosures, highlighting case studies and frameworks relevant to Oman's Vision 2040 goals. This thorough examination highlights the capacity of blockchain technology to improve adherence to regulatory frameworks, optimize procedural efficiencies, and facilitate principled financial governance. The findings aim to provide a valuable resource for academics, policymakers, and industry professionals exploring blockchain's evolving role in reshaping financial accounting practices in Oman.*

*Keywords: Financial Accounting, Blockchain, ESG Reporting, Regulatory Framework*

## 1. Introduction:

Blockchain is a decentralized digital ledger system that enables unchangeable and transparent recording of transactions across a distributed network (Prokopenko et al., 2024). Since the rise of cryptocurrencies, blockchain has developed into varied domains like accounting and sustainability reporting, where its features meet rising trust and transparency needs. In financial accounting, blockchain promises to transform conventional double-entry bookkeeping through concepts of triple-entry bookkeeping, real-time auditing, and tamper-proof transaction records (Cai, 2019) (Thies et al., 2023). In tandem with this, blockchain is envisaged as a means to improve the reliability of sustainability disclosures by bringing integrity and traceability in data, enhancing the way stakeholders perceive them in Environmental, Social, and Governance (ESG) reporting (Bakarich,

Castonguay & O'Brien, 2020) (Seretakis & Mezzanotte, 2023). This literature review provides a summary of peer-reviewed academic work, written between 2017 and 2024 on applying blockchain in financial accounting and ESG reporting. It identifies various theoretical frameworks and analyses concrete implementations; it pinpoints current trends and challenges in accounting and ESG reporting while suggesting future opportunities. Sources ranged from Scopus and the Web of Science to IEEE, Emerald, and Inderscience to ensure balanced discussions of how blockchain is changing accounting and ESG reporting. Citation in the APA format will be followed by a full reference list applying APA standards.

## 2. Theoretical Frameworks:

**From Double-Entry to Triple-Entry Accounting:**

The potential of blockchain to transform financial accounting is often framed around the idea of triple-entry accounting (TEA), a relative of traditional double-entry bookkeeping. In a TEA system, each transaction is cryptographically recorded on a shared ledger, along with the double records kept by the transacting parties (Cai, 2019). In essence, as noted by Cai (2019), an organization in a blockchain ecosystem may only need to record one side of a transaction internally, while the corresponding entry will automatically be recorded onto the public ledger. This will be a third, verifiable record, because it answers the basic trust and transparency issue of current accounting systems and, if properly implemented, "can fundamentally improve accounting" by decreasing errors and fraud (Cai, 2019). While immutability lies at the heart of TEA's fraud-deterrence feature (Thies et al., 2023), the recent cases of financial fraud (such as Wirecard and Luckin Coffee) have revived interest in blockchain-based TEA as a means to negotiate against potential manipulation of accounting records. A systematic literature review in 2023 by Thies et al. established that the extreme theoretical discussions about TEA dominate literature, whereas applications in practice do not exist (Thies et al., 2023). This indicates that while there is a well-recognized theoretical promise of TEA (tamper-proof shared ledgers to enhance reliability of accounts), a gap from theory to practice persists in its adoption.

Apart from these applications in bookkeeping, scholars have ventured into the matching of blockchain to accounting information systems and audit theory. An example here is Fullana and Ruiz (2020), who argue for improvements to the safety and transparency of accounting processes through a blockchain-accounting information system integrated into one another (Fullana and Ruiz, 2021). Decentralized consensus accommodates verification in Blockchains through multiple constituents on the network, validating the transactions. Blockchain is conceivable as audit infrastructure; in other words, external audit blockchains, where smart contracts would perform audit procedures automatically, have been conceived by Rozario and Vasarhelyi (2018). Blockchain's capability to add value to the audit process by making it continuous due to blockchain-enabled data integrity is

also discussed in (Bonyuet, 2020). Theoretically the discussions point out that in the future auditors will not be so busy with verification because most of it will be done by a blockchain, but rather with investigating exceptions and performing higher analysis (Bellucci et al., 2022). An example of such an effect is the academic community, giving particular attention to how blockchain may affect accounting theory and roles. Avenues to such discourse link blockchain with other areas such as computer science and management turning accounting into a multidisciplinary field (Secinaro et al., 2021). Bellucci et al. (2021) argue that automation of data recording and validation through the use of blockchain could lead to accountants' and auditors' activities moving away from manual bookkeeping and toward more demanding tasks like complex analysis and advising. In brief, the corpus constitutes a well-founded theoretical platform where blockchain is conceived as a driver empowering a new accounting paradigm – fostering trust through triple-entry record, assuring continuity through continuous assurance and leading to a retesting of the accounting principles and professional practices.

### 3. Blockchain in Financial Accounting:

**Practical Applications and Current Use Cases in Accounting:**

Although there is strong theoretical interest in this technology, its adoption in practice for financial accounting has been slow, typically only through pilot cases or other similar realms. A bibliometric analysis by Secinaro et al. (2021) indicated that blockchain research in accounting is dominant with intellectual and qualitative scenarios, few would consider providing real-time implementations. Entities have experimented with private blockchains for managing inter-company transactions and consortium-related recordkeeping. Prokopenko et al. (2024) provide case studies of eight organizations (eclectic from banking, retail, tech, etc.) that have implemented blockchain in a portion of their accounting processes, which indicated enhanced efficiency of transaction processing and lessen reconciliation effort (Prokopenko et al., 2024). Such networks provide a shared ledger between the various entities, reflective of the triple-entry concept since it provides a singular source of truth for all parties involved. Blockchain, with its ability for near real-time sharing of data, is being utilized for timely financial reporting. These tools are used in practice when auditing clients who conduct cryptocurrency transactions or when clients use blockchain for any part of their accounting systems. The smart contract-driven audits idea from Rozario and Vasarhelyi is in prototype testing, wherein compliance rules are encoded into a blockchain such that any exceptions are flagged automatically for auditors. This else indicates that concepts of continuous audit are slowly moving from theory into practice in limited scenarios, thus improving audit efficiency and coverage (Bonyuet, 2020). Overall, in practical adoption of blockchain within core financial accounting, this process is still at its infancy stage. A multitude of companies continues to monitor their traditional accounting information systems while piloting blockchain in selected areas: supply

chain finance, intercompany accounting, or crypto asset management; this is to prove its worth. Instead of replacing them, incremental adoption of accounting systems may be witnessed until 2024. The literature underlines that most implementations are experimental often led by tech firms, or consortia, and that traditional corporations take a "wait and see" approach until all regulatory and technical uncertainties settle (Pimentel & Boulianne, 2020). Whereas the practicality wears a mask of caution, theoretical frameworks develop a more optimistic aura of robustness.

**Benefits and Opportunities for Accounting:**

Regardless of a limited mass adoption, it is worth noting that a fair amount of literature constantly demonstrates substantial advantages and opportunities for integrating blockchain solutions in financial accounting. The primary promise of blockchain is that there will be a completely open ledger accessible in real-time to the relevant stakeholders. In accounting, it means that stakeholders, such as investors, regulators, and auditors, will have timely visibility into transactions and balances, thus reducing the asymmetry of information. Prokopenko et al. (2024) found that implementations of blockchain improved the transparency of financial records and enhanced stakeholders' trust in reported figures. Furthermore, since the blockchain records immutably resist tampering, the trust in the accuracy of financial data increases. Every transaction is time-stamped and cryptographically linked to the previous one. It will therefore be practically impossible to modify a transaction while concealing it (Seretakis & Mezzanotte, 2023). This feature of cancellation directly attacks the problems of fraud and the manipulation of earnings: it would be exceedingly difficult for management to backdate or falsify transactions without traceability on a blockchain. According to studies, the adoption of a shared ledger across multiple organizations will reduce reconciliation efforts and improve consistency of the data over time (Prokopenko et al., 2024). Having the system perform in much the same way will reduce the duplication of labour within accounting systems and speed up processes-agreeing intercompany balances quite faster, audit confirmations quite faster through node access etc.The transition from periodic auditing to continuous assurance is one example of this opportunity gaining wider currency. Allowing authorized parties access to blockchain records in real-time means auditors may now monitor transactions on an ongoing basis rather than waiting until year-end to conduct sampling. Rozario and Vasarhelyi's framework purported that a good number of audit tests (verification of transactions having occurred, authorization of transactions, matching contractual agreements) could be coded into a blockchain system. Moreover, audit trails on the blockchain are extremely robust; all changes are logged and attributable, allowing for simpler evidence collection in audits (Bonyuet, 2020). Pimentel and Boulianne's review in 2020 has it that the literature on blockchain has focused mainly on the auditing benefits therein; lending credence to the belief of the profession that blockchain has an opportunity to advance the auditing profession (Pimentel & Boulianne, 2020). Because of this unique

architecture with built-in security feature and consensus guidelines, it is practically impossible for a single party to spy or alter any record without some collusion happening. As described by Thies et al. (2023), blockchain's tamper-proof quality is one thing in fighting against accounting fraud and financial statement manipulation (Thies et al., 2023). By embedding rules (like GAAP/IFRS rules) into the system, blockchain promises to enable compliance with accounting regulations. For example, a smart contract could enforce that no journal entry be made without a corresponding debit and credit of equal value in the usual double-entry style. It could also allow for automatic approval flagging above a certain threshold (helping with SOX controls) or maintaining segregation of duties by requiring multiple private keys to sign a significant transaction.

**Challenges and Barriers in Accounting Adoption:**

There may be bright prospects about the significance of distributed ledger technology to accounting and finance, yet challenges still abound to impede its widespread acceptability. The literature from the interim period of 2017 to 2024 further tests these encumbrances. The accounting profession is significantly regulated, and new technologies could outpace the evolution of standards and legislation. According to Prokopenko et al. (2024), the uncertainty in the law is the most glaring obstacle, especially with an organization's fears and risks relating to compliance if the blockchain practice were to diverge from trending accepted accounting principles. Some efforts have been made, in 2024, the AICPA and ICAEW have issued discussion papers discussing blockchain's impact on audit and assurance while the IEEE has developed standards on blockchain data formats, but the regulatory clarity is still entirely lacking.Most corporations have run more established Enterprise Resource Planning (ERP) and accounting software integrated deep into the firms' operations. It is costly and difficult to replace or integrate these with the blockchain. Oz et al. shows that this interoperability issue can endanger data integrity and consistency between different blockchain systems (Oz et al., 2025). Classic blockchain networks, especially public ones, have scalability constraints and latency issues that conflict with the high-volume needs of corporate accounting. Scholars and practitioners alike have observed that the current blockchain technology might not scale up to provide transaction throughput required by enormously large enterprises, which process millions of accounting entries. Blockchain to go mainstream in accounting,thereneed to be standards so that systems will interoperate andstakeholders(auditors, regulators) will trust the data. As of yet (2024), there are noglobalstandards as to how to implement blockchain in accounting or how to format financialdata on a blockchain. IEEE has begun to create data standards (e.g., IEEE 2418.2-2020 blockchain data format standard), but they are not specific to accounting (Blockchain and Distributed Ledger Standards Committee, 2019).In the absence of standards, each implementation might be unique, making industry-wide adoption and external auditing more difficult. Auditors will need to learn each client's bespoke blockchain system, and consolidation

across different blockchains (for multi-entityfirms) can be cumbersome in the absence of common protocols. These challenges underscore that blockchain for accounting is not a plug-and-play proposition, there are significant obstacles to be overcome.

## 4. Evolving Needs for Transparency in ESG Reporting:

ESG reporting entails the disclosure of a company's performance concerning environmental, social, and governance factors. Over recent years, this practice has evolved from optional corporate social responsibility reports to a more structured and regulated approach, particularly in regions such as the European Union. ESG reporting encounters significant challenges related to credibility. Frequently generated through self-reporting without external auditing, traditional sustainability reports can vary widely in format. This inconsistency raises issues regarding greenwashing—where companies exaggerate or misrepresent their environmentally friendly initiatives—and questions surrounding data reliability (Lock & Seele, 2017). Moreover, the evolving nature of ESG disclosures—including carbon emissions and labour practices within supply chains—combined with new regulatory demands only exacerbates these concerns. For instance, the European Union's Corporate Sustainability Reporting Directive (CSRD), implemented in 2022, mandates that firms disclose a wide array of sustainability metrics while adopting a dual materiality perspective; they must report not just on how sustainability impacts their operations but also on their influence on society and the environment. The scope of this requirement extends throughout an organization's entire value chain by addressing aspects such as Scope 3 greenhouse gas emissions generated by suppliers and customers (Seretakis & Mezzanotte, 2023). Collecting and validating this extensive range of information poses considerable challenges for existing systems. As highlighted by Seretakis and Mezzanotte (2023), conventional data management tools struggle with the complexities associated with global supply chains necessary for effective ESG data collection.

## Applications and Use Cases of Blockchain in ESG Reporting:

In the years-between 2017 and 2024, there have been various use of cases and frameworks proposed for applying blockchain in ESG and sustainability reporting-and in some cases, actually implemented. Blockchain has been applied to track product provenance and verify sustainability claims. In the food industry, for example, retailers have piloted blockchain to ensure that products are sourced sustainably and ethically (Bakarich et al., 2020). Conceptual frameworks have been developed in which IoT devices capture environmental data (e.g., emissions, energy usage), automatically recording it on a blockchain. These systems promise to streamline ESG data collection and reporting while reducing manual errors (Liu et al., 2020). Sustainability report assurance (third-party verification of ESG data) is growing, though it is still less standardized than audits. Blockchain can be utilized as an assurance provider tool. Bakarich et al. (2020) discussed use cases in the United States and Canada and concluded that blockchain is well-suited to enable assurance professionals in

preparing and auditing sustainability information. Bakarich et al. foresee that with more firms implementing blockchain for ESG information, the outcome will be "more-high-quality information" in sustainability reports and perhaps more consistent standards of assessment, since the collection techniques become standardized. Now we are witnessing accounting firms collaborating with technology companies to come up with integrated assurance services that are not merely audits of financial information reported in an ESG report but also blockchain system and process assessment that generates those figures (Bakarich et al., 2020). Some proposals include the tokenization of carbon credits and renewable energy certificates. These digital tokens can be tracked on blockchain to ensure transparency in the issuance and retirement of sustainability instruments (Zhou et al., 2023). The Circle of Sustainable Europe (2025) example demonstrates how a company could utilize blockchain to provide real-time proof of the flow and final use of money invested in CSR programs (Bassoli, 2025).

**Challenges and Limitations in ESG Blockchain Integration:**

While the prospects are promising, the integration of blockchain into ESG coverage is not without obstacles. There are many fundamental concerns that need to be addressed in creative writing and pragmatic encounters. A blockchain can guarantee data integrity after entry, but it cannot guarantee that the data entered is accurate in the first place. This is known as the "oracle problem" – the challenge of linking real-world information to the blockchain. ESG data often comes from external sources. As Oz et al. (2025) highlight, if integration issues or data quality issues occur, they *"can threaten data integrity and accuracy"* even in a blockchain system (Oz et al., 2025). Similar to financial accounting, ESG blockchains, especially if public or large-scale, face technical limits. Energy use concerns are particularly ironic in ESG: using a technology that has a high carbon footprint to improve environmental reporting could be seen as counterproductive. Oz et al. (2025) note that *high energy consumption* and *low transaction speed* are perceived issues affecting the sustainability of blockchain tech itself (Oz et al., 2025). Sensitive operational data may need protection, even as transparency is increased (Oz et al., 2025). According to Oz et al. (2025), *resistance to change and lack of trust in the system* were identified as top barriers in their study on blockchain for sustainability reporting(Oz et al., 2025). The literature urges a realistic view: blockchain is not a panacea for all ESG reporting problems(Pattarake Sarajoti et al., 2023). The Oz et al. (2025) study is instructive: after analyzing various barriers, it found that the perception that blockchain "works at a limited capacity" and general resistance were most inhibiting(Oz et al., 2025). This suggests that beyond technical fixes, there is a need for education, change management, and incremental successes to convince stakeholders of blockchain's value in ESG contexts.

**Emerging Trends, Opportunities, and Future Outlook in ESG Reporting:**

Given the dynamic nature of both blockchain technology and ESG imperatives, several trends

and future opportunities are shaping how blockchain might play an expanded role in sustainability reporting. A notable trend is the convergence of financial and ESG reporting in a more integrated form. Initiatives are underway to unify financial and non-financial reporting standards (e.g., the International Integrated Reporting Framework and the upcoming ISSB standards for sustainability). Blockchain could serve as the integrative infrastructure, linking financial and ESG data. While this is forward-looking, we see early signals: as mentioned, Accountancy Europe's paper on interconnected reporting suggests leveraging new technologies for unified reporting(Bakarich et al., 2020), and blockchain fits well into that vision.In 2023, the European Company Law journal discussion by Seretakis & Mezzanotte implies regulators are interested in blockchain to manage value chain information and data quality issues in sustainability reporting (Seretakis & Mezzanotte, 2023). The synergy of blockchain with Internet of Things (IoT) and Artificial Intelligence (AI) is a recurrent theme for the future. The Circle of Sustainable Europe (2025) article explicitly mentions that blockchain networks can integrate with IoT sensors for real-time data and AI for enhancing CSR efforts (Bassoli, 2025). With blockchain, ESG performance can be turned into digital assets, as discussed (carbon credits, renewable energy certificates, etc.). We might see corporate ESG profiles or scores as digital tokens that update based on blockchain. Looking ahead, the role of blockchain in ESG reporting is poised to grow as companies, regulators, and society place more emphasis on credible sustainability information. Many researchers conclude that blockchain could significantly improve the quality and trustworthiness of ESG data, but they also caution that its success depends on broad cooperation and addressing current limitations (Cai, 2019) (Thies et al., 2023). The trends indicate that blockchain will likely become one of several digital tools (alongside big data analytics, AI, and cloud platforms) that together form the infrastructure for "ESG 2.0" – a more reliable, tech-enabled approach to sustainability accountability. Importantly, the future may also see an alignment between financial and ESG data flows: as integrated reporting takes hold, blockchain might be the common fabric ensuring that whether a metric is financial or non-financial, if it's material, it is recorded and reported with equal rigor and assurance. This holistic use of blockchain can ultimately contribute to a more sustainable economy by holding companies accountable in near real-time and by enabling data-driven strategies to improve ESG outcomes.

## 5. Conclusion:

Blockchain technology stands at the intersection of innovation in both financial accounting and ESG reporting, offering a powerful toolset to enhance transparency, trust, and efficiency. The literature from 2017 to 2024 paints a picture of substantial potential: in financial accounting, blockchain promises to reinforce the integrity of bookkeeping through triple-entry accounting, automate and continuous audit processes, and improve the reliability of financial information (Cai, 2019) (Thies et al., 2023). In ESG reporting, blockchain can transform sustainability disclosures by

providing immutable evidence for environmental and social claims, enabling traceability across complex supply chains, and elevating stakeholder trust in corporate responsibility efforts (Seretakis & Mezzanotte, 2023) (Bakarich et al., 2020). Both domains share common drivers for blockchain adoption – a need for better data integrity and stakeholder assurance – and the technology's core attributes (decentralization, immutability, real-time sharing) directly address these needs.However, the adoption journey is tempered by significant challenges. Researchers and practitioners alike acknowledge that technical barriers (scalability, integration, energy consumption) and organizational hurdles (regulatory uncertainty, change resistance, skill gaps) must be overcome before blockchain's benefits can be fully realized in routine practice(Prokopenko et al., 2024)(Oz et al., 2025). As of 2024, real-world implementations are mostly in pilot or niche applications, and much of the academic discussion remains theoretical or exploratory. Financial accounting has seen cautious steps – for example, in crypto asset accounting and inter-company ledgers – but no widespread replacement of traditional accounting systems yet. ESG reporting has fertile ground for blockchain, given its relative infancy and need for credibility, yet it also faces the complexity of involving multiple actors and data types. The current state of play suggests that blockchain is an evolving complement to existing processes, rather than a wholesale substitute: companies might use blockchain for certain transactions or specific ESG metrics while keeping conventional systems for others. Despite these hurdles, the trajectory indicated by current trends and future opportunities is largely positive. The continuous refinement of blockchain technology (e.g., more energy-efficient consensus algorithms, better interoperability) is addressing some technical concerns. Simultaneously, there is a clear movement toward digitalization and standardization in both financial and sustainability reporting (such as XBRL tagging for reports and unified global standards for ESG disclosures), which dovetails with blockchain's strengths. As standard setters and regulators increasingly engage with blockchain concepts, we can anticipate more guidance and possibly mandates that validate blockchain's role (for instance, considering blockchain records as acceptable audit evidence or encouraging blockchain-based compliance reporting). The literature highlights calls for further research and experimentation – which are likely to be answered in the coming years – including practical case studies of triple-entry accounting, development of industry-wide blockchain platforms for ESG, and cross-disciplinary approaches combining blockchain with AI and IoT for smarter reporting systems (Bassoli, 2025)(Pimentel & Boulianne, 2020)Importantly, a balanced perspective is essential. Blockchain is not a cure-all for the issues in accounting and ESG reporting, but it can be a catalyst for much-needed improvements in data governance and assurance. It shifts some paradigms: from trusting centralized authorities to trusting decentralized protocols, from periodic checks to continuous verification, and from opaque reporting to transparent, auditable disclosures. These shifts align well with the broader evolution in corporate reporting – one that

increasingly values real-time information, stakeholder inclusivity, and accountability for not just financial performance but also social and environmental impact.

In conclusion, the application of blockchain in financial accounting and ESG reporting is a dynamic frontier at the nexus of technology and accounting innovation. Current literature and early applications show that when properly implemented, blockchain can enhance the credibility, timeliness, and comprehensiveness of information that companies report to stakeholders (Prokopenko et al., 2024)(Bakarich et al., 2020). It can reduce fraud and errors in financial records, enable new forms of assurance, and combat greenwashing in sustainability claims. Yet, realizing these benefits widely will require overcoming present challenges through collaboration between technologists, accountants, standard-setters, and policymakers. The future likely holds a gradual but steady integration of blockchain into the fabric of corporate reporting, where financial statements and ESG reports alike could be underpinned by decentralized, trustworthy data systems. As businesses continue to experiment and share knowledge, and as stakeholders increasingly demand high-quality information, blockchain's role is poised to expand, driving both fields toward greater integrity and transparency. Ultimately, the literature suggests a cautiously optimistic outlook: blockchain is set to be a key enabler in building accounting and reporting systems that are fit for the complexities of the 21st century – systems that ensure not only that the books balance, but also that corporate impacts on society and the environment are faithfully represented and responsibly managed.

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