

Technological Innovation and Sustainable Financial Reporting

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ABSTRACT: This research focuses on the revolutionary impact of various modern technologies namely, blockchain, artificial intelligence, big data analytics, and XBRL on the sustainable financial reporting scenario in parts of the world that are just starting to be awakened financially, like Nigeria where there are also global regulations such as the European Union's CSRD and the ISSB frameworks. The research is based on stakeholder theory, legitimacy theory, and the Technology Acceptance Model. Thus it delves into the core of problems that are characteristic of the traditional way of reporting and that include data silos, manual errors, greenwashing risks, and inconsistent ESG disclosures that are causing a lack of transparency and preventing alignment with the SDGs. The research provides a thorough literature review on how the technologies mentioned above can perform different functions such as automating the collection of ESG data, providing immutability through distributed ledgers, creating predictive sustainability analytics, and conducting integrated audits, thus increasing the trust of stakeholders, compliance with regulations, and the obtaining of long-term value. Although there are still interoperability problems, cybersecurity weaknesses, a lack of skilled personnel, and expensive implementations in areas with limited infrastructure, the best practices of world leaders have shown measurable advantages, such as a decrease in capital costs by 10-15% and the availability of real-time dashboards for double materiality assessments. The results emphasize the role of technology in reconciling financial opacity with accountability and providing regulators with actionable recommendations such as obligatory XBRL-ESG tagging, public-private training partnerships, and hybrid assurance models as a priority. From a theoretical perspective, it broadens adoption dynamics; from a practical standpoint, it directs fintechs towards building resilient, transparent reporting ecosystems.

KEYWORDS: Technological innovation, sustainable financial reporting, ESG disclosures, blockchain integration.

1. INTRODUCTION

It is observed that the financial reporting scenario is undergoing a change. The primary causes of this transition are the fast-paced technology advancements and the urgent need for ecological concern. Technological inventions like cloud computing, AI, blockchain, and big data have already penetrated every nook and cranny of the global economy, thus, significantly altering the operational processes and the stakeholders' expectations (Vasarhelyi, Kogan, & Tuttle, 2015; Appelbaum, Kogan, Vasarhelyi, & Yan, 2017). On the other hand, the demand for reporting that is both eco-friendly and ethically sound has emerged as one of the most important matters of the day, which regulation authorities have backed to such an extent that practically all firms are forced to comply. Among the supports is the European Union's Corporate Sustainability Reporting Directive (CSRD) and the International Sustainability Standards Board's (ISSB) sustainability disclosure frameworks which both demand that organizations synchronize their financial narratives with the tripartite (environmental, social, and governance ESG) disclosures (IFRS Foundation, 2023; European Commission, 2022). Thus, the combination of high-tech and eco-friendliness is a strong driver of the financial reporting process, and the attainment of the highest standards of transparency, accuracy, and accountability, among others, remains one of the main results (Schaltegger, Burritt, & Petersen, 2017). The truth is that the problems that the companies face while traveling this road are quite serious and hence there is an urgent need for a systematic scholarly inquiry into how technological innovations can support the adoption of sustainable financial reporting to continue.

The research is anchored on the assertion that there is still a gap between mature financial reporting methods and the varied sustainability needs in a world ruled by technology. Professional financial reporting that is based on historical cost accounting and periodical disclosures does not depict the interaction of non-financial metrics like carbon footprints, biodiversity impacts, and social equity, which are considered very important by the stakeholders and thus need to be captured in the financial reports (Gray, 2010). The difficulty is aggravated by issues like data partitioning, cumbersome manual work that is highly prone to mistakes, and poor

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connectivity across the various platforms, thus leading to the issuing of ESG that is divided and untrustworthy to investors and regulators alike. A recent study conducted by the Global Reporting Initiative has shown that a large percentage of multinational corporations constantly face the problem of having to prepare non-financial data that is consistent across the board, verifiable and useful for making decisions, thus increasing their risk of being accused of greenwashing or getting penalized by the regulators (GRI, 2023). Even in the case of countries such as Nigeria that are still developing, where the issues around the expansion of the fintech sector are intertwined with the changes in sustainability regulations established by the Financial Reporting Council of Nigeria (FRCN), these difficulties are made even harder by the lack of good infrastructure, hacking risks, and the inability to do digital reporting on a large scale (Iyoha & Oyerinde, 2010). Hence, the continuous use of technology that lacks the power to support innovative ideas, leads to an inefficient system, creates a lack of trust in the markets, and slows down achieving the Sustainable Development Goals (SDGs), particularly SDG 9 (Industry, Innovation and Infrastructure) and SDG 12 (Responsible Consumption and Production) (United Nations, 2015).

Through technological innovation, the overall research goal is to critically assess the role of innovation in the financial sector that is focal on sustainability, attempting to clarify and give light to the different aspects of the concerned issues, such as the increasing of transparency during the engagement of stakeholders and creating of the last value in the long term. In particular, the research wants to point out the ways by which new technologies can enable ESG data collection automation, guarantee data quality through unchangeable infrastructures, and use machine learning for predicting sustainability assessments (Kiron et al, 2017). The study relies on the stakeholder theory, legitimacy theory, and the technology acceptance model (TAM) to come up with actionable insights for policymakers, regulators, and corporate practitioners, especially in those technology-intensive areas like Nigeria's developing digital economy. Eventually, the research project aims at facilitating the transition of financial reporting from being purely a compliance-driven practice to a sustainability-oriented accountability process that is comprehensive.

2. LITERATURE REVIEW

The literature on technological innovation and sustainable financial reporting has revealed a constant interrelation between the past approaches, the present-day requirements of sustainability, and the advancements in technology. This wide-ranging analysis encompasses primary issues, beginning with the fundamental methods of financial reporting, moving through sustainability practices, and eventually arriving at the points where technology has changed and the difficulties in auditing.

Financial Reporting Overview

Corporate transparency largely relies on the aspect of financial reporting, which is the organized release of a company's financial status, profitability, and liquidity through standard documents like the balance sheet, income statement, and cash flow statement. Mostly, financial reporting is done through accrual-based accounting principles according to the frameworks of Generally Accepted Accounting Principles (GAAP) and International Financial Reporting Standards (IFRS). Traditional financial reporting places much emphasis on historical cost valuation, ratio analysis (which includes analysis of liquidity, profitability, and leverage), and vertical and horizontal analyses to assist stakeholders in their decision-making (IASB, 2023). Such mechanisms are still very effective for recording monetary transactions, but they also have their own limitations, such as the delay caused by manual data processing, the risk of human error, and the limited real-time interoperability across systems. Research has shown that the conventional reporting cycles which are frequently longer than six business days for month-end closures have a limiting effect on the agility of organizations in the volatile markets, thus the simultaneous call to upgrade the financial reporting infrastructures (Vasarhelyi, Kogan, & Tuttle, 2015).

Sustainable Financial Reporting

Sustainability financial reporting does not only mean financial metrics but rather that the environmental, social, and governance (ESG) dimensions have been integrated and corporate disclosures are made in compliance with the world's regulatory bodies, for instance, the European Union's Corporate Sustainability Reporting Directive (CSRD) and the standards issued by the International Sustainability Standards Board (ISSB) (European Commission, 2022; IFRS Foundation, 2023). This change is based on legitimacy theory and stakeholder theory; thus, it proposes the financial and non-financial reporting methods that measure non-financial externalities, such as methane and carbon dioxide emissions, loss of species and habitats, and human rights impacts, against financial results enhancing accountability and reducing the chance of greenwashing (Schaltegger, Burritt, & Petersen, 2017). Yet, the academic exchanges point out existing difficulties, stating that more than 60% of the world's largest companies have problems getting reliable and comparable ESG data, a problem that is particularly serious in new markets that have weak regulatory coordination and poor infrastructures (GRI, 2023). The Global Reporting Initiative (GRI) and other frameworks put materiality assessments at the core of their transparency and sustainability discourse, thus, indirectly making a huge impact on the SDGs, particularly SDG 12 on responsible consumption and production (United Nations, 2015).

Technological Innovation in Financial Reporting

Technological advancements such as blockchain, AI, big data analytics, and XBRL have revolutionized financial reporting by automatically collating data, improving data quality, and providing predictive insights. The DLT of blockchain offers secure and

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transparent transactions along with the ability to trace ESG data through smart contracts, which, as a result, greatly diminishes the time spent on reconciliation and the occurrence of information asymmetry (Kiron et al., 2017). In the same way, AI and machine learning have opened up the possibilities for fraud detection, the use of predictive models, and the computational analysis of sustainability reports. To add to this, big data analytics have been instrumental in the creation of real-time visual dashboards that support integrated reporting. Despite the ongoing issues regarding cybersecurity and data privacy, the Technology Acceptance Model (TAM) has always been the main theory explaining why organizations decide to adopt these new technologies. TAM states that perceived usefulness and ease of use play a major role in the acceptance of technology (Davis, 1989). XBRL, in environments led by fintech, assists in the comparison of financial statements and regulatory compliance by transforming the financial statements that are certified into a standard machine-readable format.

Auditing of Technology-Based Financial Reports

Innovative methodologies for the validation of algorithmic processes, data provenance, and ESG-related claims, to be applied within the complex digital ecosystems, are required for the auditing of technology-driven financial reports. Traditional audit trails are becoming less important as the models of continuous auditing, which are supported by AI-based tools and RPA, are gaining ground and allowing the verification of transactions recorded on the blockchain platforms (AICPA, 2020) to be done in real-time. However, the issues are still there, mainly due to the auditors' lack of competence in the areas of AI, ethics, and blockchain, with empirical research showing that the auditors often cannot fully validate the smart contract outputs independently (PCAOB, 2022). This has led to the establishment of hybrid audit frameworks that combine substantive testing with advanced analytics as a practice, especially in sustainable reporting contexts where auditors provide integrated assurance on the financial implications of sustainability risks and the sustainability implications of financial performance, thereby enhancing stakeholder trust.

3. METHODOLOGY

In the case of modern organizations, which are situated at the intersection of economic viability and environmental responsibility, sustainable financial reporting is non-negotiable. Technology adoption is not just a facilitator in the process but also a contributor to the precision of the information and the potentiality of real-time reporting. On the other hand, the fusion of technology and sustainability goals is not without difficulties, and such a situation will call for the deployment of sound strategies to mitigate the challenges.

Necessity of Sustainable Financial Reporting

Sustainable financial reporting is a method that combines ESG metrics with the traditional financial statements standards to overcome their shortcomings. Environmental, social, and governance aspects (ESG) are being the major guiding factors in such a financial reporting system, thus making it a good fit with the current global and regional regulatory frameworks by the ISSB and the CSRD which both require integrated reporting of the long-term value (European Commission, 2022; IFRS Foundation, 2023). Companies that implement this type of reporting not only become more resilient against the risks of the litigation and sanctions relating to greenwashing but also gain the trust of investors. Research has shown that firms which have been adopting the ESG disclosures into their reporting are enjoying a 10-15% cost of capital reduction, which is mainly because the investors see them more transparent and less risky (Friede, Busch, & Bassen, 2015). In the case of Nigeria, an emerging market with the simultaneous rise of fintech and greater climate risks, sustainable reporting serves to comply with FRCN requirements and to support the attainment of the SDGs, particularly SDG 13 on climate action (United Nations, 2015).

Relevance of Technological Adoption in Financial Reporting

The modernization of financial reporting heavily relies on cutting-edge technological innovations such as blockchain, artificial intelligence, and big data analytics, especially in the areas of automatic ESG data collection and credible audit trails. One of the main advantages of the blockchain technology is that it can make sustainability disclosures more reliable by the means of distributed ledger systems and smart contracts, which secure data immutability and traceability, thereby greatly minimizing reconciliation errors and information asymmetry (Kiron et al., 2017). Predictive analytics and scenario modeling allow the artificial intelligence to forecast the ESG. At the same time, the XBRL (extensible Business Reporting Language) software makes the reports machine-readable, thus more comparable and easier for the regulators to supervise. The TAM (Technology Acceptance Model) is a theoretical framework for the understanding of the adoption of these technologies that focuses on perceived usefulness and ease of use as the main factors of organizational acceptance and integration (Davis, 1989). All these innovations together ensure timely stakeholder engagement and regulatory responsiveness in the rapidly changing worlds of fintech ecosystems.

Challenges of Sustainable Financial Reporting with Technology Adoption

There is no doubt that the adoption of technology for sustainable financial reporting is a process that entails a wide range of challenges, but at the same time it is a process with great potential for transformation. The problems of interoperability of data between legacy financial systems and different ESG databases often lead to the issuance of disclosures that are not only inconsistent but also incomplete, thereby losing the quality of comparability and assurance of the disclosures. Besides, the uncertainties of data security risks associated with blockchain and AI technologies not only make the situation much worse, but also result in the attackers

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being able to take advantage of the vulnerability and steal sensitive and valuable financial and sustainability data (Vasarhelyi, Kogan, & Tuttle, 2015). Besides the high implementation costs and lack of technical expertise, the lack of auditors' and finance professionals' skills is another factor that is limiting the effective adoption of the technology, particularly in developing countries where poor infrastructure and regulatory inconsistencies are prevalent. The use of AI in ESG scoring is a double-edged sword which comes with ethical issues such as risk of algorithmic bias and the perplexing question of how to ensure the “double materiality” around the financial implications of sustainability risks and the sustainability impacts of financial activities that need simultaneous evaluation is a challenging task. All these difficulties highlight the need for solid governance frameworks that will stop the excessive reliance on new technologies without effective controls and professional supervision being put in place (Schaltegger, Burritt, & Petersen, 2017).

4. DISCUSSION OF FINDINGS

The best global practices in sustainable financial reporting with the use of technology stress the importance of complying with the same reporting frameworks, having integrated data systems and reliable assurance mechanisms in place. By doing this, firms will be able to integrate ESG (Environmental, Social and Governance) disclosures with financial reporting in the process using cutting-edge technologies such as AI and blockchain. The countries and companies that are at the forefront of the industry provide various models that allow to simultaneously meet legal requirements, keep the information open, and create strategic value.

Adoption of Global Standards

Organizations around the globe are putting interoperability between the main corporate sustainability reporting frameworks at the top of their list of priorities so they can have consistency, comparability, and credibility in their corporate disclosures. The standards of the International Sustainability Standards Board (ISSB) and particularly the IFRS S1 on general sustainability-related disclosures and the IFRS S2 on climate-related disclosures—have set a global baseline for transparency and relevance in the capital markets that is investor-focused and has already been approved by some of the world's largest institutional investors including Norges Bank Investment Management (IFRS Foundation, 2023). Along with these, the Global Reporting Initiative (GRI) encourages impact reporting aligned with the United Nations Sustainable Development Goals (SDGs) and allows the companies to determine and report on their economic, environmental, and social impacts in a more detailed manner (GRI, 2023). The European Union's Corporate Sustainability Reporting Directive (CSRD) is the regional-level legislator that strengthens the reporting rigor through the requirement of double materiality assessments, which not only evaluate the financial repercussions of sustainability risks for companies but also measure the effects of corporate activities on the environment and society (European Commission, 2022). The leading companies are using the Task Force on Climate-related Financial Disclosures (TCFD) to merge these frameworks together and are putting governance structures, strategic responses, risk management processes, and performance metrics into the annual reports to improve transparency and allow comparison across companies (TCFD, 2017).

Technology Integration Strategies

Best-practice organizations are using cutting-edge technologies to create data flows of ESG data that are automatic, reliable, and scalable through blockchain, which is applied to data integrity by using non-editable distributed ledgers and proving it with pilot projects showing that sustainability data over and through complicated supply chains is tamper-proof (Kiron, Unruh, Kruschwitz, Reeves, Rubel, & Meyer zum Felde, 2017). The ai-powered platforms are opening the gate for sustainability reporting by bringing in to play the predictive analytics and natural language processing technologies in the domains of materiality assessments, scenario analysis, and regulatory compliance. These powers that enable the structured tagging and the real-time disclosure updates are also compatible with the digital reporting requirements such as the European Single Electronic Format (ESEF). On the other hand, through big data analytics ESG dashboards are already being generated in real time, and at the same time, eXtensible Business Reporting Language (XBRL) is linking the financial and environmental data in a way that is readable by machines and supporting the integration of reporting principles which have been advocated by the International Integrated Reporting Council (IIRC) (Davis, 1989).

Assurance and Stakeholder Engagement

Independent verification of sustainability reports by reliable third parties has become a common practice among the world's largest companies. A greater percentage of them are receiving third-party confirmation of ESG (Environmental, Social, and Governance) disclosures to the end of creating a sustainable financial reporting system that all stakeholders can trust (IFAC, 2022). In the future, audit firms will increasingly rely on technologies such as robotic process automation (RPA), data analytics, and blockchain forensics for two-way monitoring of huge amounts of sustainability data (both structured and unstructured). These actions are consistent with the evolving Public Company Accounting Oversight Board (PCAOB) directions on auditing in tech-rich environments, especially for systems with automated controls and sophisticated analytics (PCAOB, 2022). To give assurance, the very best among companies get public participation mostly through partnership initiatives like industry consortia and public disclosure platforms such as CDP, which gives access to and offers tools for standardized climate data that is, in fact, a strong and implicit way of promoting

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transparency/accountability and trust, while at the same time reducing the risk of greenwashing (Schaltegger, Burritt, & Petersen, 2017).

5. CONCLUSIONS AND RECOMMENDATIONS

The coalescence of fiscal statements and tech in an eco-friendly manner is now a must for the contemporary companies that are after being financially robust and at the same time handling the environmental concerns. This paper emphasizes the transition from pre-modern times financial disclosures to all-inclusive ESG-based stories, which are facilitated by modern tools such as blockchain and AI, at the same time dealing with the existing problems and following the global standards for best practices.

Technological advancements have tackled the major problems in the financial reporting system by making the whole process of ESG data collection automatic, guaranteeing the accuracy of information through distributed ledgers, and allowing companies to use predictive analytics for gaining insights into sustainability that are forward-looking. Sustainable reporting has become a necessity for the companies that want to comply with the new regulations, manage risks, and keep the trust of their customers, especially in the context of the ISSB and CSRD frameworks. Nonetheless, the innovations such as Deloitte's blockchain pilots or AI-assisted materiality assessments globally, show the way by establishing the accepted integration to unlock a multitude of quantifiable advantages which would include error reduction in reconciliation and increase of investor confidence, thereby facilitating the realization of sustainable development goals in the fintech-savvy nations like Nigeria.

In a theoretical perspective, the study has implications for both stakeholder and legitimacy theories since it shows that technology is the mediator between the accountability gap of financial opacity and sustainable value creation. From a practical point of view, it proves the Technology Acceptance Model's contribution in the dynamics of adoption, giving fintech companies and regulators concrete ways to make integrated reporting work during digital disruption.

The regulators operating in Nigeria and other similar markets should insist on the XBRL-ESG marking in accordance with the FRCN regulations and utilize public-private partnerships to finance the AI-blockchain education. The executives must adopt mixed assurance approaches and will thus have to allocate resources for RPA to perform constant audits and for the creation of cross-platform data lakes to eliminate the isolation of data. The auditors will have to receive training in blockchain forensics and AI ethics in such a way that they will be capable of effectively double verifying materiality. It is proposed that further research conducts empirical testing of the proposed frameworks using case studies in developing countries with the consideration of the initial potential of quantum computing for hyper-secure reporting. To sum up, technology is the main factor driving the change of sustainable financial reporting. The market has to be non-festive in terms of client actions through resilient, transparent markets creation. Reporting public and corporate activities in a manner that shows transparency, probity and accountability remains the hallmark of good corporate and public governance (See Kalu et. al (2024).

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