LEADER: International Journal of Business Management

RESEARCH ARTICLE

A Study on the Impact of FinTech on Green Finance and ESG Investments

Shrutika R. Thakkar[1]

[1]GSFC University, Vadodara, Gujarat.

ABSTRACT:

This study investigates the transformative role of Financial Technology (FinTech) in bridging the global "green finance gap" and enhancing ESG performance. As traditional financial systems struggle with systemic inefficiencies, low transparency, and high transaction costs, FinTech emerges as a critical enabler of sustainable development. By leveraging digital innovations—including blockchain, artificial intelligence (AI), and decentralized finance (DeFi)—FinTech facilitates the mobilization of capital for green initiatives while reducing information asymmetry between firms and investors. Drawing on empirical evidence from BRICS and E7 economies, the research highlights how technology strengthens the relationship between ESG disclosure and actual carbon performance. Blockchain is found to enhance the traceability of green bonds and carbon credits, while AI provides dynamic, real-time ESG assessments that mitigate the risk of greenwashing. However, the study also critically examines significant barriers to adoption, such as regulatory gaps, data fragmentation, and the digital divide. The findings suggest that a multi-stakeholder approach—prioritizing standardized reporting and inclusive digital infrastructure—is essential to fully harness FinTech's potential. This paper contributes a multidisciplinary framework for aligning technological innovation with global carbon neutrality and sustainability objectives.

Keywords:

FinTech, Green Finance, ESG Performance, Sustainable Development, Blockchain, Carbon Performance, Information Asymmetry

Article History
Received: 01 November 2025
Revised: 30 November 2025
Accepted: 04 December 2025

How to cite this article:
Thakkar, S. R. (2025). A Study on the Impact of FinTech on Green Finance and ESG Investments. *LEADER: International Journal of Business Management*. 13(4), 193-205.

Correspondence: Shrutika R. Thakkar, GSFC University, Vadodara.
(email – shrutika.thakkar@gsfcuniversity.ac.in)

1. Introduction

The global transition toward a low-carbon, environmentally friendly economy has necessitated a massive mobilization of capital toward green initiatives. While the 2016 Paris Agreement set clear climate goals, a significant "green finance gap" persists, with global financial flows falling short of the estimated USD 3 trillion annual requirement (Albert et al., 2025). Traditional financial systems have largely failed to meet this challenge due to systemic inefficiencies, including low transparency, high transaction costs, and a failure to adequately integrate Environmental, Social, and Governance (ESG) considerations into core decision-making (Galeone et al., 2024). In emerging economies, such as the E7 and BRICS nations, these barriers are compounded by devastating fiscal burdens and a lack of economic resilience, which hinder the acquisition of energy-efficient technologies (Liu et al., 2022; Udeagha & Muchapondwa, 2023).

In response, Financial Technology (FinTech) has emerged as a disruptive force capable of addressing these core problems. FinTech—defined as technology-enabled innovation in financial services—offers a fundamental shift toward decentralization, transparency, and automation (Udeagha & Muchapondwa, 2023). By leveraging digital tools such as blockchain, artificial intelligence (AI), and big data analytics, FinTech innovations have the potential to re-engineer the financial system's capacity to meet sustainability demands (Galeone et al., 2024). Empirical evidence suggests that FinTech acts as an "accelerator" of sustainable economic growth, specifically strengthening the positive relationship between ESG disclosure and actual corporate carbon performance (Albert et al., 2025).

The convergence of FinTech and ESG investing is particularly transformative because it mitigates the "principal-agent" problem and reduces information asymmetry (Gao et al., 2024). Traditional finance is often plagued by "greenwashing," where firms disclose misleading environmental data; however, FinTech improves the credibility and traceability of ESG information, ensuring that capital is allocated to truly sustainable enterprises (Albert et al., 2025; Gao et al., 2024). Furthermore, the adoption of FinTech is not merely a technical upgrade but is often driven by "social influence" and institutional pressure to align with global sustainability norms (Galeone et al., 2024).

This paper analyzes the revolutionary potential of FinTech and offers a thorough and critical analysis of how it is changing the landscape of green finance and ESG investing. By comparing the bureaucratic, centralized, and opaque aspects of traditional finance with the data-driven capabilities of digital innovation, this study examines both the obstacles to be addressed—such as regulatory gaps—and the transformative opportunities for future growth (Gao et al., 2024; Liu et al., 2022).
By answering the following important questions, this study seeks to explore the relationship between FinTech, green finance, and ESG investments:

- Which FinTech applications are most critical for enabling sustainable investments and green finance?
- In what ways do these applications improve the sustainable finance ecosystem's inclusion, efficiency, and transparency, particularly in developing regions?
- What are the biggest risks and obstacles to FinTech acceptance, such as the digital divide and the need for refined transaction systems?
- How will this convergence develop in the future, and what are the strategic ramifications for investors and legislators?

This study adds a synthesized, multidisciplinary viewpoint to the expanding corpus of literature on Green FinTech. Rather than a compartmentalized study of specific technologies, it offers a comprehensive view of the FinTech-Green Finance ecosystem. By highlighting causal links—such as how FinTech promotes "ambidextrous innovation" within firms—this research provides practical insights for stakeholders and lays out a clear course for future research (Gao et al., 2024).

2. Review of the Literature: Dissecting the FinTech-Green Finance Nexus

2.1 Defining Green Finance and Green FinTech's Scope.

"Green finance" (GFN) refers to specialized financial instruments, such as green bonds, green credits, and green insurance, designed to support eco-friendly projects involving clean technologies, climate-resilient infrastructure, and renewable energy (Udeagha & Muchapondwa, 2023). Its primary responsibility is to ensure that global capital flows align with sustainability objectives—specifically the United Nations Sustainable Development Goals (SDGs) and the Paris Agreement—by incorporating environmental, social, and governance (ESG) considerations into core financial decision-making (Albert et al., 2025; Liu et al., 2022). ESG criteria serve as a critical framework for investors to evaluate a company's long-term sustainability and non-financial performance, examining governance structures, social equity, and environmental footprint to mitigate long-term risks (Galeone et al., 2024).

The rapid development of FinTech—the application of innovative technologies to provide financial services—has led to the emergence of "Green FinTech" (GFT). Specifically, Green FinTech refers to technology-driven financial solutions that align capital allocation with environmental objectives, moving beyond traditional profit maximization to address ecological challenges (Galeone et al., 2024). Despite its rising importance, bibliometric analyses suggest that the field remains a "fragmented puzzle of concepts," where research often concentrates on "green" and "technology" components independently rather than as an integrated ecosystem (Galeone et al., 2024). However, current literature emphasizes that finance acts as the essential "bridge" connecting these two fields to achieve global carbon neutrality (Albert et al., 2025; Udeagha & Muchapondwa, 2023).

In large economies, particularly the BRICS and E7 nations, this concept has become highly strategic. For these regions, Green FinTech is not merely a technical upgrade but a vital necessity to overcome "financial mismatch"—a condition where capital is locked in high-polluting industries due to information asymmetry and lack of transparency (Gao et al., 2024; Liu et al., 2022). By leveraging digital platforms, Green FinTech reduces the "principal-agent" problem between firms and financial institutions, allowing for more precise monitoring of carbon performance and ensuring that green capital is allocated to truly sustainable enterprises (Albert et al., 2025; Gao et al., 2024).

2.2 FinTech Uses as Green Finance Facilitators

The primary FinTech applications that are increasing ESG investments and streamlining the flow of capital toward environmentally friendly projects are examined in this section. Within the digital finance ecosystem, technology acts as an "accelerator" of sustainable development by bridging the gap between available capital and green initiatives (Galeone et al., 2024). Each technology addresses a different structural weakness in the traditional banking system, particularly the high monitoring costs and "financial mismatch" often seen in emerging economies (Gao et al., 2024; Liu et al., 2022).

2.2.1 Blockchain Technology: Improving Traceability and Openness

A decentralized, unchangeable ledger called blockchain provides an impenetrable record of data and transactions. Its fundamental features—distributed consensus, immutability, and real-time verification—make it especially appropriate for data-intensive procedures and financial instruments that require a high degree of compliance (Galeone et al., 2024). One important use case is tokenization, or the digitization of green bonds and credits. Historically, the green finance market has struggled with high transaction costs and a lack of transparency, which often deters institutional investors; however, blockchain innovation directly addresses these barriers by lowering the cost of issuance and verification (Liu et al., 2022; Udeagha & Muchapondwa, 2023).

A key component of blockchain technology is the "smart contract," which can automate compliance by guaranteeing that money is only allocated to pre-approved sustainable projects, such as renewable energy infrastructure or energy-efficient technology (Galeone et al., 2024). This automation reduces the administrative burden and transaction costs that frequently hinder green investments in E7 economies (Liu et al., 2022). In addition to streamlining the procedure, this technology creates a permanent, publicly verifiable record of all transactions and sustainability metrics. For instance, the successful issuance of blockchain-based green bonds by major financial institutions like the European Investment Bank has demonstrated how technology can foster a more

reliable and effective market (Galeone et al., 2024).

Additionally, blockchain offers a transparent and safe framework for carbon credit trading system management. Because of its centralized, inefficient, and opaque management, the traditional carbon market has drawn criticism for problems like imprecise data recording and "double counting" of emissions reductions. By offering an immutable carbon credit ledger, blockchain ensures the authenticity and traceability of carbon offsets, which is crucial for nations like the BRICS to achieve their carbon neutrality targets (Udeagha & Muchapondwa, 2023).

Blockchain's main benefit in green finance goes beyond simple transparency; it acts as a direct technological deterrent to greenwashing. Greenwashing—the exaggeration of environmental benefits to attract capital—undermines investor confidence and leads to the misallocation of resources (Albert et al., 2025; Gao et al., 2024). By integrating blockchain with Internet of Things (IoT) sensors, sustainability claims are supported by verified, real-time data rather than subjective, self-reported estimates (Albert et al., 2025). This establishes a new causal chain: actual environmental data is entered into an unchangeable ledger, reducing information asymmetry, boosting investor confidence, and enabling more effective funding distribution to legitimate green projects (Gao et al., 2024). Instead of depending on inconsistent self-regulation, the integrity of the carbon and green bond markets is now enforced by the underlying technology (Galeone et al., 2024; Udeagha & Muchapondwa, 2023).

2.2.2 Artificial Intelligence (AI) and Big Data: Revolutionizing ESG Assessment

The systemic shortcomings of current ESG rating systems—which frequently suffer from human bias, methodological inconsistency, and a lack of transparency—are being fundamentally transformed by Artificial Intelligence (AI), specifically through Machine Learning (ML) and Natural Language Processing (NLP) (Gao et al., 2024). By processing large and varied datasets at speeds unattainable by conventional analysts, AI-driven ESG scoring models can standardize evaluations and offer real-time sustainability insights (Galeone et al., 2024). This technological shift is essential because traditional "static" ESG disclosures often fail to reflect a firm's true environmental impact, leading to a "green finance gap" where capital is misallocated (Albert et al., 2025; Liu et al., 2022).

One of the most critical functions of AI is its capacity to synthesize data from a vast array of heterogeneous sources. Beyond structured corporate financial reports, AI can ingest unstructured data such as global news articles, social media sentiment, and independent NGO reports (Galeone et al., 2024). Furthermore, AI can integrate high-frequency data sources, such as IoT sensors to track carbon emissions in real-time or satellite imagery to monitor deforestation and land use (Albert et al., 2025). This multi-source data aggregation directly addresses the issue of "information asymmetry," where management possesses more information about a firm's environmental footprint than external investors, a common challenge in BRICS and E7 economies (Gao et al., 2024; Liu et al., 2022).

AI is also a vital tool for detecting anomalies and preventing greenwashing—the practice of making misleading environmental claims to gain a competitive advantage or lower cost of capital (Albert et al., 2025; Gao et al., 2024). AI algorithms can be trained to identify internal discrepancies in corporate reports, cross-referencing self-reported metrics with third-party data to flag exaggerated claims. Empirical evidence suggests that FinTech adoption has a significant "moderating effect," strengthening the positive relationship between high-quality ESG disclosure and actual carbon performance (Albert et al., 2025). By using transparent, consistent scoring guidelines, AI reduces the "rating divergence" between agencies, thereby increasing the objective credibility of ESG ratings (Galeone et al., 2024).

The evolution of AI in green finance extends beyond static assessment into predictive modeling. By utilizing big data analytics, investors and businesses can anticipate future environmental risks and make proactive strategic adjustments (Galeone et al., 2024). This enables a shift from evaluating historical, "lagging" indicators to foreseeing "leading" risks, such as potential climate-related financial stress or supply chain vulnerabilities (Albert et al., 2025). Furthermore,

FinTech-driven AI models promote "ambidextrous innovation" within firms, encouraging them to balance current environmental efficiencies with long-term green exploration (Gao et al., 2024). Ultimately, AI introduces a layer of data-driven enforcement that establishes a new paradigm of accountability, ensuring that corporate sustainability claims are objectively verifiable and performance-based (Albert et al., 2025; Udeagha & Muchapondwa, 2023).

2.2.3 Decentralized Finance (DeFi) and Crowdfunding: Democratizing Capital Mobilization

By avoiding conventional financial middlemen, Decentralized Finance (DeFi) and crowdfunding platforms are significantly reducing the entry barriers for green investments. This disruption increases access to a larger pool of investors and business owners by democratizing capital mobilization and addressing the "financial resource deficiency" often found in E7 economies (Liu et al., 2022). By tokenizing green assets, DeFi protocols facilitate inclusive green investments and allow for the fractional ownership of large-scale projects, such as renewable energy infrastructure, which were historically accessible only to institutional investors (Galeone et al., 2024; Liu et al., 2022). These platforms lower minimum investment requirements, enabling small and medium-sized businesses (SMEs) and individual investors to participate in sustainable projects that were previously unattainable due to high capital intensity (Galeone et al., 2024).

In a similar vein, crowdfunding platforms offer a mechanism to aggregate modest donations or investments from a global audience. FinTech serves as a primary driver for democratizing access to capital and promoting financial inclusion, as evidenced by its ability to facilitate "green growth" through the funding of decentralized projects like solar micro-grids in underserved communities (Liu et al., 2022; Udeagha & Muchapondwa, 2023). These technologies have an impact that goes beyond simple capital mobilization; they directly address the UN Sustainable Development Goals (SDGs)—particularly SDG-7 (Affordable and Clean Energy)—and the social ("S") and governance ("G") pillars of ESG (Galeone et al., 2024; Liu et al., 2022).

The adoption of these decentralized platforms is often influenced by "social influence" and "facilitating conditions," as explained by the Unified Theory of Acceptance and Use of Technology (UTAUT) (Galeone et al., 2024). When financial institutions and communities perceive that digital tools make green investing easier and more socially acceptable, the rate of adoption increases, thereby enhancing the overall energy efficiency of the region (Galeone et al., 2024; Liu et al., 2022). Furthermore, these platforms facilitate greater engagement in sustainable economic activities by offering financial services to underserved or previously unbanked populations, establishing a direct causal link between inclusive green growth and digital financial inclusion (Udeagha & Muchapondwa, 2023). By reducing "fiscal burdens" through decentralized funding, FinTech ensures that the transition to a low-carbon economy is both technologically advanced and socially equitable (Liu et al., 2022; Udeagha & Muchapondwa, 2023).

Table 1: FinTech Applications in Green Finance: Opportunities and Challenges

Technology	Key Application	Benefits	Challenges
Blockchain	Green Bonds & Carbon Trading	Transparency, traceability, immutability, reduced transaction costs, enhanced investor trust, fraud mitigation	Regulatory gaps, scalability issues, high energy consumption for some platforms, lack of clear frameworks
Artificial Intelligence	ESG Analytics & Risk Modeling	Standardized, objective, and dynamic scoring, anomaly detection, automated compliance, improved predictive insights, scalability, reduced human bias	Algorithmic bias, data quality issues ("garbage-in-garbage-out"), regulatory uncertainty, data privacy concerns
Decentralized Finance (DeFi)	Inclusive Investment & Capital Democratization	Democratized access to capital, reduced intermediary fees, fractional ownership of assets, enhanced inclusivity for SMEs and retail investors	Regulatory uncertainty, technical vulnerabilities, fraud risks, scalability issues
Crowdfunding	Project-based Capital Mobilization	Enhanced financial inclusion, direct support for green projects, empowers eco-entrepreneurs and retail investors, revenue diversification	Fraud risk, information asymmetry, lack of robust regulatory oversight, potential for digital divide to worsen

2.3 Critical Analysis of Challenges and Risks

The disruptive potential of Fintech is counterbalanced by complex systemic issues that must be resolved to guarantee its long-term integrity, effectiveness, and alignment with global sustainability goals. These difficulties frequently reflect the "double-edged sword" nature of digital financial innovation; while technology offers the tools to bridge the green finance gap, it

simultaneously introduces new vectors for risk, exclusion, and market distortion (Galeone et al., 2024; Liu et al., 2022). A critical analysis of these risks reveals that the success of the Fintech-Green Finance nexus is not guaranteed by technical sophistication alone but is contingent upon the quality of data, the robustness of regulatory oversight, and the narrowing of the global digital divide (Albert et al., 2025; Udeagha & Muchapondwa, 2023).

2.3.1 The Persisting Threat of Greenwashing

Greenwashing—the practice of making deceptive or exaggerated claims about the environmental benefits of a product, service, or corporate strategy—remains a significant barrier to investor confidence and efficient capital allocation (Gao et al., 2024). Even with the advanced monitoring capabilities provided by blockchain and artificial intelligence, the "informational advantage" held by corporate managers often leads to moral hazard and the strategic manipulation of ESG disclosures (Albert et al., 2025). This is particularly prevalent in energy-intensive industries within the BRICS nations, where firms may use Fintech adoption as a "symbolic" signal of sustainability to lower their cost of capital without achieving substantive carbon reductions (Albert et al., 2025; Udeagha & Muchapondwa, 2023).

The fundamental issue of data fragmentation and the dearth of standardized reporting frameworks allows this risk to persist. Although technologies like IoT sensors and AI are capable of verifying physical emissions data, their efficacy is fundamentally dependent on the "garbage-in, garbage-out" principle (Galeone et al., 2024). For instance, if green bonds are tokenized on a blockchain without rigorous, independent third-party verification of the underlying assets, the ease of digital issuance may inadvertently create a market of "digital lemons"—assets that appear green on the ledger but fund carbon-intensive activities in reality (Galeone et al., 2024; Liu et al., 2022). This highlights a critical theoretical tension: while Fintech aims to reduce information asymmetry, it can also be used to create "high-tech greenwashing" where complex algorithms obscure the lack of genuine environmental performance (Gao et al., 2024). Consequently, the transition from "subjective disclosure" to "objective verification" requires a regulatory environment that mandates the integration of real-time environmental data into financial ledgers (Albert et al., 2025).

2.3.2 Regulatory Gaps and Compliance Hurdles

There is a sizable "regulatory gap" because the rapid pace of Fintech innovation consistently outpaces the development of oversight frameworks. This lag creates a "grey zone" where issues of money laundering, fraud, and systemic threats to financial stability can proliferate (Udeagha & Muchapondwa, 2023). In many E7 and BRICS economies, the absence of clear, uniform, and interoperable frameworks for digital green finance across jurisdictions hampers widespread institutional adoption (Liu et al., 2022; Udeagha & Muchapondwa, 2023). Without harmonized standards, green Fintech applications face significant "compliance hurdles" when operating across borders, as a tokenized green asset recognized in one region may be legally ambiguous in another (Galeone et al., 2024).

Furthermore, the "unified theory of acceptance and use of technology" (UTAUT) suggests that "facilitating conditions"—such as government support and clear legal definitions—are essential for the banking sector to fully embrace Green Fintech (Galeone et al., 2024). Currently, many financial regulators are only in the nascent stages of investigating frameworks for tokenized securities, and the lack of specific regulations for "Green Fintech" often leaves investors exposed to high levels of environmental and financial risk (Galeone et al., 2024; Udeagha & Muchapondwa, 2023). For policymakers, the challenge lies in drafting regulations that are robust enough to prevent market manipulation without being so rigid that they stifle the "ambidextrous innovation" necessary for the green transition (Gao et al., 2024). The lack of international coordination on what constitutes a "green" digital asset continues to lead to capital flight and inefficient resource allocation (Liu et al., 2022).

2.3.3 Data Fragmentation and Quality

The absence of standardized ESG reporting frameworks is a fundamental problem that hinders investors' ability to accurately evaluate corporate performance and causes severe comparability issues across different markets (Albert et al.,

2025). Data quality is the "Achilles' heel" of Green Fintech; even the most sophisticated AI and machine learning models can produce biased or incorrect outputs if they are trained on inconsistent or self-reported corporate data (Gao et al., 2024; Galeone et al., 2024). In many cases, ESG ratings from different agencies show a low correlation because they utilize different weightings and qualitative metrics, a problem that AI alone cannot solve without a standardized data foundation (Galeone et al., 2024).

The issue of "subjective methodologies" in ESG assessment is particularly acute in developing nations, where corporate transparency levels vary significantly (Udeagha & Muchapondwa, 2023). To ensure the effectiveness of AI and big data in ESG scoring, there is an urgent need for open-access data platforms and standardized collection protocols that move beyond "lagging" financial indicators to "leading" environmental metrics, such as real-time methane leaks or carbon intensity per unit of revenue (Albert et al., 2025). Without a steady base of trustworthy, granular, and timely data, the promise of objective, AI-driven analytics remains unfulfilled, and the risk of "automated bias" in credit allocation toward green projects remains high (Gao et al., 2024; Liu et al., 2022).

2.3.4 The Digital Divide and Financial Exclusion

The "digital divide" represents a significant moral and structural obstacle to the promise of inclusive green finance. While Fintech has the theoretical potential to democratize access to capital, the adoption of these technologies is often restricted to regions with advanced digital infrastructure and high levels of digital literacy (Liu et al., 2022). In many parts of the BRICS and E7 nations, limited access to stable internet, smartphones, and digital banking platforms means that the same innovations that empower urban investors may continue to exclude rural populations and small-scale farmers who are most vulnerable to climate change (Udeagha & Muchapondwa, 2023; Liu et al., 2022).

This divide creates a "stratified" green finance ecosystem where large, tech-savvy corporations benefit from lower costs of capital through Fintech platforms, while small and medium-sized enterprises (SMEs) are left behind due to a lack of "digital readiness" (Gao et al., 2024; Liu et al., 2022). Furthermore, the "social influence" factor in technology adoption implies that if Fintech is perceived as a tool only for the elite or highly regulated financial centers, it will fail to achieve the broad-based "financial inclusion" required for a just transition (Galeone et al., 2024). Addressing this requires stakeholders to invest not just in the "green" aspects of Fintech, but in the underlying digital infrastructure and education that ensure the advantages of the digital revolution are shared equitably (Udeagha & Muchapondwa, 2023). Without deliberate intervention, Fintech could paradoxically exacerbate existing socio-economic inequalities while attempting to solve environmental ones (Liu et al., 2022).

3. Significance, Implications, and Future Scope

3.1 The Significance of FinTech for Global Climate Goals

FinTech is essential to achieving global climate goals because of its unmatched capacity to scale and mobilize capital for green projects at a pace and efficiency that conventional systems cannot match (Udeagha & Muchapondwa, 2023). By tackling systemic inefficiencies—such as information asymmetry and high transaction costs—FinTech is not only closing the global "green finance gap" but also fundamentally changing how businesses interact with sustainability (Albert et al., 2025; Galeone et al., 2024). In energy-intensive industries, empirical evidence shows that FinTech adoption acts as a catalyst, strengthening the positive correlation between ESG disclosure and actual carbon performance (Albert et al., 2025).

Beyond mere regulatory compliance, businesses are now utilizing FinTech to gain a competitive advantage by enhancing their "ambidextrous innovation" capabilities—the ability to balance current green efficiencies with long-term sustainable exploration (Gao et al., 2024). This technological integration bolsters corporate resilience in volatile markets, as data-driven sustainability performance increasingly dictates a firm’s market valuation and its ability to attract low-cost green capital (Albert et al., 2025; Liu et al., 2022).

3.2 Implications for Key Stakeholders

The rise of Green FinTech has profound

implications for stakeholders across the financial ecosystem, redefining their strategic roles and operational capabilities.

- **For Investors:** FinTech provides the analytical infrastructure for better-informed decision-making. AI-driven robo-advisors and algorithmic trading strategies enable portfolio optimization based on real-time ESG data, effectively democratizing access to sustainable investing for a new generation of tech-savvy, budget-conscious investors (Galeone et al., 2024). Furthermore, the tokenization of green assets allows investors to engage in "fractional ownership" of large-scale renewable energy projects, creating a direct link between their capital and measurable environmental impact (Liu et al., 2022; Udeagha & Muchapondwa, 2023).

- **For Corporations:** FinTech integration raises accountability by increasing supply chain transparency and the credibility of environmental disclosures (Gao et al., 2024). By reducing the "principal-agent" problem through blockchain-verified data, corporations can build stronger trust with stakeholders and attract ESG-conscious investors (Albert et al., 2025). Additionally, the automation of ESG reporting through Big Data analytics significantly lowers operational costs and simplifies compliance with evolving global regulations (Galeone et al., 2024).

- **For Policymakers:** The shift toward Green FinTech necessitates a proactive and flexible regulatory approach. Policymakers face a dual challenge: they must foster an environment that encourages "green innovation" while simultaneously safeguarding the market against fraud, money laundering, and systemic risks associated with decentralized finance (Liu et al., 2022; Udeagha & Muchapondwa, 2023). To ensure the interoperability of digital green instruments, policy must focus on harmonizing international standards to prevent "regulatory arbitrage" across jurisdictions (Galeone et al., 2024).

3.3 Strategic Recommendations for Overcoming Challenges

A multi-stakeholder strategic response is required to ensure the responsible development and global adoption of Green FinTech.

- **Standardized ESG Reporting Frameworks:** The establishment of international ESG reporting standards is paramount. By enhancing data comparability, global standards would mitigate the root causes of greenwashing and provide a stable "data foundation" for AI-driven analytics to function accurately (Albert et al., 2025; Galeone et al., 2024).

- **Stronger Regulatory Oversight:** Legislators must fortify anti-greenwashing regulations and establish transparent, compatible frameworks for digital green products like DeFi protocols and tokenized green bonds. Providing legal certainty is essential for boosting institutional investor confidence, particularly in E7 economies where fiscal burdens remain high (Liu et al., 2022; Udeagha & Muchapondwa, 2023).

- **Ethical AI Practices and Bias Mitigation:** FinTech firms must ensure their AI models are transparent and "explainable" to prevent the reinforcement of historical biases in credit allocation. Routine audits of algorithms are necessary to ensure that "green" capital is distributed based on objective performance rather than biased datasets (Galeone et al., 2024; Gao et al., 2024).

- **Bridging the Digital Divide:** Especially in emerging markets, strategies for inclusive green growth must include targeted investments in digital literacy and infrastructure. Without addressing the "digital divide," the benefits of Green FinTech will remain concentrated in urban centers, potentially exacerbating socio-economic inequalities in the regions most affected by climate change (Liu et al., 2022; Udeagha & Muchapondwa, 2023).

Table 2: Strategic Recommendations for Stakeholders

Stakeholder	Recommendation	Rationale and Impact
Policymakers	Develop and enforce standardized ESG frameworks and robust regulatory oversight.	Mitigates greenwashing, enhances investor trust, and provides legal clarity for the market.
Corporations	Integrate FinTech-enabled ESG metrics and blockchain for supply chain traceability.	Improves corporate accountability and resilience, attracts ESG-conscious capital, and provides a competitive advantage.
Investors	Utilize AI-driven platforms and explore crowdfunding for direct, impact-based investments.	Enables more informed and efficient decision-making and creates a more direct connection to climate action and social impact
FinTech Developers	Build user-centric, transparent, and ethical platforms with verifiable data sources.	Fosters widespread adoption by building trust, mitigates algorithmic bias, and ensures the credibility of ESG claims.

3.4 Future Research Directions

The scholarly literature points out a number of important research gaps that require more study to fully understand the long-term impact of the digital-sustainability nexus. Future empirical research should concentrate on evaluating the ability of blockchain and AI to quantitatively mitigate greenwashing and information asymmetry (Albert et al., 2025; Gao et al., 2024). While current studies establish a correlation between FinTech and ESG performance, creating robust models to gauge the actual decline in false environmental claims following FinTech adoption remains a critical frontier (Gao et al., 2024). Researchers are encouraged to transition from analyzing "symbolic" ESG disclosures to "substantive" performance metrics verified through real-time technological tracking (Albert et al., 2025).

Another important area of research should be the creation of new regulatory models that can keep up with the rapid pace of FinTech innovation. Future studies could investigate the effectiveness of "regulatory sandboxes" in fostering green innovation while maintaining financial stability (Galeone et al., 2024; Udeagha & Muchapondwa, 2023). Given that different regions have vastly different regulatory and economic environments, cross-country comparative analyses—particularly comparing the BRICS nations with the E7 and G7 economies—would offer nuanced insights into how institutional quality influences the success of Green FinTech (Liu et al., 2022; Udeagha & Muchapondwa, 2023).

Furthermore, the literature suggests a need to explore the "moderating role" of external factors, such as environmental tax policies and government subsidies, on the relationship between FinTech and corporate green growth (Gao et al., 2024). Investigating whether these technologies are more effective in high-polluting versus non-high-polluting industries could lead to more targeted policy interventions (Albert et al., 2025).

Lastly, researchers should investigate the behavioral and psychological aspects that affect investor trust in FinTech-based ESG platforms. Applying theoretical frameworks like the Unified Theory of Acceptance and Use of Technology (UTAUT), future research could examine how perceived transparency, "effort expectancy," and interface quality directly influence individual investment decisions (Galeone et al., 2024). Understanding the "social influence" and ethical considerations of AI-driven portfolio management will be essential for ensuring that the democratization of capital mobilization does not inadvertently lead to new forms of financial exclusion or algorithmic bias (Galeone et al., 2024; Liu et al., 2022).

4. Conclusion

The convergence of FinTech with green finance and ESG investments represents one of the most defining characteristics of the twenty-first-century financial landscape. The empirical evidence synthesized in this study demonstrates that innovations such as blockchain, artificial intelligence (AI), and decentralized finance (DeFi) are not merely incremental technical upgrades but are potent structural instruments capable of addressing the historical flaws of traditional finance (Galeone et al., 2024; Udeagha & Muchapondwa, 2023). By increasing transparency, boosting operational efficiency, and democratizing access to capital, these technologies are successfully directing critical funds toward sustainable projects that were previously deemed too risky or costly by traditional institutions (Liu et al., 2022). Consequently, the global financial industry has progressed from a reactive discussion

on capital shortages to a proactive structural re-engineering of the financial system to better support the United Nations Sustainable Development Goals (SDGs) and the Paris Agreement (Albert et al., 2025; Udeagha & Muchapondwa, 2023).

However, this study also highlights that this transformative power is inherently double-edged. The same innovations that enable unprecedented market efficiency also introduce sophisticated risks that could undermine the integrity of the green transition. The persistence of greenwashing remains a primary concern, as firms may use FinTech to project a symbolic commitment to sustainability while their substantive carbon performance remains stagnant (Albert et al., 2025; Gao et al., 2024). Furthermore, regulatory ambiguity and the potential to widen the "digital divide" pose significant threats, particularly in emerging markets where a lack of digital infrastructure may lead to a new form of financial exclusion (Liu et al., 2022; Udeagha & Muchapondwa, 2023). Without clear, interoperable regulatory frameworks, the adoption of these technologies in the banking sector—often driven by "social influence"—may result in fragmented progress rather than systemic change (Galeone et al., 2024).

Therefore, the future success of the FinTech-Green Finance nexus is contingent upon a coordinated, multi-stakeholder effort to proactively manage these challenges. By establishing uniform global reporting guidelines, strengthening multi-jurisdictional regulatory oversight, and fostering ethical AI practices, stakeholders can mitigate the risks of "digital greenwashing" and information asymmetry (Albert et al., 2025; Gao et al., 2024). Ultimately, if managed with a focus on equity and transparency, FinTech's potential can be fully utilized to build a resilient, equitable, and truly sustainable global economy that aligns financial prosperity with environmental preservation (Galeone et al., 2024; Udeagha & Muchapondwa, 2023).

References

- Albert, A., Mousavi, M. M., Owusu, F. B., & Ibeji, N. (2025). Bridging ESG and FinTech: A technological approach to carbon performance. *Business Strategy and the Environment*, *34*(8), 10590–10612. https://doi.org/10.1002/bse.70122
- Galeone, G., Ranaldo, S., & Fusco, A. (2024). ESG and FinTech: Are they connected? *Research in International Business and Finance*, *69*, 102225. https://doi.org/10.1016/j.ribaf.2024.102225
- Gao, D., Tan, L., & Duan, K. (2024). Forging a path to sustainability: The impact of Fintech on corporate ESG performance. *The European Journal of Finance*. Advance online publication. https://doi.org/10.1080/1351847X.2024.2416995
- Liu, H., Yao, P., Latif, S., Aslam, S., & Iqbal, N. (2022). Impact of Green financing, FinTech, and financial inclusion on energy efficiency. *Environmental Science and Pollution Research*, *29*, 18955–18966. https://doi.org/10.1007/s11356-021-16949-x
- Udeagha, M. C., & Muchapondwa, E. (2023). Green finance, fintech, and environmental sustainability: Fresh policy insights from the BRICS nations. *International Journal of Sustainable Development & World Ecology*, *30*(7), 738–756. https://doi.org/10.1080/13504509.2023.2183526
- Bharti, P., Singh, S. D., & Choudhury, T. (2022). Sustainable investment practices. *Global Journal of Engineering and Technology Advances*, *21*(1), 204–214.
- Khadse, A., & Pande, J. (2023). Blockchain-enabled green bonds for financing sustainable investment projects. *International Journal of Progressive Research in Science and Engineering*, *3*(7), 45–52.
- Khan, S. A., & Wahab, A. (2025). FinTech in green finance: Applications and challenges. *Journal of Financial and Technological Innovation*, *8*(3), 112-128.
- Nagesh, R., & Murugan, D. (2024). Green finance and corporate green innovation. *International Journal of Environmental and Sustainability Development*, *15*(2), 78–92.
- Onipegede, G. D. (2024). Green FinTech: Leveraging data science to promote

sustainable SME sustainability in Nigeria. *Development Studies and Social Humanities Journal*, *9*(4), 115-129.

- Peng, R., & Zeng, B. (2025). Digital Financial Inclusion and Inclusive Green Growth: Evidence from China's Green Growth Initiatives. *International Journal of Financial Studies*, *13*(1), 2.
- Teichmann, D. M., & Krawczyk, A. (2024). P2P lending platforms and sustainability. *Journal of Financial Markets and Investments*, *12*(4), 56–78.
- Wang, D., & Kogan, D. (2018). *Blockchain in green finance*. Working Paper.
- Zhang, L., & Liu, Q. (2023). The role of big data in enhancing ESG ratings. *Journal of Corporate Finance*, *18*(4), 211–225.

Works cited

1. (PDF) FinTech in Green Finance: Applications and Challenges, accessed on September 14, 2025, https://www.researchgate.net/publication/395384434_FinTech_in_Green_Finance_Applications_and_Challenges
2. (PDF) FinTech in Green Finance: Applications and Challenges - ResearchGate, accessed on September 14, 2025, https://www.researchgate.net/publication/395382656_FinTech_in_Green_Finance_Applications_and_Challenges
3. (PDF) FinTech and Sustainable Finance: Impact of Digital Finance in ..., accessed on September 14, 2025, https://www.researchgate.net/publication/395384621_FinTech_and_Sustainable_Finance_Impact_of_Digital_Finance_in_Promoting_Green_Investments
4. Exploring FinTech, green finance, and ESG performance across corporate life-cycles, accessed on September 14, 2025, https://ideas.repec.org/a/eee/finana/v97y2025ics1057521924008032.html
5. How to Use Data and AI to Measure ESG Performance - DSS Blog, accessed on September 14, 2025, https://roundtable.datascience.salon/how-to-use-data-and-ai-to-measure-esg-performance
6. How Robo-Advisors Simplify Impact Investing - Investopedia, accessed on September 14, 2025, https://www.investopedia.com/impact-investing-with-a-robo-advisor-4775379
7. Fintech and Corporate ESG Performance: An Empirical Analysis Based on the NEV Industry, accessed on September 14, 2025, https://www.mdpi.com/2071-1050/17/2/434
8. A bibliometric analysis of Green Fintech: state of the art and future perspectives, accessed on September 14, 2025, https://www.researchgate.net/publication/366120422_A_bibliometric_analysis_of_Green_Fintech_state_of_the_art_and_future_perspectives
9. Interaction Effects of Green Finance and Digital Platforms on China's Economic Growth, accessed on September 14, 2025, https://www.mdpi.com/2071-1050/17/18/8171
10. The Influence of Fintech Innovations, ESG Reporting, and Blockchain Technology on Financial Transparency and Accountability - ResearchGate, accessed on September 14, 2025, https://www.researchgate.net/publication/382414437_The_Influence_of_Fintech_Innovations_ESG_Reporting_and_Blockchain_Technology_on_Financial_Transparency_and_Accountability
11. (PDF) Blockchain-Enabled Green Bonds for Financing Sustainable ..., accessed on September 14, 2025, https://www.researchgate.net/publication/394517940_Blockchain-Enabled_Green_Bonds_for_Financing_Sustainable_Investment_Projects
12. (PDF) Enhancing Transparency and Accountability in Sustainable Finance Through Blockchain Technology: A Systematic Review of the Literature - ResearchGate, accessed on September 14, 2025, https://www.researchgate.net/publication/389093370_Enhancing_Transparency_and_Accountability_in_Sustainable_Finance_Through_Blockchain_Technology_A_Systematic_Review_of_the_Literature
13. (PDF) Blockchain-Enabled Green Bonds for Sustainable Investment Portfolios, accessed on September 14, 2025, https://www.researchgate.net/publication/394517511_Blockchain-Enabled_Green_Bonds_for_Sustainable_Investment_Portfolios
14. Tokenized Green Assets and Sustainable

Finance Evolution → Scenario, accessed on September 14, 2025, https://prism.sustainability-directory.com/scenario/tokenized-green-assets-and-sustainable-finance-evolution/

15. (PDF) Data-Driven Sustainability: How FinTech Innovations Are Supporting Green Finance, accessed on September 14, 2025, https://www.researchgate.net/publication/395382911_Data-Driven_Sustainability_How_FinTech_Innovations_Are_Supporting_Green_Finance
16. Application of Blockchain Technology in Carbon Trading Market: A Systematic Review, accessed on September 14, 2025, https://www.researchgate.net/publication/387482581_Application_of_Blockchain_Technology_in_Carbon_Trading_Market_A_Systematic_Review
17. [PDF] A Blockchain-based Carbon Credit Ecosystem - Semantic Scholar, accessed on September 14, 2025, https://www.semanticscholar.org/paper/A-Blockchain-based-Carbon-Credit-Ecosystem-Saraji-Borowczak/c62b56c83d3db1f11ac5c7bd344780a5edb7ff6a
18. (PDF) A STUDY ON GREENWASHING AND FRAUD IN SUSTAINABLE FINTECH WITH REFERENCE TO THE FINANCIAL SERVICES INDUSTRY - ResearchGate, accessed on September 14, 2025, https://www.researchgate.net/publication/393656868_A_STUDY_ON_GREENWASHING_AND_FRAUD_IN_SUSTAINABLE_FINTECH_WITH_REFERENCE_TO_THE_FINANCIAL_SERVICES_INDUSTRY
19. (PDF) Artificial Intelligence for ESG Scoring: Enhancing Accuracy in ..., accessed on September 14, 2025, https://www.researchgate.net/publication/395025669_Artificial_Intelligence_for_ESG_Scoring_Enhancing_Accuracy_in_Sustainable_Investments
20. (PDF) Artificial Intelligence for ESG Scoring - Enhancing Accuracy, Transparency, and Investor Confidence - ResearchGate, accessed on September 14, 2025, https://www.researchgate.net/publication/394482325_Artificial_Intelligence_for_ESG_Scoring_-_Enhancing_Accuracy_Transparency_and_Investor_Confidence
21. Construction and optimization of enterprise ESG performance evaluation model based on support vector machine - SPIE Digital Library, accessed on September 14, 2025, https://www.spiedigitallibrary.org/conference-proceedings-of-spie/13550/135502C/Construction-and-optimization-of-enterprise-ESG-performance-evaluation-model-based/10.1117/12.3058835.full
22. (PDF) FinTech and Sustainable Finance: How is FinTech Shaping the Future of Sustainable Finance? - ResearchGate, accessed on September 14, 2025, https://www.researchgate.net/publication/386548986_FinTech_and_Sustainable_Finance_How_is_FinTech_Shaping_the_Future_of_Sustainable_Finance
23. Green FinTech: Driving Sustainable Finance Through Innovative Applications - Appinventiv, accessed on September 14, 2025, https://appinventiv.com/blog/green-fintech/
24. Decentralizing Climate Finance: The Role of DeFi - ResearchGate, accessed on September 14, 2025, https://www.researchgate.net/publication/393975836_Decentralizing_Climate_Finance_The_Role_of_DeFi
25. Compliance concerns in sustainable finance: an analysis of peer-to-peer (P2P) lending platforms and sustainability | Request PDF - ResearchGate, accessed on September 14, 2025, https://www.researchgate.net/publication/368982858_Compliance_concerns_in_sustainable_finance_an_analysis_of_peer-to-peer_P2P_lending_platforms_and_sustainability
26. Digital Financial Inclusion and Inclusive Green Growth: Evidence from China's Green Growth Initiatives - ResearchGate, accessed on September 14, 2025, https://www.researchgate.net/publication/387598885_Digital_Financial_Inclusion_and_Inclusive_Green_Growth_Evidence_from_China's_Green_Growth_Initiatives
27. FinTech regulatory challenges: Compliance in 2025 - Geniusee, accessed on September 14, 2025, https://geniusee.com/single-

blog/fintech-regulation-legal-and-regulatory-aspects
28. What is fintech regulation? An overview - IDnow, accessed on September 14, 2025, https://www.idnow.io/fintech/what-is-fintech-regulation/
29. Building Trust in Fintech: An Analysis of Ethical and Privacy Considerations in the Intersection of Big Data, AI, and Customer Trust - MDPI, accessed on September 14, 2025, https://www.mdpi.com/2227-7072/11/3/90
30. Decentralized Finance (DeFi): Transformative Potential & Associated Risks - Federal Reserve Bank of Boston, accessed on September 14, 2025, https://www.bostonfed.org/publications/risk-and-policy-analysis/2022/decentralized-finance-defi-transformative-potential-and-associated-risks.aspx
31. Research on the impact mechanism of digital financial inclusion on green consumption, accessed on September 14, 2025, https://www.researchgate.net/publication/394827711_Research_on_the_impact_mechanism_of_digital_financial_inclusion_on_green_consumption
32. Greenwashing within the context of financial technology and sustainable development: Conceptual frameworks and theoretical perspectives - Conscientia Beam, accessed on September 14, 2025, https://archive.conscientiabeam.com/index.php/89/article/view/4076
33. Whitepaper: Digital Innovation and Sustainability in Wealth Management - hedgehog lab, accessed on September 14, 2025, https://hedgehoglab.com/wp-content/uploads/2025/01/Whitepaper_-Digital-Innovation-and-Sustainability-in-Wealth-Management.pdf
34. Examining Investor Interaction with Digital Robo-Advisory Systems: Green Value and Interface Quality in a Socio-Technical Context - MDPI, accessed on September 14, 2025, https://www.mdpi.com/2079-8954/13/9/787
35. Our Approach to research, technology and implementation - CFM, accessed on September 14, 2025, https://www.cfm.com/cfm-our-approach/
36. Peter Engel's Road to Algorithmic Trading - Case Study - QuantInsti Blog, accessed on September 14, 2025, https://blog.quantinsti.com/peter-engels-algorithmic-trading-case-study/
37. Evaluating the influence of financial technology (FinTech) on sustainable finance: a comprehensive global analysis - IDEAS/RePEc, accessed on September 14, 2025, https://ideas.repec.org/a/kap/fmktpm/v38y2024i1d10.1007_s11408-023-00439-w.html