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Does the Integration of Fintech and Green Finance Enhance Sustainability Performance in the Banking Sector? Information Technology Governance as Moderator

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ABSTRACT

This paper investigates the impact of Fintech and green finance on enhancing sustainability performance through information technology governance. We collected questionnaires from 611 banking institutions in Nigeria, Ghana, and Cameroon from May to October 2024 and analyzed them with Partial Least Squares-Structural Equation Modeling and PROCESS models. The empirical findings show that (1) both Fintech, green finance, and IT governance positively influence sustainability performance; (2) Fintech has a positive effect on green finance and (3) IT governance acts as a significant moderator between Fintech and sustainability performance. Moreover, we find similar results at the country level, with Nigeria showing a greater impact of Fintech on sustainable performance than Ghana and Cameroon, while Ghana presents a larger effect of green finance and IT governance on sustainable performance than Nigeria and Cameroon. The paper highlights the significance of integrating Fintech and green finance in banking institutions for sustainability and IT governance in emerging markets, offering valuable insights for policymakers and practitioners.

1 | Introduction

Sustainability concerns have driven significant technological advancements. Fintech, defined as the application of technology to provide financial services (Dwivedi et al. 2021; Almaqtari 2024), has transformed banking operations by enhancing digitalization, reducing environmental impact, and optimizing resource allocation (Arner et al. 2020; Atayah et al. 2023; Lisha et al. 2023; Cruz Rambaud and López Pascual 2023). Recent research indicates that Fintech adoption improves operational efficiency, risk management, and decision-making in banks, enhancing sustainability performance (SP; Moschella et al. 2019). The adoption of Fintech by banks is influenced by the current sustainability landscape, which could potentially impact their SP (Atayah et al. 2023; Lisha et al. 2023). However, research on the impact of Fintech on sustainability remains fragmented (Atayah et al. 2023, Hidayat-Ur-Rehman and Hossain 2024). While some studies suggest that Fintech supports sustainable banking practices (Udeagha and Ngepah 2023; Guang-Wen and Siddik 2022), others highlight potential negative environmental consequences (Lisha et al. 2023).

Recently, green finance (GF) has emerged as a key mechanism for promoting sustainability in banking by supporting investments in environmentally beneficial projects (Baloch et al. 2023; Debrah et al. 2022). GF assists banks in data analysis, environmental risk assessment, sustainable investment strategies, Fintech deployment, knowledge stimulation, unlocking sustainability capability, and compliance assistance (Zhou et al. 2023; Meng and Shaikh 2023). Recent research indicates that GF positively impacts the SP of banks that adopt sustainable practices and offer green financial products (Hussain

et al. 2023, Guang-Wen and Siddik 2023, Hidayat-Ur-Rehman and Hossain 2024). Additionally, evidence suggests that Fintech adoption positively impacts GF (Guang-Wen and Siddik 2023, Hidayat-Ur-Rehman and Hossain 2024). However, studies on Fintech's role in advancing GF and its broader sustainability effects are limited (Jaiwant and Kureethara 2023; Meng and Shaikh 2023).

Despite the potential benefits of Fintech and GF in banking, challenges including regulatory barriers, digital divides, and data security risks persist (Anshari et al. 2019). Ecological Modernization Theory (EMT) suggests that technological advancements like Fintech can contribute to addressing environmental challenges and enhancing resource efficiency. While acknowledging the unique contexts of Fintech and IT sustainability efforts (Almaqtari 2024), it is widely recognized that IT governance (ITG) plays a critical role in enabling the integration of Fintech innovations and GF within banks. ITG ensures that Fintech solutions are securely integrated into banking operations, supporting GF goals and adhering to regulatory standards. In addition, the dynamic capability view (DCV) suggests that ITG assists banks in maintaining agility by utilizing Fintech innovations and GF technologies. ITG improves risk management and cybersecurity to foster trust, support Fintech and GF initiatives, and ensure banks align with sustainability goals. With the rise of mobile money solutions, ITG promotes financial inclusion and sustainable development by ensuring transparency, security, and green investments, thereby ensuring financial inclusion. Hence, effective ITG plays a critical role in mitigating these risks and ensuring the successful integration of Fintech into sustainable banking practices (Almaqtari 2024; Mutamimah et al. 2021).

Anshari et al. (2021) underline the significance of technology-driven sustainability, highlighting its potential to foster sustainable behavior but requiring a holistic evaluation that considers practical, ethical, and social dimensions. Existing research suggests that ITG enhances Fintech adoption by providing robust technological frameworks, strengthening sustainability efforts, and optimizing digital transformation strategies (Ryu and Ko 2020; Deng et al. 2019; Zhao et al. 2019). However, there is a lack of empirical studies examining the moderating role of ITG in the Fintech-sustainability nexus, particularly in the context of emerging markets. ITG significantly impacts organizations' strategic and operational objectives by establishing structures, policies, and strategies that influence technological decisions (Al-Sartawi 2020; Almaqtari, Farhan, Al-Hattami, et al. 2023; Fattah et al. 2021; Bianchi et al. 2021). The literature primarily focuses on Fintech's impact on sustainability in developed and Asian markets, leaving the African context limited, leading to a lack of comprehensive understanding. Additionally, Fintech and sustainability studies have produced inconsistent findings, highlighting the complexities of these interactions. Therefore, further research must reconcile contradictory findings and offer valuable insights for businesses, policymakers, and global banking institutions. We aim to investigate the moderating role of ITG in the relationship between Fintech and SP in banking institutions to fill a research gap. The study combines EMT and a DCV to establish our theoretical framework. EMT suggests that Fintech is a key driver of sustainability modernization by reducing environmental impacts (Khan et al. 2022). Meanwhile, the DCV emphasizes the importance of GF in providing a competitive edge in dynamic business environments, thus enhancing SP. Specifically, we aim to answer the following research questions: RQ1: Does Fintech enhance banks' SP? RQ2: To what extent does Fintech support banks' GF initiatives? RQ3: How does GF contribute to enhanced SP in banks? RQ4: Does ITG moderate the relationship between Fintech and banks' SP?

Considering significant Fintech development and sustainability challenges in emerging African countries, we chose Nigeria, Ghana, and Cameroon banking institutions to examine the effects. As a leading Fintech hub, Nigeria boasts a robust digital payment ecosystem that serves millions of users and businesses (Bonsu 2024). Ghana's Fintech sector is rapidly expanding, with a strong emphasis on financial inclusion and mobile money adoption, while in Cameroon, Fintech innovations have significantly enhanced access to financial services, particularly through mobile money solutions (Bonsu 2024). These three countries represent diverse stages of Fintech adoption and sustainable finance integration, offering valuable comparative insights. However, climate change presents substantial economic risks across these nations, affecting financial markets, banking systems, and food security due to extreme weather events (Tidjani and Madouri 2024; Appiah-Otoo et al. 2024; Molua 2007). In response, banks in Nigeria, Ghana, and Cameroon are aligning their economic strategies with global sustainability goals by leveraging Fintech solutions, GF products, and advanced climate-risk monitoring tools (Baseline-Study 2021). Additionally, differences in their economic structures, regulatory frameworks, and financial inclusion initiatives provide critical perspectives on both the challenges and opportunities shaping Africa's evolving financial ecosystem.

The study analyzes how Nigeria, Ghana, and Cameroon banks utilize Fintech and ITG to enhance SP and overcome regulatory and technological obstacles using Partial Least Squares-SEM and PROCESS Model from 611 banks from May to October 2024. Our findings indicate that Fintech has a positive effect on GF and SP. Moreover, we find that GF and ITG positively impact SP. Our findings reveal a positive moderating effect of ITG on Fintech and SP. Notably, the influence of Fintech on SP is stronger in Nigeria than in Ghana and Cameroon, while the effect of GF and ITG on SP was greater in Ghana than in Nigeria and Cameroon. Our research highlights the significant role of ITG in enhancing Fintech in the banking industry for strategic decision-making and governance policies in Africa's emerging markets.

We provide significant contributions to the existing literature. First, we develop a theoretical framework by considering both enhanced EMT and DCV in the sustainability literature on the role of Fintech and GF in enhancing banks' SP moderated by ITG. Second, the literature shows inconclusive findings regarding Fintech and SP (Almaqtari 2024; Hidayat-Ur-Rehman and Hossain 2024; Zhang et al. 2024; Lisha et al. 2023; Jian and Zhengjie 2024). In addition, the literature highlights that Fintech's impact on SP focused primarily on developed and Asian markets, leaving the African context limited. Therefore, the study indicates that Fintech implementation in banks can improve SP, explaining the inconclusive results and providing empirical evidence on its impact on GF and sustainability in

African emerging markets. Third, limited scholarship has examined the moderating effects of ITG on Fintech and banks' SP, especially in African emerging markets. Moreover, the literature primarily discusses the unrelated effects of Fintech adoption and sustainability initiatives, neglecting the crucial role of ITG in these relationships (Callsen et al. 2021; Chen et al. 2022; Guang-Wen and Siddik 2023; Macchiavello and Siri 2022). Additionally, the effect of ITG on Fintech and sustainability is underexplored. ITG is crucial for Fintech adoption and bank sustainability in emerging African markets, offering tailored insights for enhanced elasticity (Arner et al. 2020; Guang-Wen and Siddik 2023; Zhang et al. 2021). Thus, we advance the literature by examining the mediating effects of ITG on Fintech and the SP of banks (Almaqtari 2024). Finally, we explore banking institutions in Africa's emerging markets, focusing on Ghana, Nigeria, and Cameroon, contributing to the growing literature on Fintech and sustainability.

We used the next section to highlight the research background discussing Fintech and GF developments of selected countries. Section 3 discusses the theoretical background and presents the study hypothesis. The next section presents the research methodology. Section 5 was used to present and discuss the hypotheses along with robustness and additional tests. Our last section presents conclusions and implications.

2 | The Development of Fintech and GF in Nigeria, Ghana, and Cameroon Context

In recent years, Africa has witnessed a surge in Fintech and GF due to the rise in digital adoption, financial inclusion initiatives, and increased awareness of sustainability issues (Langley and Rodima-Taylor 2022; Bernards 2019). The continent is witnessing rapid growth in mobile money, digital banking, and blockchain-based innovations, which are significantly transforming financial services, particularly in underbanked nations (Holtz 2021; Raithatha et al. 2023). GF, incorporating environmental, social, and governance factors into financial decisions, is gaining popularity in African economies for climate-resilient projects and renewable energy investments. However, the widespread adoption of new technologies is hindered by regulatory uncertainty, limited infrastructure, and funding constraints.

First, Nigeria, the largest Fintech market in Africa, is home to over 200 dynamic startups (Bonsu et al. 2023). The Central Bank of Nigeria has significantly enhanced digital payment systems through policies like Payment Service Bank licenses, enhancing Nigeria's position as a leading African technological innovation hub (An and Cho 2021). Companies such as Flutterwave, Paystack, and Opay have revolutionized payment processing and digital banking (Soetan and Mogaji 2024). Beyond Fintech, Nigeria has made significant progress in GF through the implementation of policy frameworks and financial instruments like green bonds (Ojukwu et al. 2024). In 2017, Nigeria became the first African nation to issue a sovereign green bond to finance renewable energy and environmental projects. The Nigerian Sustainable Banking Principles aim to encourage banks to fund environmentally sustainable projects. As Africa's largest economy, Nigeria depends primarily on the oil and gas sector, with significant diversity through technology, agriculture, and services (Aluko et al. 2024). However, the country is grappling with infrastructural deficits, governance issues, and environmental concerns that significantly impact its sustainability. Accordingly, the government is promoting sustainability in financial markets, aligning with the Paris Agreement, and investing in renewable energy financing and green bond issuance. For example, the Nigerian government has established strategic partnerships with private investors and development agencies to promote climate-friendly investments (Isah et al. 2023).

Second, Ghana is a prominent Fintech hub in West Africa, primarily renowned for its mobile money services and digital payment platforms (Guermond 2022). The Bank of Ghana's regulatory environment has facilitated the growth of mobile financial services like MTN Mobile Money and Vodafone Cash. The Payment Systems and Services Act 2019 (Act 987) has significantly enhanced the regulatory framework for digital financial services. Meanwhile, Ghana's GF is gaining momentum, with the Ghana Green Bond Market Development Programme promoting sustainable investment and banks integrating ESG principles into lending practices (Agyekum et al. 2022). The Bank of Ghana has implemented Sustainable Banking Principles to encourage financial institutions to finance green initiatives, including the Green Ghana Project, focusing on environmental conservation, renewable energy, and sustainable agriculture (Acheampong et al. 2019). Ghana's economy is stable and diverse, with key sectors like mining, agriculture, and services, despite facing challenges like inflation and public debt. The government is promoting Fintech through favorable regulations and green bonds to attract foreign investment in renewable energy projects.

Finally, Cameroon's Fintech sector is primarily expanding through mobile payments and digital wallets driven by telecom operators like Orange Money and MTN Mobile Money. Despite its potential, Cameroon is grappling with issues like low internet penetration, regulatory hurdles, and restricted startup venture capital access. However, Cameroon dominated the Central African region in mobile money adoption in 2020, accounting for 64.8% of active accounts in the Economic and Monetary Community of Central Africa (CEMAC) region (Rabin 2020). GF in Cameroon remains underdeveloped but is gradually gaining attention, with the government promoting sustainable development through renewable energy policies and environmental conservation. Additionally, the country has participated in regional GF initiatives under CEMAC, aiming to promote sustainable investments among its member states. Cameroon's economy is heavily reliant on agriculture, oil, and minerals but holds significant potential in tourism and renewable energy sectors (Tamasang et al. 2021). Despite political instability and infrastructural limitations, Cameroon remains one of the most diverse economies in Central Africa, with the government supporting Fintech and mobile money services, leading to the promotion of rural financial inclusion. Furthermore, Cameroon is implementing GF to combat environmental issues, focusing on renewable energy investments and climate adaptation strategies to reduce carbon footprint.

Notably, we explore the impact of Fintech and GF on banks' SP across these countries, considering their varied Fintech growth, GF advancements, regulatory frameworks, economic structures,

and sustainability initiatives. Moreover, the development of ITG in these countries is crucial for the successful implementation of Fintech and GF, as it enhances data security, financial transparency, and regulatory compliance. Therefore, focusing on Ghana, Nigeria, and Cameroon offers a comprehensive understanding of the challenges and opportunities influencing Africa's digital financial transformation and sustainability agenda.

3 | Theoretical Framework and Hypothesis Development

3.1 | Theoretical Framework

EMT and DCV were utilized to develop a theoretical framework examining the intersections between Fintech, GF, ITG, and the SP of banking sectors. By integrating both theories, we provide a comprehensive framework for understanding how Fintech innovations and GF can foster SP by providing an insightful understanding of how technological and green financing impact SP. EMT suggests that technological advancements, especially in the financial sector, can enhance resource efficiency and reduce environmental harm, promoting economic growth and sustainability (Rehman Khan, Ahmad, et al. 2022; Huber 2008; Sadiq et al. 2023; Rehman et al. 2023). EMT offers a critical lens to examine Fintech's role in GF and environmental sustainability, highlighting its promotion of technological advancement, modernization, and cleaner technologies in the circular economy (Abdul-Hamid et al. 2021; Andersen and Massa 2000). While Fintech platforms can encourage sustainable consumer behavior by offering green investment options, such as green bonds, ESG investing, and sustainable loans, EMT highlights that such market-based innovations can align economic activities by channeling capital towards environmental goals. Additionally, EMT argues for systemic transformations that reconcile economic growth with ecological sustainability so that companies can achieve competitive advantages by integrating sustainability into their operations. Companies leveraging Fintech and GF to improve their SP, i.e., reducing emissions, can attract investors and customers who prioritize environmental responsibility. By highlighting the collaboration between governments, businesses, investors, and consumers, EMT provides a theoretical framework to connect Fintech, GF, and sustainable performance to achieve systemic impact.

DCV complements EMT by providing a framework for understanding how firms adapt to rapidly changing environments and leverage technological innovations to gain competitive advantages. DCV focuses on an organization's ability to adapt, integrate, and reconfigure internal and external competencies to address rapidly changing environments. This perspective is particularly relevant in the context of Fintech and GF, where banks' technological innovations, regulatory shifts, and sustainability demands require organizations to be agile and proactive. Organizations that leverage dynamic capabilities to integrate sustainability into their operations can achieve long-term success while contributing to environmental goals. As DCV highlights the role of innovation in achieving competitive advantage, it enables organizations to leverage Fintech solutions and GF strategies in response to the evolving needs of customers, regulators, and environmental challenges. By emphasizing agility, innovation, and strategic adaptation, DCV emphasizes how firms can leverage these tools to navigate complex environments, meet stakeholder expectations, and achieve long-term sustainability goals.

3.2 | Hypothesis Development

3.2.1 | Fintech and SP

The adoption of Fintech has been widely recognized as an innovation that transforms the financial landscape, particularly in enhancing SP. As defined by Pashang and Weber (2021), Fintech is a technology-driven financial innovation that influences financial markets, institutions, and services (Chueca Vergara and Ferruz Agudo 2021). According to Zheng, Siddik, Masukujjaman, and Fatema (2021), SP encompasses a firm's capability to achieve environmental, social, and economic sustainability. In banks, Fintech is believed to improve financial inclusion, enhance economic and sustainable performance, and contribute to reducing environmental impacts (Thomas and Hedrick-Wong 2019; Lee and Shin 2018). Fintech promotes sustainability by enabling GF, optimizing resource allocation, and encouraging environmentally responsible investment decisions. Additionally, Fintech improves financial accessibility, efficiency, and sustainability, aiding banks in achieving UN Sustainable Development Goals, climate action, industry innovation, and reducing inequalities (Deng et al. 2019; Jiao et al. 2021).

While research highlights Fintech's potential to enhance SP, existing studies have produced mixed findings, often limited to specific industries and geographical contexts. Rehman et al. (2023) adopted "innovation-growth" and "innovation-fragility" perspectives and argued that Fintech not only improves financial efficiency but also leads to energy efficiency gains within banks' operations. Similarly, Croutzet and Dabbous (2021) suggest that Fintech development is positively linked to renewable energy use in OECD countries using a Resource-Based View. Similarly, Almaqtari et al. (2024) finds that Fintech significantly enhances SP in Indian commercial banks, though the study lacks a theoretical foundation. Likewise, Hidayat-Ur-Rehman and Hossain (2024) highlight that Fintech improves financial services' accessibility while reducing carbon emissions in the banking sector in Pakistan. From a strategic perspective, Siddik et al. (2023) utilize the Practice-Based View and DCV to assert that the adoption of Fintech significantly improves SP in Bangladesh's manufacturing industries.

As the banking sector is characterized by intense competition and rapid technological advancements, DCV suggests that banks can enhance their competitiveness by incorporating Fintech capabilities like digital payments, cryptocurrency solutions, and mobile banking. These innovations increase operational efficiency and enhance the adoption of GF solutions, positioning banks as leaders in sustainable banking practices. For example, Fintech platforms provide banks with access to green bonds and other sustainable investment products, responding to the increasing demand for sustainable investment options. The literature argues that DCs enhance banks' SP by maintaining agility in a rapidly changing business environment (Wamba et al. 2020). Similarly, Sadik and

Rahman (2024) employ the EMT and RBV to demonstrate that Fintech adoption positively impacts environmental and social sustainability in Bangladesh's apparel industry, enhancing stakeholder engagement and promoting greener business models. Recently, Almaqtari et al. (2024) incorporated agency and stakeholder theories to explain the positive relationship between Fintech adoption and SP in Indian banks leading to stakeholder expectations. Li et al. (2024) revealed that utilizing Fintech can effectively lower the expenses associated with financial services, enhance financial accessibility, and concurrently diminish carbon emissions. Similarly, Tao et al. (2022) demonstrated that the effective utilization of fintech innovation has the potential to address environmental degradation and promote sustainability. Technological advancements have transformed the banking sector, enhanced service delivery efficiency, and promoted sustainability. However, additional research has produced conflicting results in contrast to the aforementioned studies. Zhang et al. (2024) suggest that Fintech could potentially harm the sustainability of BRICS countries. Lisha et al. (2023) discovered that Fintech negatively impacts environmental sustainability but neglects its economic and social dimensions, particularly in the banking sector, without a theoretical framework. Similarly, Jian and Zhengjie (2024) revealed that reliance on Fintech developments leads to an escalation in carbon emissions based on consumption in China.

Fintech integrates technology and innovation in financial services and offers sustainability benefits by reducing environmental impact and minimizing paper waste, energy consumption, and carbon emissions. DCV and EMT DCV highlight Fintech as a dynamic, ecological technology that aids banks in managing energy supply, identifying product demand, and enhancing energy efficiency, thus enhancing SP (Khan et al. 2022; Tang et al. 2024; Bonsu et al. 2025). Therefore, we argue that the adoption of Fintech technology can significantly reduce emissions and energy consumption, thereby improving the SP of banks.

Hypothesis 1. *The adoption of Fintech is positively associated with banks' sustainability performance.*

3.2.2 | The Effects of Fintech on GF

GF is a financing strategy that supports projects and initiatives, promoting sustainability including renewable energy, energy efficiency, and pollution prevention. The DCV highlights a firm's ability to adapt to changing environments and its green financing relies on its ability to process and analyze large datasets (Dubey et al. 2019). GF platforms enhance investor accessibility through user-friendly interfaces, streamlined processes, and reduced entry barriers, promoting sustainable economic activities with environmental benefits. Fintech aids in GF by enabling banks to analyze large datasets, assess environmental risks, and optimize lending decisions through technology (Macchiavello and Siri 2022). These solutions allow banks to enhance green innovation, improve credit risk assessment for environmentally friendly projects, and ensure efficient capital allocation toward renewable energy, carbon reduction, and sustainable infrastructure initiatives (Du et al. 2019). Moreover, Fintech enhances transparency and regulatory compliance in GF initiatives, while digital platforms streamline sustainable financing access, strengthening banks' role in transitioning to a low-carbon economy. Chong (2021) highlights that Fintech revolutionizes GF by enabling real-time tracking, reporting, and verification of environmental metrics, fostering trust among investors, regulators, and stakeholders. This transparency reduces data discrepancies and enhances the efficient allocation of funds to green initiatives. Leveraging diverse skills and expertise to expand GF initiatives, Fintech fosters direct connections between green enterprises and investors through crowdsourcing and peer-to-peer financing (Thomas and Hedrick-Wong 2019).

Empirical evidence suggests the positive and direct influence of Fintech on GF. Using banks in Bangladesh, Guang-Wen and Siddik (2023) found that Fintech adoption is positively related to GF. Similarly, Hidayat-Ur-Rehman and Hossain (2024) sampled Pakistan banks and underscored the direct and significant effect of Fintech adoption on GF. Mirza et al. (2023) analyze a comprehensive sample of European banks using a panel fixed effects regression model, revealing a positive relationship between Fintech investment and GF. Moreover, Wan et al. (2023) studied Chinese listed banks from 2011 to 2020 and found that Fintech development can significantly boost GF growth. Le et al. (2021) suggest that Fintech can significantly contribute to green bond development, thereby enhancing portfolio diversification. Xu et al. (2023) used provincial panel data from 2011 to 2020 in China and found that Fintech reduces carbon emission intensity by promoting the development of GF. Likewise, Song and Hao (2024) suggest that Fintech can digitally transform the financial sector, thereby promoting green project finance.

Empirical evidence highlights Fintech's role in optimizing resource allocation, supporting green bond issuance, and driving financial innovation, making Fintech a key enabler of sustainable finance. Fintech solutions can assist banks in GF by providing accurate data analysis, assessing environmental risks, identifying sustainable investment opportunities, and ensuring sustainability compliance. Therefore, Fintech by banks enhances GF by improving efficiency, reducing information asymmetry, and facilitating sustainable investments. Accordingly, we argue that Fintech can effectively support banks' GF initiatives.

Hypothesis 2. *The adoption of Fintech is positively associated with banks' green finance.*

3.2.3 | GF and SP

GF plays a pivotal role in advancing sustainable development by fostering positive environmental and social outcomes in the banking industry (Liu, Cifuentes-Faura, et al. 2024; Liu and Wang 2023). Banks increasingly contribute to a sustainable economy by financing renewable energy, energy-efficient technologies, and environmentally responsible projects (Lokuwaduge and Heenetigala 2017). Such financing initiatives accelerate the execution of sustainability-oriented projects, reinforcing positive sustainability outcomes (Karic and Losacker 2023). Banks can promote sustainable business practices by incorporating ESG factors into investment analyses and performance evaluations (Yun and Jin 2024). Research suggests that GF enables

banks to reduce environmental and climate risks while integrating sustainability into decision-making processes (Jaiwant and Kureethara 2023; Meng and Shaikh 2023). Peng and Chen (2023) emphasize the significance of environmental risk assessments in ensuring banks' lending strategies are in line with long-term sustainability objectives. Additionally, green initiatives enhance banks' reputations, fostering stakeholder engagement and attracting environmentally conscious customers, investors, and employees (Yun and Jin 2024; Islam et al. 2024).

Previous studies show GF's positive impact on SP, but most research is concentrated on developed economies and Asian markets. Hidayat-Ur-Rehman and Hossain (2024) found that Pakistani banks offering green financial products achieve improved SP. Kumar and Rani (2024) used the RBV to suggest that GF significantly influences banks' SP in India. Sadik and Rahman (2024) established similar effects in Bangladesh, suggesting that banks actively pursuing various GF investments in sustainable industrial growth lead to enhancing their SPs, while Sun et al. (2025) found that GF plays significant roles in sustainable developments across 46 countries worldwide. Guang-Wen and Siddik (2023) sampled banking institutions in Bangladesh, suggesting that banks' GF can reduce carbon emissions, leading to enhanced environmental performance. Behera et al. (2024) discovered that GF is the financial support or investment in projects aimed at reducing carbon emissions for sustainable development in 25 countries. A recent hybrid review by Joshipura et al. (2025) suggests that GF is fundamental for sustainable development, promoting ecological and renewable energy projects, and aligning with social, economic, and environmental goals. Literature findings suggest that banks' active financing of environmentally recycling projects, waste disposal, and resource conservation could enhance their SP. Based on a comprehensive literature review, Kumar, Kumar, et al. (2024) assert that GF is vital for fostering a circular economy by financing recycling initiatives, waste management, and resource conservation (Varavin et al. 2023; Omri et al. 2025).

EMT suggests that technological advancements can boost social and economic growth and environmental sustainability, enabling banks to modernize their financial strategies without compromising performance. Meanwhile, DCV emphasizes the need for banks to continuously reconfigure their financial and technological resources for sustainable growth. GF is an effective tool that assists banks in shifting toward green and sustainable economic development (Rehman et al. 2021). To investigate the growing discourse on GF and SP, we develop our hypothesis as the following:

Hypothesis 3. *Green finance is positively related to banks' sustainability performance.*

3.2.4 | ITG and SP

The relationship between IT adoption and sustainability is multifaceted, with IT reducing emissions and enhancing sustainability (Atayah et al. 2023; Lisha et al. 2023; Rais et al. 2023; Almaqtari 2024). Previous studies emphasize the necessity of integrating sustainability with IT, Fintech, artificial intelligence, and blockchain (Ahmed et al. 2021; Battisti et al. 2023; Callsen et al. 2021; Ramamohan and Mehta 2021; Sahoo et al. 2022). While these technologies contribute positively to environmental management, EMT suggests that technological advancements alone do not guarantee sustainability improvements unless they are effectively governed and embedded within regulatory and institutional frameworks.

ITG enhances business strategy, value delivery, accountability, and project performance, making it essential for maximizing IT's sustainability benefits while minimizing unintended consequences (Sirisomboonsuk et al. 2018; Sahoo et al. 2022). Despite the promise of Fintech in advancing sustainability goals, challenges such as data security, unequal access to technology, and regulatory uncertainties persist, potentially limiting its full impact (Hidayat-Ur-Rehman and Hossain 2024). From the DCV perspective, ITG can be seen as a dynamic capability that enables banks to reconfigure technological resources to achieve sustainability goals, yet existing studies provide limited insights into how firms develop and deploy these capabilities to enhance environmental outcomes.

Literature highlights the significant implications of ITG for sustainability. For instance, Aguboshim et al. (2019) through the literature review showed that ITG plays a pivotal role in shaping an organization's sustainability initiatives. Harris et al. (2017) suggest that ITG structures significantly enhance energy efficiency and reduce carbon emissions, leading to environmental sustainability. Similarly, Khuntia et al. (2018) examined organizations in India and established that ITG mechanisms can aid in monitoring and achieving sustainability targets. Almaqtari (2024) confirms a positive relationship between IT and the SP of banks in Pakistan but fails to critically examine the conditions under which ITG mechanisms yield significant sustainability benefits. In addition, limited studies exist on how ITG structures can mitigate risks associated with Fintech adoption, despite evidence suggesting ITG mechanisms enhance regulatory compliance and risk management (Karim and Purwanto 2020). Moreover, although research on the link between IT and environmental governance has grown, there is a lack of clear regulatory frameworks that integrate ITG with sustainability (Patón-Romero et al. 2019). The literature lacks a comprehensive understanding of how ITG impacts environmental decision-making, especially in industries like banking.

EMT suggests that while IT can enhance eco-efficiency, its impact is limited by institutional and regulatory gaps, necessitating the implementation of structured ITG mechanisms. Green IT initiatives are a promising solution for businesses to reduce environmental impact and promote sustainability (Almaqtari 2024; Patón-Romero et al. 2019). However, the success of these initiatives relies on governance frameworks that guarantee fair access to green technologies and align IT strategies with broader environmental policies. This study builds on prior research by examining how ITG, through the lens of EMT and DCV, enhances SP in the banking industry, addressing a critical research gap in understanding the governance mechanisms required for sustainable technological transformation. Thus, we propose that,

Hypothesis 4. *IT governance is positively associated with banks' sustainability performance.*

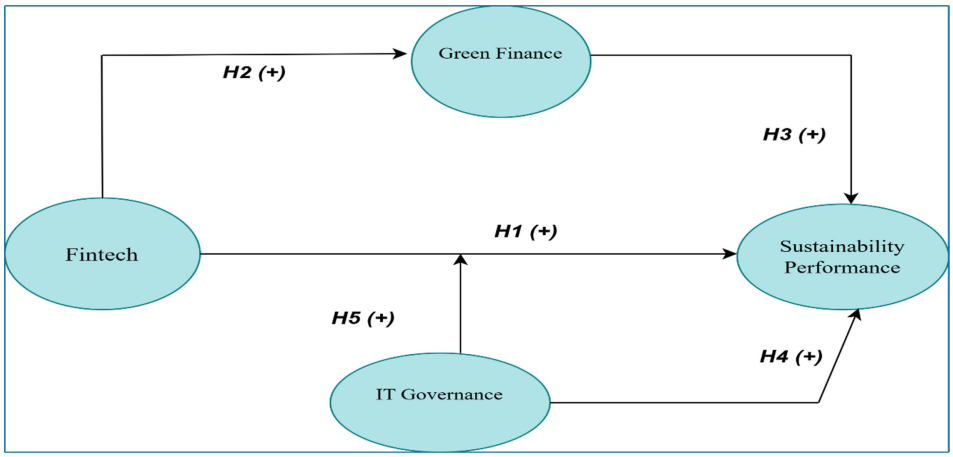

FIGURE 1 | Research conceptual framework.

3.2.5 | Moderating Effects of ITG

Digitalization-driven Fintech innovations are transforming financial services and influencing sustainability outcomes (Guang-Wen and Siddik 2023; Macchiavello and Siri 2022). Studies suggest that Fintech financing services can enhance sustainability funding initiatives financial inclusion, renewable energy adoption, and reduce carbon emissions (Arner et al. 2020; Bayram et al. 2021). Fintech also plays a role in advancing GF and supporting the UN Sustainable Development Goals (Chueca Vergara and Ferruz Agudo 2021; Arner et al. 2020). However, research presents conflicting perspectives on Fintech's sustainability impact. For instance, Deng et al. (2019) identified a U-shaped relationship between Fintech and sustainability, implying that early-stage adoption may not yield immediate benefits, while Chueca Vergara and Ferruz Agudo (2021) highlight the role of online payments in improving financial accessibility. These inconsistencies suggest the need for a moderating mechanism, such as ITG, to optimize Fintech's sustainability contributions.

Despite its potential, Fintech adoption faces challenges, including the technological divide, data security risks, and regulatory uncertainties (Anshari et al. 2019; Aysan and Bergigui 2021). The EMT argues that while technological advancements like Fintech can drive sustainability, their effectiveness depends on governance structures that ensure responsible and equitable deployment. From this perspective, ITG serves as a crucial moderating factor, enhancing Fintech's positive effects while mitigating associated risks. DCV emphasizes the need for organizations to create governance frameworks to dynamically integrate Fintech with sustainability strategies. Firms leveraging ITG as a dynamic capability can align Fintech innovations with long-term sustainability objectives, ensuring strategic coherence and risk mitigation (Almaqtari, Farhan, Al-Hattami, et al. 2023; Khalil and Belitski 2020). However, existing literature offers limited empirical insights into how ITG moderates the Fintech-sustainability relationship, particularly in banking. Karim and Purwanto (2020) argue that ITG frameworks are essential for mitigating Fintech-related risks, yet there is insufficient research on the specific governance mechanisms that enhance Fintech's sustainability impact. Moreover, while Almaqtari et al. (2024) found that ITG significantly influences banks' strategic planning regarding Fintech, its broader implications for sustainability remain underexplored. These gaps underscore the need for a comprehensive ITG approach that integrates ethical, technological, regional, and environmental considerations to ensure Fintech's alignment with sustainability goals (Almaqtari, Farhan, Al-Hattami, et al. 2023). This study posits that integrating ITG with business objectives is crucial for sustainable Fintech adoption due to its moderating role in Fintech's SP. Therefore, we propose the following hypothesis:

Hypothesis 5. *IT governance positively moderates the relationship between Fintech adoption and sustainability performance.*

Figure 1 illustrates our research conceptual framework. To summarize, we expect a positive association between Fintech and SP (Hypothesis 1). Fintech is expected to positively impact GF (Hypothesis 2). In addition, we expect a positive effect of GF and ITG impacting SP (Hypotheses 3 and 4). Finally, we expect a positive moderating impact of ITG on Fintech and SP (Hypothesis 5).

4 | Research Method

4.1 | Questionnaire Development

The survey instrument was created to gauge the Fintech adoption, GF, ITG, and SP of banking institutions. The questionnaire was written in English and included information about the respondent's demographic and firm profile. The study used a 5-point Likert-type scale to assess constructs, with academics translating English versions into French, as Cameroon is a dominant French-speaking country. The French version was translated into English and compared for reliability, and was used in Cameroon for data collection, while the English version was used in Nigeria and Ghana.

The survey form consisted of three sections. The research objectives were explained in the first segment, followed by a detailed analysis of demographic information, firm characteristics, and questions on industry competition and research and development intensity. The final segment of the investigation

required respondents to evaluate 27 items of study constructs adapted from literature and tailored to the study context, as detailed in Table 1. The instrument was enhanced by incorporating scales from previous studies to bolster its content validity. Fintech was modified and adapted from (Siddik et al. 2023; Almaqtari 2024). GF was measured with five items adopted (Zheng, Siddik, Masukujjaman, Fatema, and Alam 2021; Zhang et al. 2022; Guang-Wen and Siddik 2023). ITG was adopted from Almaqtari, Farhan, Al-Hattami, et al. (2023) and Almaqtari (2024). We categorized SP into economic, social, and environmental performance. Accordingly, we adopted five items for economic performance from Zheng, Siddik, Masukujjaman, Fatema, and Alam (2021), Akter et al. (2018), Raihan (2019), and Zheng, Siddik, Masukujjaman, and Fatema (2021), six items for environmental SP adapted from Taneja and Ali (2021) and Almaqtari (2024) and six items for social sustainability from Zheng, Siddik, Masukujjaman, and Fatema (2021), Zahid et al. (2021), and Almaqtari (2024).

A pretest was conducted with Fintech and Sustainability experts to review the questionnaire's validity, relevance, clarity, and alignment with the study's objectives and the target population's understanding. Moreover, two green investments and IT experts were consulted to ensure the questionnaire's content validity and accurate capture of key constructs and dimensions. The instrument was revised to enhance its representativeness, accuracy, and comprehensive coverage of research variables, and maintain contextual relevance, considering their suggestions. Additionally, a pilot test with 18 banking institutions (Nigeria, $N = 10$, Ghana, $N = 5$, Cameroon, $N = 3$) improved the instrument by addressing ambiguities and improving clarity, ensuring relevance and comprehensibility to the target population.

4.2 | Sample and Data Collection

This study designed a survey questionnaire to gather data for the empirical investigation of the conceptualized model. The data was gathered from banking institutions including board members, CFOs, senior executives, customer service representatives, loan officers, financial advisors, operations officers, and credit officers in Nigeria, Ghana, and Cameroon, three of the most significant emerging markets in Sub Sahara Africa. These countries were selected due to their rapidly growing Fintech ecosystems and increasing GF adoption, making them ideal for investigating SP in banking. Notably, the study's purpose was communicated to participants, who were assured that the data would only be used for academic purposes and confidentiality would be maintained.

In Nigeria, banks were selected from major industries such as Lagos and Abuja. These states were chosen as Nigeria's commercial and financial hub, hosting most Nigerian banks and multinational corporations' headquarters. More specifically, Lagos is a hub for Fintech and digital banking innovations, while Abuja significantly influences banking sector practices and policies within government regulatory institutions. In Ghana, banks were selected from two industry hubs: Greater Accra and Kumasi. Greater Accra houses financial institutions, while Kumasi is the second capital city that significantly contributes to Ghana's GDP through industrial activities, trade, and commerce. Notably, these cities display diverse banking environments in terms of economic activities, industrial development, and financial services

In Cameroon, we identified banks from Abidjan and Dakar, two major cities pivotal in the modernization and technological advancement of the country's banking sector.

A random sampling technique was employed to identify firms, and potential participants were contacted by email to explain the research purpose and encourage their involvement. Particularly, 500 Nigerian banks, 300 Ghanaian banks, and 250 Cameroon banks were contacted via email and phone based on their roles and motivation to participate. In both countries, participants provided informed consent before being invited to complete the online questionnaire. Comprehensive guidelines were provided to ensure participants understood the process while maintaining anonymity and confidentiality.

The data collection was conducted from May to October 2024, using questionnaires distributed to banks via online platforms and in person, mainly in Ghana and Nigeria. Board members, CFOs, senior executives, customer service representatives, loan officers, financial advisors, operations officers, and credit officers in both countries participated, leveraging their comprehensive understanding of the Fintech solution's and GF impact on sustainability through ITG. The multi-level approach confirmed the inclusion of diverse perspectives, capturing strategic, operational, and customer-facing insights. Board members, CFOs, and senior executives provided strategic insights on financial decision-making, risk management, and policy implementation at a high level. Operations and credit officers implemented ITG frameworks, while loan officers and financial advisors evaluated the adoption and effectiveness of GF initiatives. Customer service representatives provided valuable insights into customer perceptions and challenges. Our research is robust by adopting this approach, providing a comprehensive understanding of the relationship between Fintech solutions, GF, ITG, and SP in banking institutions.

4.3 | Data Analysis

We utilize the Partial Least Square-Structural Equation Modeling and PROCESS Model to test the hypothesis. In recent years, the PLS-SEM has become a prominent estimating tool in information systems and management research (Bonsu et al. 2025; Benitez et al. 2020). The adoption of the PLS-SEM for this study is due to several key advantages that align with our research objectives and data characteristics. First, we integrate two distinct theories, requiring a method capable of modelling complex relationships among multiple latent constructs (Jasim 2024; James et al. 2024). PLS-SEM is ideal for simultaneously testing these relationships while addressing measurement errors, ensuring robust results in causal predictive modeling (Guenther et al. 2023; Hair et al. 2020; Legate et al. 2024). Second, with 611 survey responses among the 27 items of the model constructs, PLS-SEM is well suited for handling large datasets, providing stable estimates and high statistical power to validate our model (Bonsu et al. 2025). The method is mostly

TABLE 1 | Variable information.

Variables	Items	Sources
Fintech	"Please specify the extent to agree or disagree with the below"	(Siddik et al. 2023, Almaqtari 2024)
	Our bank already adopted Fintech services or intends to continue using them in the future.	
	Our bank Fintech services make it easier to do online purchasing	
	Our Fintech services can easily and quickly be utilized, offering numerous advantages	
	Fintech services are better contributing to sustainability.	
	Our management gives priority to Fintech channels rather than traditional channels.	
	Fintech suits green financing operations and sustainability issues.	
	Our Fintech solutions generate a superior outcome quality.	
Green finance		(Zheng, Siddik, Masukujjaman, Fatema, and Alam 2021, Zhang et al. 2022, Guang-Wen and Siddik 2023).
	My bank tries to increase its investment for sustainable industrial growth	
	My bank is increasing its investment in recyclable resources	
	My bank is actively working to increase its investment in waste management	
	My bank is trying to raise its investment in advancing the green industry	
	My bank is trying to expand its investment in alternative energy resources	
IT governance		(Almaqtari et al. 2021, Almaqtari 2024)
	Our firm has an ERP system that facilitates the accessibility of data	
	Information and data are stored in a way that can be recovered, accessed, and operated from anywhere at any point in time	
	Our firm uses cloud computing to facilitate system operation.	
	Our firm has a robust IT governance strategy that addresses green finance and branchless operations, promoting sustainability.	

(Continues)

TABLE 1 | (Continued)

Variables	Items	Sources
Sustainability performance		
Economic performance		(Zheng, Siddik, Masukujjaman, Fatema, and Alam 2021, Akter et al. 2018, Raihan 2019)
	We integrate Fintech solutions to optimize financial resources, enhancing cost efficiency and profitability.	
	We prioritize high-quality financial products and services that meet national and international standards.	
	We ensure transparency and provide customers with accurate and complete financial information.	
	We foster stable, long-term collaborations with responsible suppliers who support sustainable finance.	
	Our economic management and green finance initiatives contribute to regional and national development.	
Environmental performance		(Taneja and Ali 2021, Almaqtari 2024).
	Our bank minimizes environmental impact by adopting digital banking and reducing paper and energy consumption.	
	We integrate energy-efficient Fintech solutions to enhance operational sustainability.	
	We invest in and promote alternative energy sources to power banking operations.	
	We actively participate in environmental protection initiatives and disclose our sustainability efforts.	
	We are committed to reducing carbon emissions, and waste production, and promoting recycling.	
	Our bank prioritizes environmentally friendly financial products, such as green bonds and sustainable investment funds.	
Social performance		(Zheng, Siddik, Masukujjaman, Fatema, and Alam 2021, Zahid et al. 2021, Almaqtari 2024).
	We promote financial inclusion by supporting underprivileged communities through digital financial services.	
	We ensure equal opportunities for all employees, fostering a diverse and inclusive workplace.	
	We prioritize employee well-being, offering training, work-life balance policies, and fair compensation.	
	We encourage employees to participate in sustainability-related volunteer activities and NGO collaborations.	
	We actively engage with stakeholders through transparent communication and IT governance.	
	We enhance our corporate reputation by integrating technological innovation ensuring sustainable and ethical business practices.	

effective in studies like ours, where the goal is hypothesis testing and predictions. Finally, PLS-SEM is a predictive tool that ensures reliable hypothesis validation and model performance by assessing predictive relevance and effect sizes (Abbasi et al. 2024; Chin et al. 2020).

Next, for the moderation analysis, the PROCESS macro version by Hayes (2017) was used to investigate whether the relationship between Fintech and SP was conditional on ITG (moderator) using Model 1 examining the effect of ITG moderation. Bootstrap methods using 5000 resamples were employed to validate the moderation results and generate a bias-corrected 95% confidence interval (Hayes 2017). This non-parametric approach enhances result validity by mitigating concerns related to sample distribution assumptions. Additionally, standardized residuals were used in model diagnostics to ensure linearity, homoscedasticity, and normality, thus validating the reliability of the moderation results. By applying this rigorous approach, we ensured that our findings regarding the moderation effect are statistically sound and theoretically meaningful.

5 | Preliminary Results

We received 207, 205, and 199 completed responses from Nigeria, Ghana, and Cameroon showing 41.4%, 41%, and 39.8% response rates for the countries after several reminders through email and phones. The response rates are consistent with previous studies using a similar questionnaire methodology (Delic and Eyers 2020; Li et al. 2020). Table 2 presents the profiles of the respondents. With 611 participants, 33.8% were obtained from Nigeria, 33.5% from Ghana, and 32.7% from Cameroon. The study found that 25.7% of participants were aged between 26 and 35 years, while 25.4% were aged between 36 and 45 years. Male participants were greater than females (M = 56.3% vs. F = 43.7%). For education, 39.1% acknowledged holding an undergraduate degree, 19.6% hold a postgraduate degree, and 41.3% declared having other certificates.

TABLE 2 | Respondents' profiles.

Profiles	Frequency	Percentage (%)
Country		
Nigeria	207	33.8%
Ghana	205	33.5%
Cameroon	199	32.7%
Gender: Male	344	56.3%
Female	267	43.7%
Age		
20–25	145	23.7%
26–35	157	25.7%
36–45	155	25.4%
46-above	154	25.2%
Education		
Undergraduate	239	39.1%
Postgraduate	120	19.6%
Others	252	41.3%
Work experience		
1–5 years	163	26.7%
6–10 years	160	26.2%
11–15 years	152	24.8%
16 years	136	22.3%

5.1 | Common Method Bias

The self-reported data has been validated to address potential common method bias issues, as all data originated from one instrument (Podsakoff et al. 2012). First, we detailed an introduction to the questionnaire, explaining the constructs that facilitated respondents' accurate responses. Second, our questionnaire's measurement items were randomized to prevent participants from recognizing causal relationships concerning constructs. Moreover, we ensured the privacy and confidentiality of respondents on the information gathered. Third, we analyzed common method bias using a single-factor Harman statistical test for statistical measurement control. The result is validated as a single factor accounts for 15.38%, below the 50% threshold of the total variance. In addition, the validity and reliability of data analysis were evaluated using a marker variable strategy (Lindell and Whitney 2001). Gender was utilized as a marker variable to examine the correlation between Fintech and the manager's gender, as it is theoretically unrelated to key variables. Results showed a non-significant connection amid the marker variable 0.100. Therefore, there is no significance of CMB on the dataset, ensuring the validity of the research findings.

5.2 | Model Assessment

We test the proposed model's fit and hypothesis interrelationship using a two-step procedure. The model's reliability and validity were assessed using SPSS AMOS V.26 through confirmatory factor analysis (CFA) and composite analysis, followed by structural path examination to test the hypothesis (Junaid et al. 2022; Singh and Rosengren 2020; Quan et al. 2023). We evaluate the measurement scale of indicators for each variable using CFA for construct reliability, convergent validity, and discriminant validity. Consequently, we utilize properties including Cronbach's alpha (CA), Factor Loadings (FL), Composite Reliability (CR), and Average Variance Extracted (AVE) to achieve this goal. From Table 3, the measurement model's outputs meet reliability standards, with factor loadings for items for all constructs exceeding 0.5. Moreover, the composite reliability and average variance estimates have been confirmed to be convergent, meeting both requirements of greater than 0.7 and 0.5, respectively (Hair 2009). Finally, CA (α) exceeds 0.7 for variables (Bonsu et al. 2025).

5.2.1 | Discriminant Validity Test

Similarly, the research assessed model validity using the square root of average variance estimates (Fornell–Larcker standard) and the Heterotrait–Monotrait ratio (HTMT) standards for

TABLE 3 | Reliability and validity tests.

Variables		Factor loading	CA	rho_A	CR	AVE
Fintech			0.84	0.87	0.88	0.53
	FT1	0.77				
	FT2	0.76				
	FT3	0.91				
	FT4	0.88				
	FT5	0.76				
	FT6	0.83				
	FT7	0.82				
Green finance			0.83	0.86	0.88	0.61
	GF1	0.83				
	GF2	0.78				
	GF3	0.86				
	GF4	0.84				
	GF5	0.61				
IT governance			0.81	0.86	0.88	0.66
	IT1	0.86				
	IT2	0.92				
	IT3	0.87				
	IT4	0.88				
Sustainability performance			0.81	0.82	0.89	0.73
Economic sustainability	ES1	0.90	0.79	0.89	0.87	0.60
	ES2	0.85				
	ES3	0.90				
	ES4	0.73				
	ES5	0.89				
Environmental sustainability			0.90	0.91	0.93	0.68
	EV1	0.90				
	EV2	0.85				
	EV3	0.90				
	EV4	0.72				
	EV5	0.89				
	EV6	0.87				
Social sustainability			0.89	0.91	0.92	0.66
	SP1	0.86				
	SP2	0.85				
	SP3	0.85				
	SP4	0.93				
	SP5	0.94				
	SP6	0.89				

discriminant validity (Henseler et al. 2015). Tables 4 and 5 display the inter-construct correlation values and the diagonal square root of AVEs. Results show that the square root of AVE values is higher than the corresponding correlation values, which meet the Fornell–Larcker criterion standards (Fornell and Larcker 1981). Consistent with Henseler et al. (2014) recommendation, we then performed a HTMT analysis to assess the discriminant validity. The results from the HTMT testing fell below the upper cut-off of 0.85 (Bonsu et al. 2025). Thus, we confirmed the discriminant validity of the study measure.

6 | Empirical Results and Discussions

We present the empirical results leading to our research hypothesis testing. Notably, the constructs' predictive relevance is assessed using R^2 and Q^2 with Cohen's (1998) requirement of R^2 being over 0.26 for substantial predictive power (Cohen 1998). Table 6 reveals that Fintech accounts for 34% of the total variance in GF. Moreover, Fintech, GF, and ITG account for 58% of the SP variance. The results indicate that both constructs have excellent predictive capacity. In addition, the Q^2 value indicates the predictive significance of endogenous components, with a value greater than 0 indicating their predictive significance. The findings further showed that research variables obtained predictive relevance (SP $Q^2 = 0.326$, GF, $Q^2 = 0.213$).

6.1 | Direct Effects

We tested the direct hypothesis using PLS-SEM and bootstrapping methods after confirming the reliability, validity, and model fitness. The PLS path results show that direct relationships are positive and significant in their corresponding outcome constructs. Figure 2 and Table 6 provide a summary of the results.

6.1.1 | Direct Effects of Fintech on GF and SP

We present the results and discussions of the effect of Fintech on GF and SP. In Table 5, Hypothesis 1 anticipated that Fintech adoption is positively related to banks' SP. The results show a positive and significant impact ($\beta = 0.466$, Pv = < 0.001), validating Hypothesis 1. The study indicates that integrating Fintech solutions into the banking sector at a 1% level can effectively tackle environmental and social issues, thereby enhancing the sector's overall SP. The study supports previous research indicating that technological innovation can significantly improve sustainability and governance practices (Battisti et al. 2023; Rais et al. 2023; Udeagha and Muchapondwa 2023).

Moreover, the findings support the literature indicating that Fintech is a dynamic capability that helps banking institutions enhance their economic, social, and environmental performance (Hu et al. 2019; Almaqtari 2024). The study suggests that while the link between Fintech and SP has yielded inconclusive results (Lee et al. 2021; Lisha et al. 2023), it could potentially support banking institutions' sustainability benefits by reducing environmental impact and minimizing paper waste, energy consumption, and carbon emissions, thereby promoting SP. Fintech adoption supports banks in strengthening their corporate social responsibility initiatives, increasing transparency in sustainability reporting, and fostering long-term stakeholder trust. These findings highlight the crucial role of Fintech

TABLE 4 | Correlation and Fornell–Lacker.

	1	2	3	4	5	6
1. Fintech	0.79					
2. Green finance	0.32***	0.78				
3. IT governance	0.43**	0.41***	0.83			
4. Economic sustainability	0.48**	0.44***	0.44***	0.89		
5. Environmental sustainability	0.38***	0.37***	0.39***	0.24***	0.78	
6. Social sustainability	0.25***	0.52***	0.46***	0.38***	0.51	0.81

***Indicates 1% significance level.

TABLE 5 | HTMT findings.

Variables	1	2	3	4	5	6
1. Fintech						
2. Green finance	0.64					
3. IT governance	0.42	0.83				
4. Economic sustainability	0.45	0.47	0.77			
5. Environmental sustainability	0.70	0.46	0.80	0.55		
6. Social sustainability	0.49	0.80	0.54	0.57	0.71	0.78

TABLE 6 | Results of direct findings.

Hypothesis	Path	β-value	*t* stats	STD DEV	*p*-Value	Hypotheses 1–4
H1	Fintech → SP	0.47	8.234	0.039	<0.001	Supported
H2	Fintech → GF	0.32	21.37	0.022	<0.001	Supported
H3	GF → SP	0.42	18.34	0.023	<0.001	Supported
H4	ITG → SP	0.43	15.78	0.027	<0.001	Supported

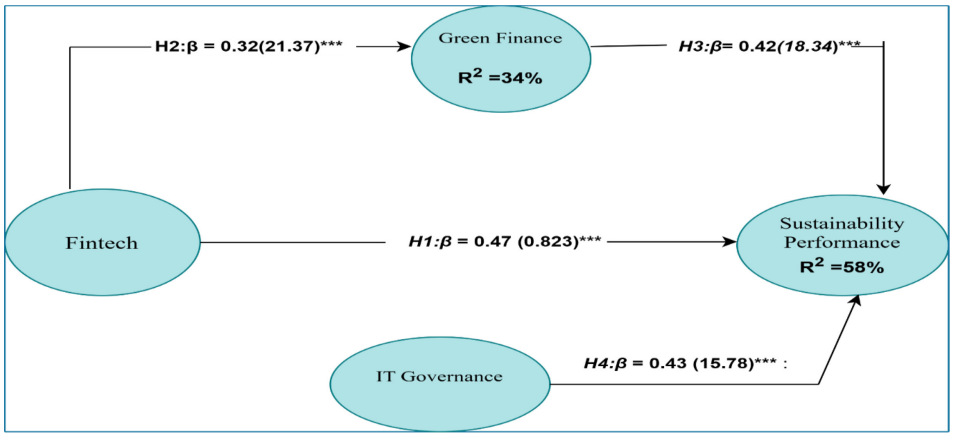

FIGURE 2 | Results from the PLS-SEM.

as an enabler of sustainable financial ecosystems. Notably, our findings align with the DCV, suggesting that technological advancements can enhance a firm's adaptability and competitive advantage. Fintech's positive impact on SP indicates its role as a dynamic capability for banks to effectively address environmental and social challenges. This empirical evidence reinforces the theoretical premise that technological innovations provide financial institutions with the necessary agility to integrate sustainability practices into their operations (Hidayat-Ur-Rehman and Hossain 2024; Siddik et al. 2023).

The findings have significant managerial and practical implications for banking institutions and policymakers. Banks should prioritize Fintech investments to enhance sustainability, reduce environmental impact, and develop regulatory frameworks that promote Fintech adoption while promoting sustainable banking practices. Additionally, the study underscores the necessity for banks to implement robust digital transformation strategies that promote sustainability, reducing paper waste, energy consumption, and carbon emissions. By doing so, banks can improve their SP while enhancing operational efficiency and customer satisfaction. Consequently, we argue that Fintech adoption as a capability promotes financial practices by fostering financial inclusion and GF initiatives, thereby enhancing SP.

In Hypothesis 2, we expected that Fintech would positively influence the GF of banks. Indeed, our result evidences a positive and significant impact on GF ($\beta = 0.322$, $PV < 0.001$). Hence, Hypothesis 2 is validated, confirming that Fintech adoption significantly enhances GF initiatives. The result aligns with Hidayat-Ur-Rehman and Hossain (2024) and advances previous studies (Wan et al. 2023; Mirza et al. 2023). The findings substantiate previous research that banking institutions are utilizing Fintech applications to promote eco-friendly financial products and services, thereby aligning with the current trend towards sustainable finance practices (Guang-Wen and Siddik 2023). Fintech is revolutionizing banking services by providing eco-friendly, efficient solutions like mobile payments, peer-to-peer transfers, and robo-advisors, thereby reducing transaction costs and waste (Ding et al. 2022). Research suggests that traditional banks are integrating Fintech services, expanding marketing channels, and payment methods to cater to emerging customer segments, boosting sales revenue, and enhancing green credit efficiency (Mirza et al. 2023; Karim et al. 2022). Despite the increasing evidence on Fintech's role in promoting sustainable finance, the literature provides limited evidence on the effects of Fintech on GF, especially on banks in Africa (Wan et al. 2023). Given the significant role that banks play in financial ecosystems and their support for Fintech development, our results provide new insights into how Fintech impacts GF, especially from African banks' perspectives. Notably, our findings support the DCV, demonstrating that Fintech adoption enables banks to develop and deploy sustainable financial innovations as a strategic capability. The capability to leverage Fintech for GF initiatives indicates that banks can enhance their resilience and adaptability to the evolving financial landscape while reinforcing their commitment to environmental sustainability. The study emphasizes the significance of incorporating Fintech innovations into banks' sustainability strategies, focusing on green credit allocation, sustainable investment options, and digital financial inclusion. In addition, the findings suggest that regulatory bodies consider implementing policies that promote a favorable environment for Fintech-driven GF solutions. Overall, our findings

highlight the growing significance of Fintech in sustainable finance, highlighting its potential to shape the future of banking by promoting environmentally responsible financial practices.

6.1.2 | Effects of GF and ITG on SP

We expected the positive effect of GF on SP. As evidenced in Table 6, GF is positively related to enhancing banks' sustainability ($\beta = 0.423$, $PV < 0.001$), validating Hypothesis 3. These results suggest that integrating GF into banking is vital for sustainability, as banks that adopt green practices and offer green financial products achieve better performance. This result validates previous studies from the literature (Hussain et al. 2023; Zhang and Wang 2021; Guang-Wen and Siddik 2023; Hidayat-Ur-Rehman and Hossain 2024; Kumar, Ahuja, et al. 2024), underscoring the crucial role of GF initiatives in reducing banks' carbon emissions. Moreover, recent studies suggest that banks prioritizing green financing in their development plans can improve sustainability, market reputation, regulatory compliance, and financial stability, contributing to sustainable growth (Guang-Wen and Siddik 2023; Hussain et al. 2023). This reflects banks committed to reducing their carbon footprint, attracting socially responsible investors, and improving operational efficiency while mitigating environmental risks. Moreover, GF assists banks in complying with regulatory requirements, enhancing public perception, and facilitating access to sustainable markets, thus enhancing their competitive edge. Our findings align with DCV and EMT, indicating that banks can improve their competitive positioning and tackle environmental challenges by utilizing GF. GF's positive impact highlights its strategic role in banks, helping them meet regulatory expectations, enhance their sustainability, and attract responsible investors. From a managerial and practical perspective, Ghana, Nigeria, and Cameroon banks should integrate GF strategies to reduce carbon footprints, attract socially responsible investors, enhance operational efficiency, and mitigate environmental risks. Additionally, GF aids banks in achieving regulatory compliance, enhancing public perception, and facilitating sustainable market access, thus enhancing their competitive advantage.

Our findings provide new evidence from African economies, particularly Nigeria, Ghana, and Cameroon, on the effects of GF on SP, extending the existing literature beyond developed economies and Asian markets. This highlights the need for policymakers and financial institutions in emerging markets to further embrace GF as a key driver of sustainability. Finally, Hypothesis 4 confirmed the positive effect of ITG on SP ($\beta = 0.429$, $PV < 0.001$). The result suggests that robust ITG frameworks significantly enhance banks' SP by fostering transparency, accountability, and the strategic use of digital innovations.

ITG ensures that technology investments align with sustainability goals, thereby optimizing operational efficiency and resource allocation. From a theoretical standpoint, these findings align with the DCV by demonstrating that effective ITG enables banks to leverage digital transformation as a strategic capability for sustainability. Furthermore, EMT suggests that financial institutions with robust ITG structures are better equipped to incorporate technological advancements that promote environmental and social sustainability. The findings confirm previous studies (Aguboshim et al. 2019; Arner et al. 2020; Guang-Wen and Siddik 2023; Zhang et al. 2021; Zhao et al. 2019), highlighting the role of ITG in enhancing corporate sustainability by ensuring compliance with environmental regulations, promoting ethical data management, and supporting digital financial innovations.

Moreover, ITG frameworks enhance the management of green IT projects, cloud computing, and AI-driven sustainability initiatives, thus promoting sustainable banking practices (Mushtaque et al. 2014; Mohapi and Njenga 2012; Almaqtari 2024; Rahman et al. 2024). The study suggests that banking institutions should strengthen their ITG mechanisms to ensure the responsible adoption of technology in their sustainability strategies. Implementing effective ITG can significantly improve banks' regulatory compliance, cybersecurity, and eco-friendly digital services. Moreover, the study indicates that policymakers urge financial institutions to adopt ITG practices that promote digital financial inclusion and green banking innovations. Our study offers fresh insights into the impact of ITG on SP in African banking institutions, notably in Ghana, Nigeria, and Cameroon. The increasing reliance on digital banking services in these economies suggests that improving ITG could significantly contribute to achieving long-term sustainability goals.

6.2 | Moderation Effects

Using Model 1 of PROCESS Macro through the SPSS, 54.1% of the variability in SP was predicted by variables ($R^2 = 0.541$, $F(3,124) = 48.724$, $p < 0.001$. From Table 7, ITG moderated Fintech effects on banks' SP ($\beta = 0.041$, $p < 0.005$), suggesting that the ITG advancements lead to increased Fintech adoption, contributing to economic, social, and environmental SP. Banks utilizing Fintech and SP improvements are anticipated to experience economic, social, and environmental advantages (Dwivedi et al. 2021; Guang-Wen and Siddik 2023; Zhang et al. 2021; Macchiavello and Siri 2022; Macpherson et al. 2021). Additionally, the study suggests that the successful implementation of ITG structures significantly enhances the SP of Fintech by ensuring proper oversight, risk management, and strategic alignment of innovations with sustainability objectives. ITG can

TABLE 7 | Moderating effect results.

	βeta	*t*-Stats	*p* value	LLCI	ULCI	Moderation
Fintech	0.08	0.32	0.75	0.57	0.42	
IT governance	0.83	1.92	0.06	0.02	1.68	
Fintech*ITG → SP	0.04	2.76	0.00	0.01	0.07	Supported

enhance Fintech's impact on SP by ensuring responsible technological deployment, leading to improved environmental, social, and governance outcomes for banks. Figure 3 reveals that low ITG banks show a marginal impact of Fintech adoption on SP, suggesting they may not fully utilize it for sustainability improvements. Meanwhile, high ITG significantly enhances the positive relationship between fintech adoption and SP, implying that banks with higher ITG experience a substantial increase in SP. The study indicates that robust ITG can significantly enhance the sustainability impact of Fintech. Overall, we indicate that robust ITG significantly enhances the connection between Fintech adoption and SP in banks, thereby maximizing the sustainability benefits.

6.3 | Robustness Analysis

We used the PLS-SEM to estimate and analyze Nigeria, Ghana, and Cameroon banks to understand individual country effects. Fintech and GF adoption in Nigeria, Ghana, and Cameroon differ significantly due to distinct regulatory environments, financial systems, and technological readiness. For instance, Nigeria's banking sector is highly competitive with advanced Fintech penetration, while Ghana and Cameroon have varying levels of competition, integration, and regulatory support for GF. Consequently, understanding local variations in ITG and bank competition can help determine their impact on country-specific outcomes. Table 8 summarizes the results.

Table 8 reveals a significant positive impact of Fintech on SP and GF in both Ghana and Nigeria, with Nigeria showing a greater impact on SP. This is not surprising as Nigeria's Fintech ecosystem is robust, with high adoption rates and a substantial digital financial services market. Nigerian banks can now effectively utilize Fintech solutions to improve sustainability outcomes, promote GF, and maintain competitiveness. However, the impact of Fintech on Ghana and Cameroon's financial metrics is still positive but not as robust as in Nigeria. On the other hand, Cameroon banks are increasingly utilizing Fintech for GF, surpassing Ghana and Nigeria in this area, demonstrating a greater focus on environmentally friendly projects and sustainable investments. Cameroon's Fintech ecosystem aligns with green financial products due to government policies, market demand, and sustainability initiatives, promoting greater alignment between fintech solutions and environmental goals. Likewise, GF and ITG have a significant positive impact on SP, with their effect being more significant in Ghana than in Nigeria and Cameroon. The findings can be linked to the below factors. First, Ghana can achieve more progressive regulations and government incentives for sustainable finance, environmentally friendly investments, and digital innovation in the banking sector. Increased regulatory support for GF and sustainability

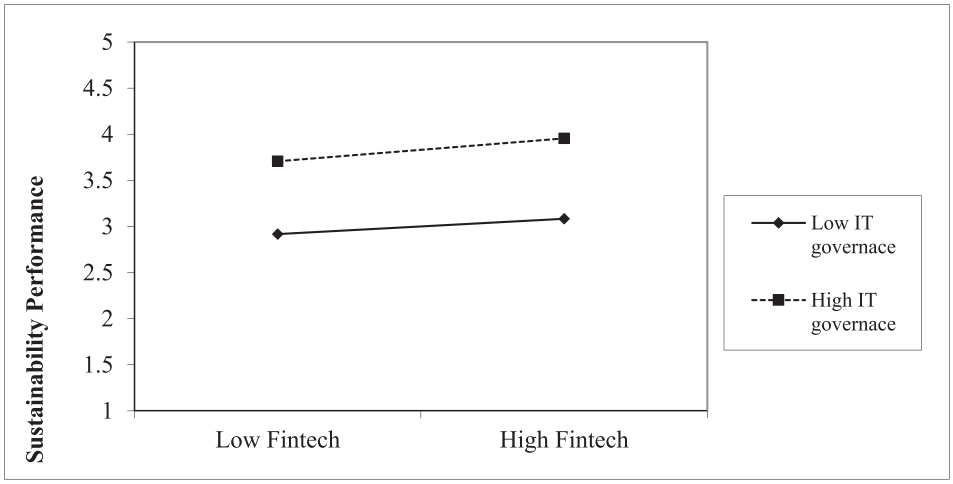

FIGURE 3 | Moderation effects.

TABLE 8 | Country comparison results.

	Nigeria	Ghana	Cameroon
Relationships	**β (*p*-value)**	**β (*p*-value)**	**β (*p*-value)**
Fintech → SP	0.07***	0.02***	0.04***
Fintech → GF	0.01***	0.02***	0.08***
GF → SP	0.02***	0.021***	0.002***
ITG → SP	0.021***	0.022***	0.002***
Fintech * ITG → SP	0.012 (0.013)***	0.002 (0.013)***	0.011 (2.014)***
Obs	207	205	199

***Represents < 0.001.

practices could encourage banks to adopt eco-friendly initiatives and integrate sustainable development goals into their core operations. Second, Ghanaian banks show a higher receptiveness to GF initiatives like renewable energy funding and sustainability-oriented lending policies compared to Nigerian and Cameroonian banks. Lastly, Ghana's banks are leveraging technology governance to improve SP, utilizing data analytics, automation, and digital platforms for environmental risk monitoring and management. Institutional investors and Ghanaian stakeholders can encourage banks to adopt ESG metrics, leading to robust adoption of GF and improved SP.

The Process Model indicates that stronger ITG frameworks can enhance the positive impact of Fintech on SP in Ghana, Nigeria, and Cameroon. Banks with robust ITG structures, including data management, cybersecurity, and technology integration, are better equipped to effectively utilize Fintech for improved sustainability outcomes. Therefore, the study confirms that ITG moderates the Fintech and SP relationships of banks in both countries, ensuring robustness.

6.4 | Additional Analysis

We analyzed the impact of Fintech, GF, and ITG on SP, considering environmental, social, and economic factors. The main findings were estimated using regression models, as shown in Table 9. From the results, Fintech has positive and 1% significant effects on all three dimensions of SP, with the effect pronounced higher on economic sustainability ($\beta = 0.28$, pv = < 0.001). This implies that Fintech's growth enhances the economic dimension, promoting the bank's sustainability and contributing to its overall growth. Fintech significantly enhances banks' economic sustainability through operational efficiency, cost reduction, profitability, and improved customer service, but its impact on social and environmental sustainability is less evident. Fintech innovations are boosting financial growth and competitive advantage in banks more effectively than addressing broader sustainability goals like environmental protection or social responsibility. Therefore, banks are enhancing financial performance through Fintech solutions like digital banking, payments, and financial products, but may be underutilizing them for social impact and environmental outcomes.

Likewise, these relationships evidence a positive influence of GF on all SP dimensions, with a larger effect on environmental sustainability, suggesting that banks are promoting the development of green financial products, such as green loans and bonds, aimed at attracting sustainable investments and enhancing environmental sustainability (Wang et al. 2021). Currently, banking institutions view investing in ecologically sustainable initiatives as a strategy to mitigate risks associated with climate change and ecological deterioration (Zhang et al. 2021). GF helps banks mitigate environmental risks by prioritizing sustainability over social or economic aspects, driven by growing market demand for sustainable investment opportunities. Lastly, ITG shows a positive effect on SP dimensions, indicating that ITG capability improved environmental performance and responsible bank behavior, playing a crucial role in driving economic success (Mohapi and Njenga 2012; Mushtaque 2015). Notably, the effect is greater on social sustainability, suggesting that effective ITG enhances transparency, trust, ethical business practices, and social responsibility in banking institutions, fostering stakeholder trust and promoting social sustainability (De Haes and Van Grembergen 2009).

Finally, we estimated whether GF mediates the effect of Fintech on SP using the SPSS Macro-Processes (Model 4) to conduct 5000 repeated samplings and construct a 95% unbiased confidence interval to examine the mediating impact of green innovation on Fintech and environmental sustainability. The research's proposed pathway was found to be statistically significant, with confidence intervals excluding zero. Results show a positive indirect effect of GF on the Fintech and SP relationships (B = 0.230, p-value = 0.000, 95% CI = (0.178,0.275). Notably, the study found significant direct and total impacts (PV < 0.001) confirming a partially mediating effect of GF between Fintech and SP. The study indicates that implementing GF principles enhances the adoption of Fintech solutions, thereby enhancing the SP of banks. GF initiatives, such as funding renewable energy projects and issuing green bonds, utilize Fintech technologies to streamline processes, reduce environmental impact, and support eco-friendly operations. Integrating GF and Fintech adoption leads to improved sustainability outcomes, aligning banks with environmental goals and enhancing their overall performance.

TABLE 9 | Multi-dimensional results.

Variables	Economic sustainability	Environmental sustainability	Social sustainability
Fintech	0.28 (17.89) < 0.001	0.20 (8.16) < 0.001	0.17(6.58) < 0.001
GF	0.29 (23.90) < 0.001	0.63 (7.28) < 0.001	0.21 (4.87) < 0.001
ITG	0.01 (0.36) ns	0.36 (6.42) < 0.001	0.43 (7.21) < 0.001
R^2	0.82	0.56	0.49
Adj R^2	0.81	0.55	0.48
F stats	889.1 (< 0.001)***	257.1 (< 0.001)***	196.5 (< 0.001)***
Max VIF	3.25	2.96	3.25
Obs:	611	611	611

***Indicates 1% significance level.

7 | Conclusions

We utilize DCV and EMT to illustrate the impact of Fintech on banks' SP through ITG. The proposed links were empirically verified using data from 611 Nigeria, Ghana, and Cameroon banking institutions. The empirical findings show that (1) Fintech positively influences SP; (2) Fintech positively supports GF; (3) GF positively enhances banks' SP; (4) ITG has a positive and significant effect on SP; and (5) ITG acts as a significant moderator between Fintech and SP. The research findings strongly support that the integration of Fintech and GF is positive for SP and ITG is the mechanism that shapes these links in the field of information systems and sustainability. Therefore, we argue that ITG is vital in guiding banks towards sustainable initiatives, Fintech development, and technical advancement, significantly enhancing their SP. Overall, we provide valuable insights for policymakers, practitioners, and scholars to navigate the evolving Fintech and sustainability landscape in the banking sector, including fostering integration, GF, and robust ITG.

7.1 | Theoretical Contributions

Our research significantly contributes to the existing literature. First, Fintech and sustainability literature cover various disciplines, tackling environmental challenges (Liu, Mahmoud, et al. 2024; Cheng et al. 2023). However, limited research explores Fintech's impact on banks' SP using management and information systems theories, revealing undiscovered variables and promising technology for sustainability improvement (Goralski and Tan 2020). The mechanisms behind the issue remain unclear, necessitating additional research on moderating the roles of IT in technological advancement. The study highlights the importance of Fintech in promoting sustainability through ITG, highlighting its role in achieving banks' SP in Nigeria, Cameroon, and Ghana.

Second, we investigate the influence of ITG between Fintech and SP. Literature indicates that IT advancements significantly enhance sustainability, playing a crucial role in improving SP (Aguboshim et al. 2019; Arner et al. 2020; Guang-Wen and Siddik 2023; Zhang et al. 2021; Zhao et al. 2019). However, limited studies have explored the moderating roles of IT in Fintech and banks' SP (Almaqtari 2024). Notably, the literature on the moderating roles of ITG in Fintech and SP relationships in emerging markets in Africa is limited. ITG can boost Fintech adoption in emerging African nations by offering customized guidance to banks to overcome technological, regulatory, and infrastructural obstacles. Therefore, this study aims to expand the literature on the moderating effects of ITG on Fintech and SP in banking institutions (Almaqtari 2024). We highlight the importance of ITG in enhancing the influence of Fintech on the banking industry in Africa's emerging markets for strategic decision-making and governance policies.

Third, this study supports EMT and DCV in sustainability literature by observing Fintech and GF's role in boosting banks' SP through moderating effects of ITG. The EMT advocates for companies to utilize innovative and integrated technologies to reduce their ecological impacts (Tang et al. 2022). This study defines Fintech as GF and technological innovations that promote sustainability modernization, aid business mitigation, and enhance bank SP using the EMT model (Rehman Khan, Yu, et al. 2022). As suggested by the DCV, this study demonstrates that GF offers a competitive edge in dynamic business environments by improving ITG and performance. Therefore, the literature on information systems and the environment is expanding the use of EMT and DCV.

Fourth, we highlight the importance of effective ITG and its potential to enhance SP in banking institutions. Consequently, ITG is crucial for banks' sustainability projects as it ensures robust oversight, efficient technological resource management, and alignment with strategic objectives. ITG boosts security, reliability, and adaptability in sustainable activities like GF, digital financial services, and energy-efficient operations, mitigating risks related to data privacy, cybersecurity, and regulatory compliance. We highlight that adopting Fintech and strengthening ITG can be critical in shaping banks' strategic planning towards sustainable activities, which in turn influence significantly and positively SP. Hence, we improve the understanding of the crucial role of ITG by providing empirical evidence on the moderating effects of ITG on the association between Fintech and SP. Finally, the study is the first to investigate the influence of Fintech and GF on the SP of banks in Africa's emerging markets. Therefore, we explore Fintech and sustainability in emerging economies by examining banks in Ghana, Nigeria, and Cameroon, contributing to the growing literature on this topic.

7.2 | Practical Implications

The study offers four significant practical implications. First, the study highlights the importance of integrating Fintech into banking strategies to improve SP and promote environmentally friendly practices and products. Fintech implementation can enhance bank operations, improve customer experiences, and promote environmental sustainability. Second, the study indicates a robust and positive correlation between Fintech and GF, emphasizing the necessity for a robust GF. In practice, banks are encouraged to develop and implement sustainable financial innovations that align with global sustainability trends and meet the increasing demand for sustainable banking practices. Banks can maintain competitiveness by prioritizing technological innovation and exceptional customer service, while fintech enhances SP, enabling them to meet market expectations and regulatory standards. Third, the study demonstrates positive results regarding the impact of Fintech and GF on SP. Therefore, banking lenders should adapt their strategies to achieve sustainable development objectives, extending beyond GF practices to the broader sustainable development of the banking industry. For instance, banks can improve sustainability by integrating Fintech, enhancing performance, adapting to environmental changes, and maintaining a competitive edge in the financial sector through eco-friendly products, AI-driven decision-making, and employee training. Finally, the study highlights the effectiveness of effective ITG in promoting sustainable practices in banking institutions. Therefore, banks must enhance their governance structures to integrate financial innovations and promote sustainability, promoting GF practices in line with

economic, environmental, and social responsibility strategies (Chueca Vergara and Ferruz Agudo 2021). Literature underscores the necessity of robust ITG standards and effective risk management in the responsible implementation of Fintech (Fattah et al. 2021; Khalil and Belitski 2020; Almaqtari 2024). Particularly, banks that prioritize sustainable practices can gain a competitive edge by establishing themselves as ethical enterprises, appealing to environmentally conscious customers and investors (Meiling et al. 2021). In addition, banking institutions can enhance their ITG and GF by promoting innovative technologies and improving their internal capabilities. Therefore, the study suggests that African banks, particularly Nigeria, Ghana, and Cameroon, can enhance their Fintech strategy by implementing ITG measures that comply with regulatory requirements.

7.3 | Policy Implications

We highlight below policy implications along with interesting practical implications.

1. This study proposes a model for sustainable finance policies, highlighting the positive impact of Fintech and robust ITG on SP. Accordingly, we suggest that financial institutions should be encouraged to adopt sustainable ITG policies by offering regulatory advantages, certifications, or preferential treatment (Almaqtari, Farhan, Yahya, et al. 2023). Additionally, we suggest that regulators can enhance reporting standards by mandating financial firms to publish both financial and environmental performance data in line with global trends (Samagaio and Diogo 2022; Chueca Vergara and Ferruz Agudo 2021).
2. The regulation of Fintech requires the implementation of capacity development and training programs to mitigate its associated risks. Tok and Yesuf (2022) and Nasiri et al. (2022) emphasize the importance of establishing partnerships between regulatory organizations and financial institutions for information exchange, best practices, and sustainable finance initiatives. African banks can integrate GF concepts into their lending and investment procedures to align their sustainability practices with global standards.
3. We examine Fintech's role in enhancing SP in banks, revealing a striking resemblance in the strategic approach of Nigeria, Ghana, and Cameroon. These countries' policies, including Ghana's Payment Systems and Services Act (2019) and the National Financial Inclusion and Development Strategy (NFIDS), Nigeria's National Financial Inclusion Strategy (NFIS) and CBN's Fintech Regulatory Framework, and Cameroon's Financial Inclusion Strategy and National Development Strategy, resonate with our findings on the importance of Fintech in transforming banking practices. The study aligns with the strategic approach of these countries to Fintech, resulting in policy recommendations based on comprehensive findings. (1) Governments should foster Fintech integration in banking operations by providing incentives, regulatory frameworks, and infrastructure, and fostering collaboration between financial institutions and Fintech companies. (2) Policymakers should encourage financial institutions to adopt GF initiatives through regulations, tax benefits, and awareness campaigns promoting environmentally friendly financial products and services. (3) Governments should prioritize financial inclusion programs, including financial literacy, to ensure Fintech adoption and sustainable banking practices reach all segments of the population.

7.4 | Limitations and Further Research

This study encountered certain limitations despite significant findings. First, the study focuses on banks in Nigeria, Ghana, and Cameroon, which may limit the generalizability of our findings to other countries, financial institutions, or industries. Future research could expand the scope to different geographic regions and sectors to explore whether the observed relationships hold across diverse economic and regulatory environments. Additionally, cross-industry comparisons would provide deeper insights into the role of Fintech adoption and ITG in SP. Second, we utilized survey-based questionnaire data; although it effectively captured perceptions and behaviors, it may introduce method bias and measurement errors. The use of self-reported data also raises the possibility of endogeneity, particularly due to omitted variables or reverse causality. Future research could enhance causal inferences by utilizing secondary data sources, instrumental variable (IV) approaches, or panel data analysis. Finally, our analysis is based on cross-sectional estimates, limiting our ability to capture dynamic changes over time. To enhance robustness, future research should consider longitudinal studies, which would allow for the assessment of causal relationships and the impact of internal and external factors on Fintech adoption, ITG, and SP.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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