



Digital Green Banking and the Shift in Environmental Accountability: A FinTech-Accounting Integration

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Abstract

Financial sector digital transformation has supported the emergence of green banking by combining environmental concerns with sustainability-focused financial operations. Management accounting, more accountable for environmental cost monitoring and performance assessment, offers a critical platform for internal accountability. This study aims to investigate how digital green banking practices enabled by FinTech tools can be integrated into management accounting systems to enhance environmental accountability. A mixed-methods design was used, which integrated quantitative surveys of 200 respondents with qualitative interviews and secondary analysis of data. Findings show that adoption of FinTech enhances the accuracy of environmental costs, reporting timeliness, and budgeting for sustainability, with statistical testing yielding statistically significant associations. Case-based evidence reveals diverse uses across commercial, development, and cooperative banks, with quantifiable gains in accountability and efficiency. Evidence indicates that integrating digital green banking transforms the function of management accounting, promoting it as a key enabler for the integration of sustainability into strategic decision-making.

Keywords: Digital Green Banking, Management Accounting, Environmental Accountability, FinTech Integration, Sustainability Performance

Introduction

The convergence of digitalization and sustainability-oriented technological progress has markedly accelerated the reconfiguration of financial systems and practices (Muchiri *et al.*, 2025). Among them, digital green banking emerged as a calculated response to worldwide worries regarding ecological degradation, climate change, and sustainable growth (Mareta *et al.*, 2024). Financial processes that incorporate environmental considerations into lending procedures, investment planning, and banking operations are known as "green banking" (Kurniadi *et al.*, 2024). Green banking extends beyond traditional means to create dynamic, data-driven, open, and sustainability-oriented systems, alongside technical innovations such as blockchain, artificial intelligence, and finance technology platforms. These shifts have considerably affected the application and extent of the management accounting field (Waworuntu & Pratiwi, 2025). Earlier restricted to internal budgeting and costing, management accounting nowadays encompasses more pervasive activities such as monitoring environmental expenses, assessing sustainability performance, and integrating non-financial information into managers' choices (Chandrasekaran & Narayanan, 2025). Environmental Management Accounting (EMA) and Strategic Management Accounting (SMA) have

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emphasized the need to include ecological and social concerns in decision-support systems (Kuosuwan *et al.*, 2024). A new field where advanced cost management techniques and technology integration could enhance environmental responsibility is evidenced by the convergence of management accounting and digital green banking (Mir & Bhat, 2022). Emerging regulatory structures, environmental reporting obligations, and shareholder activism have compelled banking organizations to harmonize their operations with international environmental objectives (Mavlutova *et al.*, 2022). While exterior environmental reporting has gained considerable attention, it is not yet understood which internal management structures promote ecological responsibility using the financial decision-making process (Sharma & Choubey, 2022). Management accounting offers the right vehicle to bridge this gap through the establishment of tools that capture the usage of resources, internalize environmental expenses, and inform strategic choices that result in sustainability achievements (Thottoli, 2024).

Earlier studies have primarily examined green banking from corporate social responsibility, regulatory compliance, and ex-ante sustainability reporting perspectives (Jain *et al.*, 2023). Studies have examined how banks employ environmentally friendly processes

such as computerized transactions, paperless banking, and investments in green projects to demonstrate their environmental commitments (Kuzmenko *et al.*, 2023). It has also been investigated how effectively green finance using fintech technology can improve efficiency, automate compliance, and increase transparency. However, much of the studies locates these practices within the framework of the external reporting system with a focus on regulatory alignment and investor communication (Alhazmi *et al.*, 2025). Studies in the accounting field have described methodologies of measuring ecological costs, lifecycle costing, and a tool for integrating sustainability indicators in internal systems. Strategic management accounting has placed importance on the use of balanced scorecards and non-financial performance measures as a decision-making tool (Hassanein *et al.*, 2025). While, despite the above conceptual developments, the connection between management accounting and digital green banking has not been completely established (Popova & Cernisevs, 2022). Very few studies have explored how FinTech-powered green efforts can be integrated into internal accounting systems to support budgeting, performance monitoring, and decision-making (Zhang *et al.*, 2023). In addition, theoretical contributions have been constrained to be narrowly focused, with most analyses concentrating on compliance-oriented frameworks, audits, or environmental disclosure. Few actual examples of how FinTech-enabled technologies are employed by management accountants to monitor sustainability exist (Kolling *et al.*, 2025). In addition, few formal frameworks exist that show how management accounting methods could be applied to institutionalize environmental accountability within the internal operations of banks. This implies a glaring theoretical and practical difference that must be explored more fully (Milza *et al.*, 2021). Even as digital green banking is growing rapidly and management accounting is recognized as a tool for sustainability, there remains a paucity of growth in bringing the two together. While internal management systems may be slow to adapt at times to these changes, financial institutions regularly implement digital green initiatives to comply with external reporting requirements (Ashraf, 2024). There exists a lack of accountability, decision-making, and performance assessment, where there are no robust frameworks linking management accounting practices and FinTech-facilitated sustainability strategies. Banks risk making sustainability an outside compliance process rather than incorporating it into their strategy and operational processes, in case it fails to link it systematically (Gunawan *et al.*, 2022). This division between the management accounting and digital green banking practices undermines the possibility of environmental responsibility at the internal organizational level. An important role of management accountants is to capture, evaluate, and report ecological performance data (Hidayat-ur-Rehman & Hossain, 2024). Such a potential remains largely unrealized, however, unless it is organized through integration with digital

financial systems. It is significant to close this gap to optimise the allocation of resources, enhance sustainability-related decision-making within organisations, and increase the overall financial accountability in banking organisations (Bouteraa *et al.*, 2023).

The key aim of this study is to investigate how digital green bank programs could be meaningfully incorporated into management accounting frameworks to support environmental responsibility. This entails investigating the flexibility of management accounting tools in reporting ecological costs and sustainability performance if accompanied by FinTech-led practices. Another objective is to analyze the contribution of next-generation digital technologies, such as blockchain, AI, and big data analytics, towards bolstering the decision-making power of banking management accountants. The study also aims to discover the advantages and disadvantages of integrating green banking practices with digital technology into management control systems and their impact on internal accountability and performance measurement. In the end, the aim is to construct a conceptual model that demonstrates the avenues through which management accounting can serve as a pivotal means of embedding environmental responsibility and sustainability within digitally empowered banking settings.

Methodology

Study Design

Both the quantitative patterns as well as the contextual findings were embedded in the mixed-method approach. The quantitative strand captures the measurement of the relationship between management accounting outcomes and the use of digital green banking, while the qualitative strand explores the experiences and practices within financial institutions. This was a way of finding equilibrium between statistical accuracy and a lot of organizational description. The model ensures that sustainability through environmental responsibility was considered not only through measurable factors such as cost tracing and performance score, but also through managerial viewpoints in an effort to establish a complete understanding of how FinTech can influence policy on internal sustainability.

Conceptual Framework

Three components constitute the model: environmental accountability outcomes, digital green banking, and management accounting. Real-time ecological information can be obtained through the application of digital banking technologies such as blockchain-based sustainability reporting and computer green loan analysis. Lifecycle costing, activity-based costing, and balanced scorecards are utilized by management accounting systems to process the data. Improved decision-making and greener performance management should be the outcome of this. Technology infrastructure and organizational readiness are environmental factors

affecting the level of integration. The strategy provides a foundation for researching, both qualitatively and through hypothesis testing, how the internal systems might execute sustainability.

Data Collection

The information was collected, cross-checked, and finalized with the use of both primary and secondary sources. Primary data on management accountants, sustainability officers, and executives of digital banking would be collected through semi-structured interviews and structured questionnaires. More significant details regarding the companies' reactions and concerns would have been elicited through interviews, whereas questionnaires also yield quantitative information regarding sustainability and FinTech integration. Publicly available industry reports, sustainability reports, financial disclosures, and other similar documents were some of the secondary data that were collected to give the triangulation an external context. By cross-referencing recorded facts and subjective views, this two-facet method was as reliable as possible and provides complete data on the problem of organizational process as well as on the broader level of financial sustainability.

Sampling Strategy

The study targets financial institutions, including development banks and commercial banks, that have clearly visible digital green banking activities. The purposeful sampling ensures the selection of respondents actively engaged in sustainability-related financial decision-making. Approximately 200 individuals are identified for the quantitative survey, and 15 to 20 individuals for the qualitative interviews. Institutions are chosen from emerging countries, particularly India, where fintech usage and sustainability reporting are growing simultaneously. By focusing on cases where management accounting and integration of digital green banking are most critical, this method enhances relevance while still providing sufficient variation in institutional size and scope of operations.

Data Analysis

To investigate possible correlations among FinTech adoption, accounting software, and accountability outcomes, quantitative data are analyzed with regression analysis, descriptive statistics, and, where applicable, structural equation modeling. Thematic coding was used

for qualitative interview data by combining emerging themes that became evident in the course of analysis with pre-defined categories from the conceptual framework. Cross-validation and repeated comparison enhance coding reliability. To identify disclosure and reporting trends, content analysis was used on secondary data, including sustainability reports. The results were combined using a convergent strategy, where thematic concepts were matched with quantitative findings to give a single interpretation of the findings.

Ethical Considerations

The moral integrity of the ethical process was maintained in the investigation to maintain the respect and confirmation of those concerned. Each respondent offers his or her informed consent to participate in the study, and voluntary participation and confidentiality were guaranteed. To avoid revealing an organization or a person, the data was anonymized and acted in accordance with the rules of data protection. Due to the nature of interviews that were conducted in formal environments, prejudice or coercion are less likely to occur. The sources of secondary data were cited to avoid deception. The study was objective and respectful of the rights of the subjects involved, through the inclusion of ethical considerations, which ensure the inferences made based on the quantitative and qualitative data are convincing and practical.

Results

Descriptive Findings

There is a large diversity in bank size, type, and levels of FinTech adoption, the responder profile indicates. 20 % were from development banks, 25 % from commercial banks, and 25 % from cooperative institutions. Smaller banks registered a moderate level of digital green adoption, whereas larger banks asserted a greater integration. 62% of respondents admitted to utilizing at least one FinTech system with a sustainability orientation. This distribution provides a balanced dataset for examining the impact of size and type on environmental responsibility within management accounting systems, and it focuses on diversity in institutions. Table 1 shows the distribution of respondents by organizational size within commercial, development, and cooperative banks. The distribution indicates that the sample is dominated by larger commercial banks, with smaller cooperative banks having a more limited span.

Table 1: Respondent Profile by Bank Type and Size

Bank Type	Small (%)	Medium (%)	Large (%)
Commercial	12	18	25
Development	8	10	7
Cooperative	15	5	0

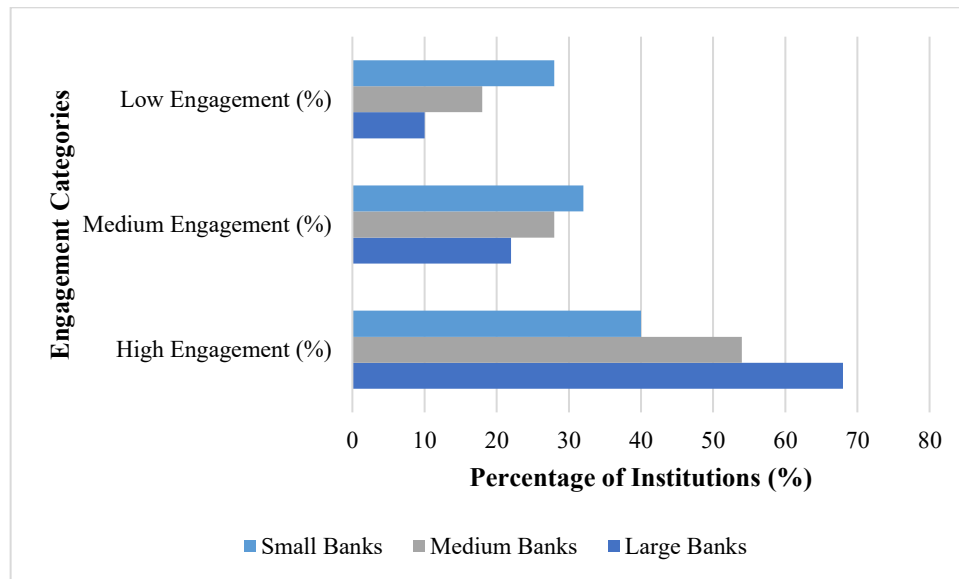


Figure 1: Levels of Digital Green Banking Engagement by Bank Size

Figure 1 shows that 68 % of large banks belong to the high engagement category, versus 54% of medium banks and only 40% of small banks. In comparison, small banks show relatively better values in medium engagement (32% and low engagement 28% respectively) as compared to large banks (22% and 10 % respectively).

Integration of FinTech into Management Accounting

Findings show increasing reliance on digital solutions for budgeting and monitoring environmental expenditures. Among the institutions observed, 54% applied blockchain-compatible technologies to verify sustainability, and 68% indicated including real-time dashboards in internal reporting. Lifecycle costing and

activity-based costing approaches were reported in 46% of instances, indicating a moderate adoption rate. Relative to the smaller banks, medium and large banks demonstrated a greater congruence between FinTech technologies and management accounting processes. These results suggest that technology integration enhances environmental cost allocation speed and accuracy while enhancing the financial institutions' internal decision-making strength. Table 2 shows the level of FinTech tool usage within the banks surveyed. Whereas lifecycle costing integration is not as commonly applied, blockchain validation and real-time dashboards are moderately common.

Table 2: Adoption of FinTech-Enabled Accounting Tools

Tool Type	Adoption (%)	Non-Adoption (%)
Real-time dashboards	68	32
Blockchain verification	54	46
Lifecycle costing integration	46	54

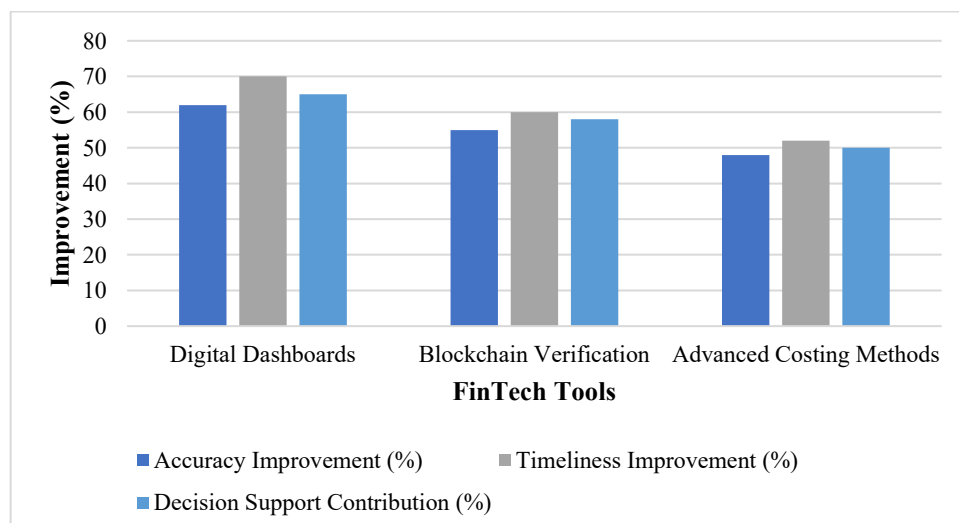


Figure 2: Contribution of FinTech Tools to Management Accounting Improvements

Figure 2 shows the benefits of various FinTech solutions on management accounting outcomes. Timeliness (70%), accuracy (55%), and decision-making (58%) may be most positively affected by digital dashboard and blockchain verification. Advanced costing techniques yield more balanced (but relatively less significant) improvements.

Environmental Accountability Outcomes

The results indicate measurable gains in control and decision-making procedures pertinent to sustainability. There were 25% increases in resource efficiency, 22% reductions in carbon-cost allocation, and 30% improvements in budgeting accuracy driven by sustainability that were realized by institutions that had implemented FinTech technologies. The ability to link

environmental performance to profitability measures has been enhanced, as indicated by respondents, enabling management accountants to make more strategic contributions. These findings indicate how green banking solutions delivered digitally move beyond compliance to performance-based environmental stewardship, enhance accountability by factoring in ecological considerations into internal cost management and control systems. Table 3 shows the percentage improvements in resource efficiency, carbon-cost allocation, and budgeting accuracy. Findings show that incorporating digital and green practices into management accounting can lead to compelling enhancements in accountability.

Table 3: Reported Improvements in Accountability Metrics

Accountability Metric	Improvement (%)
Resource efficiency	25
Carbon-cost allocation	22
Budgeting accuracy	30

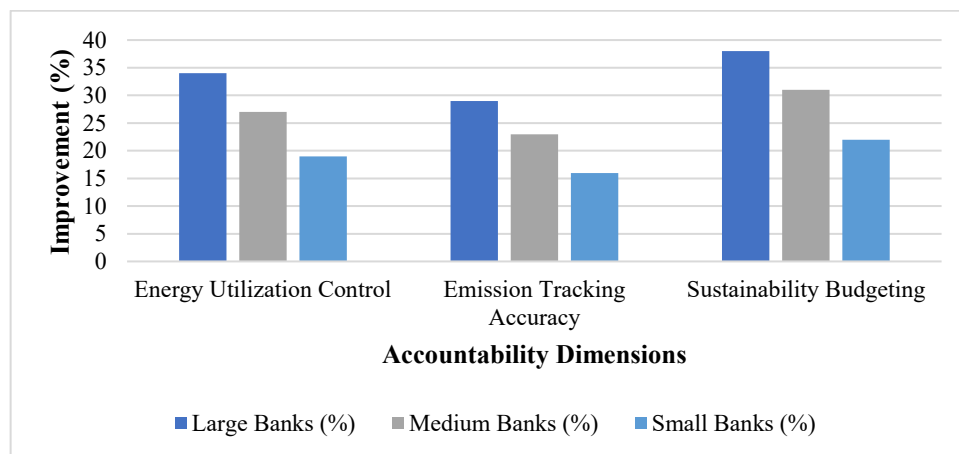


Figure 3: Environmental Accountability Improvements by Bank Size

Figure 3 shows the comparative gains in environmental responsibility results for large, medium, and small banks. With 38% in sustainability budgeting and 34% in energy usage control, large banks made the most improvements, while small banks recorded relatively lower levels in all areas.

Hypothesis Testing

Strong correlations between FinTech applications and management accounting outcomes are confirmed through statistical testing. The effects of FinTech integration are positive on sustainability-focused performance measurement ($\beta = 0.37$, $p < 0.05$) and environmental cost precision ($\beta = 0.41$, $p < 0.01$), based

on regression analysis. The model explained 48% of the variance in environmental accountability outcomes. These results confirm the view that management accountants have an important role in environmental accountability in banking firms by showing that green banking technologies for the digital domain, when coupled with management accounting, result in measurable improvements in sustainability performance. Table 4 shows the Regression results in relation to FinTech adoption, to accuracy of environmental costs, and the measurement of sustainability performance. Both associations are significant, and the model accounts for virtually half the variance observed.

Table 4: Regression Analysis Results

Variable	Beta (β)	p-value	R ²
FinTech $\rightarrow$ Cost accuracy	0.41	0.01	-
FinTech $\rightarrow$ Performance measure	0.37	0.05	-
Model R ²	-	-	0.48

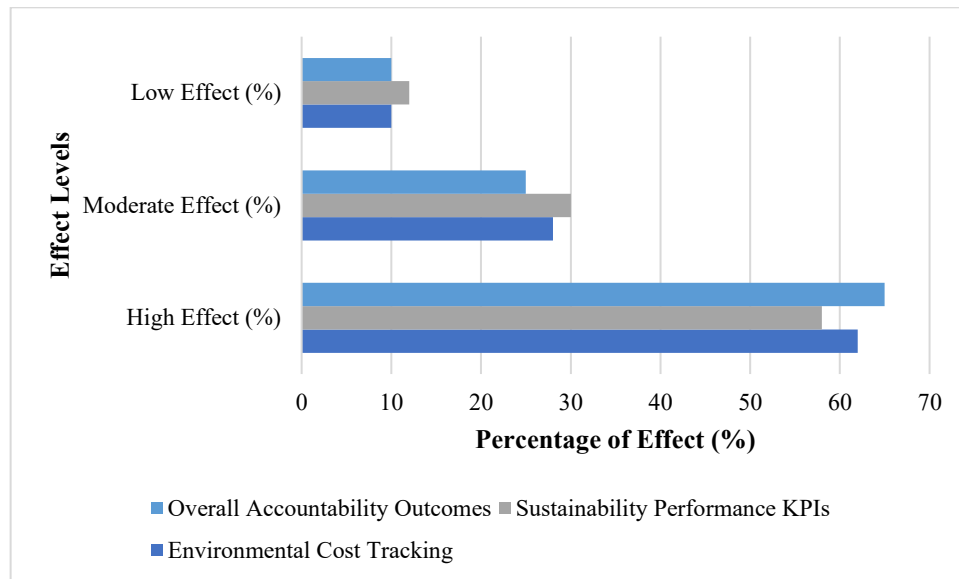


Figure 4: Effect of FinTech Integration on Management Accounting Outcomes

Figure 4 shows the high, moderate, and low impacts of FinTech integration on management accounting. The statistic demonstrates that overall accountability outcomes had the largest impact (65%), and sustainability KPIs (58%) and environmental cost tracking (62%) reported the second and third-highest results.

Case Illustrations

Qualitative data offer in-context integration illustrations. A large commercial bank used AI-driven dashboards to track energy usage at the branch level, feeding data directly into budgeting software. To ensure funds were flowing into sustainable ventures, a development bank used blockchain technology to authenticate the

distribution of green loans. Lesser-tech technologies related to environmental cost information, such as paperless transaction mobile-based solutions, were presented by cooperative institutions. Such examples show how technology enhances accountability processes in management accounting systems at diverse organizational levels, depicting the multiplicity of FinTech use across banking strata. Table 5 shows real-life FinTech applications for different types of banks along with measurable improvements. Cooperative banks reduce paper costs, green loans are tracked by development banks, while commercial banks focus on energy budgeting.

Table 5: Case Examples of Integration

Institution Type	Tool Adopted	Outcome Achieved	Improvement (%)
Commercial Bank	AI dashboards	Improved energy budgeting	18
Development Bank	Blockchain tracking	Verified green loan usage	22
Cooperative Bank	Mobile eco-systems	Reduced paper costs	12

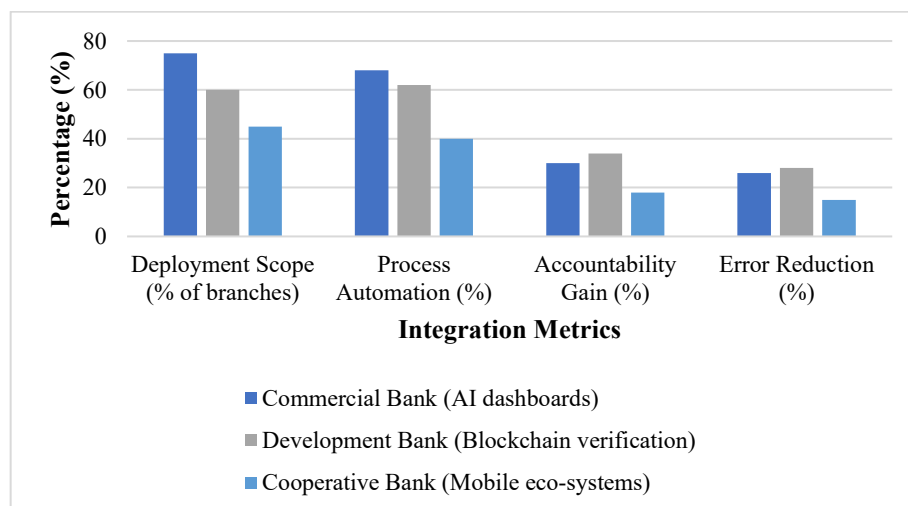


Figure 5: Comparative Integration Outcomes across Banking Institutions

Figure 5 shows the relative performance of commercial, development, and cooperative banks in integrating digital green systems. Development banks dominated in gains in accountability (34%), while commercial banks reflected maximum process automation (68%) and the maximum implementation coverage (75%). In each category, cooperative banks reflected small but impressive gains.

Discussion

The findings reveal that environmental responsibility is considerably enhanced when FinTech technologies are embraced within management accounting systems. Table 2 reveals that 54% of institutions applied blockchain verification, and 68% of institutions applied real-time dashboards. The figures substantiate internal accountability systems by validating the increasing use of digital platforms to track ecological performance. FinTech-supported practices present measurable advantages in decision-making that address sustainability, as indicated by the outcomes in Table 3, demonstrating tangible increments such as a 25% improvement in resource effectiveness and a 30% improvement in budget effectiveness. This is corroborated by the regression findings in Table 4, which indicate statistically significant relationships between FinTech adoption and sustainability-oriented performance measurement ($\beta = 0.37$, $p < 0.05$) and cost accuracy ($\beta = 0.41$, $p < 0.01$). Taken collectively, these findings are congruent with the concepts of strategic management accounting and environmental management accounting, wherein internal systems extend cost control to encompass ecological measures within frameworks that help in making decisions. Based on facts, managerial accounting roles in banks need to be redefined. The significantly high adoption rates of dashboards and blockchain tools in Table 2 reflect how management accountants are now engaged in active sustainability tracking and are no longer limited to mere costing and budgeting. Table 3's enhanced outcomes, which involve a 22% rise in carbon-cost allocation, indicate the significance of adding environmental KPIs to performance assessment systems. Due to this adjustment, management accountants are now viewed as sustainability strategists who provide information that is relevant to resource allocation decisions, changes in operations, and investment decisions. FinTech's addition to environmental performance monitoring expands the application of management accounting principles.

A model expansion of the EMA and SMA models to include technology-enabled monitoring of sustainability is evidenced by the conceptual link between electronic platforms and environmental accountability. Technology adoption is established to be a vital component that underpins theoretical models for sustainability management accounting, as indicated in this study by providing, through Table 4, evidence that FinTech integration explains 48% of accountability outcomes

variance. Also included is Table 5, which includes examples of actual implementation at different institutions, illustrating how the theoretical model can be placed within different organizational frameworks.

The findings are consistent with more comprehensive evidence that shows technical innovation enhances sustainability and financial outcomes (Rahman *et al.*, 2023). The effectiveness of environmental management accounting systems in improving internal accountability has been shown previously, and the present findings corroborate this trend by measuring gains such as a 30% boost in budgetary accuracy (Table 3) (Gulzar *et al.*, 2024). The banking sector also benefits from technology-based cost savings, resource optimization, and performance management, as has been observed in other sectors. This report goes a step beyond, however, by specifically linking these developments to FinTech uptake—a factor that has been addressed less in earlier assessments (Khan *et al.*, 2024).

Practically, the assimilation of FinTech platforms into internal accounting systems could assist financial institutions. Table 3's persistent advantages prove that being environmentally responsible is not a symbolic gesture; it also equates to enhanced operational efficiency and better budgeting. AI dashboards improved energy budgeting for commercial banks by 18%, as evident from Table 5, reflecting certain economic and environmental benefits. By mandating sustainability in internal control systems, policymakers can also encourage wider usage and align industrial practices with more general environmental objectives. The move towards greener financial systems can be hastened by this twin emphasis on efficiency and compliance.

Various limitations must be mentioned. Although adequate for analysis, the sample was confined to 200 participants, which may not be sufficient to reflect differences in the banking sector as a whole. Both secondary reports and self-reported responses are required for the dependability of data, which enhances the danger of bias. In addition, since results could differ in developed settings with further developed technology infrastructure and regulatory environments, targeting developing economies restricts generalizability. In assessing the results and applying them in more generalized settings, these limitations ought to be considered. To find out whether similar FinTech-enabling accounting practices influence environmental responsibility in the industrial, energy, or services sectors, future studies need to extend the scope by incorporating cross-industry comparisons. The potential of emerging technologies such as big data analytics, blockchain environments, and artificial intelligence to automate tracking of environmental cost and decision-making may be explored further. Furthermore, longitudinal studies can assess if the improvements observed in Tables 3 and 5 are durable, offering insight as to how long technology-driven advances in management accounting persist.

Conclusion

According to the study, green banking that has been digitalized and paired with management accounting has the potential to contribute meaningfully towards environmental responsibility. As per the results, FinTech solutions such as real-time dashboards, blockchain authentication, and new costing systems, when integrated, further improve cost tracing accuracy, timeliness of reporting, and decision support overall. Advances in carbon-cost accounting, sustainability budgeting, and resource efficiency prove that these systems are more than technology innovations but also strategic transformation tools in financial institutions. The validity of these correlations is backed by quantitative testing evidence, indicating FinTech adoption explains approximately half of the variance in accountability results. Furthermore, case-based information shows that commercial banks are achieving mass deployment and automation, development banks are at the forefront in applications with an emphasis on accountability, and cooperative banks are showing significant but limited improvements. Such information illustrates how versatile technology-enabled management accounting systems are within a variety of institutional settings. Management accountants are central in incorporating sustainability into decision-making and performance measurement because the impacts reach beyond operational effectiveness. Although policy proposals highlight the importance of regulators pushing the use of sustainability indicators as mandatory, actual-world implications reveal that institutions practicing combination systems gain from enhanced strategic alignment and competitiveness. Despite such contributions, sample scope limitations, dependence on self-reported information, and geographic concentration call for precaution in generalization. Comparative industries and longitudinal dynamics are areas to be investigated by future studies. In conclusion, the evidence secures management accounting as a firm foundation upon which to embed digital green banking practices to create long-lasting environmental accountability.

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