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Fostering a Greener India: Exploring the Mediating Role of Green Finance in Banking Activities and Environmental Performance

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Abstract

The present study examines the effect of green banking initiatives on green financing and the environmental performance of Private Commercial Banks (PCBs) in India. The study discusses the relationship between green banking activities and environmental performance, with green financing mediating. The research brings out the challenges and benefits of advancing green banking in the Indian economy. By adopting the snowball sampling technique, a total of 1,280 responses were gathered from the PCBs, and Smart-Partial Least Squares (PLS) software was used to analyse the structural relations between variables as well as to assess the reliability and validity of the measurement model and validate the strength and its significance for all structural paths. The overall empirical findings revealed that green banking activities have had a positive correlation and significance regarding environmental performance through the PCBs of India. The bridge between green banking activities and environmental performance is linked through green financing. In addition, the present study highlights the benefits of the spread of green banking in India, which include enhanced competitiveness, improvement in customer goodwill, reduced long-term costs and carbon footprint minimisation that contributes to sustainable economic growth and national progress. This research provides valuable conceptual insights and policy implications for managers seeking to enhance green banking services. PCBs can play a pivotal role in addressing environmental challenges and promoting sustainability in the banking sector by fostering green financing and implementing sustainable practices. The findings will serve as a guide for policymakers and banking professionals who are aiming to integrate environmental considerations into their strategic frameworks.

Keywords: Environmental Performance, Green Banking, Green Finance, Sustainable Development, Smart PLS

1. Introduction

The increasing challenges due to climate change, which include global temperatures, erratic weather patterns, pollution levels and emissions of noxious gases, have caused great negative impacts on ecosystems worldwide. In the past two decades, the rate at which natural calamities such as droughts, storms and sea-level surges have risen has alarmed humanity, threatening the stability of life on Earth. It has gained global priority to address these environmental challenges. For India, a densely populated rapidly developing nation that has vast investment potential, safeguarding the environment is imperative (Bose *et al*., 2020). The rising temperatures and unpredictable weather patterns due to global warming have pushed India to consider innovative environmental sustainability projects, as the country is among the most vulnerable to climate change impacts (Zhixia *et al*., 2018; Yan *et al*., 2018).

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In the context of environmental sustainability, the banking sector has emerged as a critical player. Although the direct carbon footprint of banks is relatively small compared to industries like steel, oil and gas, which is attributed to paper usage, energy consumption and electronic equipment, their indirect environmental impact is enormous. Banks are financiers to industries that contribute significantly to long-term pollution, thus placing them in a pivotal position to influence sustainable practices (Peng & Zheng, 2021; Mohd & Kaushal, 2018). Financial institutions worldwide and across India are becoming increasingly conscious of green banking to join the global trend in operations that support the achievement of sustainable development goals. Green banking is the strategy or framework that implements environmental considerations in financial services, supporting sustainability, cutting costs, and reflecting environmentally responsible investment (Li, & Gan, 2020; Shang *et al*., 2023).

In a larger sense, India has made significant strides in promoting green banking within the country's framework of broader sustainable development initiatives. Green loans, green assets, and other eco-friendly policies are now going full steam supported by the Reserve Bank of India (RBI) as well as regulations by the Government of India to develop Green Finance (Sharma 2013; Chandran, 2024). However, challenges like high implementation costs and lack of awareness combined with ambiguity associated with the definition and scope of green banking products thwart its advancement (Sharma & Choubey, 2022; Kumar *et al*., 2024). There are also some risks of reputational issues, issues related to diversification and operation challenges for the banks, and all these require integrated efforts to overcome these hurdles (Chandran *et al*., 2024).

In recent times, the various aspects of green banking, such as implementation, environmental sustainability and global challenges, have been discussed (Bukhari *et al*., 2020; Chen *et al*., 2022). However, very little research has been done to explore the complex interrelationship between green banking practices and the environmental performance of banks in the Indian context. Specifically, there is a need to understand the mediating role of green finance in this relationship. Given the importance of green financing in bridging the gap between sustainable banking activities and environmental performance, this study will address this gap in research (Chandran & Sathiyabama, 2022; Mir & Bhat, 2022).

Hence, the present study explores the mediating role of green finance on the environmental performance of PCBs in India. The study examines the linkage between green banking activities and their impact on environmental outcomes while identifying the major benefits and obstacles perceived by Indian commercial banks. This study thereby contributes to the growing literature on green banking and green financing that can be used as a reference for policymakers, financial institutions and researchers to strive for sustainable economic development in India.

2. Literature Review

2.1 Green Banking

Green banking, as an approach to integrating sustainability into financial operations, has gained considerable attention in both academic and industrial contexts. As a response to the urgent need for sustainable economic development, green banking emphasises environmental protection through banking practices and financing mechanisms (Hooda & Yadav, 2023). This is because increasing global recognition of the adverse environmental impacts of industrial activities has catalysed the development of sustainable practices, especially within the financial sector (Chandran & Sc, 2024; Bose *et al*., 2017).

Green banking defines banking activities by prioritising environmental sustainability while offering economic development avenues (Hossain *et al*., 2020). Generally, financial services are intermediates that affect and influence the finances of industries involved in high and polluting products (Peng & Zheng, 2021). According to research, green banks have a footprint of reducing negative environmental footprints since they promote their operations to go digital and also paperless along with funding activities that are green and environmentally viable (Zhang *et al*., 2022).

In India, green banking is still in its infancy, with a few progressive initiatives such as green loans, green home loans, and renewable energy projects led by prominent banks such as SBI 2and ICICI Bank (Suresh & Bhavna, 2015). However, the increased awareness of customers and wider adoption are still faced with bottlenecks like initial high costs and technological resistance (Sharma & Choubey, 2022). Besides, the vagueness associated with the scope and category of green banking products creates crucial barriers to policies that can be designed and implemented effectively (Zhang *et al*., 2023).

2.2 Green Banking Programmes in India

The concept of 'green banking' can potentially provide a competitive edge to the banking industry by influencing their strategic decision-making process, as the industry has a substantial role in economic growth (Chandran *et al*., 2024). Indian banks have been noticing a rising trend towards green banking practices over recent years and have consequently made significant changes to their operational strategies (Mohd & Kaushal, 2018). Despite various challenges, which include changes in customer behaviour, technological advancements and regulatory changes, the Indian banking industry has adapted to the changing environment. In India, Green Banking is a recent concept, and several banks have started taking steps towards implementing green banking policies. For instance, the State Bank of India, which was the first green bank in India, and the Punjab National Bank have adopted measures to minimise emissions and energy consumption (Zhang *et al*., 2022). Ultimately, Green Banking is a futuristic and innovative approach that promotes long-term sustainability and can provide significant benefits to the banking industry and the economy (Miah *et al*., 2020). The Green Banking policy framework of Indian Banks is depicted in Table 1.

Table 1. Green banking policy guidelines issued by Indian banks

Policy Guidelines on Green Banking	Year	References
The RBI declared a circular stressing the significance of responsible actions by banks towards sustainable development. The circular emphasised the necessity for Indian banks to establish institutional mechanisms that uphold sustainability.	2007	Circular: RBI 2007-2008/216)
The Government of India, as part of its Green Initiatives, has recommended that all Non-Banking Financial Companies (NBFCs) and financial institutions take proactive measures to promote paperless banking and increase the usage of electronic payment systems.	2011	RBI Report /2011 – 12 / 236 DNBS (PD). CC. No 248/02.10.01 /2011-12
Bank of Baroda has implemented several green banking initiatives, including prioritising environmentally friendly projects such as windmills, solar power projects, and biomass plants.	2013	Annual Report: BoB, 2013
The Institute for Development and Research in Banking Technology (IDRBT), established by the RBI, has proposed the implementation of a standard rating system to assess green banking practices and the efficiency of Indian banks.	2014	Policy suggestion by IDRBT, 2014
A comprehensive and integrated computerised system called the Export Data Processing and Monitoring System (EDPMS) was recently implemented to improve the monitoring and tracking of export transactions.	2014	RBI Press Release: 2013-2014/1722
SBI launched the Green Channel Counter (GCC) facility in its branches in 2014 to modernise the conventional paper-based banking system.	2014	Annual Report: SBI, 2014
ICICI Bank Ltd was the first private bank to adopt the 'Go Green' initiative, which encompasses Green products/offers, Green engagement, and Green communication with customers.	2014	Annual Report: ICICI, 2014
HDFC Bank has implemented green initiatives to minimize its carbon footprint, focusing on improving waste management, reducing paper usage, and enhancing energy efficiency.	2015	Annual Report: HDFC, 2015
IndusInd Bank adopted solar-powered ATMs as a renewable energy source	2016	Annual Report: IndusInd, 2016
Union Bank of India initiated the process of offering Green Home Loans	2017	Annual Report: UBI, 2017
Axis Bank promotes the use of e-statements and other forms of electronic communication to decrease paper usage, as part of their efforts to support environmental sustainability.	2018	Annual Report: Axis Bank, 2018
By mid-2019 during the pandemic period, all the banks in India adopted the E-mechanism of making payments and improved M-Banking and E-Banking services which are still being continued.	2020	RBI Report, 2020 www.rbi.org
The Government of India made an agreement with the French Development Agency to create a Green India Financial System (GIFS) for Sustainable Development. By the end of 2030, India will achieve 35% green finance mechanism and energy independence by 2047 along with a commitment towards net zero in 2070.	2022	Green Indian Financial System Reports, 2022 https://gifsinitiative.in

#Source: Secondary Data from various published reports of banks

2.3 Green Finance – Bridging the Gap

Green finance is one of the important facilitators of green banking, which finances the projects, including renewable energy, energy-efficient technologies and green infrastructure that lead to sustainable development (Chandran *et al*., 2024). In addition to providing financial viability for environmentally friendly investments, green finance also helps to reduce risks involved in conventional industrial practices (Sachs *et al*., 2019). The role of green finance in addressing climate change and enhancing ecological resilience has been widely acknowledged, with evidence suggesting its potential to transform financial ecosystems (Hooda and Yadav, 2023).

Recent studies have underlined the mediating role of green finance in the bettering of environmental performance, especially in the banking sector. For instance, Zhang *et al*. (2022) pointed out that green financing bridges the gap between green banking activities and environmental performance, emphasising the necessity of integrated financial mechanisms for achieving sustainable outcomes.

2.4 Environmental Performance and Green Banking

The environmental performance of banking is measured through the sector's ability to reduce its ecological footprint through reduced energy consumption, carbon emissions and paper use (Xie *et al*., 2020). Green banking practices directly affect environmental performance through the promotion of eco-friendly operations and financing, which has been seen by empirical evidence for an organisation (Shaumya & Arulrajah, 2017). However, this can only be successful if green finance acts as an intermediary that helps in magnifying the effects of green banking on environmental outcomes (Xie *et al*., 2020).

Studies on Indian banking have shown that there is a direct relationship between green initiatives and environmental performance (K. Vidyakala, 2020). Training programs, renewable energy projects, and green loans are some of the notable activities that contribute to sustainable development (Maheswaran, U. *et al*., 2023). However, challenges like credit risks, operational costs, and change resistance continue to be some of the key issues that are critical to being addressed through holistic approaches (Chandran & Sathiyabama, 2022).

While many studies have examined the different components of green banking and green finance, fewer have probed into how these two concepts relate to each other and influence the environmental performance of the Indian banking sector. Further, the role of mediating variables such as green finance remains understudied, especially for PCBs (Mir & Bhat, 2022). This gap in the literature underlines the need for a nuanced understanding of how green finance acts as a catalyst to enhance the effectiveness of green banking practices.

Based on the aforesaid information, two primary research variables were identified along with one mediating variable. The independent variable is green banking practices, the mediating variable is sources of green financing, and the dependent variable is the Bank's environmental performance. Thus, the present study makes a valuable contribution to the existing body of literature by being acknowledged as one of the pioneering investigations into the relationship between green financing and the mediating role it plays between green banking activities and Banks' environmental performance in a developing economy such as India. Consequently, the following research hypotheses have been formulated based on a thorough review of the theoretical background and relevant prior studies.

Hypothesis

(H1): The adoption of Green Banking practices positively affects the environmental performance of banks.

(H2): The implementation of Green Banking practices has a considerable impact on the accessibility and utilisation of green financing options.

(H3): The utilisation and availability of green financing sources have a positive impact on the environmental performance of banks.

(H4): The association between green banking practices and the environmental performance of banks

is significantly influenced by the presence and effective use of green financing mechanisms.

These hypotheses are based on the literature review that links green banking activities, green finance mechanisms and environmental performance within the broader agenda of sustainable development. Thus, this study aims to bridge the existing gaps and contribute to the growing body of knowledge on sustainable finance in India.

3. Methodology

The study was conducted among 1280 bank customers and employees of selected PCBs. A quantitative research study was conducted to evaluate our models. The primary objective of the study was to identify the influence of Green Banking activities on the environmental performance of banks. The structured questionnaire was formulated based on the previous scales and studies conducted in the aforementioned area. To achieve this goal, both online and offline voluntarily and confidentially. The questionnaire was aimed at customers and employees of PCBs and those who use banking transactions both online and offline mode. Online data was collected through Google Forms and offline data was collected with the help of bankers. The data was collected using a snowball sampling technique. Cochran's formula was used to calculate the sample size and the results stated that 1034 samples were adequate for the study.

Out of 1500 questionnaires distributed, we received 1364 responses. After discarding the incomplete and duplicate responses, 1280 samples were chosen for the purpose of the study which indicates a response of 93.84%.

Partial Least Squares Structural Equation Modelling (PLS-SEM) was utilised to assess and validate the suggested theoretical models using Smart-PLS software (Sarstedt & Cheah, 2019). PLS-SEM was preferred due to its flexibility in handling complex models that have multiple constructs like Green Banking activities, Green Finance, and Environmental Performance while also exploring the mediating role of green finance. The PLS-SEM is preferred over covariance-based SEM (CB-SEM) because it does not require strict distributional assumptions, which aligns with this study's exploratory approach and the characteristics of the dataset.

PLS-SEM is robust for analysing small-to-medium sample sizes, even with complex models, and enhances reliability for the 1,290 samples in this study. It is particularly effective for predictive research, focusing on explaining variance in dependent variables, which aligns with the study's objective of understanding the impact of Green Banking on Environmental Performance. Additionally, PLS-SEM handles both reflective (e.g., Environmental Performance) and formative (e.g., Green Finance) constructs effectively, ensuring flexibility in model design.

The method also checks the constructs for composite reliability, convergent validity through Average Variance Extracted and discriminant validity, thus ensuring statistical rigour. PLS-SEM enables robust analysis of structural relationships and strengthens the reliability of the findings, providing valuable insights into the mediating role of green finance, thus contributing significantly to the literature on green banking and finance.

4. Results and Discussion

Table 2 illustrates the outcomes of the demographic survey. The results indicate that 48% of the participants were male, while 52% were female. Furthermore, 57.9% had graduated, 28.9% had a master's degree or post-graduation, 5.8% held a PhD and 7.4% had a professional degree. Nearly 20.5% have a work experience of less than 1 year, 12.7% have a work experience of 1 to 2 years, 15.6% have experience of 2 – 3 years, and 16.6% have an experience between 3 – 5 years. 34.6% of the respondents have experience above 5 years. 38.8% of the employees are private employees, 28.9% are Government servants,15.9% are working in a public limited company, 4.9% are doing business and 4.9% are self-employed.

4.1 Survey Instrument

Based on the literature survey, researchers identified three main variables namely, sources of green

Table 2. Socio-economic data of respondents

Variables	Classifications	No. of Respondents	%
Sex	Men	619	48
	Women	671	52
Education	Bachelors	747	57.9
	Masters	373	28.9
	PhD	75	5.8
	Professional	95	7.4
Experience	Less than 1 Year	264	20.5
	1 to 2 years	164	12.7
	2 - 3 years	201	15.6
	3 - 5 years	214	16.6
	Above 5 years	446	34.6
Profession	Private Employee	501	38.8
	Government Servant	373	28.9
	Public Ltd. Company	205	15.9
	Business	63	4.9
	Self-Employment	89	6.9
	Others	49	3.6

Note: N=1280, Source: Author's Calculations

financing, the Bank's environmental performance and Green Banking activities. The initial survey included 14 variables, consisting of 7 items related to Green Banking activities, 3 items related to the Bank's environmental performance and 4 items related to sources of green financing. The Likert scale employed in the questionnaire consisted of five points, ranging from Strongly Agree to Strongly Disagree.

4.2 Model Measurement

During the evaluation of the measurement model, items GBA2, GBA4, GBA6, and BEP3 were eliminated due to low outer loadings. All remaining observed variables had an outer loading above 0.5, which is deemed significant (Hulland, 1999) and all loadings were above 0.7, indicating well-defined variables with satisfactory reliability. Cronbach's alpha values were measured to assess the one-dimensionality and reliability of the scale of items, and values above 0.7 were considered reliable. Here all values are greater than 0.7 (Lunneborg, 1979). The Composite Reliability (CR) of the scale was evaluated to test its internal consistency. The reliability of indicators was measured using CR, with possible values ranging from 0 to 1. Adequate consistency is indicated when CR > 0.7

Table 3. Validity and reliability constructs

	Loadings	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
BEP1	0.906	0.741	0.885	0.792
BEP2	0.872			
GBA1	0.721	0.769	0.853	0.592
GBA3	0.795			
GBA5	0.846			
GBA7	0.702			
SGF1	0.811	0.877	0.916	0.731
SGF2	0.861			
SGF3	0.863			
SGF4	0.881			

Source: Primary data

Table 4. Discriminant validity

	BEP	GBA	SGF
BEP	0.891		
GBA	0.693	0.768	
SGF	0.785	0.722	0.856

Source: Primary data

(Gefen *et al*., 2024). In this study, all values exceeded 0.7, indicating good consistency. The convergent reliability of the scale was evaluated using the Average Variance Extracted (AVE) method, which measures the proportion of variance explained in the factor analysis. AVE values range from 0 to 1, and values greater than 0.5 are considered acceptable (Bagozzi & Yi, 1988). Table 3 shows that all AVE values exceeded 0.5.

The discriminant validity was observed by using the Hypertext Markup Language (HTMT) values and values below 0.9 proving discriminant validity which is depicted in Table 4. Hence all values are less than 0.9 hence the scale is valid.

4.3 Hypothesis Testing

The structural equation modelling was tested using bootstrapping model and the test results are given in the table below. Both direct and indirect relationships were tested. The results indicate that all the relationships were positive, implying that an increase in one variable would increase the other (where $0 < \beta < 1$). The first hypothesis test results state that Green Banking Activities (GBA) have a significant influence

on Bank's Environmental Performance (BEP) (β = 0.264, t value = 2.939, p-value <0.001) hence hypothesis is supported. H2 test results also show a positive significant relationship between GBA and a significant influence on the Source of Green financing (SGF) (β = 0.721, t value = 15.295, p-value <0.001) hence hypothesis is supported. H3 test results state that the Source of Green financing (SGF) has a significant influence on the BEP (β = 0.594, t value = 7.009, p-value <0.001) hence the hypothesis is supported. Henceforth all the hypotheses were supported, and the result is mentioned in Table 5.

To examine the mediating role, indirect effects were analysed between GBA and the BEP while taking the SGF as a mediator. The findings of the analysis indicate that there is a significant positive indirect effect that is mediated by SGF (β = 0.428, t value = 6.116, p value <0.001). Therefore, the hypothesis is supported (Table 6).

From the above, the trends observed in green banking adoption arise from growing pressures from regulations and increasing customer and corporate social responsibilities. The policies of the Reserve Bank of India have encouraged and supported banks that are involved with renewable energy sources and digital banks which is supported by Ray & Mohan, (2024). Moreover, growing awareness among customers about ecological issues has necessitated the requirements for green products and services such as paperless banks and eco-friendly investments (Chitra & Gokilavani, 2020). Internal organisational efforts, such as training employees in sustainability, have played a great role in these trends.

Table 5. Direct relationships of hypothesis test result

Hypothesis	Beta Coefficient (β)	Std Deviation	T	P value	Results
H1 - GBA -> BEP	0.265	0.091	2.939	0.000*	Supported
H2 - GBA -> SGF	0.722	0.046	15.295	0.000*	Supported
H3 - SGF -> BEP	0.595	0.086	7.009	0.000*	Supported

Source: Primary data

Table 6. Indirect relationships of hypothesis test result

Hypothesis	Beta Coefficient (β)	Std Deviation	T	P value	Results
H4 - GBA -> SGF -> BEP	0.428	0.070	6.116	0.000*	Supported

Source: Primary data

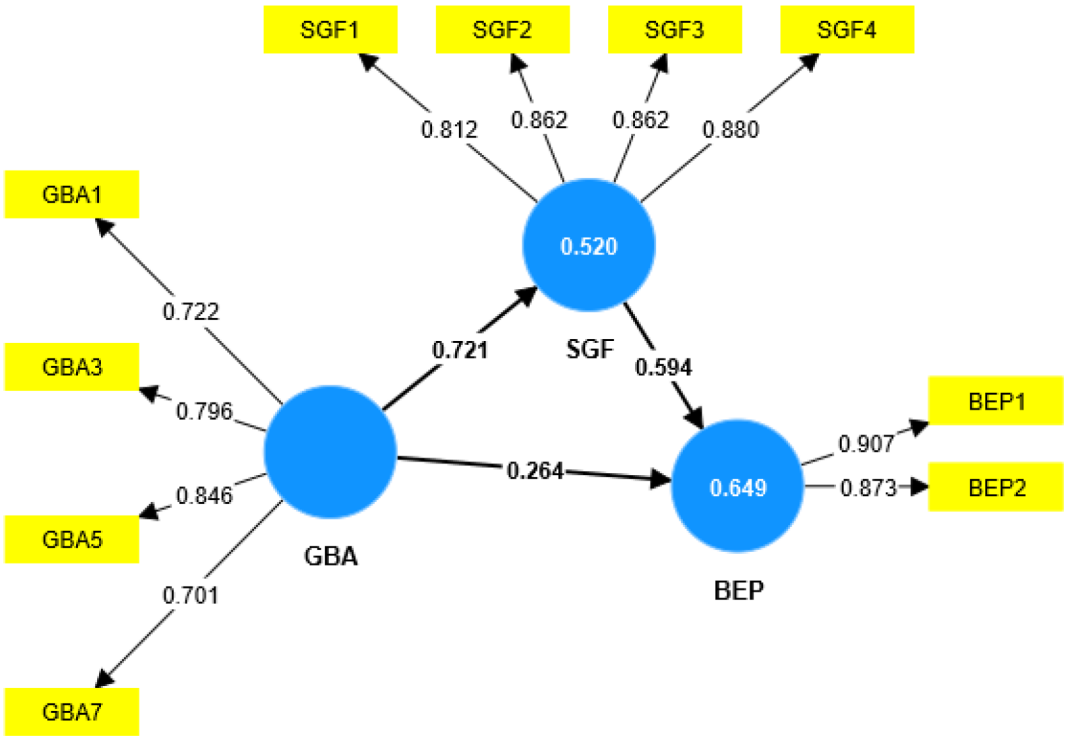


Figure 1. Structural model with mediation.
#Source: Primary Data

Significant long-term advantages are expected with the shift to green banking. The result is backed by (Jain, 2024), which says the benefits accrue to the banks in the form of goodwill to customers, greater operational efficiency, and carbon footprints. Macro-level economic benefits result from this because green banking leads to sustainable development and mitigates environmental degradation (Agan & Mehmet Balcilar, 2023). Still, hurdles include high-cost implementation and inadequate awareness among all stakeholders. Government incentives, increasing awareness, and technological advancement must go hand-in-hand to eradicate these obstacles (Dutta *et al*., 2022).

This study highlights the transformative potential of green banking practices and their capacity to drive sustainable economic growth. The findings resonate with global trends and provide a roadmap for further integration of environmental sustainability in banking supported by Peng (2024).

5. Conclusion

Green banking and green financing have received increased attention among researchers and practitioners over the last two decades with particular relevance to developing economies such as India. The purpose of this study was to investigate the relationship between GBA and the BEP with a particular focus on the mediating role of green finance. With a structured questionnaire and the use of PLS-SEM for analysis, the study ascertained that the implementation of green banking practices has a positive impact on environmental performance in banks. The findings are consistent with earlier studies, stressing the role of green banking in furthering decreases in ecological footprints and further improvements in sustainability outcomes.

Engagement in green banking activities was further revealed to positively influence green financing opportunities, which directly enhance the environment's performance. This positions green finance at the nexus of the gap between green banking practices and their external environment for broader, mitigating impacts. The study provides new insights by confirming that green financing behaves as a mediator in the relationship and adds depth to the extant literature through its importance of financial mechanisms in achieving sustainable banking outcomes. The findings, therefore, support the fact that banks should promote green banking through their operations through facilities such as online banking, green credit and debit cards, and other forms of digitalisation to promote the practice of eco-friendly behaviour.

The research outcome has vast implications for academics, practitioners and policymakers. In this regard, banking institutions may improve their profitability and sustainability if they embrace such initiatives and act as responsible corporate entities. Tax incentives can be offered to promote green banking and invest more in renewable energy, waste management, and energy efficiency projects. Proper monitoring of finance activities in line with Sustainable Development Goals (SDGs) will further strengthen the efforts; however, challenges like high cost, credit risk, technical barriers, and low awareness remain a current challenge. The challenges will need to be met with collaborative strategies, including cooperative loan schemes, educational training programs, and seminars on green banking to raise awareness and build capacity.

Though the study is exhaustive, it has limitations that give scope for future research. This study was conducted on customers and employees of PCBs, thus limiting the generalisability of the findings. Expanding the scope to include public sector banks and diverse financial service providers would strengthen the external validity of the results. Additionally, only green banking activities were examined as an independent variable. Future studies may explore other factors, such as operational policies and employee practices, to gain a holistic understanding of influences on environmental performance. Incorporation of primary as well as secondary data in future research will make the analysis richer by providing a proper vision of sustainable banking practices.

This study contributes significantly to the understanding of the role of green banking and finance in promoting sustainability. By addressing the challenges and leveraging opportunities, stakeholders can effectively implement green banking initiatives to achieve a balance between

environmental preservation and economic growth, advancing the global agenda for sustainable development.

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