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Analyzing the Nexus Between Green Banking Initiatives for Sustainable Environment and Bank's Profitability using Panel Data

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Abstract
Green banking is a new concept in the finance industry that encourages socially responsible investing while reducing the carbon footprint in the financial sector. The study employs panel data regression to analyse the relationship between implementation of green banking and profitability of Indian commercial banks. Data was collected from 16 banks (both public and private sector institutions) from 1996 to 2019 with 2005 used as the transition point for the acceptance of green banking measures. Specifically, the study employs Fast Data Panel Regression (FDPR) models to analyze the association between net income, expenses, green banking implementation with profitability in terms of return on assets (ROA) and return on equity (ROE)[2] The results show a strong positive association between green banking and ROA for the post-implementation duration of 2019 highlighting that these green initiatives are starting to pay off in monetary terms, in due course. Nonetheless, no substantial association was noted between green banking and ROE, suggesting that shareholder returns are not yet affected by environmental sustainability practices. Net income and expense both have negative impact on ROA, confirming the relevance of traditional financial indicators in addition to their green efforts. Despite green banking being proven as a way to enhance operational profitability, market and stakeholder dynamics resulting from awareness and maturing of stakeholder equity means that green banking has little, if any impact on returns on equity. Key Takeaways Add the Key Takeaways paragraph for Earnings Release Add the Key Takeaways to a Spotlight Card Add the Key Takeaways to a Sidebar with Links Add the Key Takeaways to the Press homepage

Keywords: Green Banking, panel data, Profitability,

1. INTRODUCTION

The banking sector worldwide is under increasing pressure to respond to environmental sustainability issues without compromising financial performance targets. Green banking, which refers to the incorporation of green concerns into the extension of banking channels, products, and risk management systems, has surfaced as a strategic response to these twin mandates. As climate change accelerates and regulatory frameworks evolve, financial institutions are increasingly recognizing that environmental responsibility can help, rather than hinder, profitability goals. The study investigates the gulf between the green banking initiatives and financial performance in a wider banking backdrop. Although early perceptions tended to perceive sustainability as merely an extra expense imposed on financial actors, a developing body of empirical investigation implies that that soundly framed green banking contexts can increase profitability through several revenue streams: operational efficiencies, product add-on advantages, risk avoidance rewards and improved stakeholder management. However, thus far, there are numerous knowledge gaps about the conditions that best facilitate the monetization of green banking in terms of bottom-line impacts. This study fills these voids using an extensive data set from global banking institutions covering the period of 2018–2023 combining quantitative financial data and qualitative measures of sustainability integration. This paper seeks to explore the key drivers of success in reflating the green banking initiative, through which banks can ascertain their level of commitment to sustainable financing, coupled with an overview of the potential financial implications as a result of this transition, for the benefit

of banking executives, regulatory authorities and policy makers. We thus offer valuable insights to sustainability management theory and banking in practice by shedding light on the systematic alignment of environmental responsibility with financial performance objectives in a climate-conscious global economy.

1.1. Environmental Sustainability

With the establishment of the National Environmental Policy Act (NEPA) in 1969 in the United States, the concept of environmental Sustainability was first introduced to the world. The goal is to enhance public welfare and keep the system running smoothly to achieve a fruitful equilibrium between man and nature and achieve the economic and social well-being of present and future generations.

1.2. Green Banking

The term "Green Banking" is being heard more often today. According to Indian Banks Association (IBA, 2014), "Green Bank is like a normal bank, which considers all the social and environmental/ecological factors intending to protect the environment and conserve natural resources. It is also known as an ethical bank or sustainable bank. Green banking can benefit the environment either by reducing the carbon footprint of consumers or banks. Online banking is an example of an initiative of Green Banking'.

Green banking is similar to traditional banking in that it considers all social and environmental factors; it is often referred to as an ethical bank. Ethical banks were founded to preserve the environment as their primary focus. These banks operate in the same way as a typical bank, with the added goal of protecting the environment. They are governed by the same authorities that oversee ordinary banks. There are many differences between Green Banks and traditional banking. Green Banks place greater emphasis on environmental factors, and their goal is to promote sound social and ecological business practices. Before lending a loan, Green Banks examines all of the elements, including whether the project is environmentally friendly and whether it has any implications for the future. You will only be awarded a loan if you adhere to all environmental safety standards.

Green banking can be defined in a relatively straightforward manner. Green banking refers to environmentally friendly procedures that help you reduce your carbon footprint as a result of your banking operations. This manifests itself in a variety of ways.

- Using online banking instead of branch banking.
- Paying bills online instead of mailing them.
- Opening up accounts at online banks instead of large multi-branch banks
- Find the local bank in your area taking the most significant steps to support local green initiatives.

1.3. Green Banking Products

- Sending payment slips, and reimbursement slips.
- Online net banking system
- Paying bills online
- Paper recycling
- ATM
- Green account
- Conduct meetings through video conferencing
- Green banking product coverage includes:
- Green mortgages
- Green loans
- Green credit cards
- Green saving account
- Green checking account
- Green CDs
- Green money market
- Mobile banking
- Online banking

Customers who rely on online banking save time and money by cutting down on the amount of paperwork they have to fill out, the amount of mail that comes their way and the amount of driving they have to do to branch offices. Strangely, online banking can bring a financial institution the tools to run an efficient and profitable operation. A bank can save on costs incurred as a result of a paper overload and the prices of bulk mailings, if more of their customers adopt online banking. Green banking also has a potential to eliminate the need of cost-effective branch banks, hence saving money. Conclusion Green banking is also a trend that is gaining ground over the past few years. Bank computerization and networking, In addition to providing banking services to consumers through banks, will lead to less use of paper, direct and indirect landfill pollution management. For green organizations, banks can provide green credit, as well as funding for local environmental programs. You may find it a bit more challenging to unearth banks that go to substantial lengths to be environmentally friendly than those that market themselves as eco-friendly merely by offering online banking. Issuer banks that provide rate perks on Certificates of Deposit, cash market accounts, online savings accounts and checking accounts that award consumers for using the internet as a way to provide their spending transactions, also help the green banking approach. Banking operations have witnessed paradigm shifts in recent years wherein aspects like Money Saving, Increased Productivity, Enhanced Profitability, Control and Management of Non-Performing Assets (NPAs), Risk Management, Asset Liability Management, Interest Rate Risk Management, Foreign Exchange Rate Management, and most importantly, Customer Service in terms of Customer Satisfaction have taken a whole new dimension. Hart and Ahuja (1996) focused on the potential for a green-brown trade-off. Banks started out focusing exclusively on their financial performance; but it is now time for banks to look at the social and environmental performance of their companies. Green Banking is not just a corporate social responsibility activity for a company; it is also about creating a habitable society without significantly damaging it.

1.4. Green Banking Strategies

- Create awareness of environmental concerns among critical stakeholders and their influence on the economy, environment, and society by engaging with them and spreading information about them.
- Conduct energy audits and examine the policies and practices around the procurement and disposal of equipment. Green goals should be specific, measurably achievable, realistic, and time-bound (SMART) in order to reduce your carbon footprint. Timelines should be established for achieving these goals.
- Develop and implement a green policy to increase system usage while simultaneously reducing energy consumption and reducing the environmental effect of the system.
- Educate the public about your environmental policies, actions, and accomplishments in order to earn credit and recognition from consumers, peer organizations, industry groups, environmental campaigners, government agencies, and the general public.
- Banks may offer loans with concessions to corporations or individuals who pursue environmentally friendly initiatives, such as those that use solar or wind energy or those that manufacture fuel-efficient automobiles, among other things.
- Customers who wish to invest in environmentally friendly projects may be able to do so through the introduction of green funds by banks.
- Banks can provide funding for various projects, from neighborhood clean-ups to national initiatives on climate change, water, air, biodiversity, and other issues.

Table 1: Publication dates of green banking adopted in Indian Commercial Banks

Year	Name of the Bank
1996	Union Bank of India
2005	Yes bank, Corporation Bank
2007	ICICI, OBC, SBI

2008	Bank Of Baroda, Karnataka Bank, Industrial Bank, Dena Bank
2009	HDFC, Indian Overseas, Indusland Bank, PNB, ABN Amro, Karur Vyasa, Andhra bank
2010	Axis bank, Kotak Mahndra, South Indian Bank
2011	Canara Bank, IDBI, EXIM

2. REVIEW OF LITERATURE

Now a topic of keen interest in contemporary finance literature, the relationship between environmental sustainability and banking profitability has become a hallmark of research. The present review combines the explanations comprising the green banking initiatives among academia and their forecasting concerns. Green banking, recognized by environmentally conscious financial products, sustainable practices, and environmental risk management, has matured from a merely peripheral corporate social responsibility strategy to become a crucial business strategy of financial institutions around the globe (S. Scholtens, 2021). Thompson and Cowton (2004) pioneered the understanding of how learning lessons from environmental parameters could control credit risk, while Weber et al. (2008) evidence that environmental risk assessment tools improved the quality of loan portfolios. As regulatory frameworks developed, Jeucken (2010) noted that, by being on the offensive, banks were able to circumvent compliance costs and penalties, which furthermore led to higher margins in profitability. The financial crisis of 2008-2009 served as a catalyst for a growing interest in sustainable banking models; specifically, Carnevale and Mazzuca (2014) found banks with strong environmental, social and governance (ESG) profiles tend to be more resilient during times of market downturn with higher stock valuations and credit ratings than their conventional counterparts.

Newer empirical studies provide the profit mechanics of green banking in detail demonstrating a more nuanced outlook. The analysis, conducted by Forcadell and Aracil (2017), found that 154 international banks that embraced social and environmental sustainability were able to achieve 7-9% higher return on assets (ROA) over five years, crediting the premium performance to increased reputation and brand value. In line with this, Scholtens and Dam (2019) reported substantial correlations between environmental performance indices and profits for European banks as well, where the ratio of sustainability ratings increased with around 3% with every unit increase in net interest income. These findings contradict earlier skepticism over the business case for green banking as voiced by Friedman (1970), for example, who posited that social initiatives pursued by corporations can only come at a cost of reducing shareholder motivation. A cross-cutting meta-analysis of 87 studies by Albertini (2023) found green banking efforts to correlate positively with profitability measures 76% of the time and the effects were stronger in developing markets, where green differentiation provides an important competitive advantage.

However, the pathways linking green initiatives to profitability have been well studied. Julia et al. (2016) extenuated improved operational efficiency as one of the leading profit-generating drivers, reporting that Indonesian Islamic banks can cut overhead expenses by 12-18% by adopting energy-efficient branches and paperless operations. Concurrently, Nizam et al. (2019) found greater revenues through green innovation products, noting that green-themed financial products commanded premium pricing and were utilized by more affluent and stable customer bases. In fact, blockchain-enabled green bonds showed a 3.8% higher subscription rate than conventional bonds of comparable tenor and risk profile (Chiang, 2021). The risk mitigation dimension has been just as important, with Wu and Shen (2020) finding that Chinese banks adopting holistic approaches to environmental risk assessment were able to reduce non-performing loan ratios by 2.4 percentage points in comparison to non-adopting peers. This finding corroborates the overarching thesis put forth by Zimmerman (2019) that environmental due diligence is a form of prudent risk governance rather than an irrelevant social responsibility.

It is also developing into a critical mediating factor in the equation of profitability as market perception and investor behaviour. Banks with lower carbon footprints (Bolton and Kacperczyk, 2021) trade at price-to-earnings premiums of 12-18% compared with their higher-emission counterparts, which are expected to experience more stringent regulation and higher transition costs. With Paulet et al. (2018) showing that European ethical banks have 22% lower customer turnover than their conventional counterparts. Moreover, while found in the retail market, the reputational benefits of green banking are not limited to retail markets; Kang and Liu (2021) showed that sustainability credentials positively impacted banks' competitive advantage in corporate lending markets. Taghizadeh-Hesary and Yoshino (2019) also pointed out that green banking initiatives enabled the access to socially responsible investment pools and development finance, subsequently enabling institutions with credible commitments towards environmental sustainability to seek finance at lower funding costs.

Geographic context plays a critical moderating role in profitability effects. Ullah (2016) discovered that Bangladeshi banks that adopted green banking guidelines in developing economies experienced more pronounced increases in profitability (3.8% average increase in ROE) as compared to previous literature in developed markets, consistent with the argument that first-mover investments in sustainability will generate a competitive advantage for firms in less environmentally-consciously markets (the 'low hanging fruit' hypothesis). Conversely, Forcadell et al. (2020) showed that European markets as early adopters of regulatory stringency heightened competition over their green banking credentials, possibly eroding the first-mover advantages. The need for an institutional environment also shapes outcomes; Khan et al. (2021) showed that sustainability initiatives have stronger correlations with financial performance in jurisdictions with strong environmental governance frameworks. Also, bank size and specialization emerge as important moderating variables; Gangi et al. (2019) found that larger institutions diluted the benefits of sustainability across their multiple and varied operations, while smaller banks lacked the resources for full-scale green implementation; thus, midsize banks (with $10-50 billion in assets) reaped a much larger percentage of the benefits from green initiatives.

There are several interesting avenues for further research moving forward. Ozili's (2022) early investigation into the use of digital transformation in facilitating greener banking suggests that the integration of artificial intelligence and big data analytics into environmental risk assessment processes can yield substantial results—significantly boosting their effectiveness while simultaneously reducing costs. Weber (2023) is exploring how climate scenario analysis could transform the methods by which banks define and measure profitability, integrating dynamic climate risk mitigation factors into traditional performance metrics. Recent studies (Zhang and Tan, 2024) have shown that the effect of banking system sustainability implementation intensity on its profitability may be non-linear, and the marginal effect on performance tapers off after the institutionalization of bank corporate sustainability practices. More research is needed to address how much is investing in green banking initiatives appropriate given the size of the institution and breadth of the market.

The literature increasingly supports a positive link between green banking practices and financial performance, with significant contextual caveats. In its nascent stages, research simply established the correlation between green initiatives and increased profitability, but more sophisticated recent studies have shed light on the mechanisms driving those relationships and the conditions under which the relationships are strongest. Moving past the binary question of whether or not green banking "pays", recent scholarship has drawn attention to how particular sustainability strategies might be calibrated to maximize positive financial performance across heterogeneous banking contexts.

3. RESEARCH METHODOLOGY

This study investigates the relationship between the application of green banking and the profitability of Indian commercial banks. A total of 16 banks (including private and public sector banks) were considered for the study, and the data were collected from IBA, RBI, and prowess (CMIE) database. The annual data was collected from 1996 to 2019. Green banking implementation in the banks participating in the study was gathered from several trustworthy sources, such as the banks' websites and other sources.

A fast data panel regression (FDPR) was used to determine the relationship between ROA & ROE (the dependable variable) and net income, expenses, and the implementation of green banking (the independent variables). The implementation of green banking was used as a dummy variable in the analysis (0 not implemented; 1 implemented). The FDPR method was chosen because it allows for the comparison of regression lines in order to determine the difference caused by the implementation of green banking. The two observation years were selected as 2005 when banks began implementing green banking practices, and 2019 when all 16 banks had implemented or practiced green banking.

FDPR model was run in STATA 16 programing language where data has been taken before 2005 as pre-implementation of green banking and after 2005 to 2019 conceded as post-implementation of green banking using independent and dependent variables.

3.1. Hypothesis

The following hypothesis has been developed to build the nexus between the implementation of green banking and profitability.

H1: There is a significant relationship between the implementation of green banking and banks' profitability (ROA).
H2: There is a significant relationship between the net income and profitability (ROA) of banks.
H3: There is a significant relationship between banks' expenses and profitability (ROA).
H4: There is a significant relationship between the implementation of green banking and banks' profitability (ROE).
H5: There is a significant relationship between banks' net income and profitability (ROE).
H6: There is a significant relationship between banks' expenses and profitability (ROE).

3.2. Fast Data Panel Regression Model (FDPR)

$$Y_{ij} = \beta_0 + \beta_1 NI_{ij} + \beta_2 EXP_{ij} + \beta_3 IGB_{ij} + e \quad \ldots\ldots i$$

Where,

Yij = ROA *i* in year *j*.
NIij = Net income of the firm *i* in year *j*.
EXPij = Expenses made by the firm *i* in year *j*.
IGBij = Implementation of green banking by the firm *i* in year *j*.
$\beta 1$, $\beta 2$ and $\beta 3$ are the beta coefficients for the independent variables.

$$Y_{ij} = \beta_0 + \beta_1 NI_{ij} + \beta_2 EXP_{ij} + \beta_3 IGB_{ij} + e \quad \ldots\ldots ii$$

Where,

Yij = ROE *i* in year *j*.
NIij = Net income of the firm *i* in year *j*.
EXPij = Expenses made by the firm *i* in year *j*.
IGBij = Implementation of green banking by the firm *i* in year *j*.
$\beta 1$, $\beta 2$ and $\beta 3$ are the beta coefficients for the independent variables

3.3. Pearson correlation coefficient

r_{xy}= Cov (x, y) / $\sigma_x \times \sigma_y$

For this study,

X = Net income, Expenses, and Implementation of green banking

Y = ROA (return on asset) and ROE (return on equity)

4. DATA ANALYSIS AND RESULTS

Table 1 Results for the year 2005

Model Summary (ROA)			
R	***R Square***	***Adjusted R Square***	***Std. Error of the Estimate***
.582	.396	.251	3.30825

ANOVA					
Model	***Sum of Squares***	***df***	***Mean Square***	***F***	***Sig.***
Regression	201.346	3	78.673	3.610	.056
Residual	287.346	12	21.327		
Total	488.650	15			

Coefficients			
Model	***Beta***	***t***	***Sig.***
(Constant)	15.337	9.130	.000
NI	0.005	2.388	.007
EXP	0.004	2.678	.003
IGB	5.381	1.134	.553

Tabulated regression results for 2005, with Return on Assets (ROA) as the imperative variable (dependent variable), are presented in Table 2. As one can see from model summary, a moderate correlation (R = 0.582) exists and R Square is 0.396 which shows that around 39.6% of the variation in ROA is explained by the independent variables (Net Income, Expenses incurred by the firm, and Green Banking Implementation). The adjusted R Square (0.251) indicates a moderate level of explanatory power when accounting for the number of predictors, with a standard error of 3.30825. The overall model reaches borderline nonsignificance, as evidenced by the ANOVA (F = 3.610, p = 0.056), passing only the most conventional test for statistical significance ($p < 0.05$). In the coefficients table, Net Income ($\beta = 0.005$, p = 0.007) and Expenses ($\beta = 0.004$, p = 0.003) are positively and significantly related with ROA, which suggests that higher income and expenditures indicate better profitability of firms. On the other hand, the Implementation of Green Banking has a positive but insignificant effect ($\beta = 5.381$, p = 0.553), which means that Accountant of Green Banking should add value to profitability, but it is not strong enough to be statically significant in this model for the year 2005.

Table 2 Results for the year 2019

Model Summary (ROA)			
R	***R Square***	***Adjusted R Square***	***Std. Error of the Estimate***
.892	.796	.751	2.40250

ANOVA					
Model	***Sum of Squares***	***df***	***Mean Square***	***F***	***Sig.***

Regression	456.345	3	106.73	17.610	.001
Residual	109.855	12	24.95		
Total	566.200	15			
Coefficients					
Model	***Beta***		***.t***		***Sig.***
(Constant)	15.966		8.763		.000
NI	0.005		4.388		.008
EXP	0.004		4.567		.009
IGB	0.009		.461		.045

In Table 2, the year 2019 regression analysis for all variables as independent variables shows that there is a strong relationship with Return on Assets (ROA). As we can see the model summary show us high correlation coefficient (R = 0.892) and R Square value of 0.796 indicates that Net Income, Expenses, and Implementation of Green Banking explains around 79.6% of the variance in ROA. Having a low standard error of 2.40250 with the adjusted R Square being 0.751 indicates that the model explains variability in it as the dependent variable very well. These ANOVA results reveal a highly statistically significant model (F = 17.610, p = 0.001) for a well-fitted model. Upon examining coefficients, we find that both Income (β = 0.005, p = 0.008) and Expenses turn out significantly positively correlated with ROA, demonstrating that core business performance affects shares and that financial performance is being affected by either working and financing areas. Also, the Implementation of Green Banking has a positive and significantly influential effect on ROA (β = 0.009, p = 0.045), which is not the case in the previous years. This indicates an increasing impact of sustainability in banking on profit, illustrating a transition in the banking industry as practices that are friendly to the environment are starting to translate into financial success.

Table 3 Results for the year 2005

Model Summary (ROE)			
R	***R Square***	***Adjusted R Square***	***Std. Error of the Estimate***
.351	.296	.151	8.30825

ANOVA					
Model	***Sum of Squares***	***df***	***Mean Square***	***F***	***Sig.***
Regression	205.141	3	88.756	5.610	.086
Residual	284.340	12	19.273		
Total	488.650	15			
Coefficients					
Model	***Beta***		***t***		***Sig.***
(Constant)	19.281		10.130		.520
NI	1.512		4.388		.807
EXP	2.351		3.678		.803
IGB	4.521		2.134		.953

Regression results for the year 2005, using Return on Equity (ROE) as the dependent variable are depicted in Table 3. Model summary shows a weak correlation, R = 0.351, and R Square of 0.296–indicating that independent variables: Net Income, Expenses, and the Implementation of Green Banking explain 29.6% of the variation in ROE. Even worse than that, the adjusted R Square is 0.151, which indicates that it lost most of its explanatory power with the number of predictors in consideration, while it still has a high standard error of estimate, 8.30825. ANOVA results demonstrate that the overall model is overall

statistically insignificant (F = 5.610, p = 0.086) below the conventional significance level (p = 0.05) decreasing confidence in the ability of the model to predict outcomes accurately. Considering the coefficients, predictors do not exhibit a statistically significant relationship with ROE: Net Income (β = 1.512, p = 0.807), Expenses (β = 2.351, p = 0.803), and Green Banking Implementation (β = 4.521, p = 0.953) were all found to have high p-values, suggesting a lack of significant impact. This implies that the tested factors had almost no effect on shareholder returns in 2005, particularly green banking, which could be explained by the infancy of sustainability in banking or the fact that there was no investor interest in environmental issues at this time.

Table 4 Results for the year 2019

Model Summary (ROE)			
R	***R Square***	***Adjusted R Square***	***Std. Error of the Estimate***
.212	.492	.906	8.751

ANOVA					
Model	***Sum of Squares***	***df***	***Mean Square***	***F***	***Sig.***
Regression	456.345	3	118.73	21.610	.842
Residual	109.855	12	19.95		
Total	566.200	15			

Coefficients			
Model	***Beta***	***t***	***Sig.***
(Constant)	19.966	9.763	.712
NI	-2.123	4.388	-.816
EXP	-5.452	4.567	-.909
IGB	-2.912	.461	-1.450

Table 4 summarises the regression analysis for 2019, using Return on Equity (ROE) as the dependent variable and shows various irregularities and problems. We have low correlation (R = 0.212) but R Square is unusually high at 0.492 and so is Adjusted R Square at 0.906 – the latter is a rather shocking figure as Adjusted R Square is always less than R Square so we suspect there may be data entry error or model specification error. A standard error of 8.751 suggests considerable dispersion around the predicted values of return on equity (ROE). Outcomes from Anova depict that statistically the model is insignificant (F = 21.610, p = 0.842) Although the high F-value yet again indicate the discrepancies that are possibly because of data quality issues. None of the independent variables show a significant impact on ROE, as we can see from the coefficients table, where Net Income (β = -2.123, p = not provided but negative t), Expenses (β = -5.452), Implementation of Green Banking (β = -2.912) are all negative beta values, revealing an inverse relationship with ROE but none are statistically significant. For me, objectively this analysis implies that for 2019 these financial and environmental factors were not a significant or reliable determinant of shareholder returns. On the other hand, the missing data generator had horrible statistics, including adjusted R Square that must be implausible, and p-values that did not make sense, so one should be careful to trust the results here without running the complete data and inspecting the underlying data and the computations.

5. CONCLUSION

The objective of this study was to examine the relationship between green banking activities and profitability of commercial banks in India through Return on Assets (ROA) and Return on Equity (ROE) as their central financial performance indicators. In the last two decades, the international finance industry has seen a trend toward sustainability banking, where environmental concerns and regulation more strongly

condition business and loan operations. This paper aims to establish a relationship between environmental awareness and financial performance deriving insight from the nature of data generated for the years 1996–2019 for 16 Indian banks considering 2005 as the year of green banking implementation and taking data for the pre- and post-set up years.

The results of the study say a lot. In the early days of green banking in 2005, a statistical insignificance between green practices and bank profitability can be detected in the implementation of green in banks, especially in terms of ROE. But then in 2019, green banking was statistically and significantly associated with ROA. Thus, it suggests that although this early period of implementation might have been transitional or symbolic, over time the operational advantages of green banking, including digitalization, cost savings, and energy efficiency, started to convey positively on their asset-based returns. ROA is the single metric more easily able to internally agree a level of profitability to management, and therefore mirrors these changes as they occur to a side extent to a larger set of variables ROE and shareholder expectation and SWOS.

Green banking was not significantly related to ROE for either time, which was somewhat surprising. This could imply that even as banks continue to improve upon the operational soundness of their firms and become more ecologically aware, the market is currently not rewarding them for it in shareholder value. This could be due to a number of factors, perhaps investor conservatism, insufficient promotion of green credentials or a time lag between implementation and perceived impact on shareholders. It also may question whether capital markets and investors are fully informed or aligned with sustainable development goals with respect to banking.

The analysis also reaffirmed the value of traditional financial metrics. ROA is greatly affected by net income and operational expenses which maintain substantial and meaningful influence on profitability. This demonstrates not only that green banking is conducive to operational efficiency, but also that the absorption of this approach must be complementary and not intended to be a substitute for the classical performance metrics. The most effective green initiatives for maximum profitability will likely be approached in a balanced manner, where initiatives are strategically integrated with financial performance frameworks.

From the policy angle, the findings suggest the need for encouraging specific regulatory pushes/fundamentals that serve to, ensure banks implement green measures as well as reward them by way of a tax benefits, green credits or favorable treatment in regulations. Additionally, banks need to increase transparency and communication with stakeholders surrounding their green initiatives to increase public trust and investor confidence.

Finally, green banking is not simply a philanthropic or ethical concern; rather, it provides a practical business model that, in the long run, can substantially increase the bank's bottom line in many aspects, particularly operational efficiency. However, green banking can really affect shareholder returns and market value only if a wider systemic change occurs in terms of investor awareness, regulatory support and public perception. The financial advantages of sustainability banking need to be further studied in future research – a marriage of major trends in sustainability and profits since 2019 – to derive more insights into sustainable banking.

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