

IMPACT OF DIGITAL GREEN BANKING ON FINANCIAL PERFORMANCE OF AXIS BANK: MEDIATING ROLE OF OPERATIONAL EFFICIENCY

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Abstract—This study attempts to explore the direct impact of Digital Green Banking on Financial Performance and further explores the mediating Role of Operational Efficiency in between the relationship of Digital Green Banking and Financial Performance in relation to Axis Bank. A Dual method sequential explanatory research design was followed for conducting this study. First, primary data was collected from 74 bank employees using structured Likert scale questionnaires, which was analysed using regression and mediation analysis in Jamovi. Further, secondary financial data was collected by analysing financial data from annual reports of Axis Bank for 10 years, i.e., from 2015-16 to 2024-25. The results of the regression analysis indicate a positive and statistically significant relationship between Digital Green Banking and Financial Performance ($\beta = 0.274$, $p < .001$, $R^2 = .150$). The results from the regression analysis show a positive and significant association between Digital Green Banking and Financial Performance ($\beta = 0.274$, $p < .001$, $R^2 = .150$). According to mediation analysis, Operational Efficiency plays an important role as the mediator in the relationship, showing a significant indirect effect ($\beta = 0.131$, $p = 0.006$). It is found that Digital Green Banking is a strategic resource in RBV that creates value through operational effectiveness.

Keywords: Digital Green Banking, Financial Performance, Operational Efficiency, Mediation Analysis. Resource Based View.

1. INTRODUCTION

The concepts of digital transformation and environmental sustainability have greatly impacted the strategies in banks in the 21st century. The term Digital Green Banking (DGB) can be defined as the adoption of digital technologies and sustainable practices in order to improve performance and environmental sustainability (Lumpkin & Schich, 2020; Batae et al., 2021). Practices in this regard include paperless banking, mobile/internet banking, automated banking operations, and digital reporting of transactions (Motwani & Vora, 2021; Rahman et al., 2023).

Regarding India, there is an increased need for banks to embrace DGB due to RBI guidelines on green deposits and ESG reporting. For example, banks like Axis Bank have made considerable efforts to embrace digital channels and have been successful with high digital penetration and profit growth. It should be determined whether the success achieved is directly or indirectly due to sustainability considerations.

An example of such a bank is Axis Bank, which happens to be one of the largest private banks in India. The bank has been credited with issuing India's first green bond (in 2016), achieving 96% digital adoption, and making remarkable profits (Gupta et al., 2025; Lee & Chen, 2025). However, there is a scarcity of literature that explains the effect of DGB on financial performance and through what means.

In line with the foregoing discussion, the following questions guide this study: (1) Does Digital Green Banking significantly affect Financial Performance? and (2) Does Operational Efficiency act as a mediator between Digital Green Banking and Financial Performance?

2. RESEARCH QUESTIONS

Based on the above research objective, following research questions are formulated:

- a) What was the effect of digital green banking on financial performance?
- b) Does operational efficiency mediate the connection between digital green banking and financial performance?

3. RESEARCH OBJECTIVES

- c) To evaluate the impact of Digital Green Banking on Financial Performance.
- d) To examine the mediating role of Operational Efficiency in the relationship between Digital Green Banking and Financial Performance.

4. REVIEW OF LITERATURE

4.1 DIGITAL GREEN BANKING AND FINANCIAL PERFORMANCE

Most of the literature reviews support the positive influence of digital banking on the performance of banks. Nguyen-Thi-Huong et al. (2023) assert that even though digital transformation leads to reduced profits due to expensive investment, it eventually improves efficiency and profitability. Likewise, Mirza et al. (2023) identify cost reduction and efficient risk management as the key factors contributing to profitability, which is also confirmed by Motwani & Vora (2021) for India. However, according to Inegbedion (2024), green banking contributes to better performance because of reputation rather than efficiency. Despite research findings by Gutierrez-Ponce & Wibowo (2024) about the positive influence of sustainability practices on performance, there is no literature that explains how these variables relate.

4.2 DIGITAL GREEN BANKING AND OPERATIONAL EFFICIENCY

Previous studies have established that digital banking increases efficiency through automation, speed, and less manual work (Haralayya, 2021; Jain et al., 2023; Prasad, 2024). Likewise, green banking methods such as electronic transactions minimize administrative expenses and increase efficiency (Rahman et al., 2023). Even though Aslam & Jawaid (2023) found positive results regarding sustainable banking and its influence on efficiency and effectiveness, their study does not analyze the role of efficiency as a mediator. Furthermore, the joint effect of digital banking and green banking is yet to be explored.

4.3 OPERATIONAL EFFICIENCY AND FINANCIAL PERFORMANCE

Efficiency of operations is commonly acknowledged as one of the most important factors that affect the financial performance of banks. According to Belasri et al. (2020), effective use of resources directly leads to higher profits, while according to Gupta et al. (2025) and Lee and Chen (2025), digitization contributes to better financial performance due to lower costs and higher productivity. Nevertheless, the above-mentioned sources provide evidence of a direct link between efficiency and financial performance only.

4.4 MEDIATING EFFECT OF OPERATIONAL EFFICIENCY

Although the use of operational efficiency as an intermediary in the connection between sustainability and performance has not been explored before, this is what Gutierrez-Ponce & Wibowo (2024) suggest. In addition, Gupta et al. (2025), and Lee & Chen (2025) have pointed out that operational efficiency may be one of the pathways through which digital strategies influence profitability. In this regard, contrary to previous research findings, Inegbedion (2024) asserts that reputational goodwill is the main intermediary. These conflicting results necessitate the empirical examination of the intermediary effect of operational efficiency.

5. RESEARCH GAP

The existing literature review highlights three main gaps. The first gap exists due to the fact that previous research has only studied digital banking and green banking individually, but not together. Therefore, no attempt has been made yet to understand the effect of both constructs collectively in terms of financial performance of banks. The second gap exists as only a very few studies have attempted to test the role of operational efficiency as a mediator in the Digital Green Banking – financial performance relationship through a mediation analysis approach. The third gap exists because no research on Digital Green Banking has been done for private Indian banks, specifically Axis Bank.

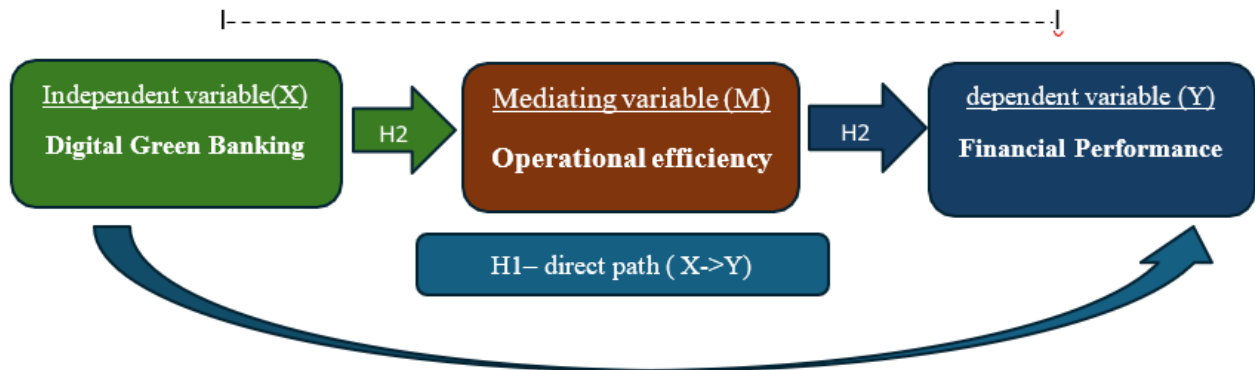
6. THEORETICAL FOUNDATION

The current research adopts the Resource-Based Theory (RBV). The theory states that companies can acquire a competitive advantage due to their ability to make effective use of resources that have high value and uniqueness. In the banking industry, Digital Green Banking (DGB) has been proposed to be a strategic resource, combining technology and sustainability. Nonetheless, according to RBV, resources can only generate value for organizations if they are converted into organizational capabilities. This paper identifies Operational Efficiency as the critical organizational capability associated with DGB.

7. CONCEPTUAL FRAMEWORK

This study proposes a conceptual framework for the impact of Digital Green Banking on financial performance of private banks through OE. The effect of DGB on financial performance can occur either directly or indirectly through operational efficiency. Previous studies have found that the use of technology leads to better experience for customers, lower costs, and increased competitiveness (Motwani & Vora, 2021). On the other hand, DGB contributes to OE by reducing manual work, costs, and time required, thereby leading to financial performance. Therefore, the mediating role of Operational Efficiency between the two variables (DGB & FP) can be suggested.

H2 – mediation through Operational Efficiency



8. HYPOTHESIS DEVELOPMENT

8.1 DIGITAL GREEN BANKING AND FINANCIAL PERFORMANCE (H1)

Digital Green Banking incorporates digitalization and green practices to boost service delivery, cost savings, and customer satisfaction. Previous research findings show that digitalization boosts performance through efficiency and competitive advantage, while green banking does so through reputation (Motwani & Vora, 2021).

H1: Digital Green Banking has a significantly positive influence on Financial Performance.

8.2 MEDIATING ROLE OF OPERATIONAL EFFICIENCY (H2)

Digital Green Banking strategies such as going paperless and adopting automated processes lead to cost reductions and efficiency improvements. Based on RBV theory, resources can be leveraged to create specific capabilities such as Operational Efficiency to achieve financial results. This leads to the formulation of the following hypotheses:

H2a: Digital Green Banking has a significant positive impact on Operational Efficiency. H2b: Operational Efficiency has a significant positive impact on Financial Performance.

H2c: Operational Efficiency significantly mediates the relationship between Digital Green Banking and Financial Performance.

9. RESEARCH METHODOLOGY

9.1 RESEARCH DESIGN

The study adopted a Mixed method explanatory research design. Phase I involved quantitative data analysis of primary data collected through a survey, which aimed at testing hypothesis H1 and H2. Phase II, on the other hand, involved trend analysis of secondary financial data obtained from the annual reports of Axis Bank to corroborate the results of the first phase.

9.2 SOURCES OF DATA AND SAMPLES

Data were collected through a structured survey using a five-point Likert scale from 74 employees of Axis Bank based on convenience sampling. The three main constructs being studied include Digital Green Banking (X), Operational Efficiency (M), and Financial Performance (Y).

Secondary data were taken from the annual reports and sustainability reports of Axis Bank covering a time frame of ten years from 2015-16 to 2024-25.

9.3 ANALYTICAL METHODS

The primary data were analyzed using the statistical software Jamovi version 2.6.44, using the following methods: (i) descriptive statistics; (ii) reliability testing by the Cronbach's Alpha test method; (iii) simple linear regression to test H1; and (iv) mediation analysis using jAMM software in Jamovi to test H2. The secondary data were analyzed using Microsoft Excel for trend analysis

9.4 SAMPLE SIZE

The sample size of 74 is deemed appropriate for conducting regression analysis and mediating tests. As stated by Hair et al. (2010), at least 5-10 data points are required per variable. In addition, as per Fritz & MacKinnon (2007), a sample size of 71 is deemed sufficient for detecting mediating effects.

9.5 TYPES OF VARIABLES

Digital Green Banking is treated as the independent variable, Operational Efficiency as the mediator, and Financial Performance as the dependent variable, all measured using a five-point Likert scale based on established indicators from prior literature.

10. INTERPRETATION AND DISCUSSION

10.1 DESCRIPTIVE STATISTICS AND REALIBILITY

Table 3: Descriptive Statistics

Construct	N	Mean	Std. Dev.	Range
Digital Green Banking (X)	74	3.92	0.818	1–5
Operational Efficiency (M)	74	3.76	0.699	1–5
Financial Performance (Y)	74	3.77	0.579	2–5

Scale Reliability Statistics

Scale Reliability Statistics			
	Mean	SD	Cronbach's α
scale	3.82	0.558	0.701

Descriptive statistics reveal that respondents have positive perceptions regarding the study constructs. The mean scores for Digital Green Banking (3.92), Operational Efficiency (3.76), and Financial Performance (3.77) denote high levels of concurrence regarding the importance of digital and green banking initiatives. All the constructs have a median value of 4.00.

Reliability analysis shows a reliability coefficient of 0.701, which exceeds the minimum criterion of 0.70. Thus, the results support the validity of the measurement tool used in this study.

10.2 HYPOTHESIS TESTING

10.2.1 OBJECTIVE 1: To evaluate the impact of Digital Green Banking on Financial Performance.

H1: Digital Green Banking significantly and positively influences Financial Performance.

Simple linear regression was conducted with Financial Performance (Y) as the dependent variable and Digital Green Banking (X) as the predictor.

Table 4: Regression Results — DGB on Financial Performance (H1)

Predictor	β (Estimate)	SE	t	p	R ²
Intercept	2.698	0.308	8.75	< .001	
Digital Green Banking (X)	0.274	0.077	3.57	< .001	0.15

Note: Shapiro-Wilk normality test: W = 0.984, p = .477 (normality assumption met). N = 74.

Regression analysis suggests that Digital Green Banking significantly positively predicts Financial Performance ($\beta = 0.274$, $p < .001$). $R^2 = .150$, which explains 15% of the total variation in the dependent variable. Thus, the results meet the accepted standards for behavioral studies. The normality assumption is met (W = 0.984, p = .477).

Decision: H1 is ACCEPTED. Digital Green Banking has a significant positive influence on Financial Performance.

10.2.2 OBJECTIVE 2: To examine the mediating role of Operational Efficiency in the relationship between Digital Green Banking and Financial Performance.

H2: Operational Efficiency acts as a mediator between Digital Green Banking and Financial Performance. Mediation analysis was conducted using the jAMM plugin in Jamovi. The analysis tests the indirect path: DGB (X) → Operational Efficiency (M) → Financial Performance (Y), while controlling for the direct path X → Y.

Table 5: Path Estimates -Mediation Analysis (H2)

Path	β (Estimate)	SE	z	p	95% CI	
					LOWER	UPPER
DGB (X) → Operational Efficiency (M) = Path a	0.412	0.087	4.73	< .001		
Operational Efficiency (M) → Financial Performance (Y) =Path b	0.319	0.094	3.38	< .001		
DGB (X) → Financial Performance (Y) [Direct] = Path c	0.143	0.081	1.78	.076 (n.s.)		
Indirect Effect (X → M → Y) = a * b	0.131	0.048	2.75	.006	0.0299	0.281
Total Effect (X → Y)	0.274	0.076	3.62	< .001		

Note: p < .01. N = 74. Mediation type determined by significance pattern of direct and total effects.

The mediating effect of the operational efficiency from Digital Green Banking to Financial Performance was tested by running a mediation analysis through the jAMM module in Jamovi software. The analysis results reveal that Digital Green Banking has a significant effect on Operational Efficiency ($\beta = 0.412$, $p < .001$), and Operational Efficiency also significantly impacts Financial Performance ($\beta = 0.319$, $p < .001$). Additionally, the indirect effect through the mediation process is also significant ($\beta = 0.131$, $p = 0.006$).

However, the direct impact of Digital Green Banking on Financial Performance became insignificant ($\beta = 0.143$, $p = 0.076$) once Operational Efficiency was added in the model, thus suggesting full mediation effect. Decision: H2a, H2b, and H2c are accepted.

Conclusion: H2 is ACCEPTED. The hypothesis about the significant and partial mediating role of Operational Efficiency in the relation between DGB and FP is supported.

Contrary to Inegbedion (2024), where reputational goodwill plays a key mediating role, this research highlights the significant mediating effect played by Operational Efficiency within the context of Indian private banking sector.

10.3 SECONDARY DATA ANALYSIS

Trend analysis of Axis Bank's ten-year secondary data (2015–16 to 2024–25) provides illustrative corroboration for both hypotheses.

Table 6: Secondary Data Trend Summary (Selected Years)

Year	Digital Usage (%)	Cost-to-Income (%)	ROA (%)	Net Profit (₹ Crore, approx.)
2015–16	87%	20.05%	1.72%	50,360
2017–18	72%	24.65%	0.04%	56,750
2019–20	81%	22.13%	0.20%	78,170
2021–22	76%	28.58%	1.21%	82,600
2023–24	62%	26.71%	1.83%	1,31,810
2024–25	96%	25.34%	1.74%	1,47,934

Note: 2018–19 ROA (0.63%) is an anomalous outlier likely due to accounting adjustments and is excluded from trend interpretation.

An analysis of the trend of Axis Bank’s ten years’ data (2015-16 to 2024-25) is presented here as an example of corroborative proof for the results obtained. As the usage of technology increases, positive financial performance, as indicated by the net profit increase and low cost- income ratios, ensues. For example, in 2024-25, the level of digitization was 96%, which is associated with the maximum net profit of ₹1,47,934 crore.

Despite the small sample size (N = 10), there is a congruence between the trends found and the primary data results, indicating that there is a relationship between the use of DGBs, operational efficiency, and financial performance.

The fluctuation in the use of technology could be due to different reporting standards and exogenous factors like demonetization.

11. THEORETICAL IMPLICATION

First, the current paper offers three novel theoretical insights. First, the RBV framework is extended into the Digital Banking area by empirically verifying the RCBF sequence: Digital Green Banking (R) → Operational Efficiency (C) → Financial Performance (B). While previous RBV research in banking has emphasized physical assets and HR, this paper sees DGB as a holistic strategic resource (Mookerjee et al., 2025; Fakruddin, 2025).

Second, the current study adds new knowledge to the mediation literature by identifying the operational efficiency variable as a complete mediator in the Digital Banking-FP link. The study reveals the mechanism behind such mediation by demonstrating that DGB positively affects financial performance by increasing operational efficiency and speed (Gupta et al., 2025; Lee & Chen, 2025). The findings further refute the view expressed in Inegbedion (2024) by indicating that in the increasingly digitized and competitive Indian private banking industry, operational efficiency is a more significant determinant of performance than reputation.

Third, by merging RBV with TAM, the current paper offers an all-encompassing theoretical model that accounts for the adoption and effect of Digital Green Banking.

12. PRATICAL IMPLICATIONS

In the case of investment in Digital Green Banking by banks' management, apart from looking at the financial benefits alone, the emphasis must also be on the ability of those investments to help banks improve efficiency. The reason being that Operational Efficiency is a critical mediator of the financial value proposition. Hence, efficiency-related parameters like cost-to-income ratio, transaction speed, and errors should be continuously monitored as early signs of financial value creation.

Here, the steps that banks can take include adopting paperless banking to save costs, improve employee training for quicker technology acceptance, use efficiency parameters in their digital dashboards, and adopt sustainable practices including digital branches.

For policy-makers and regulators, the results point towards the need to support Digital Green Banking via initiatives such as tax rebates and green bonds as a way to promote not only profitability but also sustainability.

13. CONCLUSION

This study attempted to address two specific research questions regarding the impact of the Digital Green Banking (DGB) strategy adopted by Axis Bank: Does it have a significant effect on the bank's financial performance? Is the relationship between Digital Green Banking and financial performance mediated by operational efficiency?

The results support the validity of hypotheses H1 and H2, respectively. Specifically, H1 was verified: DGB significantly and positively affects financial performance ($\beta = 0.274$, $p < .001$, $R^2 = .150$). Furthermore, H2 was verified: Operational efficiency significantly mediates the relationship between DGB and FP (indirect $\beta = 0.131$, $p = .006$), with the direct relationship becoming insignificant after controlling for operational efficiency.

The study's findings indicate that DGB adds value to the bank's financial performance through the ability to reduce costs and process times and optimise resource utilisation, thus maximising profit. In the institutional context of Axis Bank, the threefold increase in net profits in the last decade, together with increased digital adoption and decreasing cost/income ratio, provide strong supporting evidence.

The study contributes to RBV and TAM theories in the field of sustainable banking and offers actionable recommendations for management, regulatory bodies, and future researchers studying the digital-green-performance relationship.

14. LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

14.1 LIMITATIONS

Several limitations should be addressed in the interpretation of results and future research. First, although the sample size of 74 respondents is sufficient for the use of regression and mediation analysis, it is a non-random (convenience) sampling that may not provide full representation of all strata of employees working in Axis Bank. The employment of data for 10 years might prove insufficient for the identification of strong statistical trends. Firstly, the study covers one organisation (Axis Bank). It means that the results obtained may not apply to other banks with different levels of digitalisation and ownership structure. Moreover, only several factors have been taken into account in the model; external factors, including economic conditions, regulatory changes, and competition on the financial market, which could affect the financial performance of banks, were excluded from consideration.

Since the study relies on self-reported survey data might result in common method bias, Harman's single-factor test was performed. According to its results, the proportion of the total variance explained by the first unrotated factor is 47.0%, which is less than 50%.

14.2 FUTURE RESEARCH DIRECTIONS

- (i) Replication of the current model among other Indian state and private banks to verify generalisability
- (ii) Using a larger timeframe (15-20 years) for secondary data analysis
- (iii) Incorporating other mediators and moderators (for example, customer satisfaction, employee productivity, size of the bank or competition level)
- (iv) Estimation of all paths with structural equation modelling for higher precision
- (v) Examining whether certain parts of DGB (mobile banking, paperless operations or green bonds) significantly affect efficiency and performance of a bank.

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