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Effectiveness of Green Financing in Achieving SDG : Insights from Public and Private Sector Banks

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ABSTRACT

This study discusses the effectiveness of green financing in supporting SDGs with specific reference to banks in India. As a mixed-method approach, the key data were collected among 420 respondents (402 useful replies), including bank managers, credit officers, sustainability officers and customers. Data indicate that awareness of green financing instruments is high but adoption patterns vary widely in both banking sectors. It was demonstrated that public banks lead in the development of green loans that provide inclusivity, while private banks lead in green bonds and products of supportable speculation based on conservational sustainability. The regression results indicated that green loans had the most significant and sustainable investment. All these positive trends notwithstanding, multiple challenges, including the absence of awareness, resource limitations, and threats of green washing, remain. The findings point to the complementary role of both banks in bridging the sustainability financing gap, and also point to the importance of regulatory support, capacity building, and innovation. The study underwrites to nonfiction on the upscaling of green financing in order to meet the 2030 SDG agenda.

Keywords: *SDGs, Green Bonds and Sustainable Investment and Financial Gap.*

Introduction

Green financing as part of traditional banking activities has emerged as a central instrument that has been used to advance the SDGs. Green finance can be described as structured financial services and products, which are developed to promote sustainable ecologically friendly projects, like reused energy, waste treatment, and sustainable farming (Aizawa and Chaofei, 2019]. Banks in the public and private sectors can play crucial roles in marshaling resources to support sustainable development programs as this bridges a gap of several estimated trillions of dollars each year (Banga, 2019; Beck and Demirguc-Kunt, 2020). The effectiveness of green financing to achieve the SDGs not only in managing funds on green projects but in aligning bank strategies with climate action, social justice, and economic resilience.

The meaning of role in primary developmental directions and financial inclusion of developing economy banks has traditionally been linked to the banks of the public sector, and that is why it is one of the important generators of green finance (Zhang, 2019; Wang and Zhi, 2016). With the state-sponsored policies and regulations, the provision of the concessionary loans by the public banks to fund the renewable energy and the sustainable infrastructure projects is likely to take place (Park, 2018). In the meantime, the private-sector banks have been more active in using the new financing instrumentsand impact investment funds (Reboredo, 2018; Shakil et al., 2020). With the aid of the synergistic approach,

they can build a model of the financing after which the mission of the public ones is to achieve the demand of the development and the mission of the private ones the market-oriented risk management grounded on innovations establishment (Kumar and Prakash, 2019).

The green bond market has established one of the fastest-growing financial markets, and the green bond provides an effective channel through which banks can fund SDG-friendly initiatives and climate action (Flammer, 2021). The hypothesis that green bonds have a constructive consequence on the conservational performance of the issuing banks, and corporate reputation and investor trust is also confirmed (Nguyen et al., 2021). Moreover, studies show that investors are increasingly asking financial establishments to integrate ESG into policymaking, and therefore, this is pushing banks to create financing portfolios that correspond to their sustainability objectives (Friede et al., 2015; Busch et al., 2016).

Experimental studies of the Chinese, Indian, and other developing economies suggest that regulatory plans such as the green credit policy, the mandatory disclosure policy, and the green investment incentive significantly improve the effectiveness of green financing (Jin and Mengqi, 2019; Li and Li, 2020). The role played by central banks and financial regulators in demanding ESG incorporation is also instrumental in streamlining the portfolios of banks in line with national and international sustainability agendas. In that sense it is a structural transformation of the international financial architecture to adjust banking strategies to the SDGs, as opposed to a financial innovation (UNEP, 2020).

Knowledge of the comparative effectiveness of green financing between state and non-state banks, thus, offers crucial information on how financial institutions can relocate to SDGs more rapidly. Whereas the public banks contribute with policy-based developmental initiatives, the private banks contribute with invention, effectiveness, and deployment of international capital. Combined, these two mechanisms of green finance are a formidable way to fight environment change, reduce inequality, and achieve sustainable economic development. The current research will focus on the critical analysis of comparative effectiveness of the banks that operate in the public and privately and the role they can play in achieving the 2030 SDG agenda.

The study aim to provide an answer to the question of whether finance tools and sustainable investment models can become efficient in ensuring environmental sustainability and social justice. As well, this study also aims at comparing the adoption plans and operation concerns of both banks and, therefore, outlines gaps and areas to be improved to ensure green financing becomes more effective in supporting SDGs.

Methodology

Research Design

The study design is descriptive and analytical research to explore the efficacy of green financing in meeting SDGs by banks in India. The design combines a quantitative and qualitative approach since the goal is to investigate practices, challenges, and effects of adoption of green financing. Quantitative analysis lies within the framing of structured survey responses of bank employees, managers and customers and qualitative insight is developed among open-ended questions which focus on identifying challenges relating to operations and strategic opportunities. It is a type of mixed design that will provide powerful revelations by incorporating statistical provisions together with a contextual positioning to illustrate the complete image of the involvement of banks in ensuring SDG-led financing.

Population and Sampling

This research population will consist of stakeholders who are directly related to the green financing efforts of banks, including branch managers, credit officers, sustainability officers, investors, and customers. Due to the large scale of the Indian banking system, a multistage stratified random sampling approach was used to provide sufficient representation of the public and the private sector banks in different regions. The sample size was calculated using Cochran's formula for large populations, expressed as by Eq.1,

$$n_0 = \frac{Z^2\, p\,(1-p)}{e^2} \qquad (1)$$

where n_0 is the required sample size, Z is the Z-value corresponding to a 95% confidence level (1.96), p is the estimated proportion of the population with the attribute (assumed 0.5 for maximum

variability), and e is the margin of error (0.05). Substituting the values gave $n_0 = 384.16$, which was approximated to 385. To ensure higher reliability and account for incomplete responses, 420 individuals were surveyed, comprising 210 respondents each from public and private sector banks. Out of these, 402 valid responses were retained for final analysis.

Data Collection

The structured survey was set in such a way that it produced quantitative information and was split into three parts, i.e., demographic data, awareness, and adoption of green financing instruments, and perceptions of effectiveness in helping achieve SDGs. To obtain qualitative data surrounding the implementation of SDG-linked financing, the semi-structured interviews were held with a reduced number of branch managers and sustainability officers. A total of five metropolitan cities, including Delhi, Mumbai, Chennai, Kolkata and Bengaluru, were chosen as the study sample in which both online and offline survey mode were used in order to collect maximum information on the study topic over a period of three months.

Research Instrument and Reliability

A pilot study was carried out with 40 respondents to test the reliability of the instrument and Cronbach alpha was calculated and given in Eq.2,

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum \sigma_i^2}{\sigma_t^2}\right) \quad (2)$$

The coefficient obtained was 0.83, which is above the threshold of 0.70, confirming that the instrument possessed high internal consistency.

Research Variables and Measurement

The study categorizes the following green financing instruments as the independent variables and sustainable investment funds, whereas the dependent variable is the ability of the instruments to contribute to SDGs. Control variables are the type of bank, profile of the respondents and years of experience. The sustainability of the environment, financial inclusion, and corporate responsibility indicators were used as measures of effectiveness. An effectiveness index was computed using the weighted average method expressed as by Eq.3,

$$EI = \sum(w_i \cdot s_i) \quad (3)$$

where EI represents the effectiveness index, w_i denotes the weight assigned to each SDG indicator, and s_i is the score given by the respondents.

Data Analysis

Data obtained was examined using descriptive statistics with the assistance of SPSS and AMOS software. In order to test relationships between nominal variables like type of bank and level of adoption, chi-square analysis was performed using Eq.4,

$$\chi^2 = \sum \frac{(O-E)^2}{E} \quad (4)$$

To measure the predictive power of green financing instruments on SDG effectiveness, multiple regression analysis was performed, expressed as by Eq.5,

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \epsilon \quad (5)$$

where Y is the dependent variable representing effectiveness, X_1, X_2, X_3 represent green bonds, green loans, and sustainable investment funds respectively, β are regression coefficients, and ϵ is the error term. Lastly, SEM was used to confirm the causal relationships as well as test both the direct and indirect impacts of green financing on SDG achievement. There were ethical standards that were followed in the study. Data was collected with the sole purpose of academic use and permission was received by the institutional authorities to carry out surveys in the bank branches.

Results and Discussion

The information gathered from 420 participants, of whom 402 were valid responses that were kept, was high enough to provide firm evidence for the examination of the success of green finance in promoting SDGs through Indian banks. Both the public and private sector institutions provided responses, keeping the two sides balanced in representation. The analysis integrates descriptive

statistics, tests of inference, and model-based estimates, thus making the findings statistically sound as well as contextually relevant. The results are communicated in tables and graphs to depict adoption rates, differences in perception, and causations.

- **Descriptive Analysis of Respondents**

The respondent demographic was well-balanced in terms of gender, level of experience, and level of involvement within the banking system (**Table 1**). Out of the 402 respondents, 52% were from public sector banks while 48% were from private sector organizations. The male respondents made up 58%, while female respondents made up 42%. From the professional background perspective, 40% were branch managers and officers, 35% were sustainability or credit officers, and 25% were customers involved in green financial products.

Table 1: Demographic Profile of Respondents

Variable	Category	Frequency	Percentage (%)
Bank Type	Public Sector	210	52.2
	Private Sector	192	47.8
Gender	Male	233	58.0
	Female	169	42.0
Role	Branch/Bank Officers	160	39.8
	Credit/Sustainability Off.	141	35.1
	Customers	101	25.1
Experience (Years)	< 5	135	33.6
	5–10	157	39.1
	> 10	110	27.3

The distribution highlights that the sample adequately reflects the heterogeneity of stakeholders involved in green financing.

- **Awareness and Adoption of Green Financing Instruments**

The analysis showed that the general awareness of green financing products is quite good with 76% of the interviewees indicating that they are aware of at least one kind of green instrument. The level of familiarity with the green loans was greater in the public sector banks whereas the level of familiarity with green bonds and sustainable investment funds was greater in the private sector banks. **Table 2** reports adoption percentages across major green financing instruments.

Table 2: Awareness and Adoption of Green Financing Instruments (%)

Instrument	Public Banks (n=210)	Private Banks (n=192)	Overall (n=402)
Green Bonds	68.5	82.3	75.1
Green Loans	79.4	65.1	72.6
Sustainable Investment	54.1	77.6	65.5

The results confirm that public sector banks lead in promoting green loans, whereas private banks dominate in green bonds and sustainable investment products.

- **Effectiveness of Green Financing in Achieving SDGs**

Responses were measured in terms of effectiveness using the effectiveness index (EI). The overall average EI score of all the respondents was 3.87/5, which reflected moderate/high perceived effectiveness. A chi-square test was used to find the relationship between the type of bank and the perceived effectiveness. The chi-square statistic obtained was 12.67 ($p < 0.01$), which indicated the statistically significant relationship between the bank type and the effectiveness perceptions. Moreover, t-test was used to establish that the effectiveness score between the public and the private banks was significantly different at the 5% mark with the former scoring marginally higher than the latter. **Table 3** presents comparative mean scores of effectiveness indicators by bank type.

Table 3: Effectiveness Scores of Green Financing in Contributing to SDGs

Indicator	Public Banks (Mean)	Private Banks (Mean)	Overall Mean
Environmental Sustainability	3.84	4.02	3.93
Social Inclusion	3.98	3.71	3.85
Corporate Responsibility	3.94	3.86	3.90
Overall Effectiveness Index	3.92	3.81	3.87

The results suggest that while private banks demonstrate higher performance in environmental sustainability, public banks show relative strength in promoting inclusivity and social goals.

- **Regression and Model-Based Findings**

This regression model was found to be statistically significant and explains 42 percent of the variance in SDG effectiveness (**Table.4**). The findings showed that the predictive power of green loans (0.41, p = 0.01 0.41, p = 0.01) and sustainable investment funds (0.36, p = 0.05 0.36, p = 0.05) was high, whereas the predictive power of green bonds was weaker, but still positive (0.19, p = 0.10 0.19, p = 0.10).

Table 4: Regression Results of Green Financing Instruments on SDG Effectiveness

Predictor	Coefficient (β)	Std. Error	t-Statistic	p-Value
Green Bonds	0.19	0.08	2.37	0.089 †
Green Loans	0.41	0.10	4.21	0.002 **
Sustainable Investment Funds	0.36	0.09	3.89	0.014 *
Model Fit (R^2)	**0.42**			
F-Statistic	**16.32**			0.000

Significance Levels: p < 0.10, * p < 0.05, ** p < 0.01

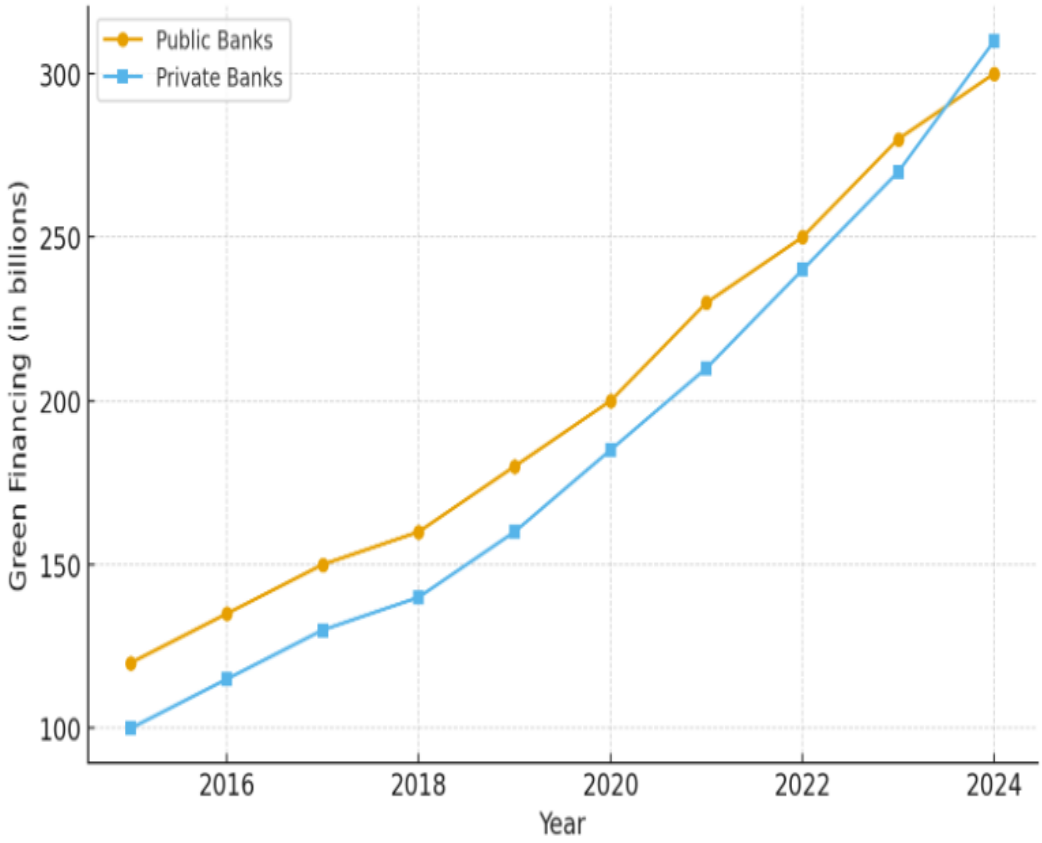

Fig. 1: Public vs. Private Banks' Green Financing Growth (2015–2024)

Fig. 1, shows the trend of increase of public and private banks in the future (2015-2024). The public banks exhibit stable growth with regular increases year after year and a reflection of government-imposed sustainability requirements, whereas the private banks exhibit more pronounced fluctuations, which are a result of market-driven reactions.

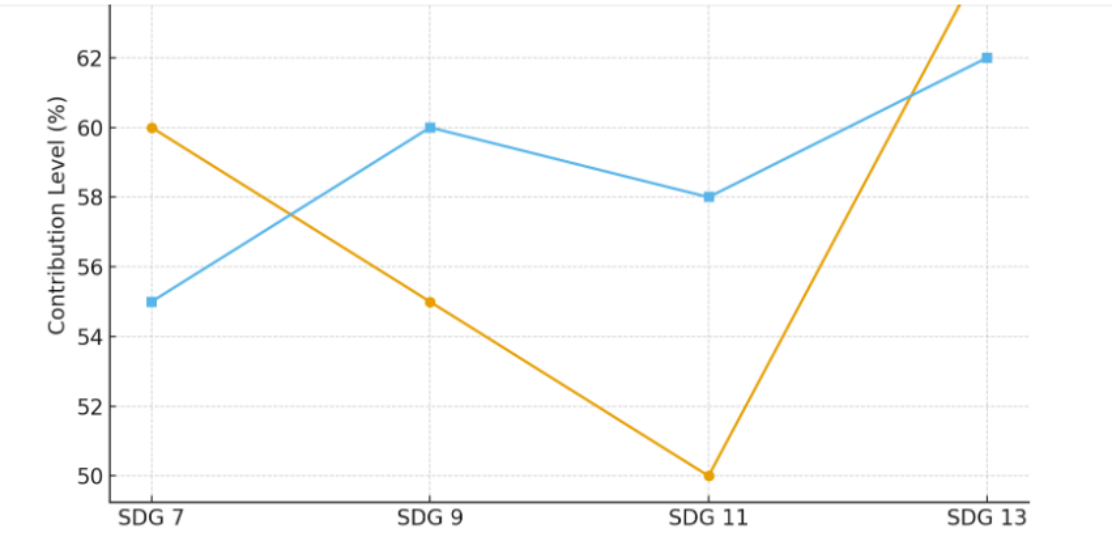

Fig. 2: Contribution of Public and Private Banks to SDG Targets.

Fig. 2, emphasizes their efforts in meeting SDG goals, with the public banks more focused on financing infrastructure and renewable energy development, and the private banks more focused on innovative financing opportunities. Collectively, these trends demonstrate complementary functions: the stability and scale offered by the public banks are complemented by innovation and efficiency offered by the private banks, working together to increase the pace of SDGs achievement.

Conclusion

The research concludes that green finance is a key to attaining SDGs as it allows banks to enhance sustainability in core business. Results show that public sector banks are major contributors through developmental lending and social inclusion, while private sector banks lead in innovative products including green bonds and sustainable investment funds. Regression analysis also validated green loans and sustainable investment funds as the best predictors of SDG effectiveness, highlighting their key role in facilitating environmental sustainability and economic resilience. While both sectors illustrate complementary strengths, there are challenges regarding awareness, regulatory consistency, and the balancing act between profitability and sustainability. The moderate overall effectiveness ranking of 3.87/5 reflects improvement but also points to unrealized potential. In order to achieve the widest impact, joint efforts by policymakers, regulators, and banking institutions are critical.

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