

Green Banking 2.0 In India: Integrating Esg Risk, Climate Finance and Digital Transformation for Sustainable Financial Growth

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Abstract—In the face of escalating environmental concerns and global climate change, the financial sector has emerged as a critical enabler of sustainable development. The accelerating climate crisis, evolving regulatory expectations, and technological advancements are redefining the role of financial institutions worldwide. In India, green banking has transitioned from operational eco-efficiency to strategic sustainability integration. Green banking the integration of environmental criteria into banking operations, products, and services has gained traction worldwide, including in India. This paper conceptualizes “Green Banking 2.0” as an advanced paradigm that integrates Environmental, Social, and Governance (ESG) risk assessment, climate finance mechanisms, and digital transformation to foster sustainable financial growth. It transforms banking from doing some green initiatives to embedding sustainability into every financial decision. Unlike traditional green banking focused primarily on paperless operations and green loans, Green Banking 2.0 embeds climate risk into credit appraisal, capital allocation, governance structures, and digital banking ecosystems. The study develops a multidimensional conceptual framework explaining how ESG integration, climate-aligned financial products, and fintech-enabled sustainability reporting collectively enhance financial resilience and long-term value creation. The paper identifies regulatory drivers, institutional barriers, and strategic enablers within the Indian context. It concludes that Green Banking 2.0 is not merely a sustainability initiative but a structural transformation necessary for achieving India’s net-zero commitments and ensuring financial stability.

Index Terms—Green Banking 2.0, ESG Risk, Climate Finance, Digital Transformation, Sustainable Finance, Net-Zero Transition

I. INTRODUCTION

Green banking refers to the banking business conducted in such areas and in such a manner that helps the overall reduction of external carbon emission and internal carbon footprint. To aid the reduction of external carbon emission, banks should finance green technology and pollution reducing projects. Although, banking is never considered a polluting industry, the present scale of banking operations has considerably increased the carbon footprint of banks due to their massive use of energy (E.g. lighting, air conditioning, electronic/electrical equipment, IT etc.), high paper wastage, lack of green buildings etc. Banks should adopt technology, process and products which result in substantial reduction of their carbon footprint as well as develop a sustainable business. Green banking refers to a set of environmentally responsible practices adopted by financial institutions to reduce ecological impact and support sustainable development. It involves reducing internal carbon footprints, financing green projects, and promoting eco-friendly financial services.

Climate change and environmental degradation pose systemic risks to global financial stability. In response, financial institutions are increasingly integrating sustainability considerations into their core operations. In India, early green banking practices focused on operational efficiency, renewable energy financing, and paperless banking. However, the growing emphasis on ESG disclosures, climate risk assessment, and sustainable finance demands a more integrated model.

“Green Banking 2.0” represents this evolution where sustainability moves beyond compliance to become a strategic determinant of financial growth. In India one of the world’s fastest-growing economies rapid industrialization and urbanization have increased the urgency for environmentally sustainable financial mechanisms. Green banking has thus become a strategic focus for both public and private sector banks. Their role is vital in supporting India’s commitments under the Paris Agreement and achieving Sustainable Development Goals (SDGs). This paper proposes a theoretical framework integrating ESG risk, climate finance, and digital innovation within the Indian banking ecosystem.

II. REVIEW OF LITERATURE

Indian banks were late adopters compared to global peers; they possess significant potential to drive sustainable development through credit policy (Sahoo & Nayak, 2008). Explores the "Business Case for Sustainability in Banking," arguing that environmental risk assessment is not just ethical but a core component of credit risk management (Weber, 2010). Provides a comparative analysis showing that green bonds and sustainability-linked loans in emerging markets like India are crucial for filling the "climate funding gap" where traditional debt often fails (Haque & Azmat, 2021). "Demystifying Sustainable Finance for Indian Banks" breaks down the complexity of "Financed Emissions" and how Indian banks must align their portfolios with the National Action Plan on Climate Change (NAPCC) (Vikas, 2024 - IIBF). This study demonstrates how Fintech reduces information asymmetry. Digital platforms allow banks to better evaluate the "greenness" of a project, thereby reducing the risk of greenwashing (Zhang & Wang ,2023). Investigates AI-driven digital transformation in Indian banking. It finds that AI-powered ESG analytics significantly enhance the precision of sustainability reporting and customer satisfaction (Bethapudi, Sharma, Iyer, and Khan, 2025/2026). Quantitative analysis showing a consistent positive correlation between high levels of digital integration (e.g., cloud-based systems, paperless KYC) and a reduction in a bank’s internal carbon footprint (Shakir Ali et al, 2026).

III. STATEMENT OF THE PROBLEM

While the Indian banking sector has successfully transitioned through Phase I (Operational Green Banking) by adopting paperless transactions and energy-efficient offices, a significant "implementation gap" exists in moving toward Green Banking 2.0. Currently, the sector faces a lack of standardized ESG (Environmental, Social, and Governance) metrics, leading to inconsistent disclosures and the rising threat of "Greenwashing." Most Indian banks struggle with Climate Risk Modelling, leaving their loan portfolios vulnerable to sudden regulatory shifts or environmental disasters (physical and transition risks). Without a clear theoretical model that integrates Digital Innovation with Climate Finance, the transition remains fragmented, preventing the Indian economy from fully tapping into global green capital and achieving national net-zero targets. This study aims at analysing the concept of Green Banking 2.0 in India.

IV. OBJECTIVES OF THE STUDY

- To conceptualize Green Banking 2.0 in the Indian context.
- To analyze the opportunities of green banking in Indian banking sector.
- To examine how challenges in green banking 2.0 affect Indian economy.
- To identify theoretical model linking ESG, climate finance, and digital innovation

V. RESEARCH METHODOLOGY

Since this is a conceptual/theoretical paper, the methodology is designed as a systematic conceptual analysis supported by secondary data. The study adopts a:

- Conceptual research design
- Qualitative analytical approach
- Secondary data-based framework development

VI. RESULTS AND DISCUSSION

1.6.1 Evolution of Green Banking in India Phase I: Operational Green Banking

- Paperless banking
- Energy-efficient branches

- CSR-driven environmental initiatives

Phase II: Green Product Development

- Renewable energy financing
- Green bonds
- Sustainability-linked loans

Phase III: Green Banking 2.0 (Strategic Integration)

- ESG-based credit appraisal
- Climate risk disclosure frameworks
- Fintech-enabled sustainability analytics
- Alignment with net-zero targets

This transformation reflects global trends and domestic regulatory momentum.

1.6.2 Theoretical Foundations

Green Banking 2.0 is grounded in multiple theoretical perspectives:

- Stakeholder Theory

Banks are accountable not only to shareholders but to society, regulators, and future generations.

- Institutional Theory

Regulatory pressures (RBI, SEBI), global standards (TCFD, Basel norms), and investor expectations shape sustainability adoption.

- Risk Management Theory

Climate change introduces physical and transition risks affecting asset quality, lending portfolios, and capital adequacy.

1.6.3 Conceptual Framework of Green Banking 2.0

The proposed model integrates three strategic pillars:

- ESG Risk Integration
- Integrating Environmental, Social, and Governance (ESG) criteria into core credit risk models is crucial for identifying and managing sustainability-related vulnerabilities.
- Risk Mitigation: By embedding ESG indicators, banks can identify potential financial risks related to climate change, resource scarcity, and social unrest, preventing high-carbon or environmentally harmful projects from becoming non-performing assets.
- Asset-Level Data & Reporting: Banks are increasingly using ESG ratings and data to evaluate client portfolios and align with international standards such as TCFD (Task Force on Climate-related Financial Disclosures).

- Transition Management: This involves evaluating the "physical risks" (direct damage to assets) and "transition risks" (regulatory changes, carbon taxes) in client portfolios.

➤ Climate Finance Expansion

- Climate finance involves directing capital toward environmentally beneficial projects and creating specialized green products.

- Green Instruments: Banks are issuing green bonds, sustainability-linked loans, and green deposits to fund renewable energy initiatives, pollution management, and sustainable farming.

- Targeted Lending: Financial institutions are expanding their portfolios to include green loans for electric vehicles (EVs), sustainable infrastructure, and energy-efficient commercial buildings.

- Sectoral Focus: There is a growing focus on financing "green" projects, such as solar power projects, waste water treatment plants, and bio-gas plants.

➤ Digital Transformation for Sustainability

- Digitalization plays a major role in reducing the environmental impact of banking operations, often referred to as "greening the bank's internal processes".

- Paperless Operations: Banks are heavily promoting digital banking services such as e-statements, online account management, and mobile banking apps to reduce paper consumption and the carbon footprint associated with physical branches.

- Operational Eco-Efficiency: Digital tools allow for tracking energy consumption and carbon emissions in branches, promoting energy-efficient practices such as using LED lighting and AI-driven energy management.

- Fintech & Data Analytics: The use of advanced data analytics and cloud storage contributes to a reduced carbon footprint, enabling more efficient and less resource-intensive banking, such as online, remote account opening with video KYC.

1.6.4 Opportunities of Green Banking 2.0 in India

➤ Growing ESG Investment Demand

Globally and domestically, investors are increasingly prioritizing Environmental, Social, and Governance

(ESG) considerations in their investment decisions. Institutional investors, sovereign wealth funds, and mutual funds are allocating capital toward ESG-compliant institutions.

In India, SEBI's BRSR framework has strengthened ESG disclosure requirements, encouraging transparency and comparability. As ESG investing becomes mainstream, banks integrating sustainability into their core strategies can attract:

- Long-term institutional investors
- Foreign portfolio investment
- Green bond subscribers
- Impact investment funds

This creates an opportunity for Indian banks to access lower-cost capital and enhance their global competitiveness.

➤ **Expansion of India's Renewable Energy Market**
India is one of the fastest-growing renewable energy markets globally, with ambitious targets for solar, wind, green hydrogen, and electric mobility.

Green Banking 2.0 allows banks to:

- Finance solar parks, wind farms, and EV infrastructure
- Support climate-resilient agriculture and green urban development
- Participate in transition finance for hard-to-abate sectors

As renewable energy demand expands, sustainable infrastructure financing becomes a high-growth banking segment.

➤ **Fintech Innovation Supporting Sustainability Analytics**

Digital transformation enhances sustainability monitoring through:

- AI-driven ESG scoring models
- Big data climate risk analysis
- Blockchain-based green bond tracking
- Digital carbon footprint assessment tools

Fintech collaboration reduces information asymmetry and strengthens risk evaluation, making sustainable finance more scalable and transparent.

➤ **Access to Global Climate Funds**

India has access to multiple international climate finance sources such as:

- Multilateral development banks

- Green Climate Fund (GCF)
- Climate investment funds
- Blended finance partnerships

Banks aligned with global sustainability standards are better positioned to mobilize these funds and co-finance large-scale infrastructure projects.

➤ **Competitive Advantage for Early Adopters**

Banks that proactively adopt Green Banking 2.0 can:

- Enhance brand reputation
- Reduce long-term credit risk exposure
- Improve investor confidence
- Achieve regulatory preparedness

Early adoption builds resilience against future climate regulations and enhances stakeholder trust.

1.6.5 Challenges of Green Banking 2.0

➤ **Lack of Standardized ESG Metrics**

India lacks a fully harmonized ESG taxonomy across sectors. Different reporting standards create:

- Inconsistent disclosures
- Difficulty in comparing ESG performance
- Risk of misclassification of green projects

Without uniform standards, effective ESG integration remains complex.

➤ **Limited Expertise in Climate Risk Modelling**

Climate risk assessment requires specialized skills in:

- Scenario analysis
- Climate stress testing
- Carbon exposure measurement
- Transition risk forecasting

Many banks face capacity constraints in integrating advanced climate modelling into risk management systems.

➤ **Data Gaps and Disclosure Inconsistencies**

Reliable environmental data at borrower-level is limited. Challenges include:

- Lack of standardized carbon accounting
- Incomplete industry emission data
- Limited climate vulnerability datasets
- Data deficiencies reduce the accuracy of ESG-based credit appraisal.

➤ **High Initial Costs of Digital Infrastructure**

Implementing AI analytics, blockchain systems, and sustainability reporting platforms requires:

- Significant capital investment
- Skilled human resources
- System integration upgrades
- Smaller banks may struggle with financial and technical barriers.

➤ Greenwashing Risks

Greenwashing refers to falsely portraying financial products as environmentally sustainable. Risks include:

- Misleading ESG claims
- Weak verification mechanisms
- Reputational damage
- Loss of investor confidence

Without strong regulatory oversight, greenwashing undermines credibility.

VII. CONCLUSION AND SUGGESTIONS

Green Banking 2.0 represents far more than an incremental improvement in environmentally friendly banking practices; it signifies a structural transformation in India's financial architecture. Traditionally, green banking in India focused on operational efficiencies such as reducing paper usage, promoting digital banking, and financing renewable energy projects. While these initiatives were important, they remained largely peripheral to the core strategic and risk management frameworks of banks. Green Banking 2.0, however, moves sustainability from the margins to the center of financial decision-making. The transition from Green Banking 1.0 (Operational) to Green Banking 2.0 (Strategic) represents a fundamental shift in the Indian financial landscape. While the initial phases focused on reducing the internal carbon footprint (paperless banking), Green Banking 2.0 embeds sustainability into the very DNA of credit risk and asset management.

A unified green taxonomy helps to develop a clear, India specific classification system for green vs Brown projects to eliminate Greenwashing. The mandatory climate stress testing phase in banks help to conduct scenario analysis on their loan portfolios to assess vulnerability to physical climate risks. Instead of building systems from scratch, banks should collaborate with Fintechs to integrate AI-driven ESG scoring and Blockchain for real-time tracking of Green

Bond proceeds. Banks should establish specialized "Green Credit Cells" staffed with environmental scientists and risk modelers who understand the technical nuances of renewable energy and sustainable agriculture. Also, banks should expand beyond corporate lending by offering lower interest rates for EV loans and Green Home Certifications to cultivate a sustainability-conscious consumer base.

In conclusion, Green Banking 2.0 emerges as a strategic imperative rather than a voluntary initiative. For India, a country balancing rapid economic growth with climate vulnerability, sustainable financial intermediation is essential. By aligning financial growth with environmental sustainability and social responsibility, Green Banking 2.0 positions the Indian banking sector not merely as a passive observer of climate change but as an active architect of a resilient, inclusive, and sustainable economic future.

Green Banking 2.0 represents a structural transformation in India's financial architecture. By integrating ESG risk, climate finance, and digital transformation, banks can transition from passive environmental responsibility to proactive sustainability leadership. The future of Indian banking depends not merely on profitability but on its ability to align financial growth with ecological resilience and social equity. Green Banking 2.0 thus emerges as a strategic imperative for sustainable financial development in India

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