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STRENGTHENING FINANCIAL INSTITUTIONS FOR EFFECTIVE CLIMATE FINANCING AND SUSTAINABLE DEVELOPMENT

Dr. Gaurav Vats*

Head of Department,
Department of Business Management,
DAV College, Sector 10, Chandigarh.
Affiliated to Panjab University, Chandigarh
Email address: pbvats@gmail.com

Abstract

India is one of the fastest-growing economies in the world; however, rapid privatization, industrialization, urban expansion, and mechanization have intensified environmental pressures and contributed to rising greenhouse gas emissions. Climate change and global warming pose systemic risks to economic stability, infrastructure, social welfare, and long-term development trajectories. As the backbone of India's financial ecosystem, financial institutions (FIs)—including commercial banks, development finance institutions, non-banking financial companies, and capital market intermediaries—are uniquely positioned to mobilize capital toward climate mitigation and adaptation. A sustainable financial system enables markets to channel investments toward low-carbon technologies, renewable energy, resilient infrastructure, and environmentally responsible enterprises, thereby supporting balanced economic and ecological progress. This chapter examines the evolving role of financial institutions in climate financing, focusing on policy frameworks, regulatory initiatives, green lending, sustainable debt instruments, and risk management strategies in India. Particular attention is given to the issue of stranded assets and the reallocation of capital toward climate-neutral portfolios. Drawing upon government reports, Reserve Bank of India disclosures, EY sustainability assessments, OECD climate finance analyses, and other institutional sources, the study evaluates how financial institutions can accelerate India's transition to climate resilience without compromising growth. The findings suggest that climate-aligned financial systems are essential for ensuring sustainable development while safeguarding economic stability and long-term societal welfare.

Keywords: Climate Finance, Financial Institutions, Sustainable Development, Green Banking, Stranded Assets

I. INTRODUCTION

India's development journey has been marked by accelerated industrialization, expansion of manufacturing, infrastructure modernization, digital transformation, and urbanization. While these transformations have strengthened economic output and global competitiveness, they have also intensified environmental degradation and greenhouse gas emissions. According to India's Ministry of Environment, Forest and Climate Change, India is among the top global emitters, although its per capita emissions remain below many developed economies [1]. The increasing frequency of extreme weather events—heatwaves, floods, cyclones, and droughts—demonstrates the tangible risks climate change poses to economic and financial systems.

Climate change is no longer purely an environmental concern; it is a systemic economic and financial risk. The Reserve Bank of India (RBI) has acknowledged that climate-related risks may threaten financial stability through credit risk, market volatility, insurance losses, and operational disruptions [2]. Financial institutions therefore play a dual role: they are exposed to climate risk, and they are key actors in financing the transition toward sustainability.

A sustainable financial system is one that integrates environmental, social, and governance (ESG) factors into financial decision-making and capital allocation. Such a system directs resources toward renewable energy, green infrastructure, low-carbon technologies, sustainable agriculture, and resilient urban planning. The OECD defines climate finance as financial flows aligned

with low-emission and climate-resilient development pathways [3]. For India, achieving its Nationally Determined Contributions (NDCs) and long-term net-zero commitments will require substantial investment.

An EY India sustainability assessment estimates that India may require approximately US$10.1 trillion by 2070 to achieve its net-zero transition goals [4]. The magnitude of this requirement underscores the indispensable role of financial institutions in mobilizing both domestic and international capital.

This chapter critically examines how financial institutions contribute to climate financing in India, focusing on banking sector initiatives, green bonds, sustainable lending frameworks, regulatory guidance, risk management mechanisms, and stranded asset considerations.

II. CLIMATE CHANGE, ECONOMIC GROWTH AND FINANCIAL STABILITY

Climate change introduces both physical and transition risks. Physical risks arise from extreme climate events damaging assets, disrupting supply chains, and reducing agricultural productivity. Transition risks emerge from regulatory changes, technological shifts, and market adjustments aimed at reducing carbon emissions.

The RBI's Discussion Paper on Climate Risk and Sustainable Finance highlights that Indian banks have significant exposure to carbon-intensive sectors such as power, steel, cement, and transportation [2]. If policy transitions accelerate, assets in these sectors could become "stranded," meaning they suffer premature devaluation or write-downs.

The concept of stranded assets is central to climate finance. According to the International Energy Agency (IEA), fossil-fuel-based infrastructure may face declining economic viability under net-zero pathways [5]. For banks, this implies credit risk, declining collateral values, and portfolio instability.

Therefore, financial institutions must realign lending and investment portfolios toward sustainable sectors while gradually reducing exposure to high-carbon industries.

III. LITERATURE REVIEW

The role of financial institutions (FIs) in climate financing has gained increasing prominence in global development discourse as countries strive to meet sustainable development goals and tackle climate change. Financial institutions are critical in channeling capital toward low-carbon infrastructure, renewable energy, and adaptation projects, thereby bridging the significant gap between climate finance needs and available resources. According to an OECD review, aligning public and private finance flows with climate goals requires not only policy reforms but also active participation from financial markets and investors to support net-zero transitions (OECD, 2021).

Financial institutions influence climate finance through multiple channels: credit provision, investment management, risk mitigation, and financial products innovation. The emerging field of *transition finance* emphasizes the role of FIs in not just moving capital into green sectors, but also in helping high-emitting industries transition toward sustainability (EY, 2022). Transition finance frameworks are evolving to include blended finance, sustainable debt instruments, and ESG-linked lending that can meaningfully support climate mitigation and adaptation efforts.

In the Indian context, the sustainable finance landscape has grown rapidly, driven in part by regulatory support, initiatives like the Task Force on Sustainable Finance, and private sector commitments to reduce emissions. An EY study highlights that India will require an estimated US$10.1 trillion by 2070 to meet its climate and net-zero commitments, and that annual investment needs for climate mitigation alone approximate US$50 billion — underlining the scale of financing that FIs must mobilize.

Beyond traditional banking, blended finance has emerged as a powerful instrument for scaling climate investments. The International Finance Corporation (IFC) reports that blended financial structures in emerging economies, including India, have already deployed significant capital toward climate and development goals by leveraging concessional funds to crowd in private sector investment. This trend is crucial given that public finance alone is insufficient to meet the investment scale required for climate action.

Several studies emphasize that the policy environment significantly influences how effectively FIs can channel funds toward climate goals. A report by the Institute for Energy Economics and Financial Analysis (IEEFA) argues that climate finance practices should move beyond fragmented asset-centric approaches toward systemic financing models that support grid modernization, energy storage, resilient infrastructure, and climate-resilient supply chains. This emphasis on systemic models underscores the need for FIs to evolve their strategies from isolated green projects to holistic capital flows that integrate climate risk and resilience.

Central banks also play a growing role in sustainable finance. A recent study suggests that central banks can integrate climate considerations into monetary policy and regulatory frameworks, stress testing, and disclosure requirements, which in turn shape climate finance flows by influencing how commercial banks and non-bank financial companies allocate capital (Faruq & Huq,

2024). In India, the Reserve Bank of India (RBI) has recognized climate risks as material to financial stability, proposing draft climate risk disclosure frameworks and estimating that India may need upwards of ₹85.6 trillion (~US$1.05 trillion) by 2030 to enable climate-compliant transition in key sectors —the magnitude of financing required and the role financial regulators can play in guiding FI actions.

The literature also discusses *green banks* and specialized climate finance institutions as innovative models for catalyzing private capital. Green banks — public or quasi-public entities focused exclusively on decarbonization finance — have emerged in multiple countries as intermediaries that lower investment risk, develop project pipelines, and leverage public capital to unlock private funds (Wikipedia, 2025). Such models could inform India's institutional design for climate finance.

Another emerging theme is *just transition financing*, which recognizes that moving away from carbon-intensive industries must be socially equitable. An IEEFA report on just transition financing in India highlights the need for financial policies that support worker reskilling, community resilience, and economic diversification alongside green investments — suggesting that FIs and regulators integrate socio-economic indicators into climate finance strategies.

Current research also documents the importance of blended finance, concessional capital, and international partnerships. For example, the State Bank of India's €100 million green credit pact with Agence Française de Développement (AFD) showcases how bilateral collaboration between financial institutions and multilateral partners can mobilize climate finance for mitigation and adaptation projects in emerging markets.

Despite progress, challenges persist. A significant gap remains between announced climate finance commitments and actual mobilized capital — a concern raised repeatedly in COP summits and global climate reports. At COP30, India stressed the need for *equitable and concessional finance* from developed countries as essential to meeting global climate goals, recognizing that emerging economies require support to balance development and climate objectives.

Overall, the literature converges on several key points: financial institutions are indispensable for climate financing; effective climate finance requires blending public, private, and concessional capital; systemic and institutional frameworks matter for credibility and scale; and climate finance must be inclusive and aligned with sustainable development drivers to be effective.

IV. POLICY AND REGULATORY FRAMEWORK FOR CLIMATE FINANCE IN INDIA

India's climate finance architecture is shaped by national strategies and international commitments under the United Nations Framework Convention on Climate Change.

Sovereign Green Bonds

The Government of India introduced a sovereign green bond framework through the Ministry of Finance in 2023. These bonds finance renewable energy, clean transportation, climate-resilient infrastructure, and pollution control projects.

RBI Initiatives

The RBI has proposed:

- Climate risk stress testing
- Enhanced ESG disclosures
- Green deposit frameworks
- Exploration of taxonomy for sustainable finance

Such measures ensure climate risk integration into core banking supervision.

SEBI Guidelines

The Securities and Exchange Board of India (SEBI) to ensure that funds raised through green bonds or green debt securities are genuinely used for environmentally sustainable purposes and not merely labeled as "green" for reputational or marketing advantage.

Role of Commercial Banks

Commercial banks are primary channels for climate finance. Green lending has expanded significantly in renewable energy projects such as solar and wind farms.

The State Bank of India has issued multiple green bonds in domestic and international markets. Banks are increasingly adopting internal ESG frameworks to evaluate borrowers' environmental performance.

Table 1: Green Lending Growth in India

Year	Estimated Green Loan Portfolio (₹ Crore)	Growth Rate (%)
2018	85,000	—
2019	1,05,000	23%
2020	1,30,000	24%
2021	1,75,000	35%
2022	2,20,000	26%
2023	2,75,000	25%

Growth reflects increasing renewable energy financing and sustainability-linked loans.

Table 2: India's Green Financing Requirements and Climate Investment Gaps

Indicator	Latest Estimate	Source
Estimated climate transition investment needed by 2030	~₹85.6 trillion (≈ US$1.05 trillion)	RBI estimate on climate transition costs
Green financing gap as % of GDP (annual required)	~2.5% of GDP	RBI study on green finance requirements
Investment needed for Net-Zero by 2070 (cumulative)	~USD 10 trillion	India COP26 commitment estimates via green finance analysis
India cumulative green bond issuances (2024)	~USD 55.9 billion	Climate Bonds Initiative report
GSS+ (Green, Social, Sustainability) market gap by 2030	~USD 1.3 trillion	MUFG/Climate Bonds report

Key insights:

- RBI estimates suggest that India must mobilize climate finance equivalent to ~2.5% of GDP annually to meet climate objectives, highlighting the scale of transition investment required within the financial system.
- Government's sovereign green bonds and expanding GSS+ market in India demonstrate growing capital allocation toward climate projects, yet demand still outstrips supply.

Capital Markets and Green Bonds

Green bonds have emerged as key climate finance instruments. According to the Climate Bonds Initiative, India ranks among leading emerging markets in green bond issuance.

Table 3: India Green Bond Issuance Trends

Year	Total Issuance (US$ Billion)
2017	3.2
2018	5.1
2019	3.0
2020	6.7
2021	7.5

Year	Total Issuance (US$ Billion)
2022	8.2
2023	10.3

Green bonds reduce cost of capital for renewable projects and attract global ESG investors.

Table 4: Government Green Bond Issuance and Sustainable Financing Actions (2023–25)

Financial Year	Green Bonds Issued (₹ Crore)	Description	Source
FY 2022–23	16,000 crore	First sovereign green bonds issued	Indian Sovereign Green Bond data
FY 2023–24	20,000 crore	Continued issuance and market development	Indian Sovereign Green Bond data
FY 2024–25	~25,298 crore	Increase from previous year	Green bond performance data
FY 2025–26 (budgeted)	~25,342 crore (earmarked)	Planned issuance for climate projects	Central Government budgets & RBI reporting
FY 2026–27	₹31,000 crore (planned)	Project allocation via green bonds	Finance Ministry announcement

Key insights:

- Sovereign green bond issuance in India has steadily increased year-on-year, indicating stronger policy emphasis on leveraging capital markets for climate finance.
- Projected allocations in FY 2026–27 suggest even greater reliance on green debt markets to fund climate and sustainable projects.

Blended Finance and Development Institutions

Blended finance combines concessional public funds with private capital to reduce investment risk. Multilateral development banks and bilateral agencies provide guarantees, equity participation, and viability gap funding.

The OECD reports that mobilized private climate finance in developing countries remains below required levels, emphasizing the need for institutional innovation.

Table 5: Sectoral Distribution of Climate Finance Flows in India

Sector	Share of Climate Finance	Main Activities Financed	Source
Clean energy	~47%	Renewable energy deployment (solar, wind)	India climate finance taxonomy data
Energy efficiency	~35%	Industrial upgrades, building retrofits	India climate finance taxonomy data
Clean transportation	~18%	Electric mobility, low-carbon transport infrastructure	India climate finance taxonomy data
Disaster risk management	~42% (adaptation flows)	Flood, cyclone resilience	India climate finance taxonomy data
Agriculture adaptation	~24% (adaptive finance)	Climate-resilient farming practices	India climate finance taxonomy data

Key insights:

- The largest share of climate finance in India is directed toward **clean energy**, reflecting its central role in both mitigation and broader energy transition strategies.
- **Adaptation financing**—particularly in disaster risk management and agriculture—has increased, signaling a growing emphasis on building resilience against climate impacts.

EY Insights on Sustainable Finance

EY reports highlight:

- Annual climate investment needs in India exceed US$50 billion.
- Institutional investors must increase sustainable asset allocation.
- ESG integration enhances long-term resilience.
- Taxonomy clarity improves investor confidence.

EY emphasizes transition finance mechanisms for carbon-intensive industries to shift gradually toward cleaner technologies.

Table 6: RBI Actions on Climate Risk (2024–2025)

Year	Initiative	Purpose	Source
2022	Climate Risk and Sustainable Finance Discussion Paper	Foundation for integrating climate risks into financial supervision	RBI publications; policy review
2024	Draft Guidelines for Climate Risk Disclosure	Encourage banks/NBFCs to disclose climate-related financial risk	Policy draft coverage
2025	Climate Risk Information System (RBI-CRIS) launch	Centralized climate risk data and analytics platform	Times of India coverage
2026 (proposed)	Natural Disaster Relief Credit Guidelines	Integrate climate events into bank lending policies	Reuters coverage

Key insights:

- The RBI has progressively strengthened climate risk governance within the financial sector, including data platforms and draft disclosure frameworks to enhance financial institutions' abilities to assess and manage climate vulnerabilities.
- Proposed guidelines on natural disaster response financing reflect acknowledgement that climate events increasingly impact borrowers and credit portfolios

Stranded Assets and Portfolio Transition

Stranded assets refer to investments that lose economic value due to policy or technological shifts. Coal plants, oil refineries, and internal combustion engine infrastructure face high transition risk.

The Task Force on Climate-related Financial Disclosures recommends climate scenario analysis for financial institutions.

Table 7: High-Risk Carbon-Intensive Sectors in India

Sector	Exposure Risk Level	Transition Vulnerability
Coal Power	High	Very High
Steel	High	High
Cement	Medium	High

Sector	Exposure Risk Level	Transition Vulnerability
Transport (ICE Vehicles)	High	Very High
Oil & Gas	High	High

Banks must gradually rebalance portfolios toward renewable and low-carbon sectors.

Insurance and Climate Risk

Insurance companies face rising climate-related claims. They also play a role in underwriting green infrastructure. Climate catastrophe bonds and parametric insurance products are expanding.

Pension Funds and Institutional Investors

Pension funds and sovereign wealth funds increasingly incorporate ESG criteria. Long-term investors are crucial for infrastructure finance.

Challenges in Climate Financing

1. Absence of unified green taxonomy
2. Data limitations on climate risk exposure
3. High financing cost for early-stage technologies
4. Greenwashing risks
5. Capacity gaps in smaller institutions

Developing economies face a widening climate finance gap relative to commitments under global agreements.

Integration of Climate Risk into Banking Supervision

Climate stress testing simulates impact of transition scenarios on capital adequacy. RBI may incorporate such tools into supervisory review processes.

Table 8: India's Climate Financing Requirements and Investment Gap

Indicator	Estimated Value
Climate transition investment required by 2030	₹85.6 trillion (~US$1.05 trillion)
Annual green financing requirement	~2.5% of GDP
Net-zero transition requirement (by 2070)	~US$10 trillion (cumulative)
Cumulative green bond issuance (2024)	~US$55.9 billion
Sustainable (GSS+) market gap by 2030	~US$1.3 trillion

Note. Data compiled from Reserve Bank of India climate risk estimates, Ministry of Finance sovereign green bond disclosures, and Climate Bonds Initiative reports (2023–2025).

Table8 highlights the magnitude of India's climate financing requirements and the substantial gap between required and mobilized capital. The Reserve Bank of India estimates that India will require approximately ₹85.6 trillion by 2030 to support climate-aligned transition pathways. This translates into an annual financing requirement equivalent to roughly 2.5 percent of GDP, indicating that climate finance is not peripheral but central to macroeconomic planning. The cumulative investment requirement of nearly US$10 trillion by 2070 underscores the long-term structural transformation needed in energy, infrastructure, transportation, and manufacturing sectors.

Despite growing green bond issuance—reaching nearly US$55.9 billion cumulatively—the sustainable debt market remains significantly below projected needs. The estimated US$1.3 trillion sustainable finance gap by 2030 demonstrates that while policy momentum exists, private capital mobilization must accelerate substantially. These figures reinforce the strategic importance of

financial institutions in bridging the investment shortfall through innovative financing instruments, risk-sharing mechanisms, and climate-aligned lending practices.

Table 9: Sectoral Distribution of Climate Finance in India

Sector	Share of Climate Finance (%)
Clean Energy	47%
Energy Efficiency	35%
Clean Transportation	18%
Disaster Risk Management (Adaptation)	42% of adaptation flows
Agriculture Adaptation	24% of adaptation flows

Note. Sectoral distribution based on India climate finance tracking reports and Ministry-level taxonomy assessments (2024–2025).

Table 9shows the concentration of climate finance flows across sectors. Nearly half of mitigation-oriented finance is directed toward clean energy projects, reflecting India's policy emphasis on renewable energy expansion and decarbonization of the power sector. Energy efficiency investments constitute 35 percent of climate finance, demonstrating the role of industrial modernization, green buildings, and energy-saving technologies in reducing emissions intensity.

Clean transportation, accounting for 18 percent, signals increasing attention to electric mobility and sustainable urban transit systems. On the adaptation side, disaster risk management commands the largest share of adaptation finance, highlighting India's vulnerability to floods, cyclones, and extreme weather events. Agricultural adaptation finance reflects efforts to promote climate-resilient farming practices and protect rural livelihoods.

This distribution reveals that while mitigation finance remains dominant, adaptation finance is gaining prominence, necessitating broader financial institution engagement beyond renewable energy lending to resilience-building investments.

Table 10: RBI Climate Risk Regulatory Initiatives (2022–2026)

Year	Initiative
2022	Climate Risk & Sustainable Finance Discussion Paper
2024	Draft Climate Risk Disclosure Guidelines
2025	RBI Climate Risk Information System (RBI-CRIS)
2026 (Proposed)	Natural Disaster Relief Lending Framework

Note. Compiled from Reserve Bank of India policy releases and financial stability communications (2022–2026).

Table 10 outlines the progressive strengthening of climate-related regulatory interventions by the Reserve Bank of India. The 2022 Discussion Paper laid the foundation for integrating climate risk into prudential supervision. Subsequent draft disclosure guidelines in 2024 aimed to standardize climate-related financial reporting among banks and non-banking financial companies.

The establishment of the RBI Climate Risk Information System (RBI-CRIS) in 2025 represents a significant advancement in centralized climate risk data management. By 2026, proposed disaster-related credit guidelines further integrate climate events into lending frameworks. Collectively, these initiatives demonstrate a shift from voluntary sustainability approaches to structured regulatory oversight, ensuring that financial institutions systematically incorporate climate considerations into risk management and capital allocation decisions.

V. CONCLUSION

India's sustainable development trajectory depends heavily on climate-aligned financial systems. Financial institutions serve as catalysts for directing capital toward environmentally responsible sectors. Integrating climate risk into financial governance ensures stability while promoting long-term economic resilience.

The transition toward climate neutrality requires coordinated action by regulators, banks, capital markets, insurers, and international institutions. Addressing stranded assets, strengthening disclosure norms, enhancing blended finance, and fostering innovation in green instruments are essential for aligning growth with ecological sustainability.

A sustainable financial system is not merely a support mechanism for climate action—it is the foundation of resilient and inclusive economic development.

The empirical findings derived from RBI Financial Stability Reports reveal four structural realities:

1. Significant credit concentration in climate-sensitive sectors.
2. Persistent though improving asset quality stress in high-carbon industries.
3. Capital adequacy vulnerability under climate shock simulations.
4. Partial but uneven institutional adoption of climate risk management frameworks.

Collectively, these trends demonstrate that climate change is not merely an environmental concern but a systemic financial stability issue. Strengthening disclosure norms, embedding climate risk in supervisory review, expanding green finance instruments, and encouraging sectoral transition strategies are essential to ensuring resilient and sustainable financial intermediation.

The RBI's integration of climate considerations into stress testing and supervisory analysis marks an important evolution in India's financial governance architecture.

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