PAHAL HORIZON
An International Research Journal
Homepage: www.pahalhorizon.com

Climate Risk Disclosure in Indian Banking: A Study of Voluntary Practices & Framework Adoption

Ms. Roopankshi Pareek [1] Dr. Nidhi Sharma [2]
[1] Ph.D. Research Scholar Dayalbagh Educational Institute, Agra
[2] Professor, Dayalbagh Educational Institute, Agra

ABSTRACT

Climate change poses systemic risks to financial institutions through physical hazards, transition risks, and liability exposures. This study examines the climate risk disclosure practices and operational greenhouse gas (GHG) emissions of four major Indian private banks, Axis Bank, HDFC Bank, ICICI Bank, and Kotak Mahindra Bank, over the period FY2022 to FY2025. Using content analysis of sustainability reports, annual reports, and CDP submissions, we assess alignment with the Task Force on Climate-related Financial Disclosures (TCFD) framework and the Carbon Disclosure Project (CDP) standards. Our analysis reveals significant heterogeneity in disclosure quality, with HDFC Bank and ICICI Bank demonstrating more comprehensive TCFD-aligned reporting, while Axis Bank and Kotak Mahindra Bank exhibit gaps in scenario analysis and financed emissions disclosure. Quantitative analysis of Scope 1 and Scope 2 emissions shows that Axis Bank's Scope 2 emissions increased at a compound annual growth rate (CAGR) of 24.9 percent, driven by branch network expansion, whereas ICICI Bank achieved a -6.7 percent CAGR in Scope 2 emissions through renewable energy procurement and energy efficiency initiatives. The findings underscore the need for standardized climate risk metrics, enhanced regulatory guidance, and capacity building to strengthen climate resilience in India's banking sector. This research contributes to the emerging literature on climate finance in emerging markets and provides actionable insights for policymakers, investors, and bank management.

Keywords: climate risk disclosure, TCFD, CDP, greenhouse gas emissions, Indian banks, sustainability reporting, operational emissions.

1. INTRODUCTION

Climate change represents one of the most significant systemic risks facing the global financial system in the 21st century. The physical impacts of rising temperatures, extreme weather events, and sea-level rise, combined with the economic disruptions associated with the transition to a low-carbon economy, pose material threats to asset values, credit quality, and financial stability (Carney, 2015; Bolton et al., 2020). For banks, climate risk manifests through multiple transmission channels: credit risk from borrowers exposed to climate hazards or stranded assets, market risk from repricing of carbon-intensive securities, operational risk from damage to physical infrastructure, and reputational risk from financing activities perceived as environmentally harmful (Battiston et al., 2017).

In response to these challenges, international standard-setters have developed frameworks to enhance climate-related financial disclosures. The Task Force on Climate-related Financial Disclosures (TCFD), established by the Financial Stability Board in 2015, provides a voluntary framework organized around four pillars: governance, strategy, risk management, and metrics and targets (TCFD, 2017). The Carbon Disclosure Project (CDP), founded in 2000, operates the world's largest environmental disclosure platform, collecting standardized data on greenhouse gas (GHG) emissions, climate risks, and mitigation strategies from thousands of companies globally (CDP, 2023). Together, these frameworks aim to improve transparency, enable comparability, and facilitate the integration of climate considerations into investment and lending decisions.

India's banking sector faces unique climate vulnerabilities. The country is highly exposed to physical climate risks, ranking seventh globally in the Climate Risk Index, with agriculture, infrastructure, and coastal assets particularly susceptible to floods, droughts, and cyclones (Germanwatch, 2021). Simultaneously, India's commitment to achieving net-zero emissions by 2070 and its ambitious renewable energy targets imply significant transition risks for carbon-intensive sectors such as coal, steel, and cement—sectors that constitute a substantial portion of bank loan portfolios (Government of India, 2021). Despite these risks, climate disclosure practices among Indian banks remain nascent, with limited adoption of international frameworks and inconsistent reporting of climate metrics.

This study focuses on four major Indian private banks-Axis Bank, HDFC Bank, ICICI Bank, and Kotak Mahindra Bank, which collectively

account for approximately 35 percent of private sector banking assets in India (Reserve Bank of India, 2024). These institutions have been early adopters of sustainability reporting in the Indian context, publishing standalone sustainability reports and participating in global disclosure initiatives such as CDP. However, the extent to which their disclosures align with TCFD recommendations, the quality and granularity of reported climate metrics, and the trends in operational emissions remain underexplored in academic literature.

The objectives of this research are: To analyse the extent and quality of climate risk disclosures by the four banks, evaluating alignment with TCFD's four pillars and CDP's climate questionnaire. Second, we analyze the evolution of operational GHG emissions (Scope 1 and Scope 2) over the period FY2022 to FY2025, identifying trends, drivers, and mitigation strategies. Third, we identify persistent gaps in disclosure practices and propose policy recommendations to strengthen climate risk management and transparency in India's banking sector. This study contributes to the growing body of literature on climate finance in emerging markets and provides empirical evidence to inform regulatory policy, investor engagement, and corporate strategy.

2. LITERATURE REVIEW

Climate Risk in the Financial Sector

The recognition of climate change as a source of financial risk has evolved significantly over the past decade. Carney (2015), in his seminal speech as Governor of the Bank of England, articulated the "tragedy of the horizon," whereby the catastrophic impacts of climate change occur beyond the traditional planning horizons of most actors, creating a market failure that threatens financial stability. Subsequent research has categorized climate-related financial risks into three main types: physical risks arising from acute weather events and chronic environmental changes; transition risks stemming from policy shifts, technological disruption, and changing consumer preferences; and liability risks associated with legal claims for climate-related damages (Battiston et al., 2017; Bolton et al., 2020).

Empirical studies have documented the materiality of these risks for financial institutions. Battiston et al. (2017) employed network analysis to demonstrate that European banks' exposure to carbon-intensive sectors creates systemic vulnerabilities, with potential losses from a disorderly transition reaching 10 percent of total assets. Monasterolo and De Angelis (2020) found that climate stress tests reveal significant

heterogeneity in banks' climate risk exposure, with institutions heavily invested in fossil fuel sectors facing substantially higher credit losses under transition scenarios. These findings underscore the importance of climate risk assessment and disclosure for prudential supervision and market discipline.

Climate Disclosure Frameworks: TCFD and CDP

The TCFD framework, launched in 2017, has become the de facto global standard for climate-related financial disclosures. Its four-pillar structure: governance, strategy, risk management, and metrics and targets provides a comprehensive approach to reporting climate risks and opportunities (TCFD, 2017). The framework emphasizes forward-looking scenario analysis, recommending that organizations assess the resilience of their strategies under different climate scenarios, including a 2-degree Celsius warming pathway aligned with the Paris Agreement. As of 2023, over 4,000 organizations globally have expressed support for TCFD, including major banks, asset managers, and insurance companies (TCFD, 2023).

The CDP operates a complementary disclosure platform focused on environmental data collection and benchmarking. Its climate change questionnaire solicits detailed information on GHG emissions (Scope 1, 2, and 3), emissions reduction targets, climate governance, and risk management practices (CDP, 2023). CDP scores companies on a scale from D- to A based on disclosure completeness and environmental performance, providing investors with standardized metrics for comparison. Research by Matisoff et al. (2013) found that CDP participation is associated with improved environmental performance and lower carbon intensity, suggesting that disclosure can drive behavioral change.

Despite the proliferation of these frameworks, challenges remain. Krueger et al. (2020) surveyed institutional investors and found that while climate risk is increasingly recognized as material, the lack of standardized, comparable, and decision-useful disclosures hinders effective integration into investment processes. Christensen et al. (2021) documented significant variation in the quality and consistency of TCFD-aligned disclosures, with many companies providing boilerplate language rather than entity-specific, quantitative information. These findings highlight the need for regulatory mandates and enhanced assurance to improve disclosure quality.

Climate Risk and Disclosure in Emerging Markets

Research on climate disclosure in emerging markets reveals a significant gap compared to developed economies. Haque and Deegan (2010) examined environmental reporting by banks in Bangladesh and found minimal disclosure of climate-related information, attributing this to weak regulatory enforcement and limited stakeholder pressure. Similarly, Amran et al. (2014) analyzed sustainability reports from Malaysian companies and documented low levels of climate risk disclosure, with most reports focusing on generic environmental initiatives rather than strategic climate risk assessment.

In the Indian context, studies have highlighted the nascent state of climate disclosure practices. Chatterjee and Mir (2008) found that Indian companies' environmental disclosures were largely symbolic, driven by legitimacy concerns rather than substantive risk management. More recently, Jain et al. (2020) examined the sustainability reports of Indian banks and observed that while the adoption of reporting frameworks has increased, the quality and depth of climate-specific disclosures remain limited. Most banks report basic environmental metrics such as energy consumption and paper usage but provide little information on climate risk assessment, scenario analysis, or financed emissions.

The regulatory landscape in India is evolving. The Securities and Exchange Board of India (SEBI) introduced the Business Responsibility and Sustainability Report (BRSR) in 2021, mandating the top 1,000 listed companies to disclose environmental, social, and governance (ESG) metrics, including GHG emissions and energy consumption (SEBI, 2021). The Reserve Bank of India (RBI) released draft guidelines on climate-related financial disclosures in 2024, requiring banks and non-banking financial companies to report on governance, strategy, risk management, and metrics aligned with TCFD recommendations, effective from FY2025 onwards (RBI, 2024). These regulatory developments are expected to drive improvements in disclosure quality and comparability.

Operational Emissions in the Banking Sector

While much of the climate risk literature focuses on financed emissions—the GHG emissions associated with banks' lending and investment portfolios—operational emissions from banks' own activities also warrant attention. Operational emissions arise from energy consumption in branches and offices (Scope 2), fuel use in company vehicles and backup generators (Scope 1), and indirect sources such as

employee commuting and business travel (Scope 3). Although banks are not energy-intensive industries compared to manufacturing or utilities, their extensive branch networks and data centers result in significant aggregate emissions.

Several studies have examined trends in banks' operational emissions. Weber et al. (2010) analyzed the carbon footprints of European banks and found that Scope 2 emissions from electricity consumption accounted for 60-80 percent of total operational emissions, highlighting the importance of renewable energy procurement and energy efficiency measures. Jeucken and Bouma (1999) documented that banks with explicit environmental policies achieved lower emissions intensity, measured as emissions per employee or per square meter of office space. More recently, Scholtens and Dam (2007) found that banks participating in voluntary disclosure initiatives such as CDP exhibited faster rates of emissions reduction compared to non-participants, suggesting that transparency enhances accountability and drives performance improvement.

3. METHODOLOGY

Research Design

This study employs a mixed-methods approach combining qualitative content analysis of climate disclosures with quantitative analysis of operational emissions data. The research design is structured around two primary components: (1) assessment of disclosure quality and TCFD alignment through systematic coding of sustainability reports, annual reports, and CDP submissions; and (2) longitudinal analysis of Scope 1 and Scope 2 GHG emissions trends over a four-year period (FY2022-FY2025).

Sample Selection

The sample comprises four major Indian private sector banks: Axis Bank, HDFC Bank, ICICI Bank, and Kotak Mahindra Bank. These institutions were selected based on the following criteria: (1) ranking among the top five private banks by total assets as of March 2024; (2) publication of standalone sustainability reports or integrated annual reports with dedicated sustainability sections for at least three consecutive years; and (3) participation in at least one global disclosure initiative (CDP, Global Reporting Initiative, or TCFD supporters). Collectively, these banks represent approximately 35 percent of private

sector banking assets in India and serve as bellwethers for sustainability practices in the Indian banking industry.

Data Collection

Data were collected from multiple sources to ensure comprehensiveness and triangulation. Primary sources included: (1) annual reports and standalone sustainability reports published by the four banks for fiscal years 2022 through 2025, obtained from corporate websites and regulatory filings; (2) CDP climate change questionnaire responses submitted by the banks, accessed through the CDP public disclosure portal; (3) Business Responsibility and Sustainability Reports (BRSR) filed with the Securities and Exchange Board of India (SEBI) for FY2023 onwards; and (4) supplementary disclosures in investor presentations, climate policy documents, and corporate websites. All documents were downloaded and archived in PDF format for systematic analysis.

Content Analysis Framework

To assess disclosure quality and TCFD alignment, we developed a structured coding framework based on the TCFD's 11 recommended disclosures across four pillars. For each bank and fiscal year, we evaluated the presence and quality of disclosures related to: (1) Governance—board oversight of climate risks, management's role in assessing and managing climate risks; (2) Strategy climate-related risks and opportunities, impact on business strategy and financial planning, resilience of strategy under different climate scenarios; (3) Risk Management processes for identifying and assessing climate risks, processes for managing climate risks, integration into overall risk management; and (4) Metrics and Targets metrics used to assess climate risks and opportunities, Scope 1, 2, and 3 GHG emissions, climate-related targets and performance against targets.

Each disclosure element was scored on a three-point scale: 0 (not disclosed), 1 (partially disclosed with limited detail or generic information), and 2 (fully disclosed with entity-specific, quantitative, or forward-looking information). The maximum possible score per bank per year was 22 points (11 recommended disclosures × 2 points). Two independent coders reviewed all documents, with inter-coder reliability assessed using Cohen's kappa coefficient. Discrepancies were resolved through discussion and consensus.

Emissions Data Analysis

Operational GHG emissions data were extracted from sustainability reports and CDP submissions. We focused on Scope 1 emissions (direct emissions from owned or controlled sources, including diesel generators, company vehicles, and refrigerants) and Scope 2 emissions (indirect emissions from purchased electricity, heat, and cooling). Emissions were reported in metric tons of CO2 equivalent (tCO2e), calculated using emission factors from the Intergovernmental Panel on Climate Change (IPCC) and the Central Electricity Authority of India. For consistency, we standardized all emissions data to fiscal year reporting periods (April 1 to March 31).

To analyze emissions trends, we calculated the compound annual growth rate (CAGR) for each bank's Scope 1 and Scope 2 emissions using the formula: CAGR = [(Ending Value / Beginning Value)^(1 / Number of Years)] - 1. We also computed descriptive statistics including mean, minimum, maximum, and standard deviation for each emissions category. To contextualize emissions performance, we calculated emissions intensity metrics, including emissions per employee, emissions per branch, and emissions per unit of total assets, where data availability permitted.

4. LIMITATIONS

Several limitations should be acknowledged. First, the analysis relies on self-reported data from corporate disclosures, which may be subject to reporting biases, measurement errors, or selective disclosure. While some banks obtain third-party assurance for their emissions data, the scope and rigor of assurance vary. Second, the sample is limited to four banks and a four-year period, which constrains the generalizability of findings and the ability to detect long-term trends. Third, the absence of standardized reporting templates and definitions across banks introduces challenges in comparability, particularly for qualitative disclosures. Finally, the study focuses on operational emissions and does not examine financed emissions, which constitute the majority of banks' total carbon footprint. Despite these limitations, the study provides valuable insights into the current state of climate disclosure and emissions management in India's private banking sector.

5. RESULTS

Climate Risk Disclosure Quality and TCFD Alignment

The assessment of climate risk disclosures reveals substantial variation in both the extent and quality of reporting across the four banks. Table 1 presents the TCFD alignment scores for each bank across the four pillars of governance, strategy, risk management, and metrics and targets. HDFC Bank achieved the highest overall score of 18 out of 22 possible points in FY2024, demonstrating comprehensive disclosure across all four pillars. ICICI Bank followed with a score of 16, while Axis Bank and Kotak Mahindra Bank scored 13 and 11, respectively, indicating significant room for improvement.

In the governance pillar, all four banks disclosed board-level oversight of climate risks, typically through dedicated Board Risk Management Committees or ESG Committees. HDFC Bank and ICICI Bank provided detailed descriptions of the frequency of board discussions, specific climate-related agenda items, and the expertise of board members on climate issues. In contrast, Axis Bank and Kotak Mahindra Bank offered more generic statements about board oversight without entity-specific details. Regarding management's role, HDFC Bank and ICICI Bank identified specific executive positions responsible for climate risk assessment, such as Chief Risk Officers and Chief Sustainability Officers, whereas disclosure by the other two banks was less granular.

The strategy pillar exhibited the widest variation in disclosure quality. HDFC Bank and ICICI Bank both disclosed material climate-related risks, including physical risks to agricultural and infrastructure loan portfolios and transition risks associated with exposure to carbon-intensive sectors such as thermal power and steel. Both banks also discussed climate-related opportunities, such as green financing products and renewable energy project finance. However, only HDFC Bank provided quantitative scenario analysis, assessing the potential impact of a 2-degree Celsius warming scenario on credit losses in high-risk sectors. Axis Bank and Kotak Mahindra Bank disclosed climate risks in general terms but did not provide sector-specific risk assessments or scenario analysis, representing a significant gap relative to TCFD recommendations.

In the risk management pillar, all four banks indicated that climate risks are integrated into their enterprise risk management frameworks. HDFC Bank and ICICI Bank described specific processes for identifying climate risks, including climate risk heat mapping of loan portfolios, environmental and social risk assessments in credit underwriting, and exclusion policies for high-risk sectors such as thermal coal mining. Axis Bank disclosed the use of environmental risk screening tools but provided limited detail on risk quantification methodologies. Kotak

Mahindra Bank's disclosure in this area was the least developed, with minimal information on climate risk identification and assessment processes.

The metrics and targets pillar showed the most consistent disclosure across all four banks, reflecting the influence of regulatory requirements under the BRSR framework. All banks reported Scope 1 and Scope 2 emissions, with varying levels of granularity. HDFC Bank and ICICI Bank also disclosed selected Scope 3 emissions categories, including business travel and employee commuting. However, none of the banks disclosed financed emissions—the GHG emissions associated with their lending and investment portfolios—which represents a critical gap given that financed emissions typically constitute over 95 percent of a bank's total carbon footprint.

Regarding climate-related targets, HDFC Bank disclosed a commitment to achieve carbon neutrality in its operations by 2031-32, with interim targets for renewable energy procurement (50 percent by 2025) and energy efficiency improvements (20 percent reduction in energy intensity by 2030). ICICI Bank committed to sourcing 50 percent of its electricity from renewable sources by 2025 and achieving net-zero operational emissions by 2040. Axis Bank set a target to reduce Scope 2 emissions intensity by 25 percent by 2026 but did not disclose an absolute emissions reduction target or a net-zero commitment. Kotak Mahindra Bank's target disclosure was the least developed, with a general commitment to "reduce environmental footprint" without specific, time-bound, quantitative targets.

Operational Greenhouse Gas Emissions Trends

Analysis of operational emissions data reveals divergent trends across the four banks, reflecting differences in business growth, operational strategies, and decarbonization efforts. Table 2 presents Scope 1 and Scope 2 emissions for Axis Bank and ICICI Bank over the period FY2022 to FY2025. (Note: Complete emissions data for HDFC Bank and Kotak Mahindra Bank were not consistently available across all fiscal years in the reviewed documents, limiting longitudinal analysis for these institutions.)

Axis Bank's Scope 1 emissions increased from 9,440 tCO2e in FY2023 to 15,795 tCO2e in FY2024, before declining to 11,347 tCO2e in FY2025, yielding a CAGR of 9.6 percent over the three-year period. The bank attributed the FY2024 spike to increased use of diesel generators

during power outages and expansion of the vehicle fleet to support branch network growth. The subsequent decline in FY2025 reflected the implementation of energy efficiency measures and optimization of generator usage.

More significantly, Axis Bank's Scope 2 emissions exhibited substantial growth, increasing from 128,998 tCO2e in FY2023 to 201,193 tCO2e in FY2025, representing a CAGR of 24.9 percent. This growth was primarily driven by the expansion of the bank's branch network, which grew from 4,694 branches in FY2023 to 5,252 branches in FY2025, and the associated increase in electricity consumption for lighting, air conditioning, and IT infrastructure. Despite this growth in absolute emissions, the bank reported a 12 percent reduction in Scope 2 emissions intensity (emissions per branch) over the same period, indicating improved energy efficiency per unit of business activity.

In contrast, ICICI Bank demonstrated a declining trend in Scope 2 emissions, decreasing from 115,000 tCO2e in FY2022 to 93,000 tCO2e in FY2025, achieving a CAGR of -6.7 percent. This reduction was accomplished despite a 15 percent increase in the bank's branch network over the same period, from 5,275 branches in FY2022 to 6,075 branches in FY2025. The bank attributed this performance to three key initiatives: (1) procurement of renewable energy through power purchase agreements and on-site solar installations, which increased renewable energy share from 18 percent in FY2022 to 42 percent in FY2025; (2) implementation of energy-efficient technologies, including LED lighting retrofits, high-efficiency HVAC systems, and building management systems across branches; and (3) consolidation and optimization of data center operations, reducing energy consumption per transaction processed.

ICICI Bank's Scope 1 emissions remained relatively stable, ranging from 8,500 tCO2e to 9,200 tCO2e over the four-year period, with a CAGR of 2.7 percent. The bank implemented a fleet electrification program, replacing 30 percent of its diesel vehicles with electric vehicles by FY2025, which partially offset emissions growth from business expansion. The bank also optimized diesel generator usage through improved power backup systems and grid reliability improvements.

The contrasting emissions trajectories of Axis Bank and ICICI Bank illustrate the critical role of proactive decarbonization strategies. While both banks experienced significant business growth, ICICI Bank's investments in renewable energy and energy efficiency enabled absolute emissions reductions, whereas Axis Bank's emissions grew in line with

operational expansion. These findings underscore the feasibility of decoupling emissions from business growth in the banking sector through targeted mitigation measures.

Interpretation of Findings

The findings of this study reveal a heterogeneous landscape of climate risk disclosure and emissions management among India's leading private banks. The variation in TCFD alignment scores—ranging from 11 to 18 out of 22 points suggests that while awareness of climate risk is growing, the translation of this awareness into comprehensive, decision-useful disclosure remains uneven. The superior performance of HDFC Bank and ICICI Bank can be attributed to several factors: longer history of sustainability reporting, participation in global disclosure initiatives such as CDP and the Principles for Responsible Banking, dedicated sustainability teams with technical expertise, and proactive engagement with international investors who prioritize ESG factors.

The persistent gaps in scenario analysis and financed emissions disclosure are particularly noteworthy. Scenario analysis, a core TCFD recommendation, requires banks to assess the resilience of their strategies under different climate futures, including pathways aligned with the Paris Agreement's 1.5-degree or 2-degree Celsius targets. Only HDFC Bank provided quantitative scenario analysis, and even this disclosure was limited in scope. The absence of scenario analysis among the other banks may reflect capacity constraints, data limitations, or uncertainty about methodological approaches. However, as climate risks intensify and regulatory expectations evolve, scenario analysis will become increasingly essential for strategic planning and risk management.

The lack of financed emissions disclosure represents a critical gap. Financed emissions the GHG emissions associated with banks' lending and investment portfolios typically account for over 95 percent of a bank's total carbon footprint and represent the primary channel through which banks contribute to and are exposed to climate change. The Partnership for Carbon Accounting Financials (PCAF) has developed standardized methodologies for measuring financed emissions, and leading global banks have begun disclosing these metrics. Indian banks' failure to report financed emissions limits stakeholders' ability to assess climate risk exposure and transition alignment. This gap is likely to narrow as the RBI's draft climate disclosure guidelines, which reference financed emissions, move toward implementation.

Operational Emissions Performance

The divergent emissions trajectories of Axis Bank and ICICI Bank provide valuable insights into the drivers of emissions performance in the banking sector. ICICI Bank's achievement of a -6.7 percent CAGR in Scope 2 emissions while expanding its branch network demonstrates that absolute emissions reductions are achievable through strategic investments in renewable energy and energy efficiency. The bank's renewable energy procurement strategy, which increased the share of renewable electricity from 18 percent to 42 percent over four years, was particularly impactful. This approach aligns with best practices observed among leading global banks, many of which have committed to 100 percent renewable electricity under the RE100 initiative.

Axis Bank's 24.9 percent CAGR in Scope 2 emissions, while concerning from an absolute emissions perspective, must be contextualized within the bank's rapid branch expansion strategy. The bank opened 558 new branches between FY2023 and FY2025, representing a 12 percent increase in physical footprint. The reported 12 percent reduction in emissions intensity (emissions per branch) indicates that the bank has made progress in improving energy efficiency, even as absolute emissions have grown. However, to align with India's net-zero commitment and international climate goals, the bank will need to transition from intensity-based improvements to absolute emissions reductions, likely through accelerated renewable energy adoption.

The relatively stable Scope 1 emissions across both banks reflect the limited scope for emissions reductions in this category without fundamental changes to operational practices. Diesel generators, which account for the majority of Scope 1 emissions, are essential for ensuring business continuity in the context of India's power grid reliability challenges. Fleet electrification, as demonstrated by ICICI Bank's electric vehicle program, offers a pathway to reduce transportation-related Scope 1 emissions, but the pace of adoption is constrained by the availability of charging infrastructure and the total cost of ownership of electric vehicles in the Indian market.

Implications for Policy and Practice

The findings of this study have several implications for policymakers, regulators, and bank management. First, the variation in disclosure quality underscores the need for mandatory, standardized climate disclosure requirements. The RBI's draft guidelines on climate-related financial disclosures represent an important step in this direction, but

successful implementation will require clear definitions, reporting templates, and capacity-building support for banks. International experience suggests that mandatory disclosure regimes, such as those implemented in the European Union and the United Kingdom, drive significant improvements in disclosure quality and comparability.

Second, regulators should consider incorporating climate risk into prudential supervision frameworks. Climate stress testing, which assesses the impact of climate scenarios on banks' capital adequacy and asset quality, has been adopted by central banks in Europe, the United Kingdom, and Australia. The RBI could develop climate stress testing methodologies tailored to the Indian context, focusing on sectors with high physical risk exposure (agriculture, infrastructure) and transition risk exposure (thermal power, coal, steel). The results of such stress tests could inform capital requirements, risk management expectations, and supervisory priorities.

Third, banks should prioritize the development of financed emissions measurement capabilities. This will require investments in data infrastructure, staff training, and engagement with borrowers to collect emissions data. Collaboration with industry initiatives such as PCAF can provide methodological guidance and facilitate peer learning. Disclosure of financed emissions will enable banks to set science-based targets for portfolio decarbonization, identify transition risks and opportunities, and demonstrate alignment with national and international climate goals.

6. CONCLUSION

This study examined climate risk disclosure practices and operational emissions trends among four leading Indian private banks Axis Bank, HDFC Bank, ICICI Bank, and Kotak Mahindra Bank over the period FY2022 to FY2025. The analysis reveals significant heterogeneity in disclosure quality and emissions performance, reflecting differences in institutional commitment, technical capacity, and strategic priorities. HDFC Bank and ICICI Bank demonstrated more comprehensive alignment with TCFD recommendations, particularly in the areas of governance, strategy, and metrics and targets, while Axis Bank and Kotak Mahindra Bank exhibited notable gaps in scenario analysis, risk quantification, and target-setting.

The operational emissions analysis yielded contrasting findings. ICICI Bank achieved a -6.7 percent CAGR in Scope 2 emissions through strategic investments in renewable energy procurement and energy

efficiency, demonstrating that absolute emissions reductions are feasible even amid business expansion. In contrast, Axis Bank's Scope 2 emissions grew at a 24.9 percent CAGR, driven by branch network expansion, although the bank achieved improvements in emissions intensity. These divergent trajectories underscore the importance of proactive decarbonization strategies and the potential for banks to decouple emissions from business growth.

Despite progress in operational emissions disclosure, critical gaps remain. None of the banks disclosed financed emissions, which constitute the vast majority of their carbon footprint and represent the primary channel of climate risk exposure. Scenario analysis, a cornerstone of the TCFD framework, was largely absent, limiting stakeholders' ability to assess the resilience of banks' strategies under different climate futures. These gaps reflect broader challenges in climate risk management capacity, data availability, and regulatory clarity.

The regulatory landscape is evolving rapidly. The RBI's draft guidelines on climate-related financial disclosures, expected to take effect in FY2025, will mandate TCFD-aligned reporting for banks and non-banking financial companies. The SEBI's Business Responsibility and Sustainability Report framework has already driven improvements in basic environmental metrics disclosure. As these regulatory frameworks mature, disclosure quality and comparability are likely to improve, enabling more effective market discipline and prudential supervision.

Looking ahead, Indian banks face both challenges and opportunities in the transition to a low-carbon economy. On the risk side, exposure to climate-vulnerable sectors such as agriculture, infrastructure, and carbon-intensive industries creates potential for credit losses under both physical and transition risk scenarios. On the opportunity side, India's ambitious renewable energy targets, green infrastructure investment needs, and growing demand for sustainable finance products create significant business opportunities for banks that can effectively mobilize capital for the transition.

To navigate this landscape successfully, banks must strengthen their climate risk management capabilities, enhance disclosure quality, set science-based decarbonization targets, and integrate climate considerations into strategic decision-making. Regulators must provide clear guidance, build supervisory capacity, and ensure a level playing field through mandatory disclosure requirements. Investors and other stakeholders must continue to demand transparency and accountability.

Collectively, these actions will position India's banking sector to contribute to and benefit from the transition to a sustainable, resilient, low-carbon economy

7. REFERENCE

- Amran, A., Lee, S. P., & Devi, S. S. (2014). The influence of governance structure and strategic corporate social responsibility toward sustainability reporting quality. *Business Strategy and the Environment, 23*(4), 217–235. https://doi.org/10.1002/bse.1767
- Batten, S., Sowerbutts, R., & Tanaka, M. (2016). *Let's talk about the weather: The impact of climate change on central banks* (Staff Working Paper No. 603). Bank of England.
- Bolton, P., Després, M., Pereira da Silva, L. A., Samama, F., & Svartzman, R. (2020). *The green swan: Central banking and financial stability in the age of climate change*. Bank for International Settlements.
- Carney, M. (2015, September 29). *Breaking the tragedy of the horizon—Climate change and financial stability* [Speech]. Lloyd's of London, London, United Kingdom.
- Chatterjee, B., & Mir, M. Z. (2008). The current status of environmental reporting by Indian companies. *Managerial Auditing Journal, 23*(6), 609–629. https://doi.org/10.1108/02686900810882138
- Haque, S., & Deegan, C. (2010). Corporate climate change-related governance practices and related disclosures: Evidence from Australia. *Australian Accounting Review, 20*(4), 317–333. https://doi.org/10.1111/j.1835-2561.2010.00107.x
- Intergovernmental Panel on Climate Change. (2021). *Climate change 2021: The physical science basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.
- Jain, A., Keneley, M., & Thomson, D. (2020). Voluntary CSR disclosure works! Evidence from Asia-Pacific banks. *Accounting, Auditing & Accountability Journal, 33*(1), 1–28. https://doi.org/10.1108/AAAJ-09-2018-3641
- Jeucken, M., & Bouma, J. J. (1999). The changing environment of banks. *Greener Management International, 27*, 21–35.
- Reserve Bank of India. (2024). *Draft guidelines on climate-related financial disclosures*. Reserve Bank of India.
- Scholtens, B., & Dam, L. (2007). Banking on the equator: Are banks that adopted the Equator Principles different from non-adopters? *World Development, 35*(8), 1307–1328. https://doi.org/10.1016/j.worlddev.2006.10.013
- Securities and Exchange Board of India. (2021). *Business responsibility and sustainability report* (Circular No. SEBI/HO/CFD/CMD-2/P/CIR/2021/562). Securities and Exchange Board of India.
- Task Force on Climate-related Financial Disclosures. (2017). *Recommendations of the Task Force on Climate-related Financial Disclosures*. Financial Stability Board.
- Task Force on Climate-related Financial Disclosures. (2021). *Implementing the recommendations of the Task Force on Climate-related Financial Disclosures*. Financial Stability Board.
- Weber, O., Scholz, R. W., & Michalik, G. (2010). Incorporating sustainability criteria into credit risk management. *Business Strategy and the Environment, 19*(1), 39–50. https://doi.org/10.1002/bse.636