

The Digital-to-Sustainable Shift in Indian Banking: Regulatory Pathways to Green Finance

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Abstract

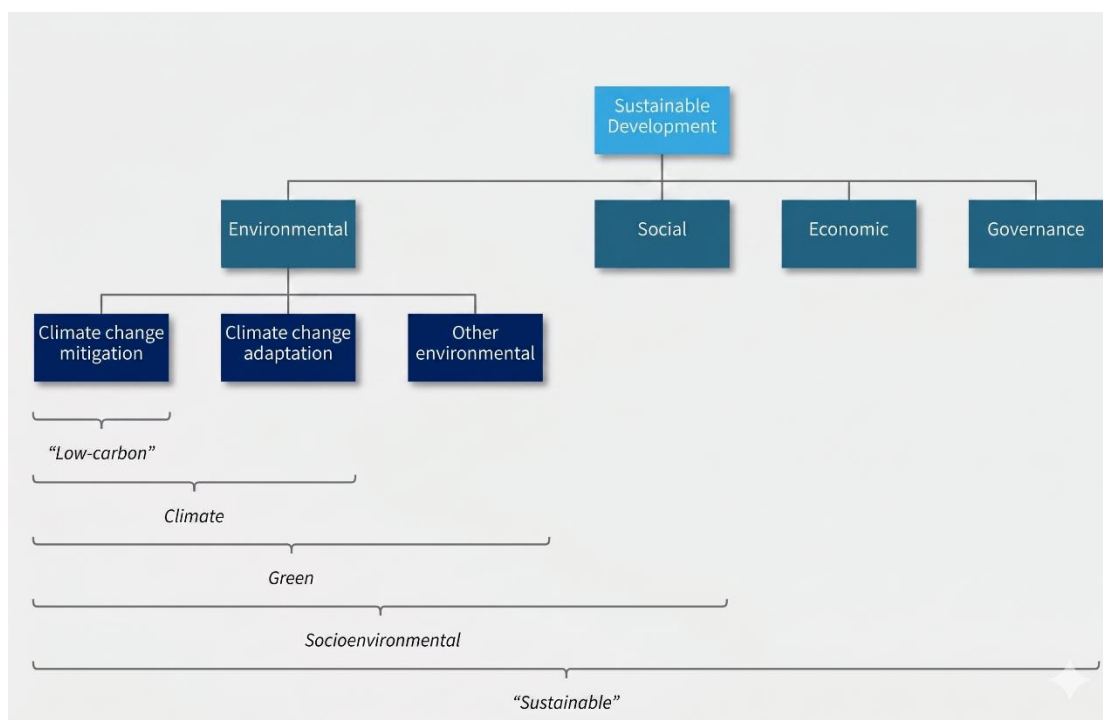
The digital transformation in the Indian economy has changed the traditional banking system, the newest imperative is to address the sustainability goals. The sustainable development in an economy cannot be truly achieved without providing proper financial instruments under green initiatives. Thus, Green finance and green banking become indispensable to channelise savers' funds into lucrative green investments. This study aims to examine the latest regulatory schemes in green investment and the implementation of the same by the commercial banks. The study describes the green initiatives of selected public and private sector banks and enables them to understand the innovations and technology in sustainable banking. The detailed analysis also helps us find the challenges involved in the process which helps the researcher in deducing possible solutions. The study concludes that a clear taxonomy of regulations along with the use of AI with clear carbon footprint measurement techniques and information exchange and verification by an independent party may result in favourable results in green banking.

Keywords: *Green Finance, Green Banking in India, Regulatory framework of green banking in India, Green initiatives in Indian Commercial banks.*

Introduction

The global economic scenario has transitioned from growth to development to sustainable development correspondingly, banking and financing institutions in India, followed the same stages in the post-independence era but with a different timing. The advent of Internet banking in the last two decades was a stage of development and further with the coming of climatic changes and global warming, the concern of sustainable banking or Green Banking has been in discussion in recent studies. The use of digital banking has proved to be a major transformation in the Indian banking system after the 1990s. Digital banking has broken all geographical borders in a populous country like India. This system helped immensely in financial inclusion and made banking extremely convenient. It is accessible round the clock and reduces the cost of infrastructure along with the cost of human labour on a large scale. Further natural evolution of the banking system after including the majority of people is expected to lean towards sustainability measures. Thus, the concept of green banking was introduced. According to Institute for Development and Research in Banking Technology (2013) "Green Banking is an umbrella term referring to practices and guidelines that make banks sustainable in economic, environmental, and social dimensions. It aims to make banking processes and use of technology and infrastructure as efficient and effective as possible, with zero or minimal impact on the environment." Meanwhile, the United Nations Environment Programme (2026) explains that there is a difference between Sustainable finance and green finance; and green finance is part of sustainable finance. In addition to Green Finance, sustainable finance also includes issues in economic, social and governance matters. Green finance means using finance where climate issues are reduced, problems of climate change are addressed and efforts are made to minimise the loss in the environmental ecosystem. Till date, the issues related to socio-economic

and governance were already managed in the monetary policy by the regulatory authorities. The increasing concerns of degradation of the planet have induced the policymakers to amalgamate environment friendly practices in the development process.



Source: Adapted from Annual Report 2025, by United Nations Environment Programme, 2026
(<https://www.unep.org/resources/annual-report-2025>).

The system of green banking ensures that banks as commercial organisations do not have profit as the sole motivator, and that they also assume social responsibility in the economy. It is a wide spectrum and includes digital banking and helps in financing of renewable energy projects and assessment of environmental risk in funding projects. This system automatically leads to efficiency in energy, transportation without pollution, prevention of wastage of water and management of industry waste. It helps in balanced socio-economic development along with environmental benefits by channelising funds in green infrastructure and technology, providing robust growth opportunities to sustainable industries and developing environment friendly practices in businesses.

Research Objectives

The main objective of this study is to analyse the role of Indian banks in saving the environment and identifying the norms adopted by banks under the systems of green banking. The study also aims to understand the role of the Reserve Bank of India and compare the policies related to sustainability among the major commercial banks in the country.

Literature Review

The issue of sustainability and green banking has been analysed in the academic field for a long time, but the actual seriousness and gravity of the issue has been emphasized in recent studies. The earlier studies concentrated on sustainable development in general and the triple bottom line framework; the concept of green banking has evolved after the prevalence of severe degradation of the earth's resources in recent years.

The major green banking practices in India have been explained by Mondal and Das (2025) as an indispensable part to promote sustainable development. The study describes the challenges faced in green banking framework like lack of consciousness, expensive set up costs, regulatory indecisiveness, and mismatch in skills. It also identifies the advantages in this system due to incentives of the government, environmental concerns, and benefits resulting from positive publicity. It assesses the role of Indian authorities like RBI, SEBI, IBA and BIS to further increase the adherence to sustainable ways. The routine banking operations have green practices ingrained in them which contributes to energy saving environment friendly infrastructure and showcases a shift towards sound ecofriendly financial development.

Parihar (2025) explained how green banks perform all banking operations and considers social factors and environment conservation factors. This system tries to decrease the carbon footprints. The study analysed various green banking initiatives assumed by HDFC bank and SBI bank in India using secondary data and descriptive analysis. The key findings were similar in both banks in spite of one being from the private sector and the other being from the public sector. It found that SBI followed the approach which offered loans at discounted rates for renewable sources of energy, setting up of digital infrastructure, setting up of solar ATMs, management of wastes, water, paper, and greenhouse gas emissions. The privately backed HDFC bank has had a greenhouse gas reduction policy since 2010. It issued green bonds and followed sustainable practices with sincerity.

A comparative analysis of top 10 banks from India was conducted by Chevli and Mali (2025) using the secondary data from annual and sustainability reports of the banks. All major banks have taken initiatives with respect to promotion of renewable sources of energy, clean energy finance, and online banking to reduce paper use. These initiatives are significant in terms of costs, benefits as well as efforts. However, there is still a need for stricter regulations and innovations in financial technology to maintain a stability in green banking practices in India. The study states important insights for RBI and commercial banks to lead towards empowerment of sustainability and smoothen the transition from digital to green banking system.

A CSIR publication by Sakthi (2024) describes the RBI guideline for green finance and its implementation. The system of green banking strives to change capital formation in pollution generating avenues to environment friendly practices. This system is still in the nascent stage and needs to evolve on a large scale. The Green banking system tries to develop awareness of sustainability among all sectors in the economy like businesses, individuals, and government. The study explains the concept of green deposits in detail and policy guidelines given by RBI pertaining to green deposits and measures to identify and avoid green washing.

Desai and Prajapati (2024) studied the regulatory aspects of the green banking system in both developed nations and emerging nations like India. Green banking is a judicious mix of promotion of sustainable finance along with protection of the environment according to climatic conditions. The study has undertaken a comprehensive literature review to identify best green banking practices, best regulatory mediation and best scenario implementations corresponding to sustainable development goals. The study found that developed countries have strict Economic Social and Governance systems in place and strong green finance policies. The developing world is yet to reach the pinnacle of green banking practices but is progressively moving towards best practices in green banking. The study provided useful insights on global and Indian green banking practices and tried to provide solutions for the multifaceted challenges faced and finally concluded the need for wholesome customer support and policy framework using AI technology.

Muhammad et al. (2023) analysed Asia and Africa to understand the similarities and dissimilarities in sustainable finance adoption. It reiterated the importance of sustainable banking as an impetus for

environmentally friendly and socially responsible investments. Various joint partnerships, capacity building efforts have initiated unique mechanisms like green bonds, green investments, and environment friendly loans in Asia. On the other hand, African regulatory systems, technological and financial innovations have changed the scenario altogether. The study elaborated multiple cases of significant sustainable finance initiatives in the two regions and the resultant impact on development. The study recommends sustainable finance, clear policy guidelines, and unification of sustainable measures with technology and investment in programmes to nurture ecofriendly finance.

The green banking system is still in its early stage in India. In order to bear consistent fruits of sustainability; it must be adopted on a large scale in the whole economy involving participation of individuals and institutions through appropriate financial tools.

The Indian Regulatory Landscape

The central bank of a country is the role supervisor, facilitator, and controller of the commercial banks, thereby all the green banking framework in India is controlled by the Reserve Bank of India (RBI). Various frameworks have been introduced by the RBI in this respect which have been further developed by the commercial banks specifically to suit their business plan.

In 2023, RBI released comprehensive guidelines for banks and a few selected non-banking financial institutions to create a system of green deposits (Reserve Bank of India, 2023). This implies that investment of the customers will be used for renewable sources investment, energy efficiency, clean transportations, sustainable agriculture, and waste management. The commercial banks should trace the allocation of funds and validate through third parties along with disclosures of impact parameters.

The RBI had conducted a survey to understand the current sustainable practices in the commercial banking system and found a lot of gaps. This pushed the authorities to initiate the Disclosure framework on Climate-related Financial Risks, 2024 (Reserve Bank of India, 2023). There are four thematic pillars namely Governance, Strategy and Risk management to be disclosed 2025-26 onwards along with the metrics and targets to be disclosed 2026-27 onwards according to the specifications of the RBI.

According to the Press Information Bureau (2023) of the RBI, it issued Sovereign green bonds and auctioned ₹16,000 crores for renewable energy and electric vehicles. These bonds correspond to ICMA principles and are exempted from tax and are expected to mobilise ₹50,000 crores by 2026 in various green industries.

Under Priority sector lending expansion, commercial banks are expected to allot 40% of net bank credit to priority areas where RBI mandates ₹35 crore per project in 2026 including solar rooftop, biomass, mini hydel power plant, and farmers use of green energy (NITI Aayog, 2026). Non-conformity to the set standards may invite penalties. Further, the digitalisation of banks, increasing use of UPI, presence of e-KYC, solar ATMs, compulsory green audits have reduced the carbon footprints significantly.

Apart from RBI, the Securities and Exchange Board of India (SEBI) is a major institutional authority in the country. In 2021, SEBI introduced Business Responsibility and Sustainability Reporting (BRSR) to increase economic, social and governance clarity for 1000 listed entities by market capitalization which included all leading banks of the country (Securities and Exchange Board of India, 2021). BRSR is included in annual reports and features three sections. It consists of 140 indicators to address 9 principles namely ethics, ecosystem, employee well-being, human rights, product responsibility, stakeholder engagement, community, customer relations, and governance with 98 compulsory (Core) indicators and 42 voluntary disclosures

(Leadership) (IBM, n.d.). The banks are required to highlight Principle 6 Environment with indicators like GHG emissions (Scope 1-3), renewable energy use, water management, waste recycling, and green credits.

The policy framework of the SEBI and the RBI is strongly supported by Government of India initiatives. The Government of India (GOI) is pushing economic growth through renewable energy. The use of green hydrogen extensively can change the dynamics of the energy situation in the country. The government has approved the launching of National Green Hydrogen Mission (NGHM) in January 2023 along with International Financial Services Centres Authority (IFSCA) to help in creating channels of sustainable finance (Press Information Bureau, 2025). "The GOI has allotted ₹19,744 crore in National Green Hydrogen Mission (NGHM) to make the country a focal point in generation, consumption, and export of green hydrogen by 2029-30." (Press Information Bureau, 2025). These funds are to be allocated in certain proportions in specific activities clearly stated in the detailed plan like Strategic Interventions for Green Hydrogen Transition (SIGHT) programme; pilot projects; research and development; green hydrogen hubs; green hydrogen certification schemes and fiscal incentives to support the whole mission (Ministry of New and Renewable Energy, n.d.).

The International Financial Services Centres Authority (IFSCA) has been set up to facilitate international investment in India's green hydrogen projects and is in the Gift city. The presence of IFSCA in the gift city supports sustainable and green finance as it encourages foreign investment due to economic incentives (Press Information Bureau, 2025). The Gift city is a hub for international investment and provides an international standards administrative set up for both investors and producers in industry. The framework also helps in mitigating risks involved through innovation as it provides opportunities for specialised financial instruments which combine private and public funds.

According to PIB 2025 in India, the two systemised frameworks are expected to show results by 2030. They are projected to increase production of green hydrogen by 5million metric tonnes per year; increase 125GW capacity of renewable energy; increase investment by approximately ₹8 lakh crores; create jobs for more than 6 lakh people and reduce the value of fossil fuel imports above ₹1 lakh crores by 2030.

Overall, the regulatory framework of green banking and finance is still in the planning phase and expected to show impact after a few years of full implementation, market perceptions, business cycle, and world economic sustainability scenario.

Conceptual Framework: The Transition Pillars

The shift from internet banking to green banking is backed by the transition pillar in the financial system. During the transition, Internal Process Transformation (Green Operations); Green Financing and Investment; Green Products and Services; Environmental Risk Management and Policy; and Regulatory Compliance and Corporate Social Responsibility need to be coordinated to achieve a systematic foundation for the system. These processes would help the banks to reduce carbon footprints and gain sustainable and inclusive economic growth.

The first step in transition starts with the reduction of carbon footprints in the internal operations of the banks. The use of paper is also reduced in great proportion with the use of Internet banking systems with contactless and cashless financial systems. The Internet banking system and their backend digital infrastructure need a humungous amount of energy. Cloud data centres used in processing millions of UPI and IMPS transactions need to be prioritised in the process of creating greener systems. Banks are increasingly adopting energy saving systems with liquid coolants and AI supported work management while reducing electricity consumption up to 40% (RBI, 2025). The establishment of Solar ATMs has been a major innovation towards

banking sustainability. Due to round the clock operations in ATMs, they consume a major chunk of electricity and pressurise urban power infrastructure. Solar energy ATMs were set up in Gujarat and Maharashtra by ICICI bank; they generate 5-10 KWH every day (ICICI Bank, n.d.). All ATM functions like cash withdrawals, balance enquiry, statement generation can be performed reducing the operational emissions. RBI has given a suggestion to target 20 % solar ATMs presence for the commercial banks.

Secondly, financial entities have innovated products to empower sustainable systems. Innovations have tried to decrease the obstacles to entry for consumers and businesses to accept and use sustainable technology through specific financial instruments. The customers have been provided incentives like green home loans, Electric Vehicle financing and ESG mutual funds to acquire green assets. Green home loans are concessional interest rate loans given to properties with IGBC or GRIHA certifications (GRIHA Council, n.d.). Axis bank and Kotak Mahindra banks are earliest providers of these loans and they require appropriate energy audits to be uploaded in their portals for the whole process. Green loans have increased the percentage of the sustainable housing acquisition in urban regions of Gujarat. Electric Vehicle (EV) financing is also on a rise where loans are given on electric two-wheelers and cars at less than normal lending rates. Niti Aayog 2025, states that the loans have increased the EV purchase by more than 10 %. ESG mutual funds enable the customers to invest in portfolios which maintain the sustainable standards in terms of indices pertaining to environmental, social, and governance levels.

Finally, the spectrum of Digital catalysts which blend sustainability in banking. According to the annual report of the RBI, 2025, Internet banking has led to reduction in physical bank visits by 60% and thereby reducing use of paper (Department of Financial Services, 2025). Specialised portal trackers and AI chatbots share sustainable options in both spending and investments. NPCI as part of regulatory authority under RBI issues block chain enabled green bonds which keeps a track of funds for solar projects (RBI, 2023). As per McKinsey report 2023, wholesome digitalisation and sustainable methods could cut emissions significantly in the banking sector.

The above mentioned three "Transition Pillars" frameworks namely Internal Operations, Product Innovation, and Digital Catalysts provide a robust base with smooth shift towards environment friendly banking. These systems however do face challenges like cybersecurity but the regulatory efforts have consistently lowered these risks.

Selected Case Studies from the Indian Market

The green transition ecosystem provided by the regulatory authorities have been harnessed by public sector, private sector and other financial institutions and have witnessed first mover advantage. This section describes the practical implementation of green banking by State Bank of India (SBI), HDFC Bank, ICICI Bank, and other applications like Paytm.

State Bank of India (SBI) is the only major public sector bank prevalent in the country on a massive scale and has made sincere efforts to illustrate green banking in India. SBI has launched the Green Channel Counter (GCC) on 1st July 2010 on pilot basis at 57 branches. GCC is a paperless banking system for all transactions like withdrawals, deposits, and fund transfers up to a certain limit using debit cards and PIN numbers (State Bank of India, 2025). It expanded to more than 5000 branches in the country by the next year and received the IBA Banking Technology Award 2010 for Best Customer Initiative and saving paper equivalent to many trees (State Bank of India, 2025). The transactions were completed almost instantly without any administrative hassles for all age groups along with environmental conservation in an efficient manner. Apart from being a

financier, SBI also owns windmills in partnership with Suzlon energy. There are 10 wind mills installed in Gujarat, Maharashtra, and Tamil Nadu with 15 MW capacity in 2010 State Bank of India, (2025). The focus of this set up was to attain energy neutrality and prioritise addressing environmental concerns rather than profit motive. SBI also launched 'Carbon Credit Plus' loans for clean development mechanism projects for the customers thereby supporting green finance.

Among the private sector banks, HDFC bank was one of the few first banks to take initiatives towards green banking as it is one of the largest private sector lenders. HDFC bank has tried to align its activities with the environmental issues. It analyses climate risks while offering loans, or financing vehicles. Asia's largest waste to energy plant in Indore has been funded through HDFC which in turn processed around 550 tonnes per day (HDFC Bank, 2022). It supported the 'Parivartan' programme where it installed more than 60,000 solar energy installations in 22 states for 1000 villages by the year 2025 (HDFC Bank, 2025). It issued green and social bonds to raise capital for environment friendly transportation and MSME loans. ICICI bank is another pioneer in the green banking system. According to the estimates by ICICI Bank Canada (2025), ₹906.24 billion was invested in green bonds by March 2025 along with ₹19,366 crore in green finance like renewables, Electric vehicles and Hydrogen Mission. The digitalisation process automatically reduces use of paper and conducts ESG verification for loans. It has developed a complex ESG risk assessment tool which conducts thorough investigation. It uses techniques of climate risk scores to sectors specifically to high pollution generating industries like cement, steel, and thermal power (ICICI Bank, 2024). The bank also offers to fund clients in carbon intensive industries by providing concessional loans after achieving specific sustainability scores. The bank has aimed to achieve carbon neutrality by 2032 through innovations like storage of batteries.

Finally other financial institutions and financial technology startups use AI, data analysis, and behavioural science judiciously to encourage consumers and society to support environmental conservation. The use of green wallets has created paperless systems and has efficiently implemented a system of biodegradable cards supporting environment conservation. Technology enabled tracking systems have been introduced where the entities try to further counterbalance by investing in green projects according to RBI and SEBI guidelines. Neobanks (purely digital banks) like Fi and Jupiter use behavioural psychology to move towards environment friendly consumption and investment. These banks also help mitigate the environmental impact by offering mechanisms to invest in carbon reducing projects. Certain startups like Zerodha's Rainmatter have combined investment and environmental conservation like Akshyakalpa (Start up for farmers to help them move towards organic farming) and Solar square (Application to provide convenience for solar panel installation, financing, and tracking) (Zerodha, 2024). These wallets use APIs for real-time carbon tracking and create carbon offset receipt. Carbon trackers were used to assess the emission trajectory, ESG risks, funding of green projects and ensuring transparency in the system (Dagur et al., 2025). The banking sector may not support small green projects, platforms like RevFin give loans to individual borrowers for improving sustainability. The two main challenges to these innovations are accuracy on calculation of carbon footprints and greenwashing where individuals are provided with deceptive information. Efforts are made to solve these issues by providing for independent audits, provision of an independent carbon market and strict vigilance by RBI and SEBI.

These are the few detailed descriptions of banking evolution towards green banking which tried to consolidate public sector, private sectors, and innovations in financial and technological industries. All the above efforts laid the foundation for a net zero goal by 2070 which implies a high percentage reduction in emissions and offsetting carbon emissions.

Challenges and Implementation Barriers

The development of banking to green banking faces a lot of obstacles despite strong regulatory systems and promising plans of the entities. The movement towards a green banking system has the problem of data inadequacy, high costs and regulatory loopholes which may reduce the adoption of this technology and decrease investor confidence in green projects.

The major problem in the system of green banking is lack of credible information on environmental impacts. Environmental ecosystems are complex in nature; the exact impact is difficult to assess due to absence of verifiable metrics of carbon footprints and biodiversity impact. This may lead to widescale greenwashing where projects are falsely marketed as environment friendly. The reporting standards are voluntary and inconsistent across institutions. The Reserve Bank of India (RBI) has made compulsory ESG disclosures for large lenders, but the smaller institutions and SMEs are inadequate in this respect (RBI, 2023). Greenwashing has a detrimental impact on foreign investors as they comply with stringent standards. According to a report by PwC, 40% of Indian green bonds were verified in detail due to misleading claims and risk of reputation.

Secondly, the green banking system requires high initial capital to set up the infrastructure which may not be economically viable for the private sector and may increase the burden in deficit financing to a great extent. The system needs to be expanded at a regular interval giving cost constraints due consideration. These initiatives have a long gestation period of more than 10 years. According to the International Energy Agency (IEA) (2023), solar farms, Electric charging stations, and energy saving infrastructure requires more than twice the capital required in conventional alternatives. According to the estimates from International Energy Agency (2025), India will need \$1.4 trillion per year by 2030 for clean energy, but public private partnerships may prove to be expensive for green loans as compared to global rates. The problems of clean energy multiply in rural areas due to delays in land possession; supply chain delays for importing technological inputs; and perceived risks of commercial banks in remote areas. The system of tax rebates and other incentives from multilateral financial institutions like Asian Development bank are helpful but their demand outweighs the supply.

Finally, the crucial regulatory lapse in green banking system in India is that RBI has not given clear taxonomy with exact formal classification of sustainable projects. The existing framework excludes social adaptation criterion and is not aligned with major global frameworks. This leads to green washing and taking advantage of loopholes by industry predators. The Climate Bonds Initiative data shows that green bond issues have reduced in 2025 in India due to compliance confusion (Institute for Energy Economics and Financial Analysis, 2025). A standardised taxonomy in correspondence with global standards can change the picture of green banking by leaps and bounds and help attain India's green finance potential.

Policy Recommendations

The green banking system in India has a lot of potential to mobilise funds worth \$ 10 trillion and achieve net zero goals estimated by Niti Aayog. The study recommends that innovations in technology along with AI can overcome many obstacles, enhancing carbon reducing banking systems. The use of appropriate digital innovations and regulatory reforms can make India a hotspot for green investment banking and a global leader in sustainable financial technology. The ESG norms combined with digital green banking with real time accounting AI applications can make a considerable difference in sustainable development goals. A system where applications like UPI linked wallets and internet banking can use AI algorithms to track the carbon footprint instantly can accrue multiple levels of benefits. Using the data through RBI and NPCI, applications

can provide users with green scores and a reward system for making sustainable choices. Pilot projects can be initiated to test the reliability of green technological solutions. The challenges of data privacy can be solved by systematic learning and ensuring compliance by helping to decentralise sensitive information.

The first and foremost policy recommendations for the regulatory authority is to enforce a detailed and clear green taxonomy according to international standards. A Green Refinance facility can be channelled through already set institutions. A proper data exchange platform can be established under regulatory authorities to verify carbon footprints.

In conclusion, using AI with clear policy regulations can set in motion sustainable banking and help the economy to achieve the twin objectives of profit maximisation and environment conservation. The reconciliation of the existing inadequacies can be addressed by presence of third-party verifications with respect to real time data through digital applications, the implementation lags across the country also need to be rectified.

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