

Trend, Scope and Challenges of Green Finance in India: A Conceptual Review

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Abstract

This paper provides a comprehensive overview of the current trends, scope, and challenges associated with green finance in India. It explores the growing importance of sustainable finance in addressing climate change and promoting economic growth. The paper analyzes the various initiatives and policies implemented by the Indian government to foster green finance, including regulations, incentives, and financial instruments. Additionally, it identifies the key challenges hindering the widespread adoption of green finance in India, such as a lack of awareness, limited data availability, and regulatory complexities. The paper concludes by discussing potential solutions and recommendations to overcome these challenges and accelerate the transition towards a sustainable financial system in India.

Keywords: Green Finance, Sustainable Development, Renewable Energy,

1. Introduction

Green finance plays a crucial role in linking economic growth with environmental responsibility. As climate change and ecological degradation become more pressing, directing financial investments toward sustainable outcomes has become a national

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priority. For a developing country like India, where economic ambitions are high and environmental concerns are growing, green finance has emerged as a key strategy to support low-carbon and climate-resilient development.

In recent years, India has taken significant steps by introducing green bonds, funding renewable energy projects, and encouraging sustainable infrastructure. Banks and financial institutions are gradually integrating environmental concerns into their lending and investment decisions (Ansari & Anand, 2022). However, several roadblocks remain. These include gaps in regulatory policies, limited technical knowledge among stakeholders, and insufficient global financial partnerships (Bhatnagar & Sharma, 2022).

This chapter explores the current state of green finance in India, mapping its development, challenges, and potential for reform. It also draws lessons from international practices that may suit India's unique policy and financial landscape. By examining these aspects, the study aims to identify practical strategies to strengthen India's green finance ecosystem.

Advancing green finance directly supports the United Nations Sustainable Development Goals (SDGs), particularly those focused on climate action, clean energy, and sustainable economic growth. Enhancing this financial avenue is not only crucial for environmental sustainability but also essential for fostering inclusive and resilient development.

1.1 Definition:

Green finance refers to the flow of financial resources toward environmentally responsible and socially inclusive activities. It supports projects that lower carbon emissions, enhance energy efficiency, and promote a low-carbon economic transition. Key tools include green bonds, climate-focused funds, and sustainable lending practices. The goal is to achieve long-term economic growth while protecting natural ecosystems and improving societal well-being.

Scholars have examined green finance from various perspectives. Flammer (2021) found that green bonds encourage firms to adopt sustainable practices, especially when backed by clear

policies. Nedopil (2022) highlighted how China leverages green investments under the Belt and Road Initiative to promote both development and diplomacy. Weber (2021) emphasized aligning financial strategies with the UN's Sustainable Development Goals through corporate responsibility efforts.



Fig. 1 Green Finance

In the Indian context, green finance has gained momentum as part of the country's climate action strategy. The government's launch of sovereign green bonds is a step toward funding clean energy and low-carbon projects. However, challenges remain. Limited investor awareness, weak regulatory support, and shallow market infrastructure slow the sector's growth (Freytag, 2020). Addressing these barriers is vital for aligning India's financial system with its sustainability goals.

1.2 Evolution of Green Finance in India

Green finance in India has evolved substantially over the past decade, showing the country's growing commitment to sustainable development. Initially, the drive for green finance came from government actions such as the National Action Plan on Climate Change (NAPCC) and initiatives supporting renewable energy. The introduction of mechanisms like the Perform, Achieve, and Trade (PAT) scheme and the Standards and Labelling Program highlighted India's dedication to reducing carbon emissions and improving energy efficiency (Jha & Verma, 2020).

In more recent years, private sector involvement has gained momentum. Financial institutions and investors are increasingly integrating environmental, social, and governance (ESG) factors

into their decision-making, driven by the recognition of climate risks and the potential long-term financial returns of green investments. The rise of green bonds and sustainable investment funds in India reflects this shift, providing opportunities to fund projects with a positive environmental impact (Naeem et.al., 2023).

Looking forward, the future of green finance in India looks promising, with the government aiming for net-zero emissions by 2070. Efforts to enhance transparency and standardize green finance practices will likely propel growth in this sector. As India tackles its environmental challenges, the continued development of green finance will be crucial in fostering a greener economy (Naeem et.al., 2023).

1.3 Key Policies and Regulations Associated with Green Finance in India

Over the past decade, India's green finance sector has undergone significant transformation, reflecting the nation's commitment to sustainable development. Initially, government-led initiatives such as the National Action Plan on Climate Change (NAPCC) played a pivotal role in this evolution. The NAPCC introduced eight national missions targeting various climate-related challenges, including the National Solar Mission and the National Mission for Enhanced Energy Efficiency (Ministry of Environment, Forest and Climate Change, 2008). A key component of these efforts was the Perform, Achieve, and Trade (PAT) scheme, designed to set energy consumption reduction targets for energy-intensive industries, allowing them to trade Energy Saving Certificates upon achieving these goals (Bureau of Energy Efficiency, n.d.-a). Complementing this, the Standards and Labelling Programme was established to guide consumers toward energy-efficient appliances by providing clear information on energy performance (Bureau of Energy Efficiency, n.d.-b).

In recent years, the private sector's role in green finance has become increasingly prominent. By February 2023, India had issued approximately \$21 billion in green bonds, with the private sector contributing 84% of this total (World Bank, 2023). This surge in private investment underscores a growing recognition of the long-term financial benefits associated with

environmentally sustainable projects. Green bonds have emerged as a crucial instrument for funding initiatives that yield positive environmental outcomes, such as renewable energy ventures and sustainable infrastructure developments.

Looking ahead, India's commitment to achieving net-zero emissions by 2070 sets a clear trajectory for future policies and financial strategies. Achieving this ambitious goal will require substantial investment, with estimates suggesting a need for over \$10 trillion (ICF, 2023). To bridge this financial gap, enhancing transparency and standardization in green finance practices is essential to attract both domestic and international investments. As India continues to address its environmental challenges, the evolution of green finance will be pivotal in promoting sustainable development and transitioning to a greener economy.

1.4 Need of Green Finance in India

Green finance plays a pivotal role in India's journey towards sustainable development by channeling investments into eco-friendly projects like renewable energy and energy efficiency. This financial approach not only drives economic growth but also addresses environmental challenges. For instance, the issuance of green bonds has become a significant tool in attracting both domestic and international investors interested in supporting sustainable initiatives (Mohd & Kaushal, 2018; Bhatnagar et.al.,2025).

Beyond economic advantages, green finance contributes to social well-being. Investing in clean energy and sustainable agriculture can lead to improved public health outcomes and job creation, promoting inclusive growth. Studies have shown that green financial policies can enhance public health by reducing pollution and encouraging healthier lifestyles (Chhaocharia, 2021).

Government policies and incentives are crucial in advancing green finance. The Green Energy Open Access Rules, 2022, for example, have clarified aspects like consumer eligibility and electricity banking, facilitating greater participation in green energy projects (Institute for Energy Economics and Financial Analysis, 2024).

As urbanization accelerates, integrating green finance into city planning becomes essential. Case studies from Hyderabad and

Kolkata demonstrate how mapping green finance flows can support climate change mitigation and adaptation efforts at the urban level (Climate Policy Initiative, 2021).

2. Review of Literature

Green finance in India is steadily gaining ground, particularly in areas that promote environmental well-being. Current studies show a sharp rise in investments in renewable energy, especially solar and wind, supported by national energy goals (Keerthi, 2013). The market for green bonds is also expanding, with both government and private organizations using them to fund eco-friendly initiatives (Agrawal et.al., 2024; Desai & Prajapati, 2024). Additionally, financial institutions are beginning to integrate environmental, social, and governance (ESG) standards into their investment choices, signaling a move toward sustainability in finance (Kumar & Luthra, 2021).

The reach of green finance is wide, covering renewable energy, sustainable farming, waste handling, and efficient energy use (Ali et al., 2024). This opens up new economic opportunities while addressing environmental needs. Financial institutions play a key role here by directing funds into green ventures that can drive innovation and new technologies (Naeem et.al., 2023). Global support, particularly from the World Bank and the International Finance Corporation, is also boosting India's green ambitions (Ali & Jafar, 2024; Khan & Roy, 2022).

Despite the progress, several barriers remain. A major issue is the limited understanding of green finance among key players, which affects project execution (Freytag, 2020; Sarangi, 2018). Another challenge lies in the absence of common standards to measure and report the outcomes of green investments (Desai, 2023). High initial costs and perceived financial risks discourage funding, while inconsistent policies and regulations create further hesitation among investors (Soni & Baheti, 2017).

To tap the full benefits of green finance, India needs to raise awareness, create unified evaluation systems, ease financial entry points, and maintain clear, long-term policy support.

3. Objectives of the Study

- To study the scenario of green finance in India
- To study the scope and challenges of green finance in India.
- To explore different kinds of green finance products available in India.

4. Research Methodology

The methodology for this paper involves a systematic literature review to synthesize existing research. Relevant studies have been gathered from various academic secondary sources like books, journals, industry reports, policy documents, etc., to understand the evolution, scope, and challenges of green finance in India. Data has been extracted focusing on trends, case studies, and regulatory impacts, with particular attention to recent advancements. The review also incorporated qualitative insights and real-life examples to offer a comprehensive perspective.

5. Trends of Green Finance in India

Green finance in India has seen strong growth in recent years, with increasing support from both the government and financial institutions. Instruments like green bonds, sustainability-linked loans, and green mortgages have been introduced to fund eco-friendly projects. A major milestone was the State Bank of India's green bond issue in 2018, which raised \$650 million for renewable energy. By 2023, India's green bond market had reached a cumulative issuance of \$10.8 billion, positioning the country as a leader among emerging economies (Mohanty et al., 2023).

The private sector has also become more active, especially as businesses respond to rising expectations around environmental responsibility. Large firms such as Tata and Mahindra are setting the pace. Tata Power has pledged to raise its renewable energy share to 80% by 2030. Meanwhile, sustainability-linked loans increased by 35% in 2022, showing that companies are aligning financial strategies with environmental goals (Fu et al., 2023).

However, the sector still faces roadblocks. Limited data, lack of common standards, and the high cost of green technologies make it difficult to scale up. There is also a pressing need to build awareness and strengthen the capacities of various stakeholders.

Overcoming these issues is essential for green finance to truly support India's sustainable development goals (Mohanty et al., 2023).

Comparative Analysis with Global Green Finance Trends

Globally, green finance has grown significantly, driven by climate policies, technological innovation, and heightened environmental awareness. For instance, in 2020, the global green bond market reached a record \$269.5 billion in issuance, up from just \$3 billion in 2007 (Climate Bonds Initiative, 2021). Countries like China and members of the European Union have established sophisticated green finance systems, integrating green bonds and sustainable investment standards. In 2020, China issued \$13.4 billion in green bonds, while the EU launched a €750 billion green recovery fund as part of its European Green Deal (European Commission, 2020). These countries' proactive approach has created influential green finance markets, offering valuable frameworks for other nations.

India's green finance sector, though progressing, is still developing. The Indian government has introduced key initiatives like the National Clean Energy Fund (NCEF), launched in 2010, which supports renewable energy projects (Ministry of Finance, 2021). Furthermore, in 2017, India issued its first sovereign green bond worth \$500 million, demonstrating its commitment to sustainable finance (Reserve Bank of India, 2017). However, challenges remain, including policy inconsistencies, low market liquidity, and limited investor awareness. Despite these hurdles, India has the potential to align more closely with global green finance trends by strengthening its infrastructure and regulatory framework.

6. Scope and Sectoral Reach of Green Finance in India

Green finance in India has emerged as a critical pathway for steering investments into environmentally responsible ventures. With rising concerns over climate change and resource depletion, India's development priorities now include renewable energy, sustainable farming, and efficient waste systems. Green finance supports this shift by funding projects that reduce emissions, conserve resources, and promote cleaner alternatives.

Over the years, the government has introduced several measures to encourage green financing—ranging from regulatory support

to incentives for issuing green bonds. Such tools have helped attract both domestic and international capital into sustainable projects. However, the sector still faces some bottlenecks. The absence of a clear, uniform definition of what qualifies as 'green' financing often leads to inconsistencies. Additionally, financial institutions frequently lack the skills or frameworks needed to assess the long-term value and impact of green projects.

Despite these challenges, digital technologies are beginning to make a difference—by improving the traceability of green funds and building investor confidence through better data and transparency. To unlock the full potential of green finance, India needs continued policy innovation, stronger public-private coordination, and better awareness within the financial ecosystem.

Several sectors stand out as prime beneficiaries of this green transition:

- **Renewable Energy:** India has significantly expanded its renewable energy base, surpassing 150 GW by 2023, led by large-scale solar and wind projects. This progress is largely funded by green bonds, which have become a preferred instrument for financing clean energy infrastructure. The outcome is twofold—lower carbon emissions and improved energy security.
- **Waste Management:** Cities across India generate enormous volumes of waste daily. Green finance has supported the creation of modern waste treatment and recycling plants. Some municipal bodies have even raised funds independently to build waste-to-energy units. These efforts not only reduce pressure on landfills but also improve urban sanitation and public health.
- **Sustainable Agriculture:** Agriculture, the backbone of India's rural economy, is now seeing a push toward eco-friendly practices. Green finance supports organic farming, water-saving irrigation systems, and climate-resilient crops. Financial institutions and rural development banks have played an active role in funding these projects, ensuring that small farmers can adopt sustainable methods without bearing all the costs themselves.

While Green Finance holds a vast promise for transforming key sectors, realizing its full potential depends on bridging policy gaps, building institutional capacity, and driving innovation across the financial landscape.

7. Challenges in Implementing Green Finance in India

- 7.1 Regulatory and Policy Barriers:** India's green finance sector faces hurdles due to inconsistent regulations and a lack of cohesive policy frameworks. Despite initiatives like the National Clean Energy Fund, regulatory uncertainty and fragmented policies impede progress (Kumar et.al.,2024). The complexity of navigating different regulations across states further complicates the implementation of green finance.
- 7.2 Financial and Market Challenges:** Green finance in India is constrained by limited access to capital and high investment risks. Green projects often face difficulty in attracting investors due to their perceived higher risk and lower short-term returns (Jha & Bakhshi, 2019). Additionally, the absence of standardized metrics for evaluating green investments can deter potential financiers.
- 7.3 Technological and Infrastructure Constraints:** The lack of advanced technological infrastructure hampers the growth of green finance. Many green technologies are still emerging and require substantial investments for development and deployment (Keerthi,2013; Patel, 2023). Additionally, inadequate infrastructure for monitoring and managing green projects affects their efficiency and effectiveness.
- 7.4 Socio-economic Factors and Public Awareness:** Limited public awareness and understanding of green finance contribute to its slow adoption. Socio-economic factors, such as low financial literacy and limited exposure to green concepts, hinder widespread acceptance and participation in green finance initiatives (Kumar et.al., 2024).
- 7.5 Institutional Capacity and Expertise:** There is a shortage of skilled professionals and institutional capacity to support green finance initiatives. Many institutions lack the necessary expertise and resources to effectively manage and implement green finance projects (Jha & Bakhshi, 2019).

- 7.6 Reporting and Transparency Issues:** The absence of standardized reporting frameworks for green investments affects transparency and accountability. Investors and stakeholders often face challenges in assessing the environmental impact of their investments due to inconsistent reporting practices (Sarangi, 2018).
- 7.7 Political and Economic Instability:** Political and economic instability can disrupt green finance initiatives. Changes in government policies, economic downturns, and political uncertainties can impact the stability and attractiveness of green investments (Kundu & Kumar, 2025).

7. Green Finance Instruments in India

- 7.1 Green Bonds:** Green bonds are debt securities issued to finance projects with positive environmental impacts. In India, the green bond market has witnessed substantial growth, with notable issuances by companies like the Indian Renewable Energy Development Agency (IREDA) and the National Bank for Agriculture and Rural Development (NABARD). For instance, in 2022, NABARD issued green bonds worth ₹1,500 crores to support renewable energy projects.
- 7.2 Green Loans:** Green loans are provided for projects that have clear environmental benefits. Indian banks such as SBI and HDFC offer green loans with favorable terms for renewable energy, energy efficiency, and sustainable infrastructure projects. In 2023, the State Bank of India allocated ₹2,000 crores in green loans for solar power and energy-efficient projects.
- 7.3 Green Taxonomy:** The green taxonomy is a classification system that defines which activities and projects are considered environmentally sustainable. India introduced its green taxonomy in 2021, aligning with international standards to guide investments in sustainable projects.
- 7.4 Green Mutual Funds:** These are investment funds that focus on green and sustainable projects. In India, mutual funds like the SBI Green Fund and Aditya Birla Sun Life Green Fund target investments in clean energy and environmental

sustainability. As of 2023, the SBI Green Fund managed assets worth ₹1,200 crores (SBI, 2023).

- 7.5 Green ETFs:** Green Exchange Traded Funds (ETFs) track indices composed of environmentally friendly companies. The Nifty Green Index ETF, launched in 2022, includes companies involved in renewable energy and sustainable practices, offering investors exposure to green investments (NSE, 2022).
- 7.6 Green Project Financing:** This involves financing specific projects aimed at reducing environmental impact. The Indian government's Clean Energy Fund supports large-scale green projects, including wind and solar farms. For example, the Solar Park Development Fund has been instrumental in financing solar projects worth over ₹10,000 crores.
- 7.7 Green Certificates:** These are tradable instruments certifying the generation of green energy. The Renewable Energy Certificates (RECs) market in India, regulated by the Central Electricity Regulatory Commission (CERC), facilitates the trade of certificates to meet renewable purchase obligations.
- 7.8 Green Insurance:** Green insurance products are designed to cover risks associated with environmentally friendly projects. The New India Assurance Company offers policies for renewable energy projects, covering risks related to equipment and operation (Insurance Regulatory and Development Authority of India (IRDAI, 2023).
- 7.9 Carbon Credits:** Carbon credits are permits that allow the holder to emit a certain amount of CO₂. India participates in international carbon trading under mechanisms like the Clean Development Mechanism (CDM). As of 2024, India has issued over 400 million carbon credits.
- 7.10 Green Development Bank:** The Green Development Bank focuses on financing green projects. India established the Green Climate Fund (GCF) to support projects aimed at climate change mitigation and adaptation. In 2023, the GCF allocated \$500 million for various green projects in India (GCF, 2023).

9. Successful Green Finance Projects in India

India has seen a range of successful green finance projects that contribute significantly to its sustainable development goals. Here are ten notable projects:

- 9.1 Indian Green Bond Market:** India's green bond market has seen significant growth, with projects like the Green Bonds issued by Yes Bank and SBI, which fund renewable energy and energy efficiency projects (SBI Green Bond, 2021; Yes Bank Green Bond, 2022).
- 9.2 Re-New Power's Solar Projects:** Re-New Power has implemented large-scale solar power projects across India, including a 600 MW solar park in Karnataka, funded through green financing (Re-New Power, 2023).
- 9.3 Tata Power's Green Bonds:** Tata Power has issued green bonds to finance renewable energy projects, including solar and wind energy initiatives. These bonds support the company's commitment to clean energy (Tata Power, 2023).
- 9.4 India's National Electric Mobility Mission Plan (NEMMP):** This project aims to promote electric vehicles (EVs) and has been funded through green finance mechanisms to reduce the carbon footprint of transportation (NEMMP, 2023).
- 9.5 Green Climate Fund Projects:** Several Indian projects have received funding from the Green Climate Fund (GCF), including those focused on climate-resilient agriculture and renewable energy (GCF, 2023).
- 9.6 Indian Renewable Energy Development Agency (IREDA) Projects:** IREDA provides financial support for renewable energy projects, including wind, solar, and hydroelectric projects, driving India's green energy agenda (IREDA, 2023).

10. Conclusion

India has taken meaningful steps to blend environmental concerns with financial practices through tools like green bonds, climate-linked loans, and sustainability-focused insurance. These instruments are helping direct funds into projects that support clean energy, climate resilience, and ecological conservation.

Still, some key barriers remain. These include unclear standards for measuring green impacts, low stakeholder awareness, and a need for stronger policies and coordination. Overcoming these challenges will require joint efforts from the government, financial sector, and industry leaders to design practical guidelines and build investor confidence.

Looking ahead, green finance can play a major role in achieving multiple Sustainable Development Goals. It directly contributes to SDG 7 (Affordable and Clean Energy), SDG 9 (Industry, Innovation, and Infrastructure), and SDG 13 (Climate Action). Indirectly, it supports SDG 11 (Sustainable Cities) and SDG 17 (Partnerships for the Goals) by encouraging sustainable urban development and multi-sector collaboration.

As India aims for a low-carbon future, green finance will be key to aligning growth with sustainability. With the right strategies and long-term vision, it can help balance environmental protection with economic advancement, paving the way for a more inclusive and greener tomorrow.

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