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The Effectiveness of Green Finance in Carbon Emission Reduction: A Case Study Approach

Taisheng Yang[1,*]

[1]Singapore Management University, 328689, Singapore; ts.yang.2024@smu.edu.sg

*** Correspondence:**

Taisheng Yang

ts.yang.2024@smu.edu.sg

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Abstract

Green finance is a key policy tool for reducing carbon emissions, yet it has faced critical scrutiny for often serving as a superficial label rather than driving real change. This study examines the effectiveness of green financial instruments, such as green bonds and carbon trading in lowering emissions across different economic contexts. Using a case study approach, the research reveals that the success of green finance depends on clear policy design, well-developed market mechanisms, and compatibility with local socioeconomic conditions. In cities with high levels of green finance, these instruments play a more significant role in cutting emissions, whereas in areas with limited green finance, green innovation becomes more critical. Critical analysis in this study exposes the limitations of current green finance practices and provides policy recommendations to overcome systemic barriers and enhance the impact of green finance on decarbonization efforts.

Keywords: Green Finance, Green Bonds, Carbon Trading, Emission Reduction, Policy Design, Market Mechanisms, Green Innovation, Decarbonization.

1. Introduction

Human-induced activities have definitively triggered planetary warming, primarily through greenhouse gas emissions. Global surface temperatures have risen to 1.1° C above pre-industrial levels (1850-1900) during the 2011-2020 period, this temperature increase is directly attributable to anthropogenic factors (IPCC, 2023). As of the third quarter of 2024, the global cumulative issuance of standardized green, social, sustainable and sustainability-linked (GSS+) debt has reached $5.4 trillion, with new issuances in 2024 amounting to $818.2 billion, representing an 11% increase compared to the same period in 2023 (*"Sustainable Debt Market Summary Q3 2024",* 2024). However, critics argue that green finance is essentially a rhetorical exercise that beautifies traditional economic activities through clever wording but fails to truly promote systematic emission reductions. It's becoming more and more obvious that financial products only need to be

labeled as "green" to be flooded with investment money. Not only are companies riding this wave, but governments are doing it too (Rocholl, 2021). In 2024, the six largest American banks announced their withdrawal from the United Nations "Net-Zero Banking Alliance." Institutions like JPMorgan Chase and Bank of America had previously promised to achieve net-zero emissions by 2050 but chose to withdraw due to policy pressure and competing interests (Winters, 2025). This means they may still be committed to supporting low-carbon transition, but need more flexible ways to balance various interests, which also raises questions about green finance's effectiveness in reducing carbon emissions.

2. Literature Review

2.1. Definition of Green Finance

Green finance covers funding for environmental investments and services, climate damage prevention, environmental policies that support green initiatives, and specialized financial tools (like green bonds and funds) with their supporting frameworks (Lindenberg, 2014). Green finance is seen as a key area of research that cuts across environmental, social and economic sectors, with a focus on addressing climate change through financial mechanisms. Green finance is seen as fundamentally policy-driven, and achieving its goals requires regulatory and policy support (Zhang et al., 2019). This means that green finance is not only about investing in technology or infrastructure but also about integrating sustainability into all financial decision-making processes. Because green finance is fundamentally driven by policies, its effectiveness largely depends on having clear government regulations and supportive policy frameworks. These policies help ensure that investments are directed toward projects that truly contribute to a low-carbon and sustainable future.

2.2. Impact to Carbon Emissions Reduction

Green banks and green bonds demonstrate significant potential for advancing clean energy development. Green banks offer several key advantages, including more favorable credit terms for clean energy projects, the capability to consolidate smaller projects into commercially viable scales, development of innovative financial instruments, and market growth through effective communication about clean energy benefits (Sachs et al., 2019). Green finance demonstrates a negative and statistically significant impact on carbon emissions. The analysis shows that a 1% increase in green finance, measured through green bond issuance, corresponds to a 0.012% reduction in carbon emissions (Baştürk, 2024). Implementation of green finance reform and innovation pilot zone policies significantly reduced carbon emission intensity in pilot areas, and the level of financial development played a positive regulatory role in the carbon reduction effects of these policies (Meo and Karim, 2021). The issuance of green bonds is indeed associated with reduced carbon emissions, especially green bonds certified by third parties, which are more effective (Flammer, 2023). This provides empirical evidence supporting green financial instruments as effective tools for reducing carbon emissions. This finding underscores the importance of transparency and credibility in green financial instruments, suggesting that proper certification can enhance the actual impact on lowering carbon emissions. The effectiveness of green financial

instruments (such as green bonds and carbon trading markets) depends on whether policy design is clear, and market mechanisms are mature. A good policy environment and mature market mechanisms can reduce debt financing costs for businesses, providing financial support for investments in low-carbon technologies, thereby promoting carbon emission reductions (Li et al., 2025). This finding reinforces the view that a supportive policy framework is critical for the success of green finance in achieving significant carbon emission reductions. Green financing improves ESG performance by alleviating financial constraints, increases profitability, and enhances ESG-related financing, thereby reducing greenwashing behaviors. This indicates that green finance creates genuine incentives and capabilities for environmental improvements, not just the appearance of environmental responsibility (Zhang, 2023). When companies access green finance, they are more likely to make substantial environmental improvements rather than merely claiming to be environmentally friendly without taking meaningful action.

2.3. Limitations of Green Finance

The issuance of green bonds by companies leads to an increase in the number of green patent applications. However, more and more of these patents are non-invention patents, which suggests that companies may be strategically pursuing green innovation. In addition, after the issuance of green bonds, there is no improvement in the grant rate and citation rate of green patents (Shi et al., 2023). This suggests that some companies may be merely creating an image of 'green innovation' by increasing the number of green patent applications, aimed at enhancing their environmental reputation or meeting regulatory requirements, without substantially improving their green innovation capabilities. It makes people believe companies are promoting green innovation on the surface, while they are not delivering genuine technological breakthroughs or environmental benefits. Green bond financing can play a key role in decarbonizing the global economy. This role is more decisive in countries with developed credit markets, higher levels of technological development, and those more likely to suffer from climate risks (Al et al., 2022). A study in China also found similar conclusions. By constructing a comprehensive green finance index (including green credit, insurance, and investment) and applying a panel data regression for 30 provinces from 2010 to 2021, the study finds that green finance is positively correlated with poverty reduction, with the strongest impact observed in eastern China, followed by central China, and the weakest in western China (Xu et al., 2025). In essence, both pieces of literature suggest that a mature financial system and supportive socioeconomic conditions are critical for green finance to achieve its environmental and sustainable development goals. A study in China also found that the correlation between a bank's green credit ratio and its credit risk primarily depends on its size and ownership structure, the implementation of China's green credit policy helps reduce credit risk for large state-owned banks but increases credit risk for city or local commercial banks (Zhou et al., 2020). This is because local banks lack professional capacity to assess the technical feasibility and environmental benefits of green projects, leading to increased loan default risks. Additionally, mandatory green credit quotas force local banks to direct limited resources to high-risk projects (such as small and medium-sized photovoltaic enterprises), while lacking central government risk compensation mechanisms. In cities with high levels of green finance, green finance plays a more significant role in reducing carbon emissions than green innovation, whereas in cities with low

levels of green finance, green innovation becomes more important for lowering carbon emissions (Li et al., 2024). This further demonstrates that green finance can only fully realize its environmental benefits in a strongly supportive financial environment, which aligns with the previously emphasized importance of good policy design and market mechanisms for green financial instruments to be effective. Despite the existence of green funds, many African economies have limited access to financing due to bureaucracy, lack of collateral, and the high risks associated with investing on the African continent. Additionally, for many African countries, socioeconomic pressures caused by poverty, unemployment, and food insecurity often take priority over environmental concerns, prompting governments to prioritize immediate economic development over long-term sustainability initiatives (Jawadi et al., 2024). This indicates that in these regions, green finance is not significantly different in essence from traditional financial mechanisms, as it still allocates funds based on the borrower's risk level. Therefore, for these impoverished areas, obtaining financing that brings immediate economic benefits is more urgent than pursuing long-term environmental benefits, such as reducing carbon emissions. This phenomenon explains why the promotion of green finance has limited effectiveness in some regions and struggles to fulfill its role in long-term environmental improvement.

Existing research has provided extensive support for the theoretical foundations in the field of green finance, but the development effects of green finance are often influenced by multiple factors such as different national economic systems, levels of economic development, policy support and market environments. Therefore, it is difficult to fully assess the effectiveness and challenges of green finance based on theoretical discussions alone. This study examines the application of green finance in different economic systems, examines the actual contribution of green finance to carbon emission reduction, and reveals possible obstacles to the development of green finance in different countries. The results of the case studies will improve the framework for the development of green finance and provide a basis for the formulation of future green finance policies.

3. Case Study Rationale

This study chooses Japan, China and India as the research subjects for case study, mainly because they have certain development foundation in the field of green finance and have regional representation and data availability.

3.1. Foundations for Green Finance Development

Japan, China, and India have established significant foundations in the realm of green finance, each developing mature frameworks that integrate both practice and policy. Japan, as a pioneer in this field, has implemented stringent environmental laws and regulatory measures that not only foster compliance but also stimulate innovation in energy efficiency and emission reduction. Its early adoption of green finance instruments has yielded substantial achievements, positioning Japan as a benchmark for sustainable financial practices. In contrast, China has, in recent years, aggressively advanced its green finance agenda under strong policy support. The establishment of the world’s largest green bond market is a testament to its commitment to sustainable development, facilitating large-scale investments in renewable energy and low-carbon technologies. India, while

at a relatively nascent stage, is demonstrating marked progress in renewable investments. Its ongoing efforts to integrate green finance mechanisms into its economic development trajectory offer promising prospects for bridging the gap between policy ambition and practical implementation. The diverse developmental stages and policies of these countries provide robust case support for analyzing the multifaceted impact of green finance on emission reduction.

3.2. Regional Representation

The selection of Japan, China, and India enhances the breadth and applicability of this study by capturing the dynamics across different economic stages and regional contexts. These three nations represent distinct segments of economic maturity: Japan exemplifies a mature economy with well-established green finance practices, China embodies a transitional economy that is rapidly evolving its sustainable finance infrastructure, and India illustrates a growth-stage economy with emerging renewable investment strategies. This heterogeneity not only underscores regional differences in green finance development but also enriches the comparative analysis by highlighting how varying institutional, cultural, and economic contexts shape the design and outcomes of green finance initiatives. Consequently, the study's findings can be extrapolated to a broader set of economies, offering valuable insights for policymakers and financial institutions aiming to tailor green finance strategies to diverse regional realities.

3.3. Data Availability

A key strength of this research lies in the robust availability of data within the Asian context, where Japan, China, and India maintain comprehensive financial market information disclosure mechanisms. These mechanisms ensure the regular publication and accessibility of critical indicators—such as green bonds, green credit, and carbon emission data—which are essential for a rigorous empirical assessment of green finance impacts. The relative richness of this data infrastructure, compared to other regions, provides a solid empirical foundation for the case study analysis. It enables researchers to undertake nuanced, quantitative evaluations of the performance of green finance policies and to trace the linkages between financial instruments and environmental outcomes. This transparency and accessibility of data not only bolsters the credibility of the findings but also facilitates a more detailed and systematic exploration of the mechanisms through which green finance can contribute to sustainable development.

4. Methodology

This study uses a case analysis method to compare both successful and failed cases of green finance implementation in Japan, China, and India. The goal is to examine how effective green finance is in reducing carbon emissions. First, data and cases from these three countries on green finance policymaking, market applications, technological innovations, and international cooperation were collected and organized. Then, each country's strengths, bottlenecks, and weaknesses in green finance practices were analyzed, and the carbon reduction outcomes under different models were evaluated. Finally, by combining theory with practice, the key factors driving success in using green finance to achieve carbon neutrality were summarized and replicable experiences identified. The findings provide policy recommendations and practical guidance for global efforts to tackle climate change and promote sustainable development.

5. Case Study

Please note that due to space constraints, very large tables (spanning several pages) cannot be included in the main body of the text. Please include these tables as attachments at the end of the paper. India's Green Jobs Initiative promotes youth employment in slums through solar training centers (Bora, 2025).

Green microfinance in Kenya, climate finance (solar loans) to reduce energy expenditures of poor households (poverty materiality) while reducing carbon emissions (climate materiality). China's carbon trading market, launched in 2021, allows impoverished regions to sell carbon allowances through carbon sink projects (e.g., afforestation, forest protection). Inner Mongolia's carbon sink projects have generated annual revenues of over 100 million CNY, benefiting 50,000 poor people. Liangshan Prefecture in Sichuan Province has been able to lift itself out of poverty through carbon sink trading, with carbon sink revenues in 2022 reaching 50 million CNY.

5.1. Japan Case

5.1.1. Success Case

"Green Electricity Tariff System" is an innovative energy policy mechanism in Japan. It requires users to donate 5% of their monthly electricity bill to a green fund, which finances the construction of community power plants, such as community wind power projects. For example, if a monthly bill is 8,000 yen, the donation would be 400 yen. Instead of raising electricity prices, this system sets aside the 5% savings from energy efficiency improvements and invests that money in the green fund. The fund's income and expenditures are regularly reported to members to ensure transparency. In 2001, in Hamatonbetsu, Shibetsu District, Hokkaido, the first citizen-funded windmill project was successfully completed through expert guidance and the joint efforts of many members. This project became Japan's first community windmill and laid the foundation for promoting renewable energy and building a sustainable society that does not rely on nuclear power or fossil fuels (*"Community Wind Power | Hokkaido Green Fund",* 2022).

This system not only encourages citizens to actively join in building green energy but also promotes energy savings and the spread of renewable energy. By investing the savings from lower electricity use into a green fund, residents show real support for protecting the environment while raising public awareness and responsibility. The system effectively reduces energy use and boosts the development of green projects like community wind power. It shows how collective action and transparent management can achieve sustainable development, offering an effective model for a more eco-friendly and resilient future. In fact, this model has helped build 19 wind power projects in northern Japan, which not only improve green energy efficiency but also enhance public environmental awareness (Ledlightsblog, 2020). It creates a win-win situation between green finance and environmental protection, and it also provides valuable lessons for solar energy projects, further promoting local green energy development and laying a solid foundation for a sustainable society.

5.1.2. Failure Case

Governments and businesses worldwide have proposed net-zero targets. To achieve net-zero emissions, transition finance plays a crucial role, with bond issuance being considered the primary financing method. Currently, China and Japan are the most active in issuing transition bonds (Lui, 2023). In Japan's energy transition strategy, transition bonds are positioned as a key financial tool aimed at providing funds for low-carbon transformation in high-carbon industries like steel and power. The Japanese Ministry of Finance conducted a 10-year Green Transformation (GX) economic transition bond auction to support the country's energy transition plan. According to Japanese media, the bond plan was to issue 800 billion yen, with financial institutions bidding around 2 trillion yen. The bid-to-cover ratio was 2.9, reflecting bond demand, which was lower than the previous auction's 3.65 and weaker than expected (*"Japan's Energy Transition Bonds Struggle to Sell",* 2024). These bonds' core concept is "supporting gradual emissions reduction," allowing companies to raise funds for transitional technologies like hydrogen-based steel production and ammonia-coal mixed power generation. However, the actual fund allocation has sparked widespread controversy. A typical example is power companies using bond financing for "ammonia and coal co-firing" projects - a technique that reduces carbon emission intensity in the short term but still relies on fossil fuels and cannot achieve zero emissions. Critics argue that such practices exploit the policy's ambiguous definition of "transitional technologies," raising suspicions of "greenwashing" and questioning the environmental benefits of transition bonds. This potentially undermines investor confidence in Japan's green financial market.

The core of Japan's transition bond controversy lies in policy design and implementation flaws. The first reason is standard ambiguity: the government has not strictly defined the scope of "qualifying transition activities". For instance, they did not explicitly require technologies to directly align with the Paris Agreement's net-zero goals, allowing companies to obtain financing through "pseudo-low-carbon" technologies like low-percentage ammonia blending. The second reason is insufficient technological effectiveness. Some "transitional technologies" supported by these bonds (such as hydrogen-reduced steel production) are costly and time-consuming, making them difficult to replace traditional high-carbon processes in the short term. This delays the industry's deep decarbonization process. The third reason is regulatory and transparency gaps. Bond issuers do not sufficiently disclose fund usage, and there is a lack of independent institutions to verify emissions reduction effectiveness. This makes it challenging for investors to assess environmental risks, ultimately triggering a market trust crisis. These loopholes expose how transition financial instruments, without strict constraints, might become an "umbrella" for high-carbon industries to postpone substantive reforms.

5.2. China Case

5.2.1. Success Case

Driven by innovative green finance, Yunnan has taken the lead in overcoming the bottleneck of forestry carbon sink financial instruments. It has implemented the nation's first forestry carbon sink expected revenue pledge loan and carbon sink index insurance. In one typical case, the Agricultural Bank of Ning'er County used a "forestry carbon sink future revenue pledge plus forest rights mortgage" model to issue a special loan of 12 million yuan to Pu'er Kemao Linhua Co., Ltd., supporting its afforestation project covering 51,000 mu of land. According to an evaluation by the

Beijing Green Exchange, the project is expected to reduce emissions by 719,700 tons of CO_2 equivalent. At the same time, China Life Property & Casualty Insurance's Yunnan branch launched forestry carbon sink index insurance, providing 3 million yuan of risk protection for carbon sink losses for 223,900 mu of forest in Wenshan Prefecture. This dual upgrade in both insurance and carbon sink models shows that Yunnan is using a market-based green finance mechanism to unlock the value of ecological resources, offering a replicable path for rural revitalization under carbon neutrality goals (*"Forestry Carbon Sinks - Yunnan's Practice in Transforming Green Mountains into 'Golden Mountains'",* 2023).

The success of Yunnan's green finance practice lies in the combination of innovative financial tools and market-based ecological value. By capitalizing carbon sink assets, it creates a closed loop of ecological protection, financial investment, and emission reduction, solving the financing challenges of forestry projects while providing sustainable incentives for carbon reduction. Policy support and market mechanisms play a key role, such as defining carbon asset ownership and trading rules and introducing carbon pricing mechanisms, like the certification of 71.97 million tons of CO_2 equivalent by the Beijing Green Exchange, reducing valuation barriers for financial institutions. Financial innovation breaks away from traditional collateral models by using future carbon sink revenues as pledges, such as the 12-million-yuan loan to Puer Kemao, and applying carbon sink index insurance, like the 3-million-yuan coverage in Wenshan, to mitigate natural risks and boost investor confidence. The Agricultural Bank ensures targeted funding for carbon forestry projects through a forest rights mortgage and carbon sink pledge model, while China Life Insurance shares ecological risks through carbon sink insurance, forming a positive cycle of emission reduction, insurance protection, and reinvestment. Green finance has not only directly supported afforestation and forest management, such as Puer Kemao's 51,000-acre forest, which is expected to sequester 1.08 million tons of CO_2 over 30 years but has also encouraged high-emission industries to internalize carbon costs through carbon trading, accelerating industrial transformation. At the same time, data-driven governance, such as linking carbon sink certification with loan issuance, has improved emission reduction efficiency.

5.2.2. Failure Case

In 2016, Xihu Village in Tianquanhu Town, Xuyi County, Jiangsu Province, launched a photovoltaic (PV) poverty alleviation project, exemplifying the "green finance + poverty reduction" policy. The project was financed through government subsidies, bank loans (green credit), and corporate partnerships, with a total investment of 2.7 million yuan to construct a distributed PV power station with an installed capacity of 317 kilowatts. The goal was to achieve village collective poverty alleviation through electricity sales revenue while reducing carbon emissions by replacing traditional coal-fired power generation. The project was designed to have an annual power generation of 330,000 kilowatt-hours, resulting in an annual reduction of 260 tons of CO_2 emissions (calculated based on China's grid emission factor), with a net annual income of 140,000 yuan for the village collective and a loan repayment period of 15 years (*"Why Photovoltaic Poverty Alleviation Projects Are 'Sunbathing' - Xinhua News Agency",* 2020).

The project failed to meet expectations due to scattered installation making maintenance difficult, substandard PV equipment, low power generation efficiency, and lack of professional operation

and maintenance. As a result, the actual annual power generation dropped from the expected 330,000 kWh to less than 100,000 kWh, with CO_2reduction falling to only 80 tons (30% of the original plan). Due to insufficient revenue (annual income fell from 390,000 yuan to 100,000 yuan), some villagers returned to coal heating or diesel generators, causing a rebound in carbon emissions. This led to a waste of green finance resources, as green credit flowed into inefficient projects, losing opportunity costs. Local governments and banks played a major role in this failure. The government overlooked key performance indicators such as power generation and emission reduction, while banks issued green loans based solely on the "PV" label without assessing technical feasibility or equipment quality. Once green credit was used, there was no requirement for third-party verification of actual emission reductions, leading to an abundance of "nominally green" projects. This ultimately transferred risks to village collectives, forcing the township government to cover losses, creating a chain from financial risk to fiscal burden.

5.3. India Case

5.3.1. Success Case

In 2009, Prime Minister Manmohan Singh made the pivotal decision to launch a national solar mission, setting the stage for the country's solar energy development. At the time, India’s solar power capacity was limited to a few hundred megawatts (MW). The mission, which was officially launched in 2010, set an ambitious target of achieving 20,000 MW of solar power capacity by 2022. Today, India has surpassed 70,000 MW of solar power capacity and ranks fourth in the world in terms of solar energy production (Shankar, 2024). In recent years, solar energy has had a positive impact in India, especially in rural areas, by providing clean energy for cooking, lighting, and other needs. This has helped improve living standards, reduce health risks, and create employment opportunities (Ministry of New and Renewable Energy, 2022).

India's solar energy development shows significant strategic value. Through the National Solar Mission (JNNSM), the government has not only established a clear long-term energy transformation path but also innovatively introduced diverse market support mechanisms, such as generation-based incentives, transparent bidding, and e-reverse auctions. This strategy aims to reduce dependence on fossil fuels, promote green development, and improve energy accessibility, laying a solid foundation for achieving 4500 GW of renewable energy by 2030. By collaborating across different sectors, supporting research and development, and developing human resources, India is systematically building a sustainable and inclusive energy ecosystem, demonstrating a forward-thinking and strategic approach to future energy challenges (Upadhyay & Singh, 2021). This case shows how green finance can help reduce carbon emissions. The government issues sovereign green bonds to provide low-cost funds for renewable energy and energy-saving projects. This ensures that money goes to projects that significantly lower emissions and reduce the economy's overall carbon intensity. With the support of sovereign credit, these green bonds offer low-risk investment options for international investors, attracting global capital to the energy transition. International institutions also help by increasing capital and offering project guarantees, which boosts private investors' confidence and promotes the large-scale use of efficient energy-saving technology. Green finance also links the flow of funds with carbon performance and uses digital monitoring to improve the accuracy of emission reductions, creating a sustainable cycle of

"investment - emission reduction - profit." This model, guided by policy to balance risk and return, provides developing countries with a new way to transition to a low-carbon economy through financial innovation and international capital cooperation, driving global progress toward carbon neutrality.

5.3.2. Failure Case

US prosecutors have accused one of Adani Group's companies of hiding a bribery scheme worth up to $265 million to force an Indian state-owned power company to sign a contract for a major solar project. This accusation reveals a lack of transparency and cronyism in India's solar sector, especially in regulation, market mechanisms, and the relationships between companies and the government. Although President Trump suspended the law banning overseas business bribes, which provided some relief to Adani Group, the case still shows the risks and weaknesses in India's clean energy transition under green finance support. At the same time, the Indian government is working to support renewable energy projects through green bonds and other financial tools to shift to clean energy on a large scale. However, this case suggests that weak regulation and market imbalances may weaken the real emission reduction effects of these green finance tools, ultimately affecting the country's low-carbon transition process (Inamdar, 2024).

This case shows many reasons why green finance in India has failed to reduce carbon emissions. Because of bribery and corruption, some green finance funds were not used for low-carbon projects but were instead misused for improper purposes. This misuse of funds weakened investor trust and stopped international capital from investing in India's clean energy sector. Also, there are serious problems with policy implementation. Government agencies did not manage contracts and long-term power purchase agreements well, which led to rising project costs and high risks that were later covered by public funds. This situation shows that the regulatory system is weak and cannot ensure that green finance funds are used properly. At the same time, structural problems in the industry also limit the effectiveness of green finance. Many state-owned power companies face financial difficulties and cannot pay for renewable energy projects, so the projects do not generate the expected revenue.

5.4. Standardized Case Analysis Framework

Based on the above case narratives, a standardized analytical framework has been constructed to further distill and compare key variables in the green finance practices of different countries. The framework aims to systematize the performance of each case in terms of policy instruments, key objectives, implementation modes, major challenges, and ultimate effects. The following table provides a comparative perspective of the cross-country cases, which helps to reveal the common factors and regional differences affecting the effectiveness of green finance policy implementation and provides a quantitative basis and empirical support for subsequent theoretical discussions and policy recommendations.

Table 1. Comparative Analysis of Green Finance Projects

Project	Country and Type	Key Factors/Issues	Policy Implications
Hokkaido Green Fund	Japan - Success	Bottom-up participatory mechanisms, NGO transparency, community trust driven	Promoting Decentralized Governance: Establish community-led green funds, rely on NGOs to enhance transparency and public participation, reduce resistance to policy implementation
Yunnan Forest Carbon	China - Success	Carbon Pricing Mechanism innovation, Insurance Guarantee to reduce risk, Third Party Certification to enhance credibility	Innovative Risk Sharing: Promote "carbon sink + insurance" models, attract capital to institutionally weak regions through green finance
Sovereign Green Bonds	India - Success	International capital investment, centralized solar energy project management	International Capital + Local Adaptation: Aligned with global green finance guidelines, such as the International Capital Market Association (ICMA) principles, while tailoring a whitelist of projects that address the local energy transition needs and utilize funding from international multilateral institutions to mitigate sovereign credit risks and strengthen the enforceability of power purchase agreements through legal measures to ensure investor returns.
Transition Bonds	Japan Failure	Transitional technologies vaguely defined, lack of emission reduction KPIs tied to them, lack of regulation	Clarifying Transition Standards: Develop a technology whitelist (such as excluding "pseudo low carbon" technologies), mandate disclosure of fund usage and link it to emission reduction performance indicators
Solar Poverty Alleviation Project	China Failure	Scattered layout difficult to manage and protect, equipment of inferior quality passed off as good quality, and lack of post-installation operation and maintenance	Comprehensive Lifecycle Regulatory Mechanism: Establish mandatory certification for project site selection and technical standards, implement integrated "construction-operation and maintenance" bidding system to avoid separation of authority and responsibility, and set up special operation and maintenance funds with shared risk between government and businesses
Renewable Energy Project	India Failure	Corruption leading to misuse of funds, financial crisis in state-owned power companies, contract implementation failure	Addressing persistent structural problems: Establishing an independent anti-corruption body to monitor the flow of funds and reorganizing State-owned utility companies

6. Discussion

Case studies from Japan, China and India reveal the effectiveness of green finance in reducing carbon emissions. Among them, the success stories of Japan's Green Tariff System, China's Forestry Carbon Sinks Financing, and India's National Solar Mission demonstrate that green finance can significantly reduce emissions when supported by strong policy frameworks, transparent market mechanisms, and alignment with local socio-economic priorities. Community wind energy projects in Japan have flourished thanks to citizen participation and clear rules for managing funds, while carbon sink loans in China use policy-driven market mechanisms to monetize ecological assets. India's success in solar energy stems from the government's strategic goals and innovative financing structures such as sovereign green bonds. In contrast, the failures of Japan's transition bond controversy, China's inefficient PV poverty alleviation program, and India's Adani bribery scandal highlight systemic vulnerabilities. Ambiguous policy definitions, lack of technical oversight, and weak governance led to laundering and misallocation of funds. These cases emphasize that green finance cannot operate in a vacuum and that its environmental impact depends on rigorous accountability measures, third-party verification and adaptive policies tailored to regional challenges.

These findings are consistent with the literature emphasizing the role of financial sophistication and institutional capacity. Developed credit markets amplify the carbon mitigation effects of green finance, while regions with limited financial infrastructure rely more on grassroots innovation. This dichotomy suggests a two-way approach: mature economies should refine market-based instruments such as carbon trading, while developing regions need hybrid financial models that combine green credit with technical assistance and risk-sharing mechanisms. Critics' fears that green finance is a superficial label are partially confirmed, especially when lax standards lead to token compliance. However, the study also shows that well-designed green finance can incentivize real decarbonization, as seen in Yunnan's carbon sink projects or India's solar expansion. To bridge the gap between rhetoric and impact, policymakers must prioritize standardization, capacity-building and transparency.

7. Conclusions

This study confirms that green finance has great potential to accelerate decarbonization, but its success depends on environmental and systemic factors. Policy clarity and enforcement are fundamental. Ambiguous standards or weak regulation undermined credibility, while precise regulation enhanced accountability. Market mechanisms must be aligned with local realities. Developed regions benefited from sophisticated instruments such as carbon trading, while developing regions needed hybrid models combining green credit, insurance and international assistance to reduce risk. In resource-constrained environments, green innovation complements green finance. The solar mission in India and green microfinance in Kenya illustrated how grassroots innovation could fill the gaps left by underdeveloped financial systems. Transparency and governance are non-negotiable. Corruption or poor project management erodes trust and diverts funds from impactful initiatives.

To maximize the impact of green finance, governments and institutions should establish mandatory certification frameworks for green financial products to curb greenwashing. Develop risk-sharing mechanisms (e.g., carbon sink insurance) to attract private capital to high-risk sectors. Prioritize capacity-building projects for local banks and small and medium-sized enterprises (SMEs) to increase the viability of green projects. Promote international cooperation to harmonize standards and mobilize cross-border climate finance. Future research should explore the long-term outcomes of green finance interventions and assess the scalability of hybrid models in different socio-economic contexts. By addressing systemic barriers and utilizing localized strategies, green finance could evolve from a buzzword to a cornerstone of global decarbonization efforts.

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