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Case study on Sovereign Green Bonds (SGBs) Impact on Sustainable Green Public Sector Infrastructure: For Reducing Green Finance Gap

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Abstract
Purpose: The Indian government and RBI have introduced sovereign green bonds to adhere to the Nationally Determined Contribution (NDC) and the framework of the United Nations Framework Convention on Climate Change (UNFCCC). The 2021 COP 26 UN Climate Change conference in Glasgow and COP27 conference in Egypt will focus on the low carbon economy and the role of financial institutions in fostering a green economy. In order to meet the funding needs of public sector projects in the fields of wind, solar, hydropower, and a sustainable future, these initiatives seek to improve the Geranium of the Public Sector Infrastructure and solve social, economic, and environmental challenges. The International Energy Agency estimates that India has to spend about 160 billion a year in order to reach net-zero emissions and promote green jobs. The Green Bonds are issued by major countries like the UK, France, Germany, and the USA to finance environmental causes. The Climate Risk has an impact on GDP. It enables India to meet Sustainable Development Goals "SDG-6: Sustainable Water and Waste Management SDG -7: Affordable and Clean Energy, SDG-9: Industry, Innovation and Infrastructure, SDG-11: Sustainable Cities and Communities, SDG-13 Climate Action and SDG-15: sustainable use of the terrestrial ecosystem." . The funds raised through SGRBs can support India's Sustainable Development Goals (SDGs) and promote a green economy. This includes focusing on renewable energy, reducing reliance on fossil fuels, improving water and waste management, and promoting clean transportation. The Sovereign Green Bond (SGrB) framework was launched in 2022 to enable the Indian government to raise funds from the international market. Retail investors, foreign investors, and NRIs trading through the "International Financial Services Centre (IFSC) " can invest in these bonds with 100% FDI through the automatic route. India enters the JP Morgan Bond Index which will help to inflow FPI and integrate the Indian economy with the world economy—the Sovereign Green Bond 5PS Approach focuses on Protecting, Promoting, and Partnering, Public sectors and Plant for Sustainability.
Design/Methodology/Approach: This research relies on the case study approach, collecting secondary data from websites, journals, and literature reviews about public sector projects.
Findings/Results: The research aims to determine how the Sovereign Green Bond can help reduce the green finance gap and enable India's public sector to achieve Viksit Bharat.
Originality/Value/Novelty: The Sovereign Green Bond **Five P'S Approach** Protects, Promotes, and Partners with Public Sector Projects and Plants for Sustainability, which is designed to foster sustainable green public sector infrastructure and sustainable development.
Social Implication: The research focuses on how sovereign green bonds in India impact Sustainable Development Goals and how public sectors are utilizing the funds to protect the Environment, Social, and Corporate Governance.

Keywords: Government Policy; Reserve Bank of India; Sovereign Green Bonds; Public Sectors Projects; Viksit Bharat; Green Finance; SDGs; International Financial Services Centre (IFSC).

Introduction
The Government of India and its regulatory institutions have implemented measures for green growth, which is one of the seven priorities for environmental sustainability and economic development. These measures aim to broaden international financial resources in addition to domestic funds for green projects, focusing on attaining net zero carbon emissions and lowering the carbon footprint by 2070, as outlined in the "Panchamrit"

framework. India committed to increase financial flows during the 27th United Nations Conference of Parties (COP) held in Egypt. India's obligation to the 2015 Paris Agreement is fulfilled in part by the Green Bond market. Bansal, S et al.2023[1] and has shown the way for financial banking for green fiancé to combat climate change, The Indian government has begun mobilising private sector funds to close the financing gap in sustainable finance. The Green Bond in 2015-2016, developed a roadmap for a green bond debt finance instrument. In order to promote the responsible use of natural resources, SEBI and RBI have taken a number of actions to bring themselves into line with global markets and fulfill the Intended Nationally Determined Contributions (INDCs) and Lifestyle for the Environment at COP26. Based on the Green Bond Principles (GBP), their initiatives seek to grow the green bond market in both foreign and Indian contexts.

These principles focus on various projects, including renewable energy, sustainable waste management, clean transportation, climate change adaptation, sustainable water management, and energy efficiency projects first green bond was issued by banking namely YES Bank in the year 2015, by various organizations, Export-Import Bank of India, NTPC Ltd., they have raised the funds for RE, Low corban Transport, the investor for these projects are Commercial Banks, Institutional Investors, Corporates, Individual investors, World Bank, Asian Development Banks and Government Agencies.

Journey of Green Bond regulatory framework to promote Green Bond

Green bonds are debt instruments used to finance environmental projects that positively impact climate change. They are also referred to as climate bonds. These bonds can be issued by governments or businesses, including banks, to secure low-cost debt capital for environmentally friendly initiatives. At the conclusion of the loan period, the borrower promises to return the principal amount plus interest.

Year	Framework
2013	PACE-D TA Partnership to Advance Clean Energy Program for Development and Technical Assistance between US and India promoting Green Bonds focusing Financial Institutions IREDA, EESL, SECI and Indian Railways.
2014	Guidelines for Sustainability Green Bonds, Social Green Bond Principles, and Principles for Green Bonds (GBP) are maintained by the International Capital Market Association Secretariat.
2015	RBI published guidelines for issuing INR-denominated Masala Bonds for Banks, Corporate and Infrastructure Investment Trust.
2015	SEBI issued a Consultation Paper for Issuing and Listing Green Bonds for Green Projects.
2016	Passing of Finance Act to allow FPI and set up dedicated debt Segment exchange.

Source: Author

To support sustainable development of the environment, society, and economy, the green bond market serves as a financial source for green finance and expansion. The public sector's investment demands can be met, and sustainable development can be supported by using this financial instrument to raise money for projects at a comparatively cheap cost (Wiśniewski et al., 2019).[3]. In order to carry out eight key programs in the areas of solar energy, water, agriculture, the Smart Cities Mission, Green India, the Himalayan ecology, and strategic knowledge for climate change, the Indian government implemented the The NAPCC stands for National Action Plan on Climate Change. And habitat that is sustainable. Sovereign projects are financed with the backing of a sovereign entity (the Government of India), assuring risk and financing. These projects have significant environmental, social, and economic impacts. As of December 31, 2023, the Asian Development Bank (ADB) has committed to funding sovereign projects in sectors such as power, urban development, horticulture, and industrial corridors. The ADB has provided 623 public loans, grants, and technical assistance totaling $55.3 billion to India, with its current portfolio comprising 67 loans worth $14.15 billion (Source: Mint newspaper, May 29, 2024). The Sovereign Projects in India are also funded by the Multilateral Development Bank (MDB), The International Fund for Agricultural Development (IFAD), the Global Environmental Facility (GEF), and the World Bank Group, which have promoted more finance to emerging and developing economics to meet SDGs. MDBs provide external financial assistance to borrowers through different Instruments according meet the shifting requirements of borrowing nations via climate financing or fiancé
(Salian, P. V.,2023).) [4].

In accordance with the Paris Agreement, governments and corporations can issue green bonds to fund their Nationally Determined Contributions (NDCs). An important factor in luring investments meant to further sustainability is the green tax incentive. The SEBI Regulation 2023 divides green bonds into two subtypes: Yellow Bonds, which are intended for solar energy projects, and Blue Bonds, which are focused on marine and water management. This is true for both public sector projects and Indian corporate companies. They have made a substantial contribution to the advancement of sustainable finance by issuing green bonds in compliance with the Green Bond Framework.

As per the Bloomberg NEF report India has raised 42.9$ billion through green bonds between January 2014 to March 2023, it includes both Private Corporate and Government Owned REC, IRDA, NTPC, Indian Railway Finance Corporation and NHPC.

Sustainable Finance for achieving development goals and Net zero, to make India a developed nation by 2047, Sustainable finance will integrate Social, Environmental and Governances. In the year 2023, the Sovereign Green Bonds will promote green investment in the Nine sectors they are Solar, wind power, clean transportation initiatives, green building, waste management, sustainable forestry and agriculture, biodiversity conservation, sustainable infrastructure upgradation for mitigation and adoption and also achieving sustainable development goals(SDGs), the 17 SDGs include climate change, innovation, economic, equity, sustainable consumption, peace and justice., Green Bonds financing is an effective way It offers a more sustainable future by advancing environmental preservation and sustainability. The term "sustainable finance" describes funding for development in the three interrelated areas of the economy, environment, and society. Through public

and private sector initiatives, green finance entails investing in renewable energy, lowering industrial emissions, encouraging sustainable transportation, putting recycling programs into place, supporting organic agriculture, managing waste and water resources, encouraging eco-innovation, and developing clean technology. The goal of climate financing is to support efforts to mitigate and adapt to the effects of climate change. (Ryszawska, B. (2016) [5].
The RBI, SEBI and the International Financial Services Centre have strengthened the sustainable finance framework to reduce the funding gap by creating and developing the framework for sustainability-linked bonds, social bonds, sustainable bonds, green debt securities, and sovereign Green Bond to enhance the flow of foreign investment in environmentally sustainable projects. SEBI has framed the Business Responsibility and Sustainability Report (BRSR) relating to the ESG risk.
Sources of Sustainable finance for green projects and climate-related risks are: These finances are debt instruments issued to environmental projects:

Green bonds	Sustainable equity
Social or sustainable development bonds	Socially linked Bonds (SLB)
Carbon Credits	Impact Investments
Sovereign Green Bonds	Transition Bonds

Source: Author

Sovereign Green Bond Pathway for Green Infrastructure and Sustainable Development

India is committed to its Nationally Determined Contributions (NDC), which focus on achieving net-zero emissions, combating climate change, bridging infrastructure gaps, ensuring sustainable economic growth, and attracting investors for sustainable development.

1	To meet the subsidies to irrigation pumps under the PM-Kusum Scheme
2	Produce hydrogen under National Green Hydrogen Mission-Hydro Projects.
3	The carbon credit market is more inclusive by allowing companies to participate in reducing their carbon footprint.
4	More EVs by reducing battery cost through introducing a Battery Swapping policy through the PLI Scheme on Advanced Chemistry Cell
5	Nagar Van Yojana to build 1000 Nagar Vans (Urbanforests) in India.
6	To Build renewable energy through solar, wind, and tidal to reduce coal consumption to achieve net zero and also create a green energy corridor
7	Public EV charging stations to support EV adoption
8	Green transportation through FAME Scheme (Faster adoption and manufacturing of electric vehicles).
9	DeDeveloping carbon Capture, Utilization and Storage (CCUMS) technology

Source: Forbes

Management of Sovereign Green Bond Issue and Proceeds in India.

Process	Focus Area
Issue and management of SGrB	Government of India and RBI issue and manage SGrBs
Regulation and Investment by FII	"The Reserve Bank of India (RBI) has allowed Foreign Institutional Investors (FIIs) operating within the International Financial Services (IFSC) to invest in India Sovereign Green Bonds (SGrBs)"
Deposit of the proceeds	SGrBs proceeds will be deposited into the Consolidated Fund of India and managed by the "Ministry of Finances Public Debt Management Cell."
Audit of Allocation and Utilization of SGrBs	The Comptroller of Auditor General (CAG) of India will audit allocation and Utilization.
Selection of Eligible Project for Funding	Chief Economic Advisor Heads Green Finance Working Committee (GFWC).
Types of Projects for Utilization of SGrBs	Climate adaptation and climate mitigation projects such as clean transport, climate change adaptation projects, aquatic biodiversity conservation, renewable energy infrastructure, energy efficiency and land preservation.
Investors for SGrB	Retail investor, NRIs, Foreign Portfolio Investors (FPIs) registered with SEBI
Sustainable Development Goals	Funds from SGrBs can be utilized for initiatives that contribute to India's Sustainable Development Goals (SDGs) for a sustainable future.
Interest payment	Inventors receive interest payments on their investments twice a year which are credited to the primary Bank Account.
Tracking the performance of Sovereign Green Bonds	NSE has launched Sovereign Green Bond indices to track the performance of Green Bonds issued by the GOI.
Role of IFSCA-International Financial Services Centres Authority	It provides a platform (Secondary Market) for trading and settlement of SGrBs for attracting foreign Investment for green infrastructure projects

Source: Author

Indian Sovereign Green Bond Market to Create Green Assets

To further the nation's sustainability objectives, the Indian government suggested introducing Sovereign Green Bonds in the Union Budget for 2022–2023. These bonds' revenues will go toward public sector initiatives to create green assets, like sustainable fields and green buildings. From an economic, social, and environmental standpoint, this project is noteworthy (Cretu, R. F. et al., 2014). [6]. According to guidelines released by the Reserve Bank of

India (RBI), persons, Non-Resident Indians (NRI), Foreign Portfolio Investors (FPI) registered with the Securities and Exchange Board of India (SEBI), and Overseas Citizens of India (OCI) may all invest in Indian Sovereign Green Bonds (SGrBs).

Indian Sovereign Green Bond Framework is recognised and aligned with International Capital Market Association (ICMA) Green Bond Principles 2021, These bonds will be listed on the "NSE Sovereign Green Bond Indices" and traded in the "Gujarat International Finance Tec-City International Financial Services Centre" (GIFT IFSC) and the BSE-established India International Exchange (India INX) in the IFSC. This initiative is supported by the "International Financial Services Centres Authority (IFSCA)", which aims to attract foreign investment and create a platform for sustainable finance in India. The IFSCA was established by passing a special act in Parliament in 2020, the International Financial Services Centre Authority Act, 2000 (Kashyap, A. K. et al., 2022) [7].

The IFSCA has regulatory powers over four financial services authorities in India: "The Reserve Bank of India (RBI), the Securities and Exchange Board of India (SEBI), the Insurance Regulatory and Development Authority of India (IRDAI), and the Pension Fund Regulatory and Development Authority of India (PFRDAI)."

2. Conceptual Framework for The 5P APPROACH: (Protecting, Promoting, Partnering, Public Sector and Planet)

The much-needed new capital pool to fund the nation's green transition may be drawn to India by its sovereign green bond. Since none of the BRICS countries have yet to issue a sovereign green bond, India's would put it in a leadership position among the main emerging economies. An important step to increase the rupee's liquidity in international markets and reduce foreign exchange risk is the issuance of a sovereign bonds denominated in rupees. the money raised from the bond will be used for clean transportation, climate change adaption initiatives, and the preservation of aquatic biodiversity.

Infrastructure for renewable energy, land preservation, and energy efficiency are some initiatives that have benefited from the profits of sovereign bonds. Infrastructure is seriously at risk from the frequent occurrence of extreme weather events including floods, droughts, and cyclones. By offering affordable financing choices, sovereign green bonds can aid in the expansion of electric buses and related charging infrastructure in India. The "Strategic Framework for Development and Climate Change" was introduced by the World Bank in 2008 to help organize and encourage governmental and private sector efforts to address climate change. The first green bond issued by the Polish government in 2016 marked the beginning of this movement. Up to 38 national governments have released green bonds.

India's SGrB framework. The framework highlights the government's intended use of this funding. It declares that all qualified green spending must include public spending on public sector programs that help reduce the economy's carbon intensity, including investment, subsidies, grants-in-aid or tax-foregone, and research and development expenditures. The architecture also determines areas that are completely forbidden to SGrBs. Green transportation is one of the sectors the government wants to focus on luring investments into with its sovereign green bonds.

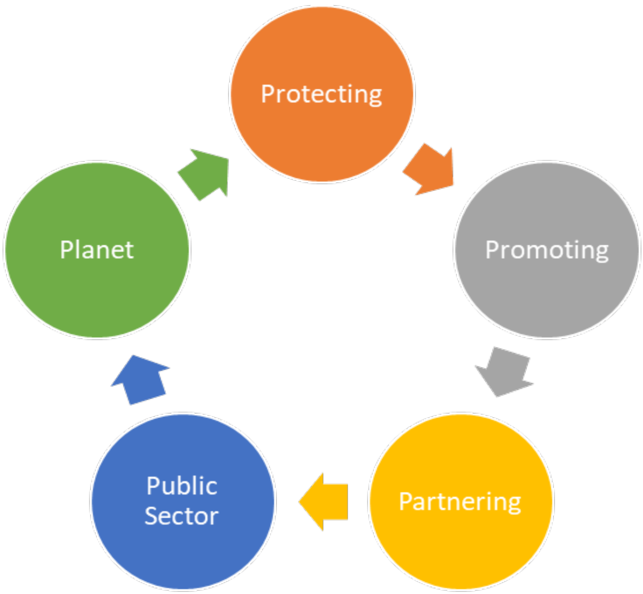


Fig. 1: Conceptual framework for the 5P approach.

2.1Protecting:

Protecting in several ways. In order to facilitate the transaction, the Government of India received technical support from the Services. The Chief Economic Adviser chairs the green finance working committee, which is composed of representatives from the Ministry of Finance (MoF), the Ministry of Environment, Forests, and Climate Change, the Niti Aayog (India's leading public policy think tank), and implementing departments. Consists of representatives from implementing departments, the Ministry of Environment, Forests, and Climate Change, the Niti Aayog (India's leading public policy think tank), and the Ministry of Finance (MoF). It is chaired by the Chief Economic Adviser and consists of representatives from the Ministry of Environment, Forests, and Climate Change, the Ministry of Economy, and the Ministry of Finance (MoF)."

2.2 Promoting through policy: The Government of India to facilitate the Promoting through policy: want to issue sovereign green bonds to fund carbon intensity reduction projects in the public sector. An important step towards sustainability has been taken with the launch of India's first sovereign green bonds, which are in line with India's five "Panchamrit" essential climate action components. India launched the LIFE movement has forced SGrBs issued by the Government of India. It marks a significant amendment to existing Foreign Exchange Management regulations, detailing that the RBI has mandated stringent “Know Your Customer (KYC) and Anti-Money Laundering (AML)” practices, along with rigorous data management and reporting protocols to ensure transparency and compliance with Indian laws. Scope of participation, settlement processes, and the roles of various entities within the IFSC and the Green Bonds Principles of the “International Capital Market Association (ICMA)” include projects that qualify for green bond funding. ESG and Sustainable Finance Advisory from the World Bank.

2.3 Partnering for Sustainability: The Indian government and RBI launched the Sovereign Bonds, a financial instrument that. Encourage environmentally sustainable projects. India's Sovereign Green Bonds (SGrBs) have partnered with the World Bank to get technical assistance and to maximise finance for climate transition, and SIDBI has partnered with AFD and Shakti to launch the Green Indian Financial System (GIFS) Initiative for green growth. The Indian Government bonds in JP Morgan emerging market debt index and SIDBI have partnered with AFD and Shakti to launch the Green Indian Financial System (GIFS) Initiatives, and indices National Stock Exchange subsidiary has launched Sovereign Green Bond indices to track the performance.

In 2019, the India INX, the Luxembourg Stock Exchange, introduced its sustainable listings and trading platform. Opportunities for dual listing, boosting visibility, and secondary market trading in green will be provided by the Luxembourg Stock Exchange, one of the largest and most popular venues for issuers internationally to list green and sustainable bonds. GSM Green is a marketplace dedicated to trading and generating money for sustainable, socially conscious, and green bonds.

To grow the market and draw in foreign investors, the RBI has introduced a program for the exchange and payment of Sovereign Green Bonds (SGrBs) in the International Financial Services.

2.4 Public Sector Undertaking: Sovereign. The purpose of green bonds is to finance public sector green infrastructure initiatives. The bonds' revenues will be used to fund environmentally friendly public sector initiatives, lowering the economy's carbon footprint.

It aids in the creation of environmentally friendly public sector resources. It includes clean transportation, energy efficiency, environmental transformation, green construction, environmentally friendly waste and water management, environmental damage prevention and control, and initiatives to preserve terrestrial and aquatic biodiversity in order to help the government raise money for public sector projects with sustainable goals. SGrBs are used as financing or refinancing expenditures in green public projects to reduce the carbon intensity of the economy.

Public spending made through investment, grants, subsidies, or taxes avoided, as well as certain operational and research and development costs in public sector initiatives, will be included in all qualified green project expenses.

2.5Planet:

The country's Law contains clauses about the protection of wildlife, forests, and the improvement and preservation of the environment. India underlined the necessity of boosting financial inflows to countries that are developing to aid in their fight against and adjustment to global warming. As India progresses toward resilient, inclusive, and green development, it also underlined the importance of funding as well as green initiatives and endeavours that will support the country's ecological and economic objectives. The financial industry may drastically lower the total risks related to climate change by shifting money from carbon-emitting sectors to those that mitigate carbon emissions and promote ecological preservation.

3. Literature Review

An essential financial tool for financing environmentally friendly initiatives is the Green Bonds.

The issuance of bonds greatly improves issuer accountability and the transparency of environmental investments, claims Flammer (2021). The report emphasises the necessity of regulated frameworks to guarantee the integrity of green projects and the significance of investor confidence in the green bond market.

Sl.No	Focus	Authors	Area of Study
1	Research paper Explore the evolving market of green bonds in India, revealing that they are crucial for mobilizing private investments in renewable energy and sustainable infrastructure. Their findings indicate that regulatory support, such as issuing guidelines by the Regulatory body SEBI , is essential for promoting green bond adoption.	**Karpouzas et al. (2021) [8]**	**Green Bonds**
2	This study examines the way sustainable bonds affect business conduct and finds that companies that issue green bonds typically implement more environmentally friendly procedures. According to their research, green bond issuance and corporate social responsibility (CSR) initiatives are positively correlated, underscoring the advantages that both issuers and investors enjoy.	**Ghosh s (2020) [9]**	**Green Bonds**
3	This study examines the way sustainable bonds affect business conduct and finds that companies that issue green bonds typically implement more environmentally friendly procedures. According to their research, green bond issuance and corporate social responsibility (CSR) initiatives are positively correlated, underscoring the advantages that both issuers and investors enjoy.	**Chatterjee (2022) [10]**	**green Bonds**
4	presents a thorough rundown of the Asian sustainable bond market with an emphasis on India's involvement. In order to increase the appeal of green bonds to both domestic and foreign investors and ultimately support sustainable development goals, the paper highlights the necessity of strong regulatory frameworks and incentives.	**ADB (2020) [11]**	**Green Bonds**

Source: Author

Governments must issue sovereignty green bonds in order to fund ecologically friendly initiatives. 2020 World Bank research claims that these bonds can attract international investment and demonstrate a nation's commitment to achieving its climate goals. The report provides India with a helpful model to follow by listing a number of nations that have successfully issued sovereign green bonds.

Sl.No	Focus	Authors	Area of Study
5	**This article** examines India's first sovereign green bond issuance, focusing on the implications for fiscal policy and green finance. The study concludes that such initiatives can catalyze investment in renewable energy and infrastructure, driving long-term sustainable growth.	**Patel (2021) [12]**	**SGrB**
6	Analyze the impact of Sovereign green bonds on national economies, arguing that these instruments can lead to lower borrowing costs and improve fiscal stability. The research highlights how India's commitment to sustainable development can be reinforced through sovereign green bonds.	**Khan et al. (2022) [13]**	**SGrB**
7	The difficulties emerging economies, like India, encounter while issuing sovereign green bonds are covered in the study piece. According to the study, in order to improve market participation and investor confidence in these products, a strong regulatory framework and investor education are required.	**Sakson (2021) [14]**	**SGrB**
8	It sheds light on the possible advantages of sovereign ecological bonds for Indian public financing. According to their research, these bonds can successfully raise funds for infrastructure that is climate resilient, bringing public financial management into line with sustainable development objectives.	**Iyer et al. (2021) [15]**	
9	This study employs a descriptive research methodology to examine the evolution, operational characteristics, challenges, and investor expectations surrounding Sovereign Green Bonds (SGBs) using India as a case study. The research covers the years 2016–2023 and uses a conceptual approach to examine the market's evolution. The findings demonstrate that by integrating science-based solutions, fiscal policy, and investment, SGBs provide a novel way to connect green finance with environmental concerns. Future SGB frameworks and strategies aimed at allocating funds to pressing global sustainability concerns are intended to be informed by these observations. Issued with central government support, Sovereign Green Bonds have become more and more well-known. SGB profits are used to fund green projects, such as efforts to reduce greenhouse gas emissions, employ alternative energy sources, and develop renewable energy. as well as initiatives to lessen dependency on carbon-based energy sources and mitigate climate change. Global interest in SGBs is predicted to increase as governments work to meet UN climate change targets.	**Yadav, A [2024] [16]**	**SGrB and SDG**
10	The emergence of successful sovereign green bond programs has provided significant insights for the European Union. Specifically, the experiences of countries such as France and Germany illustrate effective strategies for establishing robust frameworks for green finance. Frances's initiative is one of the earliest, generating significant capital for sustainable projects while adhering to strict climate-related guidelines. This commitment not only bolstered domestic investments but also attracted international interest, reinforcing Frances's position as a leader in environmental finance. Similarly, Germany's green bond framework exemplifies transparency and accountability, with quantifiable environmental results and thorough reporting on the distribution of profits. These successful models demonstrate that aligning governmental fiscal strategies with sustainability goals can enhance investor confidence and catalyze additional funding for eco-friendly initiatives (Ketterer JA et al., 2019-09-27). Thus, these case studies underscore the potential for sovereign green bonds to facilitate substantial progress toward a greener economy within the EU.	**Dencheva Tsonkova, V. (2019) [17]**	**SGrB**

4. Research Gap

A number of research gaps still exist in spite of the expanding corpus of work on environmentally friendly sovereignty green securities, sustainability in infrastructure projects managed by public sector organizations (PSUs), and the alignment of green finance with the Sustainable Development Goals (SDGs). First, there is little empirical study on the long-term effects of green bonds on social and environmental outcomes, especially in the Indian setting, despite the fact that many studies emphasize their potential to raise money for sustainable initiatives. Furthermore, the existing literature often focuses on individual aspects of green finance without sufficiently addressing the interplay between various financing mechanisms, such as sovereign green bonds and private sector investments. Additionally, while some studies explore the challenges faced by PSUs in implementing sustainable infrastructure projects, there is a lack of comprehensive frameworks that evaluate the effectiveness of policies and regulations designed to promote sustainability within these units. Moreover, the role of stakeholder engagement and public awareness in enhancing the success of green finance initiatives remains underexplored, limiting our understanding of how to effectively mobilize community support. Finally, although the alignment of green finance with SDGs is increasingly recognized, the operationalization of these goals in financing practices and the measurement of their impact require further investigation. Addressing these gaps could offer insightful information to practitioners and policymakers that want to increase the efficiency of green financing in attaining sustainable development.

5. Research Objectives

Sustainable finance, or climate finance, supports green infrastructure, reduces the finance gap related to climate change, and meets The 17 Sustainable Development Goals (SDGs) and the nation-wide contributions (NDCs). Maintaining a financial flow is crucial. The goals are framed as follows:

1. To comprehend how green bonds progress to become

sovereignty sustainable bonds.
2. To Determine the Sovereign Green Bond's Impact
3. To research the Emerging Economy's Sovereign Green Bonds for the development of green infrastructure.
4. To examine the market for Indian Sovereign Green Bonds
5. To evaluate the Sustainable Development Goals of the Sovereign Green Bond

6. Methodology

Research Method: This research relies on the case study approach and gives direction for sustainable finance growth.

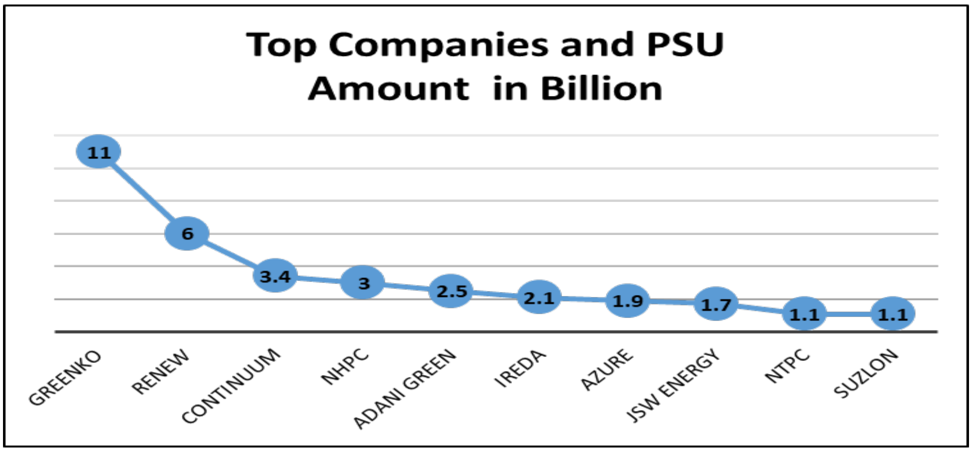
Data Collection: A variety of academic and commercial periodicals, textbooks, research papers, and official websites are the sources of secondary data used in this study. Because this topic is always changing, pertinent information has also been gleaned from business media and examined in government publications.

7. Data Analysis

Table 1: Green Bond issued by both Corporate and Public Sector Undertaking (In Billion$ 2023).

Top Companies and PSU	Amount in Billion
Greenko	11.0
Renew	6.0
Continuum	3.4
NHPC	3.0
Adani Green	2.5
IREDA	2.1
Azure	1.9
JSW Energy	1.7
NTPC	1.1
Suzlon	1.1

Source: Grip. Invest.



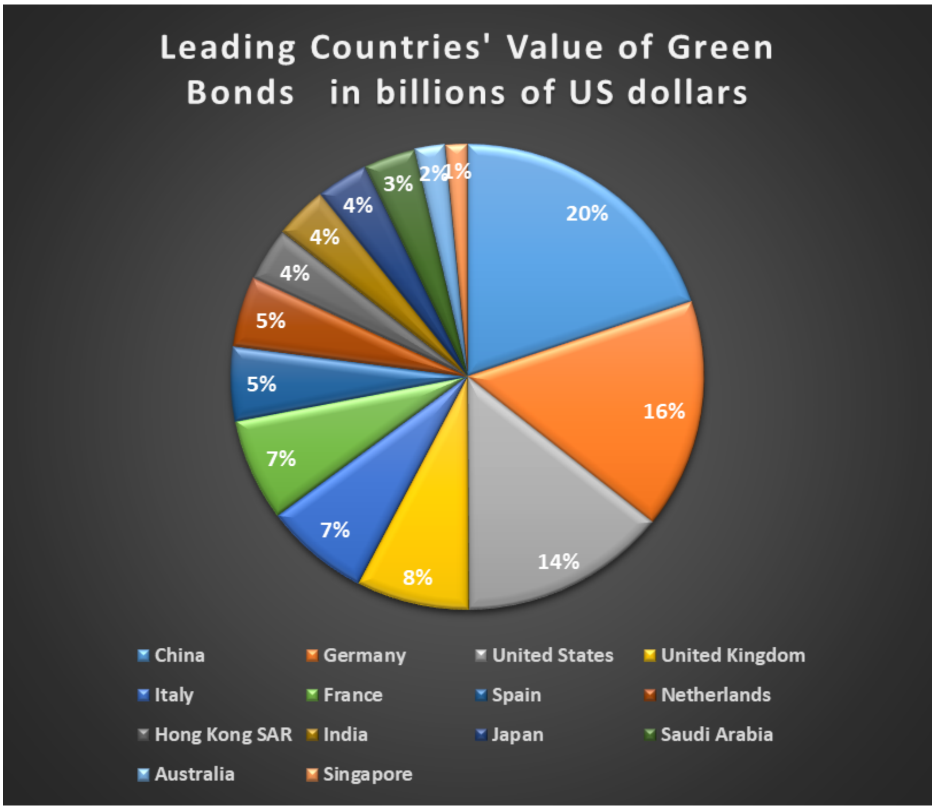
Graph 1: Green Bond issued by both Corporate and Public Sector Undertaking.

Financing sustainable infrastructure in both developed and emerging markets requires using sustainable finance instruments such as social bonds, sustainability bonds, green bonds, Environmental bonds, and sustainability-linked bonds. As they seek to produce financial gains while preserving the environment, these instruments are crucial to achieving the 2030 Goals for Sustainable Development that has been set forth by the UN.

Table 2: Value of Green Bonds Issued Worldwide in 2023 by Leading Countries (in billions of US dollars).

Countries	Value in billions of US dollars
China	$83.51
Germany	$67.51
United States	$59.85
United Kingdom	$32.67
Italy	$3034
France	$29.97
Spain	$21.77
Netherlands	$20.59
Hong Kong SAR	$15.63
India	$15.39
Japan	$15.02
Saudi Arabia	$15.01
Australia	$8.78
Singapore	$6.38

Source: STATISTA.COM



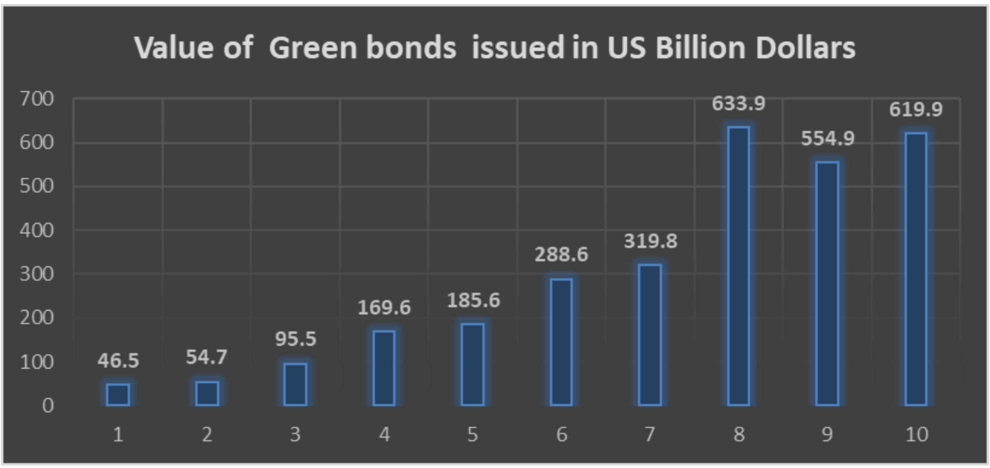
Graph 2: Leading Countries' Value of Green Bonds Issued Worldwide in 2023.

One important financial tool for ecologically sustainable activities is the green bond market, which also supports such activities by allocating the proceeds to eco-friendly initiatives (Dan, A. et al.2021). According to Statista, there are over 150 countries and 28 currencies that are issued by various nations.

Table 3: Global Green Bond Issue Value, 2014–2023.

Year	US Billion Dollars
2014	46.5
2015	54.7
2016	95.5
2017	169.6
2018	185.6
2019	288.6
2020	319.8
2021	633.9
2022	554.9
2023	619.9

Source: statista.com



Graph 3: Global Green Bond Issue Value, 2014–2023.

Table 4: Auction Result of Sovereign Green Bonds.

Sovereign Green Bonds- Full Auction Results

	Auction Results	NEW GOI SGrB 2028	NEW GOI SGrB 2033
I.	Notified Amount	₹4000 Crore	₹4000 Crore
II.	Underwriting Notified Amount	₹4000 Crore	₹4000 Crore
III.	Competitive Bids Received		
	(i) Number	96	170
	(ii) Amount	₹13525 Crore	₹19367 Crore
IV.	Cut-off price / Yield	-	-
		7.10%	7.29%
V.	Competitive Bids Accepted		
	(i) Number	32	57
	(ii) Amount	₹3993.124 Crore	₹3948.646 Crore
VI.	Partial Allotment Percentage of Competitive Bids	81.62%	22.15%
		(11 Bids)	(23 Bids)
VII.	Weighted Average Price/Yield	100	100
		(WAY: 7.1000%)	(WAY: 7.2900%)
VIII.	Non-Competitive Bids Received		
	(i) Number	2	4
	(ii) Amount	₹6.876 Crore	₹51.354 Crore
IX.	Non-Competitive Bids Accepted		
	(i) Number	2	4
	(ii) Amount	₹6.876 Crore	₹51.354 Crore
	(iii) Partial Allotment Percentage	100% (0 Bids)	100% (0 Bids)
X.	Amount of Underwriting accepted from primary dealers	₹4000 Crore	₹4000 Crore
XI.	Devolvement on Primary Dealers	NIL	NIL

Source: RBI Press Release

8. Analysis Of Case Studies

8.1. An Analysis of a Non-Sovereign Green Bond Case

1. Case Study on ADB Issued Indian Rupee Green Bond to Meet –Sustainable Finance

1. **Asian Development Bank (ADB**) has committed to funding sovereign projects and for the funding requirements ABD has sold Green Masala Bonds worth Rs3 Billion $46 Million to fund solar and wind energy. The Maturity period is 3.75 years at the rate of 6%, the subscribers to these green Masala bonds are Europe at %, Americas21 at % and Asia at 9%. It will be listed on the Luxembourg Stock Exchange. ADB raised its first Indian rupee green bond in 2017. (Source: Clean technical.com, MERCOM and Author)
2. **ADB has financed** $200 million to enhance clean energy in the state of Uttarakhand Electricity Supply.
3. **IFC-International Finance Corporation** backed by the World Bank issued Masala Bonds in 2014 to raise 1000 core finance and in 2015 issued green masala Bonds worth3.15 billion to promote funds for climate change.

Masala Bonds are denominated in Indian currency and issued outside India by Indian entities to raise funds for infrastructure projects.

Through a number of organizations, such as Public Sector Banks, State-level Public Enterprises, and Central Public Sector Enterprises, the Indian public sector has been instrumental in the country's economic development. These organisations are classified as Maharatna, Navratna, and Miniratna, key players in the green finance market. Addressing climate change and lowering greenhouse gas emissions are the goals of their initiatives. Initiatives to address the financing gap in sustainable finance, such issuing green bonds, are necessary to mitigate climate change.

2. Case Study on Green Bond Issue by REC Ltd.,

In 2024, Indian PSU issued its first USD bond, a $500 million green dollar bond issued by REC Ltd, a Maharatna firm registered with the RBI as a Public Finance Institution, Infrastructure Finance firm, and Non-Banking Financial Company (NBFC). This issue complies with the RBI's External Commercial Borrowings (ECB) regulations and the Green Finance Framework. The bond, which is intended to finance a variety of green projects, has a five-year term and a coupon rate of 4.75% that is paid semi-annually. It would be listed on the NSE IFSC in GIFT City as well as. the India International Exchange's Global Securities Market (India INX). also constructs roads and other non-power infrastructure and serves as a strategic partner in government initiatives.

.By issuing yen-denominated green bonds, REC Ltd., the biggest non-sovereign yen-denominated issue from, Asia's South and Southeast entered the Japanese bond market. At a yield of 1.76%, the issue size of 61.1 billion is equal to $10 billion USD over five, five-and-a-half, and ten years.1.179% and 2.20 percent to build sustainable development projects

8.2 Countries issue sovereignty green bonds to mitigate the economic effects of environmental change.

3. Case study on Sovereign Green Bond issued globally in -2023

The UNFCCC standing committee notes in the Business World report "Partly Cloudy, Partly Clear Skies" that developing countries will need at least $5.8 trillion by 2030 to meet climate adaptation goals and reduce the climate finance gap.

Their Nationally Determined Contributions (NDCs), which seek to cut emissions and prepare for the effects of climate change, depend on this funding. In 2022, 35 sovereign nations sold $169 billion in Sovereign Green Bonds (SGrB) to support climate adaption goals and the financing gap in underdeveloped and emerging markets. Of them, 169 countries issued sovereign green bonds, including seven that issued SGrB for the first time and 17 developed and 18 rising nations.

4. Case study of Sovereign Green Bonds issued global country:

1.Polond:

It granted USD 850 million and used it for afforestation, sustainable agriculture, clean transportation, renewable energy, and subsidies.
2. Nigeria: USD 29.7 million Energy and resource efficiency, a better electrical infrastructure, clean technologies, and renewable energy are examples of mitigation. Sustainable forest management through adaptation. The Central Bank of Nigeria's (CBN) Green Bond Proceeds Account will receive the proceeds. Amounts will be moved to sub-accounts that are specific to each project.
3. Fiji: (USD50m): The first developing nation to issue a sovereign green bond, it covers expenses like tax exemptions, tax credits, and subsidies that encourage additional private sector capital mobilization for green investment.
4. Nigeria: USD 29.7 million Nigeria is the initial African nation to issue the government sustainable bond. It is the first Climate Bonds as well. A sovereign bond with certification Projects in the following categories are eligible: Examples of mitigation include clean technologies, renewable energy, improved electrical infrastructure, and energy and resource efficiency. Adaptation-based sustainable forest management.
5. Belgium: The two primary strategic objectives of Belgium's EUR4.5 billion sovereign green bond are to assist the expansion of the market for ecological bonds and to raise funds for the country's environmental and climate policy. The funds will support the circular economy, energy efficiency, renewable energy, low-carbon transportation, and resource and land use.

Source: climate bond initiatives.

9. ABCD Analysis

The advantages, benefits, restrictions, and disadvantages (Aithal P.S et al.) [18–32] associated with the Sovereign green bond and sustainable development goals were analyzed using the ABCD framework.

9.1 Advantages of Sovereign green bond:

1. 1. SGrB promotes the Indian currency worldwide while also supporting ecological objectives.
2. The revenue generated from the sovereign green bonds will be used to fund green investments and environmentally friendly initiatives in the government sector that will lower the carbon intensity of the economy.
3.SGrB stimulate economic growth and create green jobs.
4.Government-backed bonds SGrB provide stable returns and consider safer investment compared to corporate bonds.
4.RBI has permitted to FIIs including insurance companies, pension funds to invest in India’s green projects and it has expanded the capital available for funding the country’s sustainability goals.
5.SGrB has been given importance for Greenium for investors to invest in environmental sustainability.
6. Green bond investments may be eligible for the statutory liquidity ratio (SLR), which is the minimal proportion of deposits that commercial banks must allocate to liquid assets including SGrBs, government bonds, and green bonds.
7. Government Insurance Regulation Improvement Board of India considers SGrB investments as financing investments in government securities.

9.2 Benefits of the Sovereign green bond

1.Financing in green infrastructure projects has positive impact on the Indian Economy interms of Employment,GDP, health and technology innovations.
2. Sovereign green bond positive impact on Sustainable development goals such as Innovation, Health, Community, Environment.
3. Sovereign green bond will build a global green finance ecosystem
4. Two new financial instruments that might attract private investors are green bonds and the straightforwardness with which a company's CSR funds can be distributed to green projects.
5. Sovereign green bond is safe financial instrument and generate safe return to investors.
6. In addition to supporting India's energy transformation initiatives, Sovereign Green Bonds will provide funding for renewable energy and green infrastructure projects.

9.3 Constraints of the Sovereign Green bond

1.the complexity of measuring the actual environmental benefits associated with SGrB.
2.The green bond certification for the green infrastructure in developing countries hindrance for fund infow.
3.There should be separate Sovereign green bond reporting framework (SGrBR)for the public sectors Undertaking to bring more transparency and governance.
4.Sovereign green bond market in india is a early stage and it as more associated with different regulations like SEBI, IRDA, Pension funds Regulations has created more transparency.
5.Greenwashing including false positives impact by the PSU on Green infrastructure.
6.Enhancing investor education on the financial returns and green bonds' effects on the environment are essential for increasing SGrB participation.

9.4 Disadvantage of the Sovereign green bond

1.The Greenium for the SGrB based point (bps) are very from country-to-country issue it makes the investor portfolio diversification.
2.the term of Sovereign green bond is to longer it attracts the investor.
3. Sovereign green bond is not attractive to the domestic investor due to limited liquidity.
4. There is a lack of credit rating and rating guidelines for SGrB bonds.
5. SGrB required clear criteria for analysing the environment impact and it discharge the investor.
6. FPI prefer the dollar due to widely accepted currency, to overcome this RBI should issue the SGrB in three different currencies to attract Investment for green infrastructure.

10. Conclusion

Sovereign Green Bonds (SGBs) have become an essential instrument. in financing sustainable public infrastructure and narrowing the green finance gap. Mobilizing funds specifically for environmentally friendly projects, SGBs enable governments to align economic growth with sustainability goals, such as transitioning to renewable energy, increasing urban resilience and energy efficiency. Adopting SGBs increases investor confidence by diversifying funding sources and promoting open use-of-proceeds frameworks and thorough impact reporting.

The issuance of SGBs catalyzes private investment in green infrastructure by setting benchmarks and demonstrating the feasibility of sustainable projects, thereby fostering a broader green finance ecosystem. However, to maximize impact, governments must ensure efficient deployment of funds, implement stringent monitoring mechanisms, and address challenges such as market volatility and institutional capacity gaps. By strengthening collaboration among stakeholders, SGBs can significantly advance sustainable development goals while mitigating climate risks, setting a precedent for long-term environmental and economic stability.

11. Further Research

Future research on sovereign green bonds (SGBs) could focus on comparing India's approach with those of developed and emerging economies, particularly in raising funds for sustainable infrastructure. Key areas of exploration include assessing the impact of SGBs on financing green projects and reducing carbon emissions, understanding investor behavior and strategies to broaden participation, and analyzing the implications of SGBs on policy and regulatory frameworks.

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