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A SYSTEMATIC LITERATURE REVIEW OF ESG EVALUATION IN INDIA'S RENEWABLE ENERGY LEADERS

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Abstract

This study systematically reviews the integration of Environmental, Social, and Governance (ESG) evaluation frameworks in India's renewable energy sector, focusing on their alignment with sustainable finance objectives. As India emerges as a global leader in renewable energy, the demand for robust ESG evaluation has grown, driven by stakeholders' increasing awareness of sustainability. It introduces about the nexus between ESG principles and India's renewable energy landscape, emphasizing their critical role in advancing sustainable development goals (SDGs).

In this research paper researchers tried to identify renewable sector companies which is registered on NSE and primarily focused on ESG parameter. Researchers focus on SLR method (Systematic Literature Review) and tried to study its impact on society. It's The literature review explores key academic and industry research on ESG practices in India's leading renewable energy companies, identifying methodologies, challenges, and the evolving regulatory landscape. Furthermore, the study discusses how sustainable finance mechanisms—such as green bonds, impact investing, and carbon credits—complement ESG-focused strategies to enhance environmental and social outcomes.

The findings contribute actionable insights for policymakers, investors, and industry stakeholders to strengthen ESG evaluation frameworks. By bridging existing research gaps, this review aims to support the renewable energy sector in achieving a balance between financial performance and sustainability imperatives.

Keywords: *ESG, financial framework, SLR, societal outcomes*

1. INTRODUCTION

Environmental, Social, and Governance (ESG) metrics have become integral to sustainable finance, reshaping the way businesses operate in the modern economy. As a frontrunner in the global renewable energy transition, India provides a compelling case for examining how ESG assessments contribute to the sustainable development of its energy sector. With ambitious goals for renewable energy expansion and a growing emphasis on sustainability, Indian corporations are increasingly focused on aligning financial performance with environmental stewardship and social accountability.

This research undertakes a systematic review of existing literature to evaluate ESG practices among India's leading renewable energy companies. By analysing prior studies, the review explores how ESG frameworks affect critical aspects such as financial planning, operational effectiveness, and value creation over time. Additionally, it identifies existing gaps in ESG assessment methodologies and emphasizes the importance of policy frameworks, technological advancements, and stakeholder involvement in enhancing ESG performance.

The study is positioned within the larger paradigm of sustainable finance, where environmental conservation, social responsibility, and robust governance practices redefine the parameters of corporate achievement. As India advances toward a sustainable and low-carbon economy, understanding the interdependencies between ESG principles and renewable energy strategies becomes essential. This systematic review offers an academic perspective to guide stakeholders in fostering a more inclusive and resilient renewable energy ecosystem in India.
To study this researcher focused on the method of SLR – (Systematic Literature Review) and tried to identify renewable sector which adopt ESG as a major determinant and it's impact on economic decision. Researchers tried to study PESTEL analysis at global glance which suggested some important movement of this factor.
In this research the following papers would study at the first glance and then from different parameters we came to identify the final paper which were related to our study. We decided total **Nine Parameter** bases for the SLR and on the bases we evaluated our literature review.

- Company base
- Ratio base
- Green finance
- Renewable energy
- Sustainable finance
- Case study base LR
- Government policies impact of ESG
- CSR activities association with ESG and financial performance of RE companies
- ESG Landscape

OBJECTIVE OF THE RESEARCH:

- To evaluate the impact of corporate renewable energy initiatives on advancing sustainable development.
- To examine the critical drivers of green growth, including policy frameworks, socioeconomic progress, energy utilization, and technological advancements.
- To explore the connection between green finance and renewable energy production.

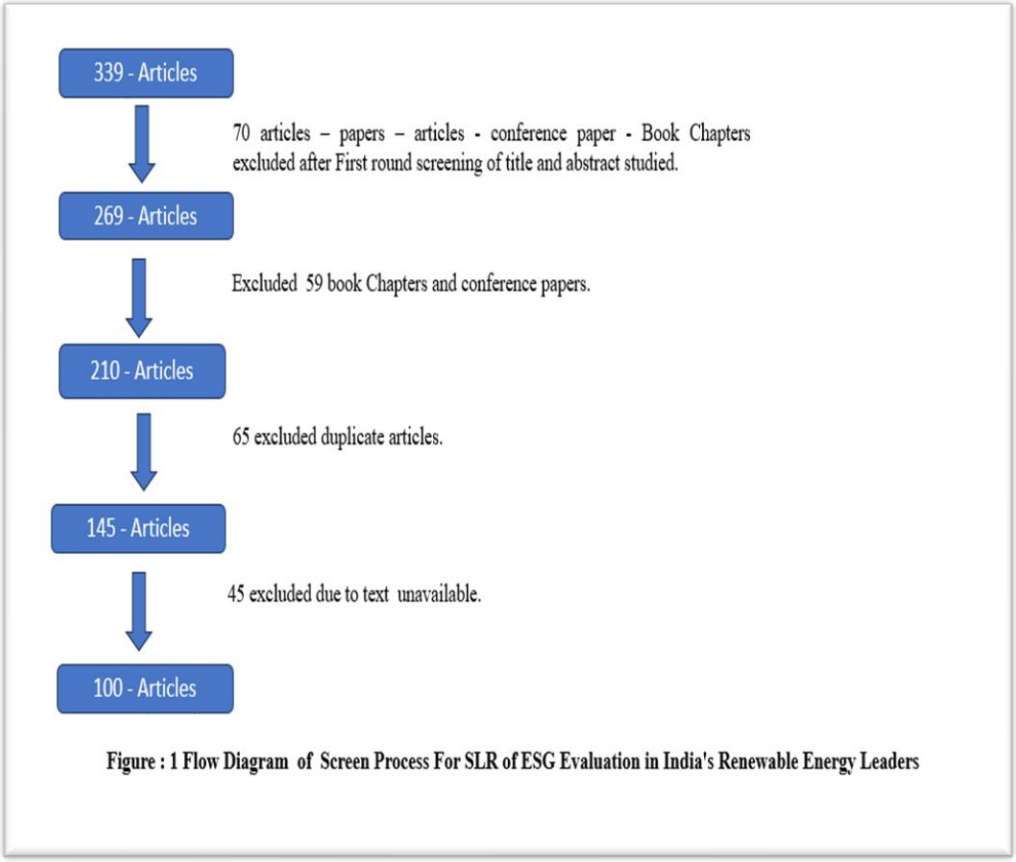

Figure : 1 Flow Diagram of Screen Process For SLR of ESG Evaluation in India's Renewable Energy Leaders

2. LITERATURE REVIEW

2.1 Company Base:

Researchers focusing on the company's base identified over 12 papers, out of which the following were found to be relevant to their research.

Adani Green Energy Limited (AGEL) plays a crucial role in India's renewable energy sector, focusing on wind and solar capacities with a target of achieving a 25 GW renewable portfolio by 2025. The study highlights AGEL's key acquisitions, such as SB Energy Holdings, its "Growth with Goodness" philosophy, and strategies for carbon dioxide displacement. Using a descriptive methodology, the research examines AGEL's global sustainability rankings, vision, and transformative impact on India's renewable energy landscape. **Dr. Jindal N.** (2024) reviewed in their paper *"Financial and Operational Performance of Adani Green Energy Ltd (AGEL)"* analyses AGEL's financial health using key ratios related to liquidity, solvency, and profitability from 2019 to 2023.**Chatnani N. (**2023) reviewed in their paper *"NTPC Limited Green Bond Framework"* highlights NTPC's use of green bond proceeds for renewable energy projects, emphasizing governance and international standards like the Climate Bonds Standard. **Vrajlal K.** (2010) reviewed in their paper *"Milching the Winds: The Suzlon Way"* investigates Suzlon Energy's strategies and contributions to harnessing wind energy as a sustainable source. **Pradhan D.** (2021) reviewed in their study "*Suzlon Energy Ltd: Making Foray Abroad*" investigates Suzlon Energy's global expansion strategy and its efforts to become a vertically integrated company. The study evaluates the effectiveness of past acquisitions and their value to the organization, while exploring future expansion decisions and the development of more powerful turbines to meet growing demand. **Takkallapalli C.** (2018) explored in their study "*Explaining Rapid Internationalization Process of Emerging Economy Firms: The Case of Suzlon Energy*" investigates the factors driving Suzlon Energy's rapid internationalization. The study examines opportunity identification, networks, and capital markets and develops a conceptual model to understand rapid internationalization through the lens of Suzlon Energy. **Cholez, P.** (2023) reviewed in their study "*Frugal Energy and the Global Markets of Pico Solar Systems"* investigates markets for low-cost solar technologies designed for off-grid populations in Africa. The study explores innovations and the role of these solar products in local economies, emphasizing business models and the influence of "globalization from below". **Mishra R.** (2022) explained in their study "*Does NTPC Have a Dominant Position? A Critical Analysis"* investigates whether NTPC Ltd. holds a dominant position in the Indian power sector. The study assesses risks of anti-competitive behaviour and uses analytical tools to explore competition dynamics post-reforms. **Khurana A.** (2016) reviewed in their study "*Accounting System in Power Companies: A Case Study of NTPC Limited"* investigates the accounting systems used by NTPC Ltd., examining the evolution of the power sector in India. The research provides insights into accounting practices and the broader context of India's power sector development. **Tripathi T. (**2021) explained in their study "*NTPC's Growth and Diversification in the Power Generation Sector"* investigates NTPC's development and diversification in India's power sector, focusing on its growth in consultancy, coal mining, and renewable energy, and its ambitious future targets. **Sinha S.** (2016) explained in their study "*Suzlon Energy's Financial Restructuring and Stake Acquisition Offer"* investigates Suzlon's financial restructuring strategies following a financial crisis and the implications of stake acquisition offers on its recovery. The study uses both descriptive and exploratory methods to analyse Suzlon's financial health and market positioning. **Brand K.** (2013) reviewed in their study "*Suzlon: Competing to Be Competitive"* investigates Suzlon Energy Ltd.'s strategies in the wind energy market. The study emphasizes Suzlon's global presence, innovation, cost management, and market-specific strategies, providing insights into the company's competitive positioning.

2.2 RATIO BASE:

Researchers focusing on the Ratio base identified over 2 papers, out of which the following were found to be relevant to their research.

Dr. Jindal N. (2024) reviewed in their paper *"Financial and Operational Performance of Adani Green Energy Ltd (AGEL)"* analyses AGEL's financial health using key ratios related to liquidity, solvency, and profitability from 2019 to 2023.**Chatnani N. (**2018) reviewed in their paper *"Green Investing and Indian Investors: The Case of Suzlon Energy"* examines financial ratios and sustainability metrics to assess Suzlon Energy's investment appeal in the green energy sector.

2.3 Green finance:

Researchers focusing on the green finance base identified over 15 papers, out of which the following were found to be relevant to their research.

Alharbi s. and Mamun A. (2023) discussed the role of green finance in promoting renewable energy production in their paper, *"Green Finance and Renewable Energy: Worldwide Evidence*." The study focuses on key areas such as green bond issuance, climate change exposure, emissions per GDP, technological capacity, and credit market development. It emphasizes the need for countries to work towards net-zero emissions through the development of green financing mechanisms, thereby contributing positively to renewable resource development. **Ikevuje A.** (2024) explored in their paper *"Exploring Sustainable Finance Mechanisms for Green Energy Transition: A Comprehensive Review and Analysis"* how sustainable finance supports the transition to renewable energy. This paper focuses on sustainable finance mechanisms like green bonds, loans, and investment funds, as well as regulatory frameworks and ESG criteria. **Muhmad S.** (2024) reviewed in their paper "*Systematic Literature Review and Bibliometric Analysis of Green Finance and Renewable Energy Development*" provides a systematic overview of research growth, emphasizing green finance's role in accelerating renewable energy adoption worldwide for climate resilience and energy sustainability.**Mudalige H.** (2023), explored in their paper *"Emerging New Themes in Green Finance,"* analysed 978 publications to identify evolving themes, challenges, and barriers in green finance. The study employed bibliometric analysis to uncover trends in sustainability, investments, and innovation. **Chengbo F.** (2022), explained in their paper *"Green Finance and Sustainable Development,"* examined the role of green finance in addressing climate change. The study highlighted ESG factors and regulatory frameworks' importance for achieving carbon neutrality. **Kingsley J.** (2024), in their paper *"Green Finance and Green Growth,"* reviewed 70 studies on green finance's impact on growth, emphasizing policy, socio-economic factors, and innovation. The research identified gaps and established a framework for future studies. **Fathihani, H.** (2021), in their paper *"Review of Sustainable Green Finance Literature,"* summarized 30 articles on green finance challenges. The study highlighted government and financial institutions' roles in promoting sustainability and addressing barriers. **Khoury, E.** (2024), in their paper *"The Nexus of Green Finance, Renewable Energy, and CO2 Emissions,"* studied G7 nations, showing renewable energy's role in reducing CO2 emissions. The research provided insights into green finance strategies for policymakers. **Ranjan N.** (2021) reviewed in their paper *"Green Finance in India: Scope and Challenges"* examines public awareness, financing options, and green bond issuance trends, identifying barriers and potential growth opportunities for green finance. **Mansoor P.** (2023) explained in their study "*The Relationship Between Green Finance and Sustainable Development, with a Focus on Climate Change Mitigation and Carbon Neutrality"* investigates how green finance supports sustainability, funding eco-friendly projects and addressing climate risks to promote carbon-neutral practices.**Zhihao H.** (2024) reviewed in their study "*The Role of Green Finance and Higher Education in Advancing Sustainable Energy Practices and Energy Transition within the RCEP Region"* investigates how education and green finance promote the transition to sustainable energy in the RCEP region, emphasizing fossil fuel reduction and green energy development. **Chinalu A.** (2024) explained in their study "*Sustainable Finance Mechanisms and Their Role in Facilitating the Transition to Green Energy"* investigates how sustainable finance tools, like green bonds and loans, fund renewable energy projects, highlighting the importance of clear regulations and stakeholder collaboration. **Chengbo F.** (2021) reviewed in their study "*The Role of Green Finance in Promoting Sustainable Development, Addressing Climate Change, and Achieving Carbon Neutrality"* explores the role of green finance in sustainable development, focusing on funding eco-friendly projects, managing climate risks, and promoting carbon-neutral practices. **Macchiavello S.** (2024) reviewed in their paper "*The Intersection of Sustainable Finance and Fintech: The Role of Green Fintech in Achieving Environmental Goals"* explores the emerging role of Green Fintech in addressing environmental challenges and achieving sustainability objectives within the field of sustainable finance. **Gronwald W.** (2024) reviewed in their paper *"My Name is Bond. Green Bond. Informational Efficiency of Climate Finance Markets"* investigates the informational efficiency of green bond markets, analysing how market inefficiencies and expectations affect green bond price volatility.

2.4 Renewable energy:

Researchers focusing on the Renewable Energy base identified over 19 papers, out of which the following were found to be relevant to their research.

Chen J. (2024) explained in their paper *"Green Finance and Renewable Energy Growth in Developing Nations: A GMM Analysis"* analysing data from 30 developing nations over the period 1990–2018, the study underscores the

importance of financial instruments and systems in fostering renewable energy development, thereby driving sustainable progress in emerging economies. **Sinha A.** (2023), explained in their paper *"Green Financing of Renewable Energy Generation,"* explored the link between green finance and renewable energy, highlighting socio-economic and political factors. The study used Quantile-on-Quantile Regression to provide recommendations for achieving SDG 7 in the USA. **Mardani A.** (2016), explained in their paper *"An Overview of Renewable Energy Companies in Stock Exchange,"* examined stock relationships of renewable energy firms using the MST approach. The research identified key companies driving renewable energy markets based on market capitalization. **Rahiman H.** (2024), reviewed in their paper *"Renewable Energy Initiatives by Corporates,"* studied corporate renewable energy initiatives' effects on sustainable development. The research used mediation analysis and quantitative methods to explore social, economic, and environmental impacts. **Kazemilari M.** (2010), in explained in their paper *"Overview of Renewable Energy Companies in Stock Exchange,"* analysed the interconnections of renewable energy companies using MST. The study identified market leaders influencing renewable energy stock dynamics. **Odilova S.** (2023), *"Investing in the Future,"* reviewed 35 studies on renewable energy investments' financial returns. The study emphasized renewable energy's positive impact on financial performance and sustainable investment strategies. **Xiong, D.** (2023) reviewed in their paper *"Impact of Green Finance Investment on Sustainable Development"* analyses green finance's role in promoting renewable energy and technological innovation in China, focusing on economic and environmental sustainability. **Muhammad U.** (2022) reviewed in their paper *"The Impact of Green Finance Development Goals on Renewable Energy in China"* investigates how financial inclusion and private sector participation foster renewable energy growth and sustainable development. **Muhammad U.** (2024) reviewed in their paper *"Green Finance and Renewable Energy Growth in Developing Nations: A GMM Analysis"* explores the impact of green bonds, carbon markets, and banking systems on renewable energy adoption in 30 developing nations. **Sajid I.** (2022) reviewed in their paper *"Green Financing's Role on Renewable Energy Dependence and Energy Transition in E7 Economies"* analysis DEA findings on renewable energy demand and the shift from fossil fuels to green energy. **Muhammad F.** (2022) reviewed in their paper *"Does Green Finance Counteract Climate Change Mitigation: Asymmetric Effect of Renewable Energy Investment and R&D"* explores green finance's contribution to CO2 emission reduction in G20 economies through innovative and financial mechanisms. **Rastogi R.** (2020) reviewed in their paper *"Renewable Energy Firm's Performance Analysis Using Machine Learning Approach"* investigates financial performance trends of renewable energy firms using machine learning techniques. **Jaiswal K.** (2016) reviewed in their paper *"Status of the Solar and Wind Industries in the U.S., with a Focus on Product and Service Suppliers in the Appalachian Region"* examines the solar and wind industries' structure, challenges, and competitive strategies in the U.S. **Muhammad I.** (2019) explained in their study "*Critical Factors Influencing Wind Power Industry: A Diamond Model-Based Study of India*" investigates the critical factors affecting the development and competitiveness of India's wind power industry using the Diamond Model framework. The research offers insights and policy recommendations for sustainable development, addressing global and local factors. **Lingyun, H.** (2019) reviewed in their study "*Can Green Financial Development Promote Renewable Energy Investment Efficiency? A Consideration of Bank Credit"* investigates the relationship between green finance and investment efficiency in China's renewable energy sector. The study uses the Richardson model to analyses the impact of green financial development through short-term and long-term bank loans. **Muhammad A.** (2018) explained in their study "*Application of Technology Roadmaps for Renewable Energy Sector"* investigates the use of Technology Road mapping (TRM) in the renewable energy sector, categorizing roadmaps at national, industry, and organizational levels. The study reviews goals, methods, and geographic trends in renewable energy development. **Julian I.** (2015) reviewed in their study "*The Dynamics of Returns on Renewable Energy Companies: A State-Space Approach"* examines the factors affecting excess returns in the renewable energy sector, using a time-varying asset pricing model to identify relationships between market variables and returns in the industry. **Lingyun H.** (2019) explained in their study "*Can Green Financial Development Promote Renewable Energy Investment Efficiency? A Consideration of Bank Credit"* investigates the investment efficiency of 141 listed renewable energy companies in China, focusing on how green finance impacts investment through bank loans. **Sardor A.** (2023) reviewed in their study *"The Relationship Between Renewable Energy Investments and Financial Returns for Organizations"* investigates how renewable energy investments impact financial performance and sustainability goals, providing an overview of the financial and sustainability outcomes.

2.5 Sustainable finance:

Researchers focusing on the Sustainable finance base identified over 41 papers, out of which the following were found to be relevant to their research.

Orsato M. (2021) reviewed in their paper "*Sustainable Finance and Investment: Review and Research Agenda,"* investigates the fragmented nature of Sustainable Finance and Investment (SFI) research, aiming to integrate the main elements of the SFI field and propose a research agenda for future studies. **Haigh K.** (2012) reviewed in their paper "*Publishing and Defining Sustainable Finance and Investment,"* explores the aims, scopes, and challenges faced by journals publishing research on responsible and sustainable finance and investment. **Schoenmaker S.** (2019) reviewed in their paper "*Principles of Sustainable Finance,"* investigates how the financial sector can contribute to a sustainable economy by aligning financial practices with social and environmental goals while maintaining profitability. **Schoenmaker L.** (2017) reviewed in their paper *"Investing for the Common Good: A Sustainable Finance Framework,"* proposes a framework for sustainable finance that focuses on long-term value creation for the wider community and addresses challenges like short-termism and inadequate private sector efforts in promoting sustainability. **Iberdrola G. (**2023) reviewed in their paper *"Sustainable Finance,"* analysis the economic and financial impact of Iberdrola's sustainable finance initiatives in the electricity industry, including their contribution to global GDP, job creation, and environmental sustainability. **Yilan M. (2022)** reviewed in their paper *"Evaluating and Managing the Sustainability of Investments in Green and Sustainable Chemistry: An Overview of Sustainable Finance Approaches and Tools,"* provides an overview of sustainable finance tools for evaluating investments in green and sustainable chemistry (GSC).**Liang R.** (2020) reviewed in their paper *"Sustainable Finance in Emerging Markets: A Venture Capital Investment Decision Dilemma,"* discusses the integration of ESG considerations into corporate management, financial decision-making, and investor strategies. **Fatemi F.** (2013) reviewed in their paper *"Sustainable Finance: A New Paradigm,"* advocates for a shift in financial practices towards long-term value creation and incorporates social and environmental considerations into decision-making. **Schoenmaker R.** (2017) reviewed in their paper *"From Risk to Opportunity: A Framework for Sustainable Finance,"* presents a framework advocating for a shift towards integrating environmental, social, and financial returns in sustainable finance. **Zeidan P.** (2020) reviewed in their paper *"Obstacles to Sustainable Finance and the COVID-19 Crisis,"* explores the challenges of aligning financial returns with ESG issues during the pandemic and examines the role of financial products in supporting sustainable investments. **Wang L.** (2020) reviewed in their paper *"Addressing the Missing Linkage in Sustainable Finance: The 'SDG Finance Taxonomy,"* develops the UNDP SDG Finance Taxonomy, providing a clear framework for identifying and financing SDG-aligned projects.**Claringbould K.** (2018) reviewed in their paper *"Sustainable Finance: The European Union's Approach to Increasing Sustainable Investments and Growth – Opportunities and Challenges,"* explores EU initiatives and the role of sustainable finance in achieving EU and international policy goals.**Purnomo S.** (2021) reviewed in their paper *"Sustainable Finance Study of Bibliometric Overview,"* maps international sustainable finance studies indexed by Scopus using bibliometric analysis and provides insights into global research trends.**Lehner J.** (2021) reviewed in the *"Routledge Handbook of Social and Sustainable Finance,"* offers a comprehensive overview of social and sustainable finance, presenting global perspectives on its challenges and institutional frameworks.**Ryszawska H.** (2016) reviewed in her paper *"Sustainable Finance and the Transition to a Green Economy,"* emphasizes the role of sustainable finance in supporting the transition to a green economy, focusing on financial models that prioritize environmental and social responsibility. **Setyowati T.** (2020) reviewed in her paper "Examining the Implementation of Indonesia's Sustainable Finance Roadmap," explores the challenges faced in implementing Indonesia's sustainable finance roadmap, particularly around climate finance and regulatory oversight. **Schoenmaker R.** (2018) reviewed in his paper *"Developing a Framework for Sustainable Finance"* aims to develop a comprehensive framework for sustainable finance while analysing its evolution, focusing on sustainable development, ESG risks, corporate governance, and short-termism in sustainable finance practices. **Durrani R.** (2019) reviewed in their paper *"The Role of Central Banks in Scaling Up Sustainable Finance – What Do Monetary Authorities in the Asia-Pacific Region Think?"* investigates the views and policies of central banks in the Asia-Pacific regarding sustainable finance, focusing on their role in addressing climate change and integrating sustainable finance into operations. **Bem D.** (2017) reviewed in their edited volume *"Finance and Sustainability"* explores the role of sustainable finance in enabling a transition to a low-carbon, climate-resilient economy, analysing financial practices in corporate, public finance, and capital markets.**Dimmelmeier S.** (2021) reviewed in his study *"Sustainable Finance as a Contested Concept: Tracing the Evolution of Five Frames between 1998 and*

2018" examines the evolution of sustainable finance and its various interpretations, including SRI, ESG risks, and green bonds, while exploring the actors and networks shaping the field. **Wang Y.** (2022) reviewed in their study *"Welfare Consequences of Sustainable Finance"* investigates the welfare implications of portfolio mandates requiring investors to hold net-zero carbon-emission firms, focusing on decarbonization capital and the role of such mandates in achieving decarbonization targets.**Streimikiene B.** (2023) reviewed in their study *"The Role of Sustainable Finance in Achieving Sustainable Development Goals"* explores the impact of sustainable finance on the implementation of SDGs, examining how various financial approaches contribute to sustainability outcomes. **González M.** (2021) reviewed in her study *"Overview of Global and European Institutional Sustainable Finance Initiatives"* analyses global and European institutional efforts to tackle climate change and the transition to a carbon-neutral economy. **Leal A.** (2017) reviewed in their book *"Sustainable Economic Development: Green Economy and Green Growth"* addresses the relationship between green economy policies, sustainable development, and poverty eradication, with case studies on green growth practices. **Lannoo T.** (2020) reviewed in his study *"Derivatives in Sustainable Finance"* explores the role of derivatives in supporting sustainable finance, focusing on the EU's Green Deal and the transition to a low-carbon economy. **Adeoye I.** (2024) reviewed in their study *"A Conceptual Framework for Data-Driven Sustainable Finance in Green Energy Transition"* proposes a framework integrating data analytics into sustainable finance to support the green energy transition, focusing on risk assessment and investment strategies.**Muhairi N.** (2018) reviewed in their study *"Sustainable Financial Management"* examines how sustainable financial management practices contribute to long-term growth by emphasizing environmental responsibility, social inclusion, and economic sustainability. **Yakovlev N.** (2019) reviewed in their study *"Indonesia's Strategy for Sustainable Finance"* investigates the country's sustainable finance framework, focusing on green bonds and regulatory policies supporting green investments. **Weber R.** (2011) reviewed in her edited volume *"Social Banks and the Future of Sustainable Finance"* explores the development and impact of social banks, microfinance, and ethical banking in fostering sustainability. **Goel N.** (2022) reviewed in their study *"Sustainable Finance in Emerging Markets: Evolution, Challenges, and Policy Priorities"* analyses the evolution, challenges, and policy priorities of sustainable finance in emerging markets, focusing on ESG factors and policy recommendations. **Yakovlev N.** (2018) reviewed in his article *"Sustainable Finance Ratings as the Latest Symptom of 'Rating Addiction'"* examines the integration of ESG factors by credit rating agencies in sustainable finance and their implications for the broader financial system.**Ahbabi N.** (2023) reviewed in their study *"Conceptual Building of Sustainable Financial Management and Sustainable Financial Growth"* explores the connection between financial management practices and sustainable business growth, emphasizing corporate sustainability and risk management.**Och K.** (2020) reviewed in her study *"Sustainable Finance and the EU Taxonomy Regulation – Hype or Hope?"* investigates the EU Taxonomy Regulation's role in advancing sustainable finance, critically evaluating its effectiveness and challenges. **Carney** (2020) reviewed in his article *"TCFD: Strengthening the Foundations of Sustainable Finance"* emphasizes the role of financial disclosures in addressing climate risks and supporting the transition to a net-zero economy through the TCFD recommendations. **Weber P.** (2024) reviewed in their paper "*Governance Mechanisms for AI in Sustainable Finance"* explores the role of artificial intelligence (AI) in advancing sustainable finance and its alignment with the Sustainable Development Goals (SDGs), emphasizing the governance mechanisms required for effective AI integration into financial systems. **Oman S.** (2021) reviewed in their paper *"Justifications for Sustainable Finance Measures and Implications for Policymakers"* investigates the rationale behind sustainable finance initiatives and their significance for policymakers, focusing on the challenges of aligning financial systems with sustainability goals in the context of climate change. **Oyewole et al.** (2024) reviewed in their paper *"How Sustainable Finance Can Enhance the Global Competitiveness of U.S. SMEs"* discusses how integrating Environmental, Social, and Governance (ESG) criteria into SME financing can enhance global competitiveness, while proposing future research directions in sustainable growth. **Fuest M.** (2022) reviewed in their paper "*Sustainable Finance and Climate Change: Wasteful but a Political Commitment Device?"* analyses the political and economic consequences of sustainable finance policies, focusing on the trade-offs and distortions in subsidizing clean industry investments within a small open economy model.**Zioło N.** (2021) reviewed in their paper "*Sustainable Financial Systems Toward Sustainability in Finance: Institutional and Managerial Approach"* examines the role of financial managers' awareness and institutional models in developing sustainable financial systems and managing ESG risks. **Mitchell P.** (2021) reviewed in their paper "*Developing Capacity for a Protected Planet"* examines the impact of COVID-19 on protected and conserved areas, highlighting the necessity of fostering a deeper connection with nature to prevent future crises. **Kemfert S.** (2021) reviewed in their paper *"Political Challenges in Developing and Implementing Framework Conditions for*

Sustainable Finance" explores the political challenges involved in creating and implementing frameworks for sustainable finance, emphasizing the role of public institutions in promoting sustainability in the financial sector.

2.6 Case study base LR:

Researchers focusing on the case study base identified over 2 papers, out of which the following were found to be relevant to their research.

Kulkarni V. (2019) explored in their study "*A Study of Instruments Used in Trade Finance Suzlon Energy Ltd.*" investigates the trade finance instruments used by Suzlon Energy, providing practical insights into the processes of trade finance during an internship at Suzlon. **Aggarwal E.** (2018) reviewed in their paper *"Sustainable Finance in Emerging Markets: A Venture Capital Investment Decision Dilemma,"* investigates the challenges of aligning social impact investments with commercial objectives in India.

2.7 Government policies impact of ESG:

Researchers focusing on Government policies impact of ESG base identified over 4 papers, out of which the following were found to be relevant to their research.

Tarek, S. (2020), explained in their paper *"Renewable Energy Policies and Their Impacts,"* analysed government policies like tax incentives and feed-in tariffs. The study evaluated their effects on emissions, growth, and electricity prices to guide future strategies. **Mohammad, H.** (2019) reviewed in their paper *"Alternative Arrangements of Power Generation Energy Resources and Reserve in India"* explores India's energy mix and the role of renewable energy in bridging the supply-demand gap. **Cheng H.** (2019) reviewed in their paper *"Spatial Dynamics and Socio-Economic Determinants of Venture Capital Investment in China,"* investigates the socio-economic factors influencing venture capital investment in China, with a focus on sustainable finance. **Strandberg T.** (2005) reviewed in her study *"Best Practices in Sustainable Finance"* assesses the trends, standards, and best practices in sustainable finance and CSR, focusing on governance, risk management, and stakeholder engagement.

2.8 CSR activities association with ESG and financial performance of RE companies:

Researchers focusing on CSR activities association with ESG and financial performance of RE company's base identified over 2 papers, out of which the following were found to be relevant to their research.

Gupta A. (2019) reviewed in their study "*Suzlon Foundation: Evolution of CSR Activities and Strategic Philanthropy"* explores how Suzlon's CSR activities evolved from ad-hoc charity to a structured initiative. The research also addresses sustainability challenges, particularly in land acquisition for infrastructure projects. **Chang J. (**2022) reviewed in their paper *"Sustainable Finance: ESG|CSR, Firm Value, and Investment Returns,"* examines how ESG and CSR practices influence firm value, investment returns, and long-term sustainability.

2.9 ESG Landscape:

Researchers focusing on ESG Landscape base identified over 3 papers, out of which the following were found to be relevant to their research.

Păun P. (2021) reviewed in their study *"Advancing Strategic Management Through Sustainable Finance"* explores the challenges of sustainable strategic management, its relation to ESG practices, and its role in value creation, resilience, and organizational agility. **Schumacher R.** (2021) reviewed in their paper *"Environmental, Social, and Governance (ESG) Factors and Green Productivity: The Impacts of Greenwashing and Competence Greenwashing on Sustainable Finance and ESG Investing"* discusses the challenges of greenwashing in sustainable finance and its impact on ESG investing, emphasizing the importance of ESG expertise. **Fullwiler H.** (2022) reviewed in their paper *"Sustainable Finance: Building a More General Theory of Finance,"* develops a theoretical framework to expand financial theory, incorporating sustainability factors beyond traditional risk and return.

RESEARCH GAP:

The systematic review reveals several significant gaps in understanding how ESG (Environmental, Social, and Governance) factors are assessed in India's renewable energy sector, particularly among industry leaders. These gaps are as follows:

1. Sector-Specific Insights:

Current research lacks a detailed comparative analysis of ESG practices across renewable energy sectors such as solar, wind, and hydro. This limitation restricts an understanding of the distinct challenges and benefits associated with each sector.

2. **Socio-Economic Considerations:**

There is inadequate attention to the socio-economic outcomes of ESG integration, particularly regarding improving energy access for underserved communities and fostering social equity through renewable energy projects.

3. **Role of Technological Innovation:**

Limited research explores how advancements in technology, including innovations in R&D and the application of digital tools like AI and blockchain, contribute to enhanced ESG performance and sustainable development in renewable energy.

4. **Cross-Sector and Regional Analyses:**

Studies predominantly focus on individual companies or specific regions, with little emphasis on cross-sector or international comparisons. Such analyses could provide valuable insights into best practices, policy efficiency, and financial models across diverse settings.

5. **Sustainable Financing:**

While much of the existing research centers on mobilizing initial funding, it insufficiently addresses the long-term sustainability and scalability of financing mechanisms like green bonds in supporting renewable energy initiatives.

6. **Challenges and Strategic Solutions:**

There is a lack of in-depth exploration of the practical challenges and strategies for overcoming barriers to ESG adoption, including regulatory shortcomings, market conditions, and operational difficulties unique to India's renewable energy sector.

7. **Private Sector Engagement:**

The role of India's private sector in driving ESG initiatives and renewable energy adoption is underexplored, especially in comparison to international benchmarks. Research also lacks a thorough examination of how policy incentives and obstacles influence private sector involvement.

These identified gaps underscore the urgent need for more detailed, inclusive, and localized research to effectively address the complexities and evolving nature of ESG evaluation in India's renewable energy sector.

FINDINGS

1. **Sector-Specific Analysis**

- Current research does not adequately compare ESG practices across key renewable energy sectors such as solar, wind, and hydro. This limits the understanding of unique challenges, opportunities, and best practices inherent to each sector.

2. **Socio-Economic Impacts**

- There is a notable gap in examining the socio-economic dimensions of ESG integration, particularly its effects on energy access for underprivileged communities and its role in promoting social equity through renewable energy initiatives.

3. **Technological Innovation**

- The potential of emerging technologies such as artificial intelligence (AI), blockchain, and the Internet of Things (IoT) to enhance ESG performance and foster innovation remains largely underexplored.

4. **Cross-Sectoral and Regional Comparisons**

- The predominant focus on isolated companies or regions hampers the development of a holistic understanding of ESG practices. Comprehensive cross-sectoral and cross-regional analyses are missing, which could offer valuable insights into best practices and policy effectiveness.

5. **Sustainable Finance Mechanisms**

- Research emphasizes the mobilization of initial capital but inadequately addresses the long-term viability, scalability, and impact of sustainable finance mechanisms, such as green bonds and ESG-linked investments, within renewable energy projects.

6. **Barriers and Implementation Strategies**

- Limited exploration of practical challenges, including regulatory deficiencies, market dynamics, and operational complexities, leaves critical gaps in understanding how to effectively integrate ESG practices.

7. **Private Sector Contributions**
   - The role of India's private sector in driving ESG advancements remains insufficiently analysed, particularly in terms of leveraging policy incentives and benchmarking against global standards.

SUGGESTIONS

1. **In-Depth Sector-Specific Research**
   - Conduct comparative studies to analyse ESG practices across solar, wind, and hydro sectors. Such research should delve into sector-specific regulatory, operational, and market intricacies, facilitating the development of tailored strategies.
2. **Focus on Socio-Economic Dimensions**
   - Prioritize studies that evaluate the socio-economic outcomes of ESG initiatives, including their impact on energy accessibility, employment generation, and the promotion of social equity in renewable energy development.
3. **Leverage Technological Innovation**
   - Explore the application of advanced technologies like AI, blockchain, and IoT to enhance ESG integration. Research should assess their scalability, affordability, and adaptability within India's renewable energy landscape.
4. **Broader Cross-Sectoral and Regional Analyses**
   - Encourage studies that compare ESG practices across different regions and sectors, enabling the identification of transferable best practices, effective policies, and collaborative models to improve performance.
5. **Enhanced Focus on Sustainable Finance**
   - Extend research to evaluate the long-term efficacy and scalability of green bonds and ESG-linked finance. Examine how these mechanisms can mitigate risks and drive sustained investment in renewable energy projects.

6. **Address Barriers with Practical Strategies**
   - Investigate regulatory gaps, market challenges, and operational barriers in depth. Collaborate with policymakers and industry stakeholders to develop actionable strategies that promote seamless ESG integration.
7. **Private Sector Benchmarking and Innovation**
   - Conduct comparative analyses of India's private sector contributions to ESG integration against global benchmarks. Highlight the impact of policy incentives, innovation, and public-private partnerships in fostering renewable energy adoption.

By Addressing these critical research gaps will enable the Indian renewable energy sector to develop a deeper and more holistic understanding of ESG integration. This progress will not only strengthen sustainability across the sector but also establish India as a global frontrunner in renewable energy innovation and advancement. These findings offer a strategic roadmap for researchers, policymakers, and industry stakeholders to promote sustainable practices and foster transformative progress.

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