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Systematic Literature Review on Climate Finance Global Trends, Challenges and Future Directions

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Abstract
This article examines the current status of climate finance and green finance, focusing on their barriers, equity issues, and effectiveness through an extensive review of scholarly literature indexed in the *Science Direct* database. Studies published between 2009 and 2024 were analyzed using the keywords 'climate finance' and 'green finance.' The 1.5°C target aims to keep the rise in global temperature below 1.5°C above pre-industrial levels by the end of this century to prevent serious climate disasters. Earlier, a 2°C target was considered acceptable, but small island nations opposed it, warning that even this level of warming threatened their survival through rising sea levels and extreme weather. To achieve the 1.5°C goal, developed countries under the Paris Agreement pledged to mobilize USD 100 billion annually by 2020 to help developing nations mitigate emissions and adapt to climate impacts, though this promise remains largely unmet. The review reveals that complex governance systems, limited private sector engagement, and restrictive funding mechanisms have reduced the effectiveness of climate finance. It emphasizes the need for locally driven approaches that integrate community participation, with civil society playing a key role in ensuring equitable fund distribution. Despite efforts to scale up financing, significant gaps remain in directing resources toward the most vulnerable populations. The study concludes that enhancing transparency, governance reforms, and public–private collaboration is essential to strengthen the efficiency and equity of climate finance, thereby supporting global goals of sustainable development and inclusive climate resilience

Keywords: Climate finance; green finance; sustainable finance; climate change; renewable energy; private finance; regional disparity; institutional barriers

Introduction

Climate change is the most significant systemic challenges confronting humanity in the 21st century. Its' adverse effects span across ecological, economic, and social dimensions, leading to more frequent and intense extreme weather events, rising sea levels, biodiversity loss, and disruptions to agriculture, water systems, and human health The Sixth Assessment Report (AR6) of the Intergovernmental Panel on Climate Change (IPCC) emphasizes that global surface temperatures have already increased by approximately 1.1°C relative to pre-industrial levels, with disproportionate impacts on vulnerable communities and ecosystems (IPCC, 2021; World Meteorological Organization, 2023). The urgency of addressing climate change has galvanized international efforts through frameworks such as the United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol, and most recently, the Paris Agreement.

While international consensus increasingly acknowledges the need for deep decarbonization and climate resilience, financial constraints remain a critical bottleneck, particularly for developing countries. Climate finance—the mobilization of funds to support mitigation and adaptation actions—has emerged as a central pillar of global climate policy (UNFCCC, 2022). Defined by the UNFCCC as "local, national or transnational financing, drawn from public, private and alternative sources of financing, that seeks to support mitigation and adaptation actions to address climate change". Moreover, the standing committee on climate finance has updated the working definition of Climate Finance (CF) as "CF aims at reducing emissions and enhance sinks of green-house gases, aims at reducing vulnerability, increasing adaptive capacity, and mainstreaming and increasing

resilience of human and ecological systems to negative climate impacts, and includes financing for actions identified in a country's nationally determined contribution, adaptation communication, national adaptation plan, long term low emission development strategy, or other national plan for implementing and achieving the goals of the Paris agreement and the objective of the convention". Therefore, climate finance serves both as a tool for operationalizing equity via the principle of Common But Differentiated Responsibilities and Respective Capabilities, (CBDR-RC) and as an enabler of sustainable development in climate-vulnerable economies (UNFCCC, 2015; Roberts and Weikmans, 2017).

Other terms such as sustainable finance, green finance, and carbon finance are often used along with climate finance, but their meanings are not exactly the same. Since this paper mainly focuses on climate finance, it is important to clarify these terms before proceeding further.

Climate Finance	Green Finance	Sustainable Finance
Climate finance is defined as local, national, or transnational financing that aims to support mitigation and adaptation initiatives that will address climate change and is derived from public, private, and alternative sources of financing.	Green financing is included in green finance along with other environmental goals that are essential to promoting sustainability, particularly elements like biodiversity and resource preservation.	The goal of sustainable finance is to create an inclusive, economically, socially, and environmentally sustainable society. It encompasses a greater range of the investing universe.

Climate finance can be divided into two main parts: mitigation and adaptation. The mitigation part focuses on actions that reduce greenhouse gas emissions, such as promoting clean energy, clean transportation, and improving energy efficiency. On the other hand, the adaptation part deals with helping people and communities cope with the effects of climate change. It includes activities like setting up disaster monitoring and emergency response systems, managing floods, and addressing drought-related challenges (Khanna et al., 2022).

However, the climate finance landscape is fraught with challenges of access, adequacy, predictability, and transparency. Although developed countries pledged in 2009 to jointly mobilize USD 100 billion annually by 2020 to support climate action in developing countries, the OECD (2023) reports that only $89.6 billion was delivered in 2021. Moreover, methodological disagreements persist regarding what constitutes "climate-relevant finance," with disputes over the inclusion of loans, export credits, and non-concessional instruments (Clapp et al., 2012; Weikmans and Roberts, 2019;). These definitional ambiguities often result in over-reporting or misallocation of climate finance, undermining both trust and effectiveness in global climate governance.

The architecture of climate finance is highly complex and multilayered, involving multilateral climate funds e.g., Green Climate Fund (GCF), Global Environment Facility (GEF), Climate Investment Funds (CIF), bilateral donors, national development banks, private investors, philanthropic foundations, and increasingly innovative instruments such as green bonds, carbon markets, debt-for-climate swaps, and blended finance mechanisms (Buchner et al., 2019; Schalatek and Watson, 2020). These institutions and instruments are governed by different principles, accountability standards, and political priorities, which shape how, where, and to whom funds are allocated. Furthermore, climate finance is deeply intertwined with broader concerns of global justice, development priorities, and North–South relations (Hickel, 2020; Tanner and Allouche, 2011).

Recent literature has paid increasing attention to the effectiveness and distributional justice of climate finance. For instance, empirical studies have explored whether climate finance enhances adaptive capacity of vulnerable communities (Fankhauser and McDermott, 2016), catalyzes clean energy transitions in emerging markets (Zhang and Wang, 2022), and strengthens resilience in sectors such as agriculture and water management (Watkiss and Cimato, 2021). Others have highlighted institutional bottlenecks, such as lack of absorptive capacity in recipient countries, bureaucratic barriers, elite capture, and the centralization of funds at the national level, which often excludes local governments, civil society organizations, and indigenous communities (Nakhooda et al., 2014; Hermwille et al., 2017).

In the Global South, and particularly in emerging economies like India, climate finance is both a necessity and an opportunity. India is the third-largest emitter globally in absolute terms, but its per capita emissions remain significantly lower than the global average (IEA, 2022). The country must simultaneously meet the development needs of a rapidly growing population and transition to a low-carbon economy. India's updated Nationally Determined Contributions (NDCs), submitted under the Paris Agreement, commit to reducing the emissions intensity of its GDP by 45% by 2030 from the base of 2005 levels, achieving 50% of cumulative installed capacity from non-fossil fuel-based energy resources, and creating a carbon sink of 2.5–3.0 billion tonnes of CO_2-equivalent (MoEFCC, 2022).

Meeting these commitments requires massive financial inflows, estimated at around USD 2.5 trillion by 2030 (CPI, 2019). Though, India has made notable progress in attracting climate finance through public expenditure, sovereign green bonds, and multilateral flows, yet the quantum and quality of international support have been inadequate (Ghosh and Gangania, 2022). Institutions like the Indian Renewable Energy Development Agency (IREDA), Solar Energy Corporation of India (SECI), and the National Adaptation Fund for Climate Change (NAFCC) are actively engaged in mobilizing and deploying climate finance, yet barriers such as high project risk perception, limited pipeline of bankable projects, and policy uncertainty persist (Dubash et al., 2020; Bose, 2020).

Despite a growing body of scholarship on climate finance, the literature remains fragmented across disciplinary boundaries, with limited cross-comparison between geographic regions, sources of finance, and thematic attentions. Existing reviews tend to concentrate either on mitigation finance (especially renewable energy investment) or on multilateral institutional flows, leaving adaptation finance, local finance mechanisms, and co-benefit evaluations underexplored (Rai et al., 2015; Tol, 2021). Moreover, while India features prominently in international climate negotiations, systematic academic analyses of climate finance within the Indian context—particularly at subnational levels—remain sparse.

This systematic literature review addresses these gaps by critically synthesizing findings from papers between 2009 and 2024 in Scopus database, focusing on climate finance. The review is guided by the following research questions: (i) what are the key theoretical frameworks, themes, and typologies that underpin climate finance literature, (ii) what methodological approaches dominate the field, and where do research gaps and future agendas lie, (iii) what are the sources, instruments, and institutional mechanisms through which climate finance operates, and what challenges affect its effectiveness and equity, and (iv) How has climate finance evolved in India, and what lessons can be drawn from empirical and policy-oriented studies to enhance its impact.
By systematically reviewing the state of knowledge across these dimensions, this paper seeks to advance both scholarly understanding and policy debates around climate finance, with a focus on enhancing the transparency, effectiveness, and justice of climate financial flows in developing countries—especially in India, which stands at the intersection of global environmental responsibility and national developmental aspirations.

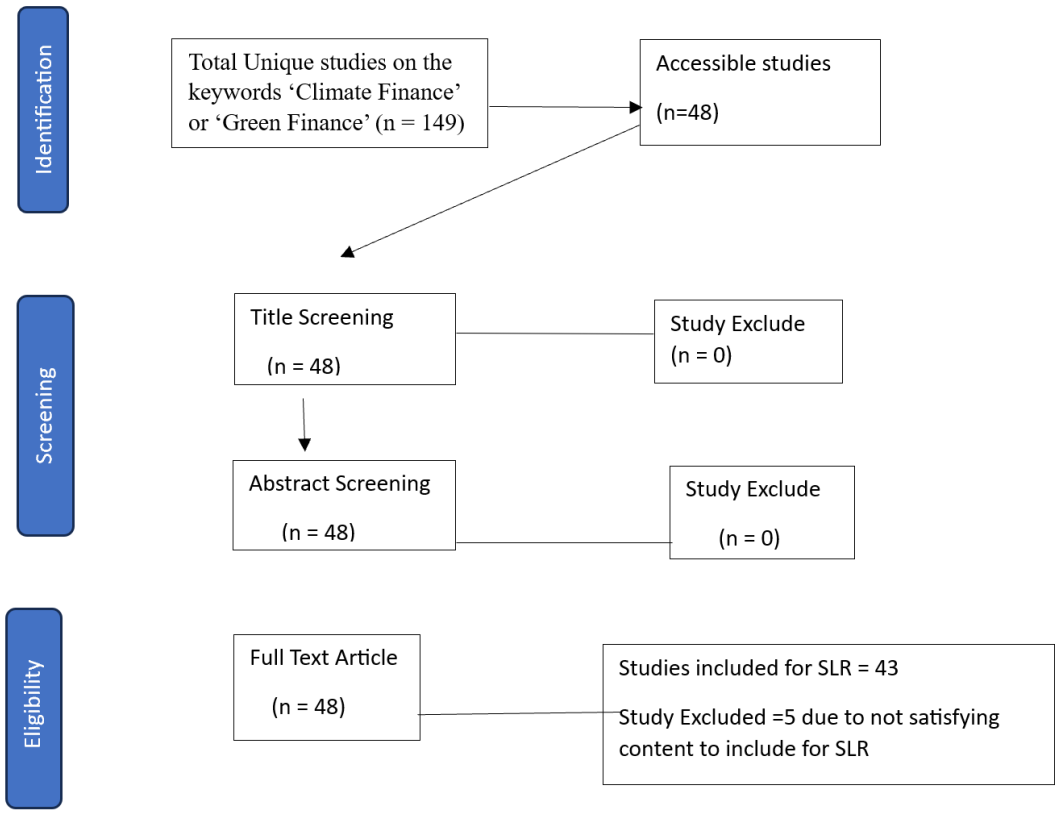
Methods and Materials

This study conducts the systematic literature review on the key words 'climate finance' and 'green finance'. However, 'climate adaptation finance', 'climate mitigation finance', 'green bonds', and 'green debts' are not included in the study because they represent only fraction of climate finance or green finance. Similarly, 'sustainable finance' is also excluded because it has broader dimension than climate finance; as it is a part of the sustainable finance. This study focuses on climate finance only, therefore, above mentioned only two keywords are taken into account for the Systematic Literature Review (SLR). To filter the relevant studies; study used PRISMA method. In first step, we found 149 studies for the specific keywords, i.e., 'Climate Finance' and 'Green Finance'. In second step, only open access studies were considered for further screening, and out of 149, 48 studies were considered, as they were open access. In last step, an extensive review was carried out and it was found that only 43 studies are closely related with climate finances, and were considered for final analysis. The following schematic view represents the method followed for selection of studies for this study.

Results and Discussion

This systematic literature review (SLR) synthesizes the key findings from 43 peer-reviewed studies on climate finance, identifying prevailing trends, key challenges, and emerging opportunities. The review underscores the increasing significance of climate finance in addressing climate change, particularly within developing economies, and critically evaluates the effectiveness of financial

mechanisms, governance frameworks, and access modalities that drive climate finance flows. The results presented below reveal how these dynamics align with and influence the objectives of global climate action.



Source: compiled by authors from ScienceDirect

Fig. 1. Flow Chart of identification of relevant studies on climate finance

Studies used in the review

S.No.	Authors	objectives	Major findings	Country/ region
1	Linus Hasselstrom , Jean-Baptiste E. Thomas (2022)	The paper aims to critically assess the environmental, ecological, and climate mitigation potential of seaweed cultivation through comprehensive life cycle assessments, identifying knowledge gaps and establishing guidelines for accurate carbon accounting and sustainable development.	The findings indicate that while seaweed cultivation has potential for climate mitigation, current evidence on its long-term carbon sequestration and overall climate benefits remains limited and uncertain.	Ocean/Sea
2	Henk Jan Reinders, Dirk Schoenmaker, Mathijs van Dijk (2023)	The objective of the study is to develop a novel financial vulnerability model to assess the impact of adverse carbon pricing scenarios on bank solvency, focusing on asset valuation shocks at the sectoral level.	The study finds that climate policies, particularly carbon taxes, can lead to significant declines in the market value of banks' assets, mainly driven by exposures to corporate loans and debt, with potential losses ranging from 2% to 29% of core capital depending on the scenario.	Dutch (Netherland)
3	Bonizella Biagini, Rosina Bierbaum, Missy Stults, Saliha Dobardzic, Shannon M. McNeeley (2014)	The objective of the study is to develop a typology of adaptation actions	The study finds that integrating empirical data with theoretical frameworks enhances understanding of practical adaptation actions,	Global

			validates their effectiveness in reducing vulnerabilities, and highlights the critical role of capacity building and community participation in successful climate adaptation efforts.	
4	Gabriela Ileana Iacobut¸aˇ, Clara Brandi, Adis Dzebo, Sofia Donaji Elizalde Duron (2022)	The objective of the study is to investigate how climate finance aligns with recipient countries' SDG and climate priorities, and to assess the effectiveness of this alignment before and after the Paris Agreement.	The study finds that climate finance has shifted slightly post-Paris Agreement towards SDGs related to renewable energy and climate mitigation, but significant untapped potential remains for better alignment with recipient priorities and SDG implementation.	Global
5	Kashi Kafle, Labisha Uprety, Gitta Shrestha, Vishnu Pandey , Aditi Mukherji (2022)	The objective of the study is to analyse the determinants of adoption, policy gaps, and issues of equity and social inclusion in Nepal's solar irrigation program supported by climate finance subsidies.	The study finds that Nepal's solar irrigation program predominantly benefits relatively well-off farmers, with barriers to equitable access for small-scale, marginalized, and women farmers due to policy gaps, application biases, and weak monitoring.	Nepal
6	Kirsty Anantharajah, Abidah B. Setyowati (2022)	The objective of the study is to empirically and theoretically investigate the deployment of climate finance in the Global South, focusing on renewable energy development and its implications for social justice and equity.	The study finds that climate finance in the Global South often perpetuates existing power structures, favors large-scale projects over rural and small-scale initiatives, and manifests intersectional injustices related to gender, race, and marginalization.	Asia and Pacific
7	Peter WARREN (2020)	The objective of the study is to identify and address the 'blind spots' in climate finance that hinder the acceleration and commercialization of technological, financial, and policy solutions for decarbonization in developing countries.	The study finds that addressing behavioral, financial, and policy blind spots through targeted climate finance and capacity-building is essential to accelerate decarbonization in hard-to-abate sectors of developing countries.	Global
8	Jingli Jiu a , Sajid Ali b,* , Raima Nazar c , Ahmad Imran Khan (2024)	The objective of the study is to investigate the asymmetric relationship between green innovation investment and energy innovation in top European nations, emphasizing their roles in sustainable energy development.	The study finds a significant positive asymmetric relationship between green innovation investment and energy innovation across different countries, with regional and temporal variations influencing the strength of this connection.	Europe
9	Robyn Clarka, James Reeda, Terry Sunderland (2017)	The objective of the study is to analyse the challenges and gaps in financing sustainable landscapes, including private investment flows, data limitations, and institutional barriers, to inform better resource allocation and policy reforms.	The study highlights significant challenges in financing sustainable landscapes, including data gaps, institutional barriers, fragmented funding approaches, and the need for systemic reforms to leverage private investment effectively.	Global

10	Elisa Calliari, Sergio Castellari, McKenna Davis, Joanne Linnerooth-Bayer, Juliette Martin, Jaroslav Mysiak, Teresa Pastorf , Emiliano Ramieri, Anna Scolobig, Marjolein Sterk, Clara Veerkamp, Laura Wendling , Marianne Zandersen (2022)	The objective of the study is to assess the fit of EU-supported research, policies, and practices for enhancing the uptake of Nature-Based Solutions (NBS) for climate change adaptation and disaster risk reduction, and to identify key dimensions for their improved implementation.	The study highlights that while NBS are effective at small scales, there is a significant gap in evidence and implementation of large-scale NBS, emphasizing the need for further research and systemic integration to maximize their climate resilience benefits.	Europe
11	Gabrielle Kissingera, Aarti Gupta, Ivo Mulderc , Natalie Unterstell	The objective of the study is to analyse developing countries' perspectives on climate financing needs and the role of fiscal policy reform in achieving land use and forest sector climate goals within their NDCs, and to assess how these countries align domestic and international finance with sustainable land use objectives.	The study finds that while developing countries recognize the need for climate finance in land use sectors, most emphasize international support over domestic fiscal reforms, which remain a key obstacle to achieving transformative climate goals.	Global
12	Nkwetta Ajong Aquilas, Johannes Tabi Atemnkeng	The objective of the study is to analyse the direct and interaction effects of climate-related development finance and renewable energy consumption on GHG emissions, with a focus on understanding how renewable energy influences the relationship between climate finance and emissions reduction.	The study finds that climate-related development finance and renewable energy consumption interact to influence GHG emissions, with higher levels of climate finance potentially increasing emissions and renewable energy playing a crucial role in emission reduction efforts.	Congo Basin
13	Rishikesh Ram Bhandary, Kelly Sims Gallagher, Amy Myers Jaffe, Zdenka Myslikova, Fang Zhang, Maria Petrova, Angeles Barrionuevo, Guillaume Fontaine, Jose Luis Fuentes, Patrick Karani, Daniela Martinez, Likeleli Seitlheko, Daniela Staicu, Najeeb Ullah, Abay Yimere (2022)	The objective of the study is to understand the drivers and decision-making processes behind Chinese policy bank financing for renewable energy projects in developing countries.	The study finds that Chinese policy bank-financed renewable energy projects in emerging economies are primarily driven by political agreements, supported by predictable policy environments and diverse incentive mechanisms, with high investment risks often mitigated through government guarantees and risk-sharing strategies.	China and others
14	Md. Mofakkarul Islam (2022)	The objective of the study is to re-examine the effects of recipient countries' climate vulnerability on the allocation of adaptation, mitigation, and overlap climate finance using advanced panel regression methods on a	The study finds that climate vulnerability positively influences adaptation and overlap funding allocations, indicating progress towards distributive justice, but disparities remain with moderately vulnerable countries often receiving more support than the most vulnerable, and mitigation	Global

		longitudinal dataset spanning two decades.	funding not primarily driven by vulnerability.	
15	Thomas Puschmann, Dario Quattrocchi (2023)	The objective of the study is to develop a solution that improves data availability, accessibility, and reliability for estimating and understanding GHG emissions within value chains to support climate change mitigation efforts.	The study found that developing a digital data infrastructure and prototype, based on literature analysis and expert input, can enhance GHG data measurement, disclosure, and reduction efforts within value chains.	Global
16	Patrícia Hipolito ´ Leal, Antonio ´ Cardoso Marques, Muhammad Shahbaz (2023)	The objective of the study is to assess the effectiveness of climate finance in reducing environmental degradation, promoting sustainable development, and improving living standards, while analysing its determinants and drivers across different country groups.	The study finds that climate finance effectively reduces environmental degradation, promotes human development, and improves living standards, with its impact influenced by governance, globalisation, and country-specific factors.	Global
17	Sungida Rashid, Mizan R. Khan, Nabil Haque (2023)	The objective of the study is to empirically assess whether prior climate finance commitments have led to an increase in mitigation ambitions, as reflected in changes in NDCs between 2015 and 2020.	The study finds that climate finance has a positive but statistically insignificant effect on increasing mitigation ambitions in developing countries' NDCs, with a stronger impact on least developed countries and a weaker effect on small island developing states.	Global
18	Muxin Liu, Changyou Xia, Hailin Lan, Zhihao Gao, Xiaojie Yu, Li Wang, Xi Liang, Yi Wu (2024)	The study finds that climate finance has a positive but statistically insignificant effect on increasing mitigation ambitions in developing countries' NDCs, with a stronger impact on least developed countries and a weaker effect on small island developing states.	The study finds that urban climate finance and investment significantly enhance urban carbon emission efficiency, primarily through promoting enterprise green technological innovation and exhibiting threshold effects based on innovation levels.	China
19	Franziska M. Hoffart, Paola D'Orazio, Franziska Holz, Claudia Kemfert (2024)	To systematically assess the interdependent impacts of the climate crisis, geopolitical energy crisis, financial stability, and energy transition, and to develop a structured framework for guiding policy responses in multiple crisis contexts.	The study finds that crisis response policies that are misaligned with climate and energy transition goals can exacerbate financial instability, hinder energy transition, and create negative feedback loops across sectors,,,.	Global
20	HUANG Ji-kun and WANG Yang-jie (2014)	The objective of the study is to examine how finance can be utilized to achieve development, mitigation, and adaptation goals in sustainable agriculture under climate change in developing countries.	The study finds that effective financing strategies are crucial for enhancing climate change adaptation, mitigation, and sustainable development in agriculture, especially through capacity building, technology adoption, and targeted interventions in developing countries.	Global

21	Hugues Chenet, Josh Ryan-Collins, Frank van Lerven (2021)	The objective of the study is to explore how existing financial policies can be shifted within a precautionary framework to better address climate-related financial risks under conditions of radical uncertainty.	The study finds that existing market-based risk assessment frameworks are insufficient to address climate-related financial risks under radical uncertainty, necessitating a shift towards precautionary policy approaches that go beyond traditional market corrections.	Global
22	Daniel B. Oerther (2016)	The objective of the study is to develop and promote innovative financial and technological strategies, including insurance products and climate-smart practices, to enhance disaster resilience and food security in Caribbean fisheries sectors amid climate change challenges.	The study finds that integrating innovative financial, technological, and country-led disaster management strategies can significantly enhance climate resilience and food security in Caribbean fisheries sectors.	Caribbean Ocean
23	Congyu Zhao, Kangyin Dong, Kun Wang, Rabindra Nepal (2024)	The objective of the study is to investigate the moderating role of climate finance (CF) in the relationship between artificial intelligence (AI) and renewable energy development (RED) to promote sustainable energy progress.	The study finds that artificial intelligence significantly enhances renewable energy development, with climate finance playing a crucial moderating role in strengthening this relationship.	Global
24	A. Damodaran, Onno van den Heuvel (2023)	The objective of the study is to analyse the challenges and opportunities in mobilizing financial resources and market-based instruments to support India's climate commitments and low-carbon transition.	The study finds that India's low-carbon value chain faces significant structural challenges, including high capital costs, market inefficiencies, limited liquidity in green bonds, and institutional barriers, which hinder effective mobilization of market-based financial instruments to meet climate commitments.	India
25	T.O. Ojo, H.S. Kassem, H. Ismail, D.S. Adebayo (2023)	The objective of the study is to assess the level of climate-smart agriculture (CSA) adoption among smallholder rice farmers and identify the determinants influencing this adoption.	The study found that gender, marital status, access to climate information, off-farm income, cooperative membership, and credit access significantly influence the level of climate-smart agriculture adoption among smallholder rice farmers.	Nigeria
26	Karsten Schulz, Marian Feist (2021)	The objective of the study is to explore how Distributed Ledger Technologies (DLTs) can be leveraged to support effective, accountable, and innovative climate finance, addressing political and technical challenges.	The study finds that while DLTs offer promising opportunities for enhancing transparency, accountability, and efficiency in climate finance, their scalability is hindered by technical, political, ethical, and infrastructural challenges, especially in developing countries.	Global

27	Zehao Liu a, Chi Paan (2024)	The objective of the study is to analyse the impact of climate finance on reducing carbon emissions and promoting ecological sustainability in developing countries.	The study finds that climate finance effectively reduces carbon emissions, especially in economically developed and small island developing states, with mitigation funding being more successful than adaptation.	Global
28	Wolfgang Buchholz, Dirk Rübbelke (2021)	The objective of the study is to analyse past experiences with international climate finance schemes to identify lessons learned and inform the improved design of future schemes under the Paris Agreement, particularly regarding co-effects and conflicting objectives.	The study finds that analysing past climate finance schemes reveals strengths and weaknesses in handling co-benefits and conflicting objectives, providing lessons to improve future scheme designs under the Paris Agreement.	Global
29	Gholamreza Haseli, Muhammet Deveci, Mehtap Isik, Ilgin Gokasar, Dragan Pamucar, Mostafa Hajiaghaei-Keshteli (2023)	The objective of the study is to analyse how social, climate change, and financial policy combinations can enhance public support for long-term climate-resilient land-use and transportation projects.	The study finds that integrating social, climate change, and financial policies significantly enhances public support and effectiveness of long-term climate-resilient land-use and transportation projects.	Global
30	Makoto M. Kelp, Andrew P. Grieshop, Conor C.O. Reynolds, Jill Baumgartner, Grishma Jain, Karthik Sethuraman, Julian D. Marshall (2018)	The objective of the study is to evaluate the effectiveness of a carbon-financed-approved cookstove intervention in reducing indoor air pollution through real-time measurements, seasonal analysis, and calculation of air-exchange rates in rural households.	The study found that real-time measurements revealed seasonal and usage-related variations in indoor air pollution and air-exchange rates, highlighting the need for improved cookstove performance and adoption to effectively reduce household air pollutants.	India
31	Lina Xie, Bert Scholtens, Swarnodeep Homroy (2023)	The objective of the study is to analyse the allocation efficiency of climate finance by MDBs in relation to countries' emission levels and climate vulnerability, and to assess the potential impacts of alternative funding distributions on climate outcomes and social equity.	The study finds that MDB climate finance predominantly supports mitigation in wealthier countries, with limited focus on vulnerable nations' adaptation needs, and suggests that reallocating funds towards adaptation could significantly reduce global climate vulnerability without notably affecting emission growth.	Global
32	J. Massé, P. J. Gerber, C. Halpern, T. Baedeker (2020)	The objective of the study is to analyse and promote sustainable practices and innovative financial mechanisms in the livestock sector to address environmental challenges and enhance climate finance efforts.	The study highlights the need to invest in sustainable livestock production systems and improve measurement, reporting, and verification (MRV) mechanisms to effectively address climate change and enhance climate finance efforts.	Global
33	Djoko Santoso Abi Suroso, Budhi Setiawan, P. Pradono, Zahara	The objective of the study is to assess the role and effectiveness of international climate finance in supporting	The study finds that international climate finance in Indonesia is still developing with limitations, but it plays a crucial role in	Indonesia

	Sitta Iskandar, Mulia Asri Hastari (2022)	Indonesia's achievement of its NDC targets, particularly in the energy sector.	supporting the energy transition and climate goals, requiring more optimal utilization of channels and innovative financing approaches.	
34	Peter Warren, Molly Frazer, Noelle Greenwood (2023)	To explore the role of international climate finance in decarbonising hard-to-abate sectors in developing countries, with a focus on mechanisms like AMCs (Advance Market Commitments) and their applicability to industries such as cement in India.	The study highlights significant gaps in research on climate finance for decarbonising international transport in developing countries and emphasizes the potential of pull mechanisms like AMCs, particularly for heavy industries such as cement in India, to facilitate deep decarbonisation through credible incentives and stakeholder trust.	Global
35	J.S. Kemerink-Seyoum, T.M. Tadesse, W.K. Mersha, A.E.C. Duker, C. De Fraiture (2018)	The objective of the study is to analyse how climate finance mechanisms influence the organizational structures, social relations, and resource conflicts in forest conservation projects in Ethiopia, highlighting the complexities and unintended consequences of institutional design.	The study finds that climate-financed forest conservation projects in Ethiopia often exacerbate social inequalities, lead to resource conflicts, and undermine local livelihoods due to institutional design flaws and social exclusion.	Ethiopia
36	ZHANG Wen, PAN Xun (2016)	The objective of the study is to systematically analyse the financial demand, mitigation costs, and priority investment areas for developing countries based on INDC reports, and to estimate the total financial needs for 2030.	The study finds that the total financial demand for developing countries to address climate change by 2030 could reach up to US$474 billion, with mitigation costs averaging US$22.3 per ton CO_2 and a mitigation-to-adaptation financial demand ratio of 1.4.	Global
37	Mercedes Grijalvo * , Carmen García-Wang (2023)	The objective of the study is to develop and empirically validate a sustainable business model framework that helps banks adapt to a climate-resilient economy.	The study demonstrates that the proposed sustainable business model framework can effectively provide a qualitative overview of banks' climate finance activities, identify challenges, and highlight managerial opportunities, though standardization and measurement metrics remain limited.	Global
38	Arturo Anton (2020)	The objective of the study is to analyse the design and potential effectiveness of a voluntary "Oil and Climate Club" that uses oil taxes to finance climate change mitigation while addressing international trade law compliance.	The study finds that forming an effective "Oil and Climate Club" could facilitate international cooperation on climate mitigation through targeted oil taxes, but its success depends on the participation of pivotal countries and compliance with trade laws.	Global

39	Gerhard Kling, Ulrich Volz, Victor Murinde, Sibel Ayas (2021)	The objective of the study is to investigate the impact of climate vulnerability on firms' cost of capital and financial exclusion, using empirical analysis and the ND-GAIN climate vulnerability index.	The study finds that higher climate vulnerability increases firms' cost of capital and leads to greater financial exclusion, with empirical evidence supporting the direct and indirect effects of climate risk on financial performance and access.	Global
40	Jessica Omukuti (2024)	The objective of the study is to analyse the effectiveness and challenges of innovative climate finance mechanisms in promoting climate-resilient development (CRD) and ensuring equitable, system-transformative outcomes.	The study finds that while innovative climate finance mechanisms have the potential to promote climate-resilient development, their effectiveness is often hindered by issues of transparency, accountability, misalignment with system transformation goals, and limited consideration of climate justice.	Global
41	Jean-Francois Mercure (2019)	The objective of the study is to develop a framework for assessing climate-related financial risks and opportunities to facilitate a smooth transition to a sustainable, low-carbon economy.	The study finds that stranded fossil-fuel assets pose significant financial, geopolitical, and systemic risks, requiring comprehensive risk assessment and strategic management to facilitate a low-carbon transition.	Global
42	Edward M. Mungai, S. Wagura Ndiritu, Izael Da Silva (2022)	The objective of the study is to financially quantify the investment potential in renewable energy and energy efficiency in SSA to inform policy, attract private investment, and bridge the energy gap.	The study finds that Ethiopia has significant renewable energy investment potential estimated at $76 billion, but faces barriers such as regulatory risks, high taxation, and inadequate policies, which hinder private sector engagement and limit the region's ability to fully harness its renewable energy and energy efficiency opportunities.	Sub-Saharan Africa
43	Ornsaran Pomme Manuamorn, Robbert Biesbroek, Victor Cebotari (2022)	The objective of the study is to assess the conditions that influence the community focus in adaptation finance (AF) projects, using a configurational approach to identify necessary and sufficient factors for stronger or weaker community engagement.	The study finds that a stronger community focus in AF projects is influenced by the presence of higher projected climate risks, the roles of civil society, and access modalities, while a weaker focus is associated with low exposure to future climate risks.	Global

The analysis indicates a gradual evolution of research activity in climate and green finance over the past two decades. While interest in the topic remained negligible prior to 2009, scholarly attention increased thereafter, with a pronounced surge observed post-2018 (Figure 2). This pattern suggests a growing recognition of the pivotal role of climate finance in facilitating low-carbon transitions and supporting international climate commitments, particularly following milestones such as the Paris Agreement in 2015.

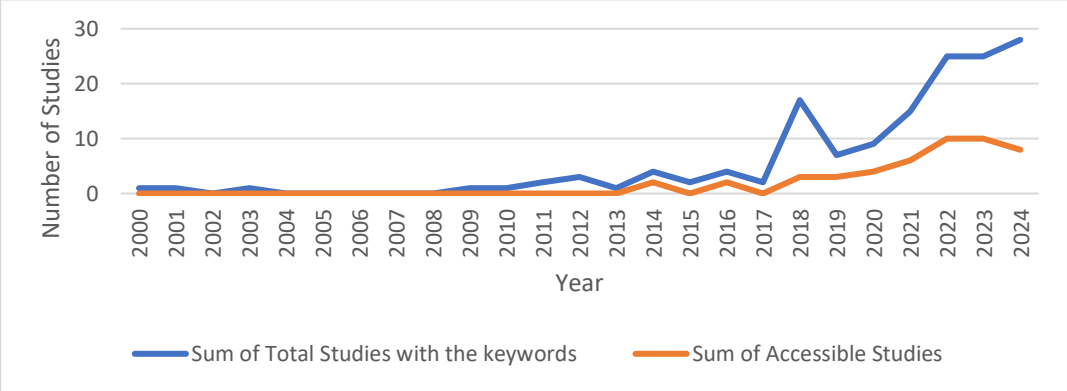


Fig. 2. Year wise studies published on the keywords Climate Finance and Green Finance
Source: Compiled by authors from ScienceDirect.

In our studies out of the 43 studies reviewed, 38 were original research articles and 5 were review papers, with other publication types contributing marginally (Figure 3). The predominance of empirical research reflects an emphasis on evidence-based analysis to inform policy and investment decisions in climate finance. However, the limited number of review articles indicates a gap in comprehensive syntheses, which are essential for consolidating knowledge and guiding future research agendas.

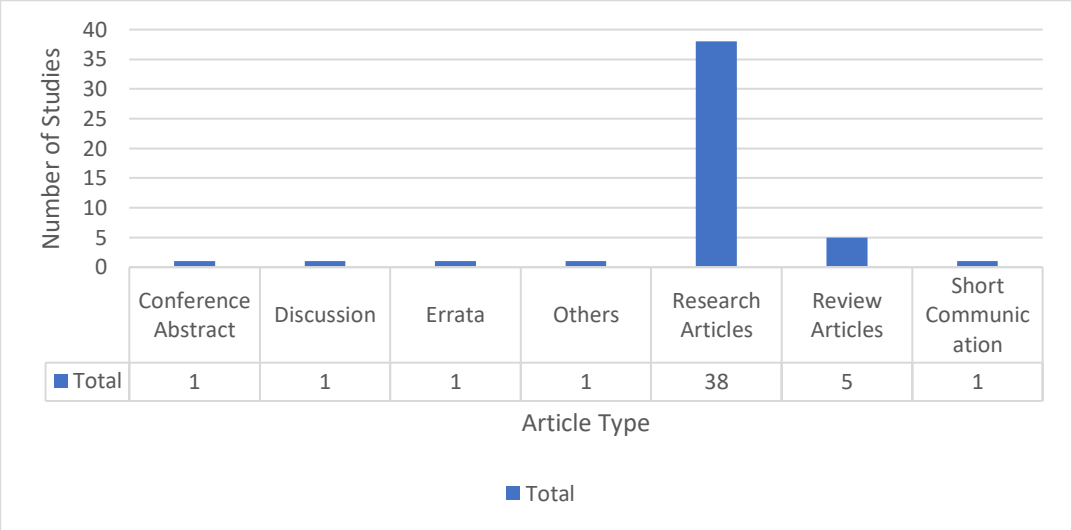


Fig. 3. Types of studies published on the keywords Climate Finance and Green Finance
Source: Compiled by authors from ScienceDirect.

A journal-wise analysis reveals that *Global Environmental Change* published the highest number of studies (5), followed by *Energy Research and Social Science* (4). Two studies each appeared in *Land Use Policy*, *Advances in Climate Change Research*, and *Heliyon*, while the remaining contributions were dispersed across various journals, each publishing a single study (Figure 4). This dispersion underscores the interdisciplinary nature of climate finance research, encompassing environmental science, economics, energy policy, and social dimensions.

In terms of geographical coverage, the majority of studies examined climate finance at the global level, reflecting its inherently transnational scope. Region-specific analyses were comparatively scarce, with only two studies focusing on Europe and two on India. The remaining region-focused studies were isolated, each addressing a distinct geographic context (Figure 5). This indicates a critical research gap, particularly in developing nations where climate finance plays a pivotal role in achieving climate resilience and sustainable development.

Climate Finance Mobilization and Allocation

One of the most significant findings across the literature is the growing recognition of climate finance as a pivotal tool for addressing both mitigation and adaptation needs. The mobilization of climate finance has increased substantially over the last decade, driven primarily by commitments made under international agreements such as the Paris Agreement (Chen et al., 2020). This review however, reveals that while developed countries have made notable financial pledges, including the $100 billion per year commitment, actual disbursements have often fallen short of the needs of developing countries, particularly for adaptation measures (Aguilar, 2022; Manuamorn et al., 2022).

Moreover, the allocation of funds remains skewed towards mitigation efforts, with a lesser proportion devoted to adaptation, even though the latter is critical for countries most vulnerable to climate impacts (Mungai et al., 2022).

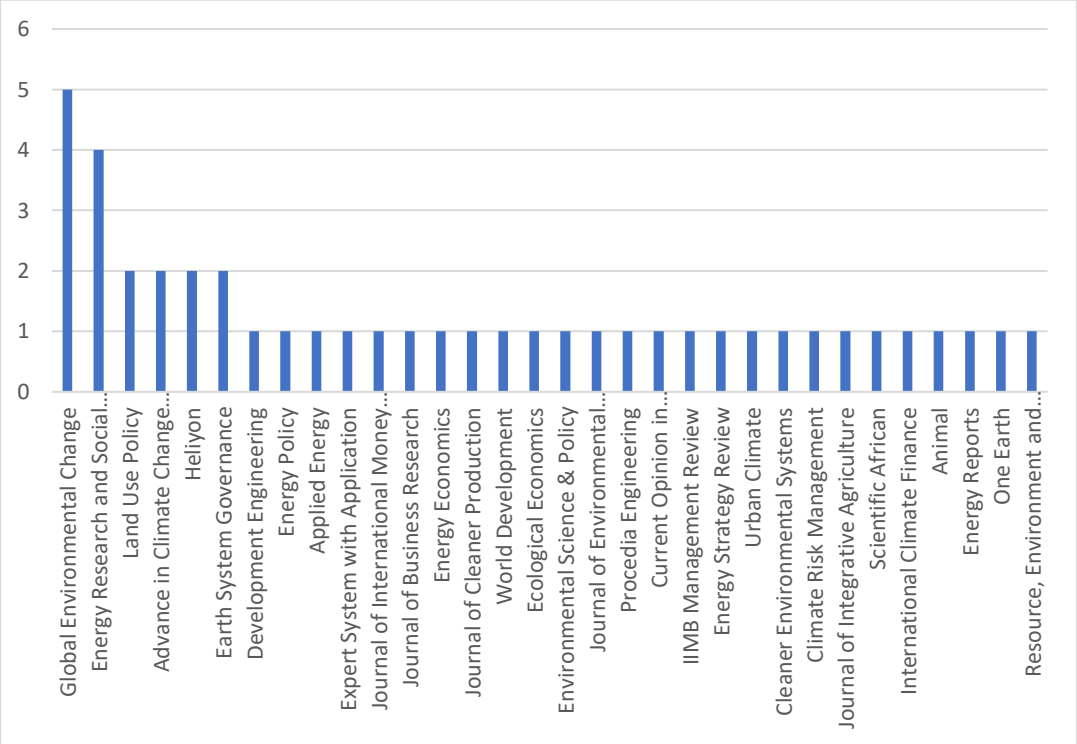


Fig. 4. Publication of studies in various journals on the keywords Climate Finance and Green Finance
Source: Compiled by authors from ScienceDirect.

For instance, a study on the Green Climate Fund (GCF) noted that although the GCF aims to balance mitigation and adaptation funding, in practice, mitigation projects receive the bulk of financing, with the dominance of renewable energy projects (Odugbesan and Rhaman, 2022). Similarly, studies focused on the Adaptation Fund (AF) found that its community-based projects often face challenges in accessing sufficient funding, largely due to a lack of strong governance frameworks in recipient countries (Manuamorn et al., 2022).

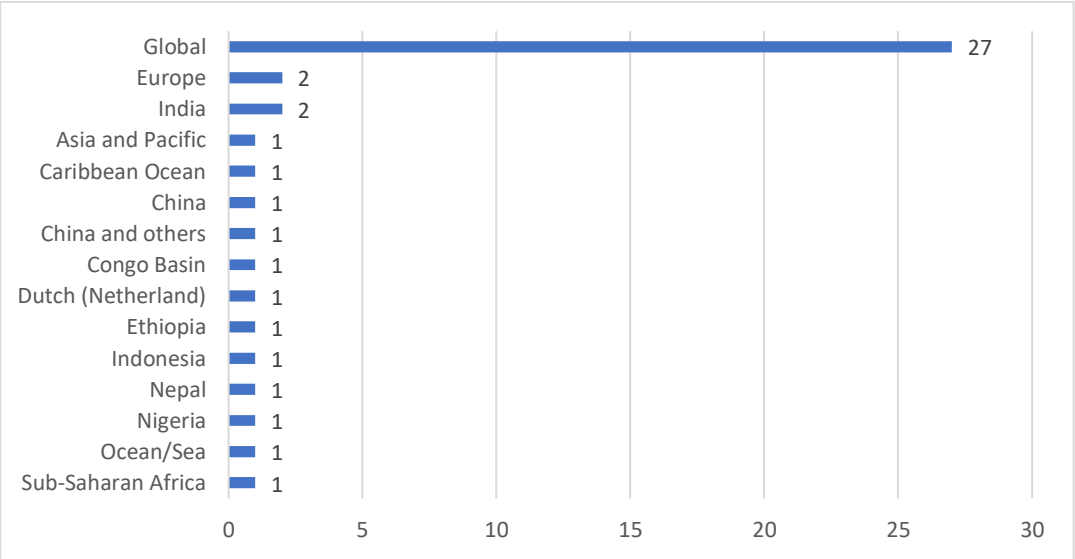


Fig. 5. Region-wise Studies Published on the keywords Climate and Green Finance
Source: ScienceDirect; compiled by authors

Regional Disparities

Existence of regional disparities in climate finance allocation is another critical issue highlighted across literature. Developing regions like Sub-Saharan Africa and small- island developing states (SIDS) continue to face significant challenges in accessing sufficient climate finance, particularly for adaptation purposes. In Sub-Saharan Africa, where climate risks are high, and energy poverty is

widespread, studies underscore that mobilizing private sector finance remains challenging due to weak institutional frameworks and perceived political risks (Mungai et al., 2022). Conversely, countries such as China and India have been more successful in attracting both public and private finance for renewable energy initiatives (Azhgaliyeva et al., 2020).
The lack of accessible finance for adaptation in SIDS was notably discussed in the work of Chen et al. (2020), which pointed out that despite these nations' extreme vulnerability to climate change, they often struggle to meet the financial criteria required by international climate funds. Moreover, many SIDS face challenges in creating bankable projects that can attract both public and private investment, often due to limited technical capacity and institutional constraints (Chen et al., 2020).

Barriers to Accessing Climate Finance
Several barriers to accessing climate finance are evident in the literature. The governance frameworks in developing countries often determine the effectiveness of climate finance, with weaker governance structures posing significant barriers to the effective mobilization and utilization of funds (Manuamorn et al., 2022). The studies frequently mention issues such as corruption, lack of transparency, and inadequate legal and regulatory frameworks that deter both public and private investment (Aguilar, 2022). For example, Mungai et al. (2022) found that in Sub-Saharan Africa, the absence of robust institutional capacity and transparency frameworks hindered countries from effectively accessing climate finance, especially from multilateral sources such as the GCF and the AF.

One recurring theme is the importance of institutional capacity and absorptive capabilities in determining whether countries can efficiently utilize climate finance. Manuamorn et al. (2022) highlighted that countries with weak institutional frameworks, such as Honduras and Paraguay, often struggle to access direct funding from climate finance sources, as these require the ability to manage, absorb, and disburse funds efficiently. In contrast, countries with stronger institutional frameworks, such as South Africa and Kenya, have been more successful in securing and utilizing climate finance for both mitigation and adaptation projects.

Private Sector Engagement
Private sector finance remains an essential yet underutilized component of climate finance. Many papers emphasize that mobilizing private finance for climate-related projects, particularly in developing economies, is a critical challenge due to the high perceived risks associated with renewable energy projects (Azhgaliyeva et al., 2020; Mungai et al., 2022). These risks include regulatory uncertainty, political instability, and market volatility. Furthermore, the lack of adequate incentives such as risk guarantees and blended finance models has further dissuaded private investors from engaging in climate finance initiatives in high-risk regions (Chen et al., 2020).

Studies suggest that financial instruments such as green bonds and PPPs (public-private partnerships) could potentially unlock more private sector investment if designed with appropriate risk mitigation strategies (Odugbesan and Rahman, 2022). However, the inconsistent application of these mechanisms across different regions remains a challenge, as many developing countries lack the institutional frameworks to support such instruments.

Governance and Access Modalities
Governance structures play a pivotal role in shaping how climate finance is accessed and distributed at both national and local levels. The review reveals that direct access modalities, where national institutions are responsible for managing and disbursing funds, tend to foster greater local ownership and accountability, thus improving project outcomes (Manuamorn et al., 2022). However, countries with weak governance and low institutional capacity often rely on indirect access through intermediaries, such as international organizations, which can limit local engagement and reduce project relevance to the specific needs of vulnerable communities (Manuamorn et al., 2022; Chen et al., 2020).

A key finding from Manuamorn et al. (2022) is that decentralized governance structures tend to facilitate stronger community engagement in climate finance projects. Countries like Paraguay and Ghana, which have supportive governance frameworks for civil society, demonstrated better outcomes in terms of community participation and project effectiveness. On the other hand, centralized governance structures, such as those in Colombia and Honduras, often hinder local engagement and reduce the effectiveness of adaptation projects, even when these countries face high climate risks (Manuamorn et al., 2022).

Climate Risk and Vulnerability

Projected climate risks are a significant determinant of climate finance flows, particularly for adaptation projects. Countries facing higher exposure to future climate risks tend to prioritize adaptation strategies in their climate finance agendas (Manuamorn et al., 2022). This is especially evident in regions like Sub-Saharan Africa, where extreme climate vulnerabilities necessitate immediate adaptation interventions (Mungai et al., 2022). However, the lack of adequate financial resources and technical capacity often hampers the implementation of these adaptation projects, further exacerbating the vulnerabilities of these regions (Chen et al., 2020).

Effectiveness of Climate Finance Projects

A major concern discussed across the literature is the effectiveness of climate finance projects, especially in terms of achieving intended outcomes. Several studies have raised questions about the impact and sustainability of climate finance interventions, particularly those targeting adaptation. Mungai et al. (2022) and Manuamorn et al. (2022) both noted that many climate finance projects suffer from poor design and implementation, resulting in limited long-term benefits. For instance, adaptation projects in Sub-Saharan Africa and parts of Latin America often fail to adequately address local needs, leading to low community engagement and reduced effectiveness (Manuamorn et al., 2022).

The literature also emphasizes the need for tailored approaches to improve the effectiveness of climate finance. Manuamorn et al. (2022) propose that projects should be designed with a stronger focus on local contexts and vulnerabilities, particularly in areas with high climate risks. Moreover, greater transparency in the allocation and disbursement of climate finance is critical to ensuring that resources reach the most vulnerable populations. Some studies advocate for the development of new methodologies to track climate finance flows, which would enhance accountability and ensure that funds are used efficiently (Azhgaliyeva et al., 2020).

Local Engagement and Inclusiveness

The effectiveness of climate finance is closely tied to the level of local engagement and inclusiveness in project design and implementation. Several studies highlight that projects with strong community involvement tend to achieve better outcomes, as they are more responsive to local needs and realities (Manuamorn et al., 2022). However, achieving local inclusiveness in climate finance remains a challenge, particularly in countries with weak civil society governance. Chen et al. (2020) argue that strengthening civil society governance frameworks is essential for fostering local ownership of climate finance projects and improving their overall effectiveness.

The Role of Governance and Institutions

Effective governance and institutional frameworks are critical for the successful deployment of climate finance. Multiple studies, including those by Sharma et al. (2021) and Mukherjee et al. (2019), underscore the importance of decentralization and civil society involvement in ensuring that climate finance reaches local communities. Countries that have decentralized governance structures, such as India and Ghana, demonstrate a higher degree of community engagement in climate finance initiatives.

The importance of governance structures is also evident in the success of direct-access climate finance mechanisms. Studies such as those by Manuamorn et al. (2022) show that countries with robust governance systems and strong civil society engagement are better able to implement direct access mechanisms, thereby improving the efficiency of climate finance allocation and project outcomes. Conversely, centralized governance structures and weak civil society environments tend to result in less community-focused adaptation projects.

Climate Finance for Adaptation vs. Mitigation

One of the most critical debates in climate finance is the allocation of funds between adaptation and mitigation. The literature shows that while mitigation projects (such as renewable energy infrastructure) attract the majority of climate finance, adaptation projects are often underfunded. Mukherjee et al. (2019) highlights this imbalance, noting that adaptation projects, particularly those aimed at vulnerable communities, face significant challenges in securing adequate funding.

This finding is echoed by Manuamorn et al. (2022), who emphasize that countries with high climate risks, such as Honduras and Paraguay, struggle to attract sufficient adaptation finance, despite being on the frontline of climate change impacts. The gap in adaptation finance raises concerns about the long-term resilience of vulnerable countries and communities.

Innovative Climate Finance Mechanisms

Several studies highlight the importance of developing innovative climate finance mechanisms to overcome existing barriers. For instance, Mukherjee et al. (2019) and Manuamorn et al. (2022) discuss the potential of green bonds and blended finance to address the financing gap for climate adaptation and mitigation projects. Green bonds, in particular, have emerged as a promising tool for mobilizing private sector investment, although their use is still limited in developing countries. Moreover, Mukherjee et al. (2019) suggests that financial instruments like risk-sharing mechanisms and guarantees can help mitigate the risks associated with climate finance, thereby encouraging greater private sector involvement. These mechanisms can also help address the challenges of financing small-scale adaptation projects, which are often overlooked by traditional climate finance channels.

Research Gaps

Effectiveness of Allocation Mechanisms

While significant efforts have been made to mobilize climate finance, there is a notable gap in understanding the efficiency and equity of its allocation mechanisms. The existing literature primarily focuses on the mobilization of funds but often neglects the nuanced question of how these funds are distributed across different sectors and projects. Future research should examine the criteria used for prioritizing climate finance allocations, such as vulnerability indices, project feasibility, and regional disparities. Investigating how funds are allocated across diverse geographic regions, economic sectors, and adaptation or mitigation strategies will be crucial in assessing whether the distribution of resources maximizes impact. More in-depth research is needed on identifying which allocation mechanisms—whether market-driven, needs-based, or merit-based—prove to be most effective in delivering sustainable outcomes.

Role of Indigenous Knowledge in Adaptation Projects

Indigenous knowledge systems, especially in relation to adaptation strategies, have often been overlooked in climate finance research. This gap is particularly critical because vulnerable communities, especially those in developing regions, rely heavily on traditional knowledge and practices that are finely attuned to local environmental changes. Future studies should delve into how climate finance mechanisms can better integrate indigenous knowledge into the design and implementation of adaptation projects. This would not only enhance the cultural relevance and effectiveness of these projects but also foster more inclusive, bottom-up approaches to climate resilience. Exploring the barriers to the inclusion of indigenous knowledge, such as institutional biases or lack of recognition, and how to overcome them should be a priority for future research.

Sectoral Diversity in Finance Distribution

A substantial portion of climate finance is directed towards energy and infrastructure projects, which dominate the mitigation landscape. However, the agriculture, forestry, and waste management sectors—often labelled as 'hard-to-abate'—continue to receive relatively limited funding, despite their significant contribution to both emissions and climate vulnerability. Future research should focus on the development of targeted financing models for these sectors, where solutions may be more complex and less commercially viable than in the energy sector. Investigating financing mechanisms that cater to sector-specific needs and identifying barriers to investment in these sectors is critical for achieving a more comprehensive approach to climate change mitigation and adaptation.

Accountability and Monitoring Frameworks

While transparency in climate finance has been widely recognized as a challenge, there is limited research on the design and implementation of robust monitoring and accountability frameworks that track the outcomes of climate finance initiatives. Beyond financial flows, there is a lack of systems to evaluate the socio-economic impacts of these investments over the long term. Future studies should explore ways to measure the true effectiveness of climate finance, including the socio-economic outcomes, such as job creation, poverty alleviation, and empowerment of marginalized groups. Developing comprehensive evaluation frameworks that go beyond financial reporting to include these long-term impacts would help ensure that climate finance delivers on its promises.

Impact of Climate Finance on Gender and Social Equity

While there is growing recognition of the need for equitable climate finance, the gendered and social equity dimensions of these investments are under-researched. Climate finance is often seen through a lens of economic efficiency or environmental outcomes, with little attention paid to how

it affects different social groups, particularly marginalized populations. Future research should focus on how financial mechanisms can be tailored to address the specific needs of women, indigenous groups, and other vulnerable communities. Studies could explore whether women's empowerment initiatives are embedded in climate finance strategies, and how financing mechanisms can mitigate gender disparities and promote social equity.

Future Directions

Innovative Allocation Models

Future studies should focus on developing innovative allocation models that integrate multidimensional vulnerability indices, allowing funds to be prioritized for the most at-risk regions and communities. These models should consider a range of factors such as exposure to climate hazards, socio-economic conditions, and adaptive capacity. Research can explore how these indices could be implemented in both international and national climate finance frameworks to ensure that resources are allocated equitably and effectively. Such models could help identify the regions and communities most in need of financial support, improving the overall impact of climate finance.

Integrating Digital Solutions

The integration of digital technologies in climate finance can significantly improve transparency, traceability, and accountability. Blockchain, for instance, offers a promising avenue for enhancing the transparency of financial flows, ensuring that funds are used for their intended purposes. Future research should explore how digital tools like blockchain and artificial intelligence can streamline the management of climate finance, reduce corruption, and provide real-time monitoring of projects. Additionally, exploring how digital technologies can help democratize access to climate finance, particularly in remote or underserved communities, could open new opportunities for inclusive finance.

Cross-Sectoral Synergies

Research should investigate the potential for cross-sectoral integration in climate finance, particularly between energy, agriculture, and water sectors. These sectors are interconnected, and climate interventions in one area often have implications for the others. For example, energy-efficient agriculture techniques or climate-smart water management can enhance the resilience of both the energy and water sectors. Future studies should explore how integrating these sectors can lead to greater synergies and co-benefits, resulting in more holistic and sustainable climate finance solutions.

Localized Climate Finance Governance

Decentralized governance structures can empower local governments and communities to manage and allocate climate finance in a way that is tailored to their unique needs and priorities. Future research should investigate the potential for localized governance models to enhance accountability, improve project ownership, and ensure that climate finance reaches the grassroots level. This would involve exploring the role of local actors in decision-making processes, the challenges of decentralization, and the ways in which local governance structures can be strengthened to improve the effectiveness of climate finance.

Long-Term Impact Studies

Longitudinal studies are needed to assess the sustainability of climate finance initiatives and their ability to build long-term resilience in vulnerable communities. These studies should track the progress of financed projects over extended periods to measure not only immediate outcomes but also long-term socio-economic impacts, including community resilience, economic diversification, and adaptive capacity. Future research could focus on developing methodologies to evaluate the lasting effects of climate finance on the communities it is intended to help, offering valuable insights into the true success of these initiatives.

Blended Finance for High-Risk Sectors

Blended finance, which combines public and private funding, offers a potential solution for de-risking investments in high-risk sectors such as agriculture, forestry, and waste management. Research should explore how blended finance mechanisms can be structured to encourage private sector involvement in these hard-to-abate sectors, while ensuring that the financial risks are shared and mitigated appropriately. Future studies could examine best practices in the design of blended finance models, and how these models can be adapted to the specific needs and challenges of different sectors.

Climate Finance as a Catalyst for Green Growth through Mitigation and Adaptation

Climate finance plays a pivotal role in advancing green growth by enabling both mitigation and adaptation strategies, especially in developing economies. A substantial body of research underscores that international and domestic climate finance has catalysed investment in clean energy, infrastructure resilience, sustainable agriculture, and institutional capacity (Buchner et al., 2019; Falcone et al., 2022; Zhao et al., 2022). For instance, climate finance mobilized through multilateral mechanisms like the Green Climate Fund and bilateral channels has facilitated the deployment of renewable energy technologies, contributing significantly to carbon emission reductions and energy transition (Ghosh and Gangania, 2022; Alam and Saini, 2021). In India, targeted climate financing through institutions such as the Indian Renewable Energy Development Agency (IREDA) and the Solar Energy Corporation of India (SECI) has expanded access to low-carbon technologies, directly contributing to mitigation efforts (Chaudhary and Singh, 2020; Singh and Sidhu, 2021). Moreover, adaptation outcomes—though less frequently funded—have been promoted through projects focused on climate-resilient agriculture, water resource management, and ecosystem-based adaptation, particularly benefiting vulnerable rural communities (Mehrotra and Venkatachalam, 2021; Jain and Jain, 2023). Despite these gains, climate finance flows remain disproportionately skewed toward mitigation, with adaptation receiving less than 25% of global funding (UNEP, 2023; Dasgupta et al., 2021). This imbalance hampers holistic green development in climate-vulnerable regions. Furthermore, absorptive capacity constraints, delays in fund disbursal, and inadequate stakeholder engagement have limited the effectiveness of climate finance in delivering transformative change (Zhang and Wang, 2022; Pahuja and Ramachandran, 2020; Gupta et al., 2019). Several studies also highlight the need for institutional reform, improved MRV (Monitoring, Reporting, Verification) systems, and local-level financial empowerment to maximize climate finance effectiveness (Mohan and Wadhawan, 2021; Dutta and Sinha, 2022).

Hence, while climate finance has demonstrated tangible progress toward green growth, its transformative potential depends on enhancing equity in finance allocation, ensuring timely disbursement, integrating adaptation priorities, and strengthening local implementation mechanisms (Buchner et al., 2019; Sodhi and Biswas, 2025; Mehrotra and Venkatachalam, 2021; Ghosh and Gangania, 2022; Jit et al., 2025; Zhao et al., 2022).

Conclusion

This systematic literature review, drawing evidence from 43 studies, provides an extensive analysis of the evolution, challenges, and future pathways of climate finance. The findings reaffirm that climate finance is a crucial instrument for enabling developing nations to implement effective mitigation and adaptation measures against climate change. However, a major concern emerging from the review is the persistent gap between financial commitments and actual needs. Under the Paris Agreement, developed countries had pledged to mobilize USD 100 billion annually by 2020 to support climate actions in developing countries, yet this target remains unfulfilled, reflecting a significant shortfall in global climate solidarity. In contrast, the actual financial requirement is far greater — the total demand for developing nations to address climate change by 2030 is projected to reach around USD 474 billion, with mitigation costs averaging USD 22.3 per ton of CO_2 and a mitigation-to-adaptation ratio of 1.4. For instance, Ethiopia alone has renewable energy investment potential of about USD 76 billion, but faces serious barriers such as regulatory risks, high taxation, and inadequate policy frameworks that limit private sector participation. These gaps highlight the urgent need to scale up and reform climate finance to make it more equitable, efficient, and accessible. Future strategies must focus on strengthening governance, integrating digital tools like blockchain for transparency, promoting blended finance to attract private investment, and ensuring greater inclusion of local communities. Only through such transformative approaches can climate finance effectively drive sustainable and resilient development across the developing world.

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