Received: May 2, 2025
Revised: October 20, 2025
Accepted: October 20, 2025
Published: October 22, 2025

Climate Financing and Low-Carbon Transition: A Systematic Review on the Role of International Development Banks

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To cite this article (APA): Lawal, M.A., Oseni, A.A. and Qadir, R.L. (2025), Climate Financing and Low-Carbon Transition: A Systematic Review on the Role of International Development Banks (IDB). *Elicit Journal of Economics and Management Studies (EJEMS),* 1, (1), 29-61.

ABSTRACT

Purpose: This study investigates the function of international development banks (IDBs) in financing climate initiatives and supporting the transition toward low-carbon economies. It examines the strategies employed, the effectiveness observed, and the challenges encountered by international development banks in augmenting climate financing, as well as their collaborative efforts with other financial entities to improve climate financing outcomes.
Methodology: The study was structured according to the PRISMA methodology, which involved a comprehensive review of scholarly literature sourced from reputable academic platforms, including Google Scholar, Elsevier's ScienceDirect, and SpringerLink, covering the timeframe from 2015 to 2024. The review identified 35 scholarly articles considered relevant to the objectives of this research.
Result: The review elucidates the strategies implemented by international development banks in promoting climate financing, including green bonds, climate funds, carbon pricing mechanisms, and partnerships with other financial institutions. Moreover, these findings illuminate the obstacles encountered in the expansion of climate finance and propose potential solutions to address these issues.
Novelty and contribution: This study offers a synthesized perspective on how IDBs integrate institutional capacity, innovation, and policy coordination to advance climate finance. It contributes a clearer understanding of their strategic role in accelerating the global low-carbon transition.
Practical and social implications: The findings guide policymakers and development financiers on improving institutional frameworks and partnerships for climate finance. Strengthened coordination can enhance green investment flows, promote sustainable growth, and support social and environmental resilience.

Keywords: Climate financing, International Development Bank, Low-carbon economy, Carbon pricing mechanisms, Climate Change

INTRODUCTION

According to the Intergovernmental Panel on Climate Change (IPCC, 2018), the global average temperature has increased by approximately 1°C, with projections indicating that it is likely to reach the 1.5°C threshold between the years 2030 and 2052, contingent upon the current trajectory of climatic alterations (Masson-Delmotte et al., 2018). In recent decades, the escalation of the global average temperature has been rising at an approximate rate of 0.2°C per decade. This trend underscores the urgent need for decisive and large-scale measures to reduce greenhouse gas emissions, ensuring that the rate of temperature increase slows sufficiently to keep global warming below the 1.5°C threshold. As emphasized in the most recent IPCC report (2022), the urgency of decarbonisation has become increasingly evident. While the ramifications of climate change are becoming more conspicuous, the temporal window for achieving a temperature increase of 1.5–2°C is diminishing. Achieving net-zero emissions by the year 2050 will require an annual reduction of 3%–5% in global greenhouse gas emissions. This benchmark was only accomplished during the COVID-19 pandemic, which serves to illustrate the magnitude of the transformative changes required to facilitate decarbonization (Daumas, 2024).

The principal strategies for climate protection encompass mitigation and adaptation. The UN International Panel on Climate Change (IPCC) articulates climate mitigation as: "An anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases." Conversely, climate adaptation pertains to the capacity of a system to modify in response to climate change (including climate variability and extremes) to mitigate potential harm, capitalize on opportunities, or manage the consequences. The IPCC defines climate adaptation as the "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities" (UN 1992). Between the two primary climate response strategies—mitigation and adaptation—mitigation has received predominant focus, whereas adaptation has been comparatively underexplored (Chiroli et al., 2023). Within the broader discourse on climate protection, a central and pressing issue is that of climate financing. Climate financing forms a component of environmental finance and partially intersects with green finance.

Climate financing pertains to the financial resources mobilized to tackle climate change mitigation, adaptation, and resilience-building initiatives (Panda, 2023). It encompasses funding from diverse sources, including public finances, private investments, and international mechanisms, aimed at diminishing greenhouse gas emissions, bolstering climate resilience, and fostering sustainable development (Pauw et al., 2021). Climate financing may enhance both the efficacy and equity of the global response to climate change, especially since adaptation financing can assist the most vulnerable nations, and mitigation financing can support developing countries in transitioning to low-carbon economies (Pickering et al., 2017). The transition to a low-carbon economy is a complex and multifaceted process that encompasses both economic and societal dimensions. Economically, it involves measures such as halting new fossil fuel extraction projects (SEI et al., 2021). Socially, it entails the implementation of climate policies, the creation of new institutional frameworks, and potentially profound lifestyle shifts toward greater sustainability and sufficiency (IPCC, 2022).

The institutional framework governing climate finance is inherently intricate and encompasses a multitude of participants (Nakhooda et al. 2015). The contributors to this framework primarily consist of developed donor nations, the European Union, and certain subnational entities. These actors establish specialized climate finance mechanisms and initiatives while also forming bilateral and multilateral organizations, including multilateral development banks (MDBs). Bilateral organizations typically collaborate with implementing agencies to facilitate the execution of their respective projects. Conversely, multilateral organizations employ both market-driven and non-market-driven methodologies to achieve their climate objectives. Market-driven methodologies—established under the Kyoto Protocol—include International Emissions Trading, the Clean Development Mechanism, and Joint Implementation (Varadarajan & Chitrah, 2021). Non-market methodologies encompass a diverse array of approaches, which may include any initiative that is not predicated on market principles, such as collaborative efforts in climate policy, fiscal strategies like carbon pricing, or tax mechanisms aimed at reducing emissions. The beneficiaries of these initiatives are predominantly developing nations, which typically engage with regional and national implementing agencies and funding sources.

In the preceding decade, there has been a marked escalation in climate finance flows directed towards developing nations, indicative of an increasing global acknowledgment of the imperative to assist vulnerable states in their efforts to mitigate and adapt to climate change According to the Climate Policy Initiative, global climate finance flows reached approximately USD 579 billion in 2019, with a considerable fraction allocated to developing nations. This financial influx comprises both public and private investments, alongside contributions from international climate financing entities such as the Green Climate Fund (GCF) and the Global Environment Facility (GEF) (Cui et al., 2020). Although the overall climate finance inflow to developing nations has surged, notable regional inequities persist in the distribution of funds. Countries situated in Africa, Asia, and small island developing states (SIDS) frequently receive a disproportionately lower share of climate finance in comparison to other regions, despite their heightened vulnerability to the ramifications of climate change. This inequality accentuates the necessity for focused initiatives aimed at addressing the distinct adaptation and mitigation requisites of these regions, which includes investments in resilient infrastructure, disaster risk management, and ecosystem rehabilitation (Chiroli et al., 2023).

Multilateral climate funding bodies such as the Green Climate Fund (GCF) and the Adaptation Fund are pivotal in directing climate finance towards developing nations. These funds employ a variety of distribution frameworks and criteria for resource allocation, which incorporate country eligibility requirements, project selection parameters, and funding modalities. For instance, the GCF emphasizes funding for projects that align with the objectives of the Paris Agreement, bolster climate resilience, and promote gender equality and social inclusivity (Puno, 2021). Furthermore, the GCF facilitates direct access to financial resources for national and sub-national organizations in developing nations, empowering them to conceive and implement climate initiatives that are customized to their unique requirements and priorities (Digitemie & Ekemezie, 2024).

Additionally, the geographic distribution of projects under the Clean Development Mechanism (CDM), an international market tool established by the Kyoto Protocol, reveals where the most efficient mitigation efforts are concentrated. As of May 2020, 75.2% of the emission credits (certified emission reductions, CERs) anticipated by the end of 2020 were tied to projects in just three countries: China, India, and Brazil (UNEP, 2020). At the same time, donors are facing growing pressure to prioritize poorer recipient nations in their development cooperation, as

outlined by commitments to "good donorship" principles, such as those in the Paris Declaration, which are tracked by various donor rankings (Michaelowa et al., 2020). Some donors may lack awareness of the differences between different types of aid and apply the same standards across all, while others may struggle to explain these distinctions to the public, succumbing to pressure even when misguided. As a result, many bilateral aid agencies face challenges in adopting efficiency-based criteria for climate change mitigation (Castro et al., 2020).

International development banks (IDBs) are central to funding climate initiatives, with a focus on both mitigation and adaptation strategies. They raise funds through financial tools like green bonds to support projects that lower greenhouse gas emissions and boost climate resilience (Varadarajan & Chitrah, 2022; Attridge & Gouett, 2021). The World Bank (WB), the largest global IDB, sets a precedent for regional development banks like the African (AfDB), Asian (ADB), Inter-American (IDB), European Bank for Reconstruction and Development (EBRD), and European Investment Bank (EIB). While these institutions are key players in global climate finance, they can only partially meet development demands. Their role is vital, as they collaborate with other public and private financial bodies to maximize resource mobilization through opportunity and risk sharing. Additionally, they are influential in developing and spreading norms (Chiroli et al., 2023).

The Paris Agreement's vision of aligning financial flows with low-carbon, climate-resilient development is a major driver in the work of multilateral development banks, which committed at COP 24 in December 2018 to align their actions with the goals of the agreement (Varadarajan & Chitrah, 2022). IDBs provide access to climate finance through concessional loans, grants, guarantees, and risk mitigation instruments to support mitigation and adaptation efforts in developing nations. They also track and report on their contributions to climate change following international agreements like the Paris Accord to ensure transparency and accountability (Xie et al., 2023). Additionally, IDBs act as knowledge hubs, facilitating knowledge sharing, capacity building, and peer learning among stakeholders to drive climate action (Manahan & Kumar, 2021). This review aims to explore the role of IDBs in financing climate change initiatives and transitioning to low-carbon economies.

1.1 The Paris Agreement

The 2015 Paris Agreement marks the first universal climate accord that assigns policy responsibilities to all participating nations. It establishes a hybrid governance model that combines both bottom-up and top-down approaches to global climate action (Bodansky, 2011). As a legally binding international treaty, it aims to address climate change and was endorsed by 196 countries during the United Nations Climate Change Conference (COP21) in Paris, France, on December 12, 2015. The agreement came into force on November 4, 2016. Operating on a laissez-faire principle, it allows countries to design their own domestic climate policies while obligating them under international law to plan, implement, and continually enhance their climate commitments (Dimitrov, 2024).

The central goal of the Paris Agreement is to limit the rise in global average temperature to well below 2°C above pre-industrial levels, with efforts directed toward constraining the increase to 1.5°C (UN, 2015). Under the agreement, UN member states must submit *nationally determined contributions* (NDCs) that outline their projected greenhouse gas (GHG) emissions for 2025 and 2030. These NDCs are to be updated every five years, guided by the results of periodic global stocktakes assessing progress toward long-term climate goals (Kuh, 2018). Through the

effective implementation of NDCs, global emissions are expected to decline relative to previous trajectories (UN, 2016). The agreement also emphasizes strengthening countries' adaptive capacities to cope with the impacts of climate change (UNFCCC, 2018).

Widely recognized as a cornerstone of international climate governance, the Paris Agreement provides a critical framework for emission reduction and resilience-building. However, despite its ambitions, projections suggest that even full implementation of current NDCs will be insufficient to achieve the 2°C target. This shortfall underscores the need for more robust carbon pricing systems and economic transformations to further reduce emissions. While the agreement fosters collective global action, it also exposes the persistent challenges of ensuring fairness, balancing economic trade-offs, and maintaining equitable participation among nations (Liu et al., 2019).

1.2 Study Rationale

To mitigate the most severe consequences of climate change, projections indicate that annual climate finance inflows amounting to US$5.2 trillion will be requisite by the year 2030 (Boehm et al. 2022). In spite of a marked increase in climate finance inflows over the preceding decade, only approximately $600 billion were accessible in 2020, with the prevailing rate of augmentation proving inadequate to realize a 1.5°C global warming threshold (Naran et al. 2022). Furthermore, a mere subset of the climate finance inflows is allocated to developing nations, where governmental budgets and capacities are notably constrained; consequently, the demand for supplementary investments continues to escalate, especially in the wake of the pandemic. The climate investment deficit cannot be sufficiently addressed by public financing alone, which encompasses resources provided by governmental entities, bilateral development finance institutions (DFIs), and multilateral development banks. Private investors possess assets totaling $210 trillion—approximately twice the gross domestic product (GDP) of the global economy (Georgieva & Adrian 2022)—and there exists an increasing impetus to channel a substantial fraction of this capital towards climate mitigation and adaptation initiatives. There exists a pressing need for international development banks to enhance collaboration with private sector entities, financial institutions, governmental bodies, and other relevant stakeholders to mitigate climate risk through adequate financial provisions. This review aims to examine the role of international development banks in climate financing and in supporting the transition toward low-carbon economies. The investigation is guided by the following research questions;

1. What strategies have international development banks adopted to facilitate climate financing for the transition to low-carbon economies?
2. How effective are these banks in mobilising and deploying climate finance to support low-carbon development?
3. What barriers do development banks commonly face in scaling up climate financing, and what measures can be taken to overcome them?
4. In what ways do international development banks collaborate with other financial institutions and governments to strengthen climate financing outcomes?

METHODOLOGY

This systematic review was carried out in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure a thorough and structured

approach to data collection and analysis (Bamiro et al., 2024). The review process started with the creation of a review protocol, which involved clearly defining the inclusion and exclusion criteria, along with developing a search strategy. Only studies published from 2015 onwards were included in the review.

2.1 Identification Phase

During the identification phase, relevant articles for this systematic review were retrieved from reputable academic databases, including Google Scholar, ScienceDirect, and SpringerLink. These platforms were chosen for their academic credibility and significant influence in scholarly research. The article search employed a combination of keywords and Boolean operators ("AND" and "OR"), using search strings such as *"Climate Financing," "Low-Carbon Transition AND International Development Banks," "Climate Funding AND Multilateral Development Banks,"* and *"Transition to Low-Carbon Economies AND International Financial Institutions."* Table 1 below presents the keywords utilized in the study's search process.

Table 1. Search Keywords

Database	**Key words**
Google scholar	"Climate Funding" AND "Multilateral Development Banks"
Springerlink	"Transition to Low Carbon Economies" AND "International Financial Institutions"
ScienceDirect	"Climate Financing, Low Carbon Transition AND International Development Banks"

2.2 Inclusion Phase

In the inclusion phase, all identified research publications were carefully assessed to determine their relevance to the study's objectives. The inclusion criteria (as summarized in Table 2) required that only peer-reviewed, English-language articles be considered, without restrictions based on the authors' nationality, reflecting the global scope of the research. Furthermore, the review targeted studies published between 2015 and 2024 to ensure the incorporation of recent and up-to-date findings.

2.3 Exclusion Phase

During the exclusion phase, the titles and abstracts of all retrieved articles were screened to assess their alignment with the study's criteria. Only those that fully met the inclusion requirements were advanced to the next stage of analysis. Publications such as book series, book chapters, reports, conference proceedings, and non-English papers were excluded. After applying these criteria, a total of 35 studies were deemed eligible and included in the systematic review (see Table 2).

Table 2. Inclusion and exclusion criteria

Criterion	**Included**	**Excluded**
Types of literature	Research articles	Conference proceedings, reports, book chapters
Language choice	English Language	Articles not in English

Country	Global	-
Span of years	2015-2024	2015 and earlier

2.3. Data extraction

This section offers a summary of the reviewed literature that aligns with the objectives of this study. A detailed analysis of the gathered data is conducted, focusing on key elements such as author names, country of origin, study titles, publication years, methodologies, findings, and the journals where the studies were published.

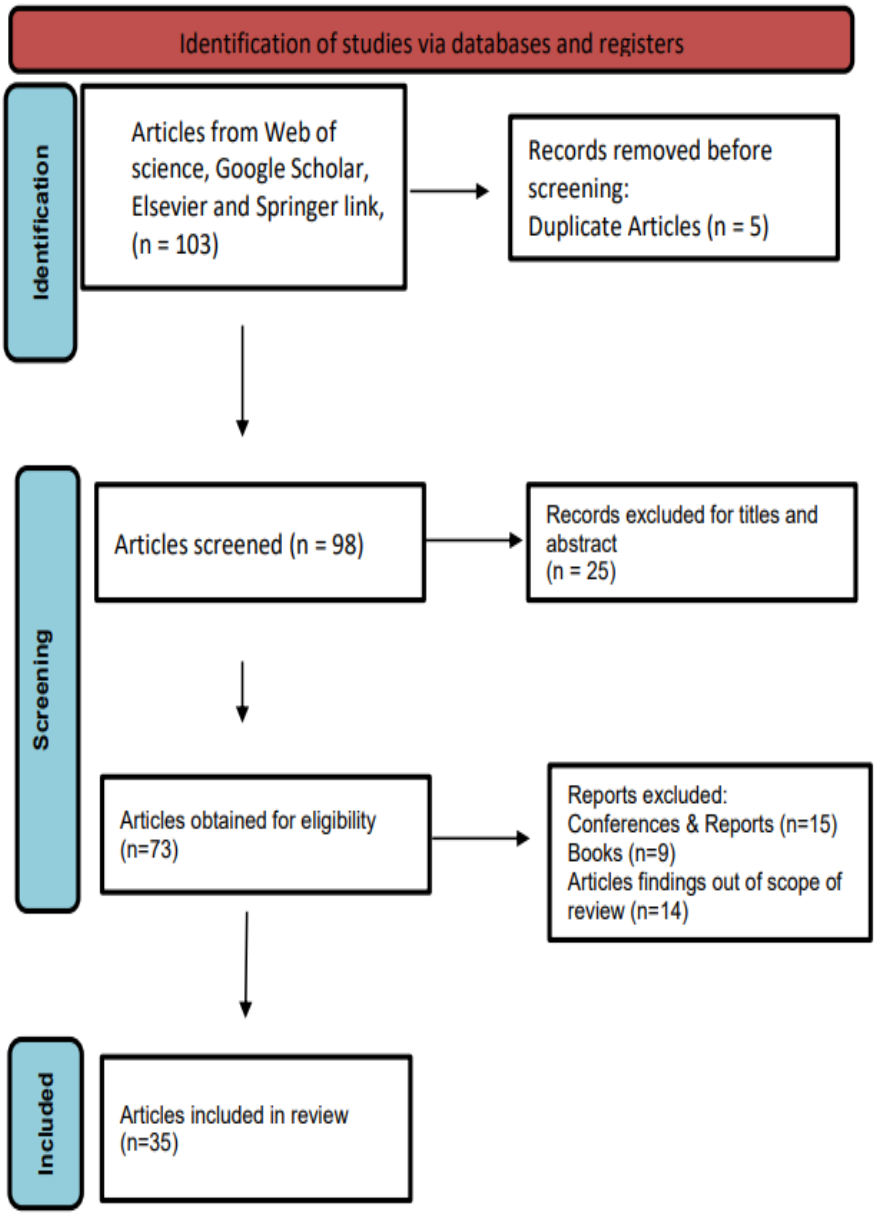


Figure. 1. PRISMA flow diagram illustrating the search and selection process

Table 3. Complete List of the Reviewed Selected Papers

S/N	Authors & Year	Method	Findings	Country	Journal
1	Omukuti (2020)	Qualitative	The paper explored the influence of multi-stakeholder engagement in climate funds. The paper found that the climate adaptation fund should be perceived as a country ownership principle	United Kingdom	Geoforum journal (Elsevier)
2.	Timilsina (2021)	Qualitative	The study provides an overview of existing international provisions on climate finance for adaptation	USA	Sustainability
3.	Digitemie and Ekemezie (2024)	Qualitative	The paper examines the allocation and distribution of climate finance, analyzing trends, disparities, and challenges in accessing and utilizing funds among developing nations.	Nigeria	Finance & Accounting Research Journal
4.	Li (2024)	Qualitative	The paper explores the challenges faced by financial institutions in the global transition to low -carbon economy. It also	China	International Journal of Social Sciences and Public Administration

			examines the mechanisms through which financial institutions can contribute to the transition towards low-carbon economies		
5.	Dasandara et al.(2022)	Qualitative	The paper examined barriers to climate financing in Sri Lanka and proposes strategies to address them.	Australia	Journal of Financial Management of Property and Construction
6.	Green (2021)	Qualitative	The study revealed that carbon pricing has a limited impact on emissions	Canada	Environmental Research Letters Journal
7.	Panda (2023)	Qualitative	The paper studies the transformative finance for climate resilient development	Japan	Current Opinion in Environmental Sustainability
8.	Adhikari and Safaee Chalkasra (2023)	Qualitative	The paper analyzed barriers that commonly inhibit private sector investment in climate adaptation action	Canada	Journal of Sustainable Finance & Investment
9.	Zhang (2020)	Qualitative	The study revealed	Hong kong	Journal of Sustainable Finance & Investment
10.	Sangiorgi and Schopohl, (2021)	Qualitative	The paper analyzed	United Kingdom	International Review of Financial Analysis
11.	Nguyen et al. (2023)	Qualitative	The paper highlighted barriers, opportunities, and	Vietnam	The European Journal of Development Research

			regulation difculties, and expected growth for the development of the green bond market		
12.	Deschryver and de Mariz (2020).	Qualitative	The paper identified barriers explaining the lack of scalability of the green bond market	USA	Journal of Risk and Financial Management
13.	Banga (2019)	Qualitative	This paper examined the potential of green bonds in mobilizing adaptation and mitigation finance for developing countries	France	Journal of Sustainable Finance & Investment
14.	Azhgaliyeva et al. (2020)	Qualitative	This paper provided a review of green bond issuance and green bond policies in ASEAN.	Singapore UK	Journal of Sustainable Finance & Investment
15.	Freeburn and Ramsay (2020)	Qualitative	The study identified the features of green bonds, green bond markets and challenges regarding the issuance of green bond by development banks	Australia	Capital Markets Law Journal (Elsevier)
16	Versal and Sholoiko (2022)	Quantitative	The paper identified the features of green bond issues and implemented green projects by	Ukraine	Investment Management and Financial Innovations

			the World Bank (the WB) and the European Bank for Reconstruction and Development (the EBRD)		
17	Mendez and Houghton (2019)	Qualitative	The study explored the role of multilateral development banks (MDBs) in originating norms of sustainable banking	Spain US	Sustainability
18	Ameli et al. (2020)	Quantitative	The paper provided an understanding of the conditions under which new actions and policies have to be taken to ensure long-term sustainable investing	UK	Climate change (Springerlink)
19	Ameli et al. (2021)	Qualitative	This study showed how modelled decarbonization pathways for developing economies are disproportionately impacted by different weighted average cost of capital (WACC) assumptions	UK	Nature communications
20	Bolton et al. (2022)	Qualitative	The paper found that price price-earnings discount has been linked to corporate carbon emissions	UK	Journal of Applied Corporate Finance

21	Gurara et al. (2020)	Qualitative	The result showed that MDBs' participation is associated with higher borrowing costs and longer maturities, signaling a greater willingness by MDBs to finance risky projects which may not be financed by the private sector	US	Journal of International Money and Finance
22	Chowdhury and Jomo (2022)	Qualitative	This article examined the state of play of climate finance and offers some suggestions to unblock the impasse	Australia	Development
23	Spencer et al. (2018)	Qualitative	The paper surveyed the political economy of coal sector transition in the context of the requirements of ambitious climate mitigation scenarios to limit warming to 1.5°C	France,China	Climate Policy
24	Fries (2023)	Qualitative	The paper found that MDBs help lower barriers to low-carbon investments in emerging markets and development economies.	United Kingdom	Policy Brief
25	Ogbo et al. (2024)	Qualitative	The paper revealed that technical barriers like inadequate infrastructure and limited expertise,	Nigeria	British Journal of Multidisciplinary and Advanced Studies,

			economic constraints due to high costs, and regulatory issues from the lack of a comprehensive legal framework leads to carbon capture storage challenges in Nigeria		
26	Wang et al. (2021)	Qualitative	The review examined breakthroughs and advancements across both established and emerging CCS/CCU systems with different Technology Readiness Levels (TRLs) in various industrial sectors	Austria	Frontiers Energy Resources
27	Boisson de Chazournes (2015)	Qualitative	The paper explored the complex web of financial assistance mechanisms in the climate change sector.	Switzerland	Laws
28	Ahamer (2021)	Qualitative	The paper explored how international financial institutions contribute to climate protection.	Austria	Project finance: Theory and Practice
29	Simpa et al. (2024)	Qualitative	This study critically evaluated the strategic implications of	UK, US	International Journal of Advanced Economics

			carbon pricing mechanisms on global environmental sustainability and economic development.		
30	Onwuka and Adu (2024)	Qualitative	The paper explored the mechanisms and comparative advantages of offshore carbon sequestration	Nigeria	Engineering Science & Technology Journal
31	Choi et al. (2020)	Quantitative	The study investigates the actors and the relationship between the actors by stage and year. As a result, the study visualized the network of PPPs in P4G, thereby revealing that the partnerships were evolving since the participants' relationships became stronger each year.	South Korea	Sustainability
32	Ugwu et al. (2024)	Qualitative	The paper investigated the role of PPPs in building clean energy infrastructure in the united states and Nigeria	USA	International Journal of Management & Entrepreneurship Research
33	Narassimhan et al. (2018)	Qualitative	The study reviewed emission trading systems in eight jurisdictions. It clarified the	USA	Climate poicy

			practices of implementing the system		
34	Florini and Pauli (2018)	Qualitative	This paper explored how and why sector collaborations are evolving, and what steps can or should be taken to ensure that partnerships create public and private value.	Singapore	Asia Pacific Policy studies
35	Nyikos and Kondor (2022)	Mixed method	The paper assessed the compliance of European national development banks with sustainability requirements by exploring their strategic objectives and investment activities.	Hungary	The Central European Journal of Regional Development And Tourism

RESULTS

3.1 Study Features

The study features include the publication year of the articles, the authors' affiliations, and the methodologies explored in each paper.

3.2 Classification by publication year

Figure 2 shows the distribution of the reviewed studies from 2015 to 2024. The year 2020 saw the highest number of publications, with 8 papers. Both 2021 and 2024 had 6 publications each, followed by 2022 with 5 papers. In 2023 and 2018, 4 and 3 papers were reviewed, respectively. There were only 2 publications in 2019, and just one paper from 2015. No papers were reviewed for the years 2016 and 2017.

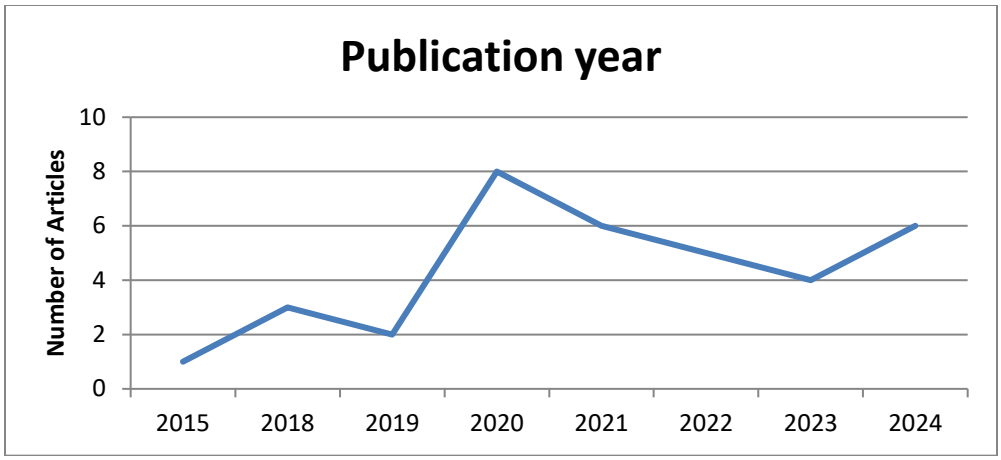
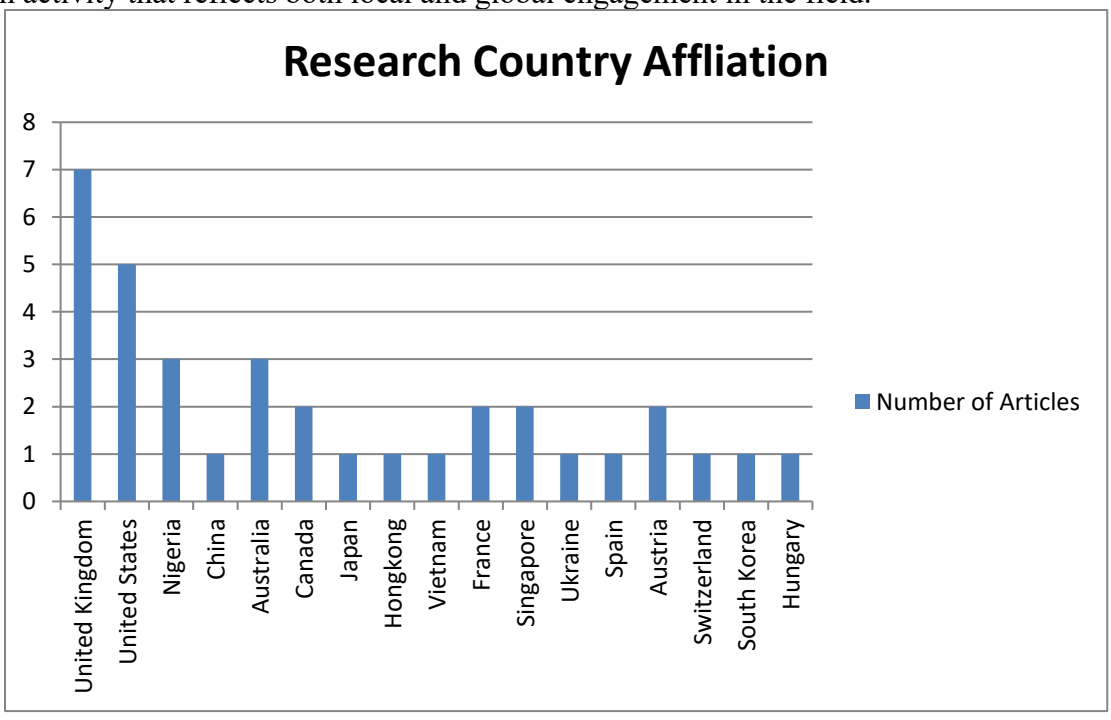


Figure 2. Years of Publication of the reviewed papers

3.3 *Geographical Distribution of Research Publications*

Table 4 shows the regional distribution of articles used in this study. The UK led with 7 articles, demonstrating a strong contribution from that region. The United States followed closely with 5 authors, highlighting its significant involvement. Nigeria and Australia each contributed 3 studies, while Canada, France, Singapore, and Austria each provided 2 studies. Additionally, China, Japan, Hong Kong, Vietnam, Ukraine, Spain, Switzerland, South Korea, and Hungary each contributed 1 study, showcasing a diverse range of geographical participation. The table also highlights collaborative research efforts across multiple countries, emphasizing a rich mix of international research activity that reflects both local and global engagement in the field.



3.4 Classification of Research Methods Used

Figure 3 illustrates the research methodologies employed in the reviewed articles. Of these, 31 studies used qualitative analysis, 3 employed quantitative methods, and 1 adopted a mixed-methods approach. This distribution highlights the prevalence of qualitative research, which typically emphasizes narrative reviews, case studies, and thorough examinations. In contrast, quantitative studies focus on data-driven statistical analyses to provide empirical evidence. The mixed-methods approach integrates both qualitative and quantitative techniques, combining detailed insights with empirical data, thus providing a more comprehensive and robust understanding of the findings.

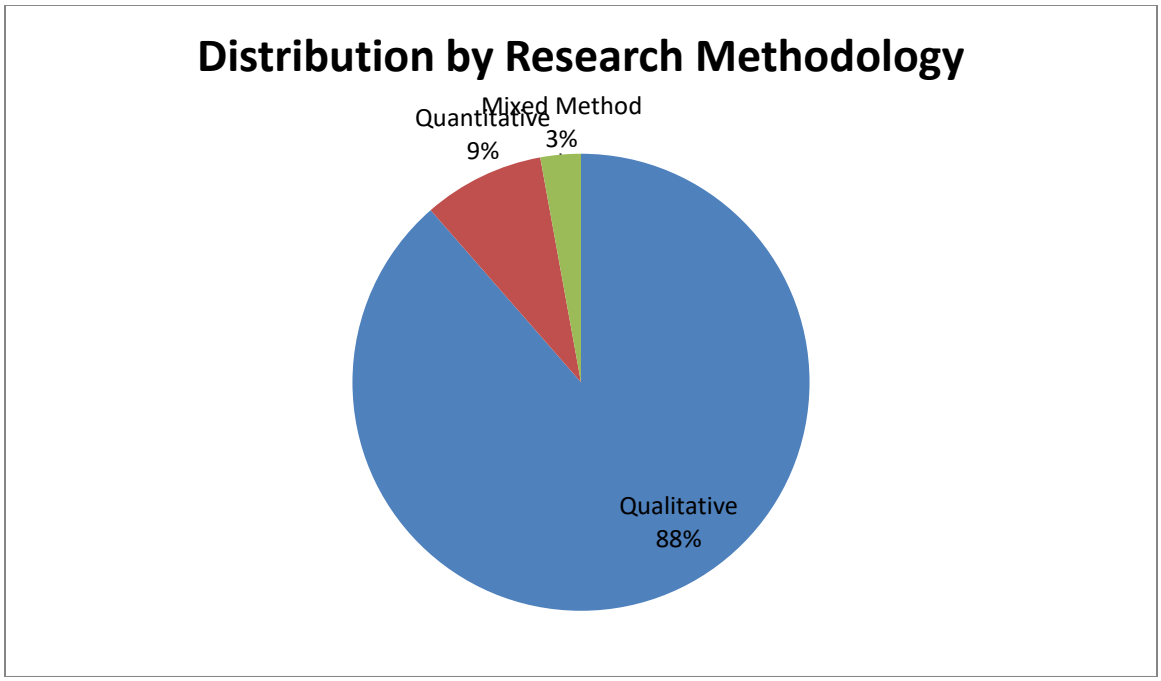


Figure 3. Distribution by research methodology

DISCUSSION

4.1 What strategies have international development banks employed to facilitate climate financing for low-carbon economies?

International Development Banks support climate financing for low-carbon economies through mechanisms such as green bonds, climate funds, carbon pricing, and partnerships with other institutions. These methods offer innovative ways to direct finance toward climate-related projects. For instance, green bonds allow investors to fund environmentally sustainable projects, while climate insurance products provide financial protection against climate risks and disasters (Rossitto, 2021; Digitemie & Ekemezie, 2024). Additionally, carbon pricing tools, such as carbon taxes and emissions trading systems, encourage emission reductions while generating revenue for climate finance.

4.1.1 Green Bonds

Green and climate bonds have gained significant attention in recent years as essential tools for funding the transition to a low-carbon economy. Initially a niche market in 2007, it has since expanded, attracting a broader range of investors and issuers (Deschryver & de Mariz, 2020). Multilateral development banks have led the way in issuing green bonds to support their environmental and development goals, while corporations and municipalities have also started to participate (Nguyen et al., 2022). The European Investment Bank (EIB) was the first to issue a climate-awareness bond in 2007, worth USD 1 billion. The World Bank followed in 2008 with its first green bond, funding climate mitigation and adaptation projects in its regions. Since then, municipalities, commercial banks, and major corporations have followed suit. By 2017, the green bond market had grown from USD 1 billion in 2007 to USD 895 billion, with USD 674 billion being self-labeled green bonds and USD 221 billion being certified labeled green bonds, according to the Climate Bonds Initiative (Banga, 2019).

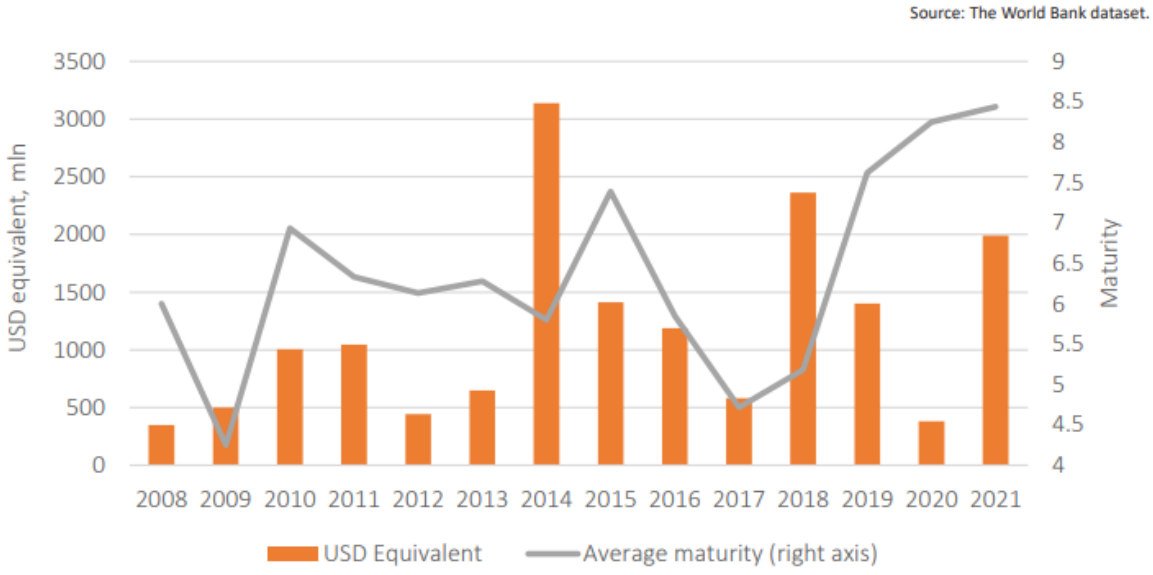


Figure 4. Green bond issues by the WB and average maturity of issues, 2008 – November 30, 2021 (Versal & Sholoiko, 2022)

Green bonds are fixed-income securities issued to raise capital for financing or refinancing projects to improve the natural environment. Essentially, they support the development of a low-carbon, climate-resilient economy. According to Azhgaliyeva et al. (2020) and Sangiorgi & Schopohl (2021), green bonds attract investors prioritizing sustainability and environmental protection over pure economic returns. Zhang (2020) noted a growing demand for green bonds among both individual and institutional investors, driven by increasing awareness of environmental issues and climate change. As a result, green bonds offer a valuable avenue for attracting investment committed to reducing emissions and addressing climate change, leading to lower financing costs for environmentally friendly projects.

However, Mendez & Houghton (2020) pointed out that multilateral development banks (MDBs) face significant challenges when issuing green bonds, particularly around project bankability, transparency, and market standards. The uncertain viability of green projects can deter investors due to perceived risks. Additionally, a lack of transparency in tracking the flow of

sustainable capital complicates the evaluation of the true environmental impact of green bonds, raising concerns about 'greenwashing' (Deschryver & de Mariz, 2020). The absence of a universal mechanism to align green investment supply with demand further creates market inefficiencies (Versal & Sholoiko, 2022). MDBs are also under pressure to relax green bond standards to meet high demand, which risks undermining the credibility of the green bond market (Freeburn & Ramsay, 2020). Together, these factors limit the scalability and effectiveness of development banks in issuing green bonds for climate financing.

4.1.2 Carbon Pricing Mechanism

The 2015 Paris Agreement has motivated governments to adopt stronger policies aimed at achieving decarbonization. One of the most economically efficient approaches to reducing greenhouse gas (GHG) emissions is through carbon pricing policy instruments. These mechanisms fall into three main types: cap-and-trade systems (or emissions trading systems, ETS), carbon taxes, and hybrid mechanisms that combine aspects of both (Narassimhan et al., 2018). Development banks utilize carbon pricing mechanisms to support climate financing by integrating standardized carbon pricing frameworks, which generate significant public revenues for climate initiatives (Simpa et al., 2024).

Liu et al. (2022) explored the links between deep decarbonization and air pollution reduction in China, revealing how carbon reduction strategies can also improve environmental quality. Their research emphasizes the transport sector's potential for significant carbon reductions, as well as the importance of energy intensity and structural changes in lowering emissions. It demonstrates that carbon pricing can effectively reduce air pollutants, although the impacts vary across different sectors and types of pollutants. Additionally, carbon pricing fosters economic development by encouraging green technology innovation and investment. The shift to a low-carbon economy, driven by carbon pricing, has the potential to stimulate economic growth, improve energy security, and drive structural changes towards more sustainable industries and supply chains (Onwuka & Adu, 2024). Moreover, carbon pricing can help finance critical infrastructure, supporting sustainable socio-economic development while bridging gaps in access to essential services. By combining carbon pricing with green bonds, immediate investments in low-carbon transitions are encouraged, ensuring that the financial responsibility for current climate mitigation efforts is shared by future generations (Deschryver & de Mariz, 2020). Development banks can also adopt flexible carbon pricing strategies to promote global cooperation and incentivize emissions reductions, contributing to a broader green transformation.

4.1.3 Partnership and Co-financing with other financial institutions

Leveraged co-financing from public and private sources has become a key policy focus for international development agencies as a way to achieve environmental and development objectives. Partnerships between development banks and other financial institutions offer significant benefits for climate financing. Anbumozhi et al. (2020) found that these collaborations help mobilize private capital, which is essential to bridging the substantial investment gap in sustainable infrastructure projects, especially in renewable energy sectors that may initially seem unattractive to private investors. Ahamer (2021) noted that by using blended finance strategies, international development banks can reduce the risk of investments, attract commercial equity and enable access to local-currency lending for projects like off-grid solar electricity. Co-financing

arrangements also expand the scale and impact of climate initiatives, as shown by the Global Environment Facility's approach to pooling resources from multiple stakeholders. This collaborative approach not only fosters innovative financial tools but also aligns investment strategies with the urgent need for low-carbon transitions, contributing to global climate goals (Li, 2024).

Choi et al. (2020) conducted a study on public-private partnership (PPP) networks using social network analysis to examine the relationships between stakeholders. Focusing on the Partnership for Green Growth and Global Goals 2030 (P4G), the research explored various actors and their connections across different stages and years. The study found that over 50 PPP initiatives in developing countries have received financial support. By analyzing the partnerships within P4G, the authors were able to track the evolution of these PPPs over time and by development stage, providing insights into how future PPPs could be implemented. Their visualization of the P4G network showed that these partnerships have become more interconnected and defined over time, with each actor's role becoming clearer at each stage of development. The study offers practical recommendations for practitioners aiming to enhance international development cooperation through PPPs in future projects.

4.2 How effective are international development banks in employing facilitation of climate financing for low carbon economies?

In their climate strategies, international development banks have pledged to enhance financing for climate projects and support policies aimed at mitigating climate change across key sectors (Fries, 2023). Multilateral development banks are instrumental in leveraging capabilities to create synergies between public and private sector operations. These efforts, which encompass technical assistance and financial support, aim to enhance policy frameworks and cultivate business environments conducive to low-carbon investments, thereby mitigating investment risks and amplifying returns. When effectively executed, these strategies are anticipated to expand investment avenues and stimulate low-carbon investments in developing nations.

To improve the business climate for low-carbon investments, implementing carbon pricing and abolishing fossil fuel subsidies is imperative. Such policy reforms are crucial for emerging markets and developing economies (Bolton et al., 2022). Nevertheless, a more urgent challenge for these nations is the swift deployment of competitively priced low-carbon technologies, including renewable energy and energy-efficient systems. Obstacles to technology adoption frequently arise from non-price factors such as energy policies and inadequate infrastructure (Ameli et al., 2020). Addressing these challenges necessitates an organized business environment and the execution of energy reforms.

Although policy reforms can enhance investment prospects, financing from development banks is vital for sustained investments in developing economies. Involvement of development banks in projects provides advantages, including specialized knowledge of local conditions, particularly in areas with limited private financing access. As debt and minority equity stakeholders, development banks play a role in risk allocation and mitigation (Gurara et al., 2020). Furthermore, their substantial involvement aids in aligning investment initiatives with sector-specific reforms.

Innovative climate finance mechanisms, such as the blended finance model utilized by multilateral development banks, efficiently mobilize concessional funds to facilitate necessary financing and investments (Fries, 2023). For instance, subsidies for private low-carbon

investments can target sectors and nations at the forefront of the transition, thereby reducing future investment costs (Spencer et al., 2018). Such cost reductions may arise from economies of scale, experiential learning, and network effects as energy systems transition from conventional to low-carbon technologies (Ameli et al., 2021).

Table5. **Climate-related financing goals and mitigation operations of multilateral development banks**

Climate-related financing goals	Policy analysis And lending		Sector priorities for low-carbon and energy efficiency investment				
	Country strategy	Sector reform	Energy	Agriculture and land use	Cities and buildings	Transport	Manufacturing
40% share of annual financing by 2020 and align operations with the Paris Agreement goals by 2025	✓	✓	✓	✓	✓	✓	✓
$80 billion in cumulative climate-related finance from 2019 to 2020	✓	✓	✓	✓	✓	✓	
50% share of annual financing by 2025 and align operations with the Paris Agreement goals by mid-2023			✓		✓	✓	
35% share of total financing from 2021 to 2025	✓	✓	✓	✓	✓	✓	✓

✓	✓	✓	✓	✓	✓	✓	Multilateral development bank
		✓	✓	✓	✓	✓	Africa Development Bank
✓	✓	✓	✓	✓	✓	✓	Asian Development Bank
✓	✓	✓		✓	✓		Asian Infrastructure Investment Bank
		✓		✓			World Bank Group

Note: Climate –related financing goals include both climate change mitigation and adaptation. The operational priorities for energy –related sectors are for climate change mitigation. Source: Source: Fries, S. (2023)

European Bank for Reconstruction and Development	50% share of annual financing by 2025 and align operations with the Paris Agreement goals
European Investment Bank	Exceed 50% share of its annual financing by 2025 and align operations with the Paris Agreement goals
Islamic Development Bank	35% share of its annual lending by 2025
Inter-American Development Bank	30% share of its annual financing from 2020 to 2023
New Development Bank	40% share of its total financing from 2022 to 2026

4.3 What are the common barriers faced in scaling up climate financing by development bank and how they can be addressed?

Climate finance is a pivotal element in supporting nations as they endeavor to mitigate and adapt to the ramifications of climate change (Omukuti, 2020). Notwithstanding the growing recognition of its significance, development banks encounter substantial impediments in augmenting financial resources. This section analyzes the barriers to the enhancement of climate finance via development banks and the methodologies deployed to surmount these challenges.

A principal obstacle is the restricted availability of financial resources, particularly for adaptation initiatives in developing nations (Timilsina, 2021). Despite commitments made by developed countries to provide financial assistance, the actual funding frequently falls short of the projected needs, thereby inhibiting numerous nations from securing the requisite resources for climate-related projects. Another critical challenge pertains to the unpredictability of policies and associated regulatory risks. Robust regulatory frameworks and incentives are essential for directing investment choices within carbon markets. However, uncertainties surrounding governmental policies, including alterations in energy subsidies, tax incentives, and carbon pricing, can engender volatility that discourages investors. Discrepancies in policies and regulatory risks compromise long-term investments in efforts aimed at carbon reduction, thereby impeding decarbonization initiatives (Digitemie & Ekemezie, 2024).

Li (2024) posited that shifts in governmental leadership and political priorities may lead to variations in energy and climate policies, which in turn engender uncertainty for investors and businesses. Inconsistencies in policy frameworks, such as modifications to renewable energy subsidies or carbon pricing mechanisms, can disrupt investment strategies and diminish investor confidence. The lack of enduring policy stability undermines the scalability and reliability of renewable energy projects and carbon reduction initiatives, potentially deterring private sector investments and decelerating the transition towards clean energy.

The intricacy of climate finance mechanisms, encompassing diverse funding sources, modalities, and criteria, poses additional challenges for development banks in accessing and

navigating funding avenues. The disjointed nature of climate finance governance, coupled with inadequate coordination among donors and financing entities, exacerbates these challenges, resulting in inefficiencies and delays in the mobilization and allocation of resources (Chowdhury & Jomo, 2022). Furthermore, protracted fund disbursement can defer the implementation of essential climate projects.

Numerous developing nations are deficient in the institutional capacity and technical expertise requisite for the effective management and utilization of climate finance, resulting in delays and inefficiencies in project execution. Ogbo et al. (2024) underscored that the development and deployment of carbon capture and storage (CCS) technologies encounter various technical and economic obstacles that limit their scalability and efficacy in mitigating emissions from fossil fuel-dependent industries. CCS technologies are crucial for alleviating emissions in carbon-intensive sectors such as power generation, manufacturing, and heavy industry. Nonetheless, they face challenges associated with exorbitant costs, energy penalties, and the availability of suitable storage sites. Public acceptance and regulatory uncertainties concerning CCS implementation, along with apprehensions regarding leakage and long-term liability, further hinder widespread adoption (Wang et al., 2024).

To address these technological and infrastructural challenges, collaborative initiatives among policymakers, industry stakeholders, and research institutions are imperative to foster innovation, curtail costs, and dismantle deployment barriers. Cooperation between public and private sectors, academia, and civil society is vital to propel technological advancement, bolster infrastructure resilience, and facilitate the transition towards a sustainable, low-carbon energy future.

Strengthening institutional capacity and enhancing coordination among stakeholders are imperative for the effective mitigation of these obstacles and the augmentation of climate finance. Green bonds, which represent debt instruments specifically designed to finance projects pertinent to climate change, such as initiatives for renewable energy, enhancements in energy efficiency, and sustainable infrastructure development, constitute a component of the overall solution. Climate funds, including the Green Climate Fund (GCF) and the Climate Investment Funds (CIFs), provide essential financial assistance for climate-related initiatives in developing nations, leveraging investments from both the public and private sectors to amplify climate finance. These financial instruments present opportunities for the mobilization of additional resources directed towards climate action while concurrently fostering sustainable development.

International development banks can proactively engage with policymakers, regulatory bodies, and governmental agencies to advocate for favorable policy frameworks and incentives that stimulate investments in renewable energy and the establishment of carbon pricing mechanisms. By contributing to the development of energy and climate policies, financial institutions can influence regulatory environments that promote the deployment of clean energy technologies, mitigate investment risks, and encourage market incentives for initiatives aimed at carbon reduction.

Climate insurance and risk-sharing mechanisms function as financial protections against climate-induced risks and disasters, thereby assisting in the alleviation of the economic and social repercussions of extreme weather events on vulnerable communities and economies. These

mechanisms, which encompass weather index insurance, catastrophe bonds, and risk pooling arrangements, serve to transfer the financial risks associated with climate hazards from susceptible populations to insurers, governmental entities, and international financial institutions, thereby providing a safety net for those disproportionately affected by climate change.

Carbon pricing mechanisms, including carbon taxes and emissions trading systems, incentivize the reduction of emissions while simultaneously generating revenue for climate finance initiatives (Green, 2021). By imposing a cost on carbon emissions, these mechanisms internalize the social and environmental repercussions of climate change, thereby motivating polluters to transition towards cleaner, low-carbon technologies and practices. The implementation of carbon pricing can mobilize significant financial resources for climate action, establishing a stable and predictable funding source for both mitigation and adaptation endeavors.

Impact investing concentrates on financing projects, enterprises, and funds that aim to generate positive social and environmental outcomes alongside financial returns. Impact investors place a premium on initiatives that confront climate change, advocate for sustainable development, and bolster resilience against climate-related risks. By aligning financial objectives with environmental and social priorities, impact investing has the potential to mobilize capital for climate finance initiatives and facilitate the transition towards a low-carbon and climate-resilient economy (Dasandara et al., 2022).

In conclusion, the scaling up of climate finance through development banks mandates collaborative efforts among governmental entities, international organizations, financial institutions, and civil society to surmount barriers, mobilize additional resources, and promote innovative financing mechanisms. By identifying opportunities for resource mobilization—such as green bonds, climate funds, climate insurance, risk-sharing mechanisms, and innovative financing tools—policymakers, practitioners, and stakeholders can expedite climate action, enhance resilience to the impacts of climate change, and realize sustainable development objectives.

4.4 How do international development banks collaborate with other financial institutions and governments to enhance climate financing outcomes?

Ahamer (2021) analyzed the role of international financial institutions in climate protection. Findings indicated that international development banks (IDBs) improve climate financing by collaborating strategically with other financial entities and governments. They employ blending tools to amalgamate funds from diverse donors, including the Green Climate Fund and the World Bank, to effectively support climate initiatives. Digitemie & Ekemezie (2024) highlighted the importance of public funds in financing climate change mitigation and adaptation activities, such as renewable energy initiatives, ecosystem restoration, and disaster risk reduction efforts.

Boisson de Chazournes (2015) emphasized the private sector's significant contribution to climate finance and the growing presence of financial mechanisms facilitated by international organizations, like the World Bank. Private investments are critical for enhancing climate finance and mobilizing additional resources for climate initiatives (Adhikari and Safaee Chalkasra, 2023). Engagement from the private sector in climate finance includes diverse activities, encompassing investments in renewable energy, energy efficiency, clean technology, and sustainable

infrastructure projects. Various entities, including institutional investors, commercial banks, venture capital firms, and impact investors, contribute to climate finance through mechanisms such as green bonds, carbon markets, climate funds, and public-private partnerships (PPPs). Harnessing private investments is vital for addressing the climate finance gap and promoting transformative changes towards a low-carbon, climate-resilient economy (Panda, 2023). Ugwu et al. (2024) supported that PPPs can expedite the transition to a low-carbon future while fostering economic growth and enhancing energy security by integrating public resources with private sector innovation and efficiency. Nyikos & Kondor (2022) evaluated the adherence of European national development banks to sustainability requirements by analyzing their strategic objectives and investment activities. The study found that government dedication to sustainable development substantially affects national development banks' involvement in sustainable finance, ensuring alignment with policy objectives and effectively addressing market failures.

Governments are crucial in this context by providing political backing and strengthening the operational frameworks that direct development banks, ensuring their financing strategies foster long-term macro-fiscal stability and a just transition to climate neutrality (Florini & Pauli, 2018). Additionally, the synchronization of policies and procedures, as highlighted in the Paris Declaration, is vital for enhancing aid effectiveness and ensuring that development efforts cater to local needs. In conclusion, it is imperative for international development banks to collaborate with climate stakeholders, including the private sector, as this cooperative approach not only optimizes funding processes but also improves the efficacy of climate projects through coordinated stakeholder efforts.

CONCLUSIONS

This study underscores the crucial function of international development banks in financing climate-related initiatives and promoting transitions towards low carbon economies. By employing a variety of financial instruments, including green bonds and carbon pricing mechanisms, these institutions enhance projects designed to mitigate greenhouse gas emissions and improve climate resilience. The review articulates the methodologies utilized by international development banks to facilitate climate financing, encompassing green bonds, climate funds, and collaborations with financial institutions. The effectiveness of these methodologies is dependent on the operational efficiency of the development banks.

Despite the promise of international development banks, challenges emerge in the scaling of climate finance for low-carbon economies, which include funding constraints, the necessity for policy stability, fragmented governance, reluctance from private investors, and political prioritization. These challenges must be addressed to effectively scale climate financing. Moreover, international development banks should actively engage with policymakers and regulators to advocate for conducive policy frameworks, incentives, and regulations that bolster climate financing and renewable energy investments. By contributing to the evolution of energy and climate policy, financial institutions can shape regulatory conditions that facilitate clean energy technologies, diminish investment risks, and encourage carbon reduction initiatives.

The study further accentuates the importance of collaboration among international development banks and various stakeholders, such as governmental entities, private sectors, non-governmental organizations, and civil societies. Such collaborations enhance the outcomes of climate finance and accelerate the transition to a low-carbon economy while promoting economic

growth. Additional empirical research is essential to thoroughly comprehend the role of international development banks in low-carbon transitions, alongside an analysis of their strengths and weaknesses.

SOCIAL AND PRACTICAL IMPLICATIONS

The findings of this study reveal that international development banks (IDBs) play a crucial role in advancing climate finance and facilitating the global transition to low-carbon economies. By promoting inclusive and equitable access to financial resources, IDBs can strengthen adaptation and resilience in climate-vulnerable regions such as Sub-Saharan Africa, Small Island developing states (SIDS), and South Asia. Enhancing IDB support for adaptation projects not only contributes to environmental sustainability but also reduces socio-economic disparities and promotes community well-being.

From a policy standpoint, the research underscores the criticality of establishing stable and coherent regulatory frameworks that incentivize investments in low-carbon technologies. Policymakers ought to formulate targeted fiscal and financial incentives, such as tax credits, concessional loans, and guarantees, to stimulate private sector engagement in renewable energy and climate adaptation endeavors. Furthermore, alignment between national climate policies and the strategic imperatives of IDBs can cultivate coherence, enhance policy credibility, and yield sustainable outcomes over the long term. The study additionally highlights the necessity for coherent governance frameworks and transparent financing mechanisms to guarantee the efficient distribution of climate funds. Strengthened collaboration among governments, IDBs, and private sector entities can expedite the transition toward sustainable, low-carbon economies. The implementation of digital technologies—such as blockchain and artificial intelligence—can further enhance accountability, monitoring, and traceability of climate finance flows.

Practically, the findings provide guidance for development practitioners and financial managers in the formulation of innovative funding models, including green bonds and blended finance instruments, aimed at mobilizing private capital for climate initiatives. Empowering local institutions through capacity-building efforts and participatory governance can also ensure that climate finance effectively addresses both mitigation and adaptation priorities.

IMPLICATION FOR THEORY DEVELOPMENT

The study contributes to theoretical discourse by extending institutional and sustainability finance frameworks to explain the evolving role of IDBs in climate governance. It underscores how institutional legitimacy, stakeholder collaboration, and policy alignment jointly influence the effectiveness of climate finance systems. The synthesis also supports the development of a multidimensional model linking financial innovation, governance quality, and sustainable development outcomes.

Future theoretical work could explore how transnational partnerships reshape the institutional landscape of climate finance. Such research would deepen scholarly understanding of climate finance as both an economic mechanism and an institutional driver of sustainable transformation

LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

This study presents a thorough synthesis of the contributions of international development banks (IDBs) to climate finance and transitions to low-carbon economies; nonetheless, several constraints warrant recognition. The research is based on a systematic literature review (SLR), which inherently depends on the scope and quality of available secondary data. While the review adheres to the PRISMA framework to uphold methodological rigor, the analysis was confined to peer-reviewed articles published between 2015 and 2024, which may inadvertently omit valuable insights derived from grey literature and institutional reports. Subsequent investigations might employ mixed-methods or bibliometric methodologies to yield more data-driven and comparative examinations of trends in climate finance. Additionally, the global perspective adopted limits the differentiation of regional and institutional contexts, potentially obscuring the distinct characteristics of development banks such as the AfDB, ADB, EBRD, and World Bank. It is advisable to conduct comparative regional studies to elucidate context-specific drivers and impediments that influence IDB interventions in climate finance.

Furthermore, the majority of the reviewed literature prioritizes mitigation-oriented instruments—such as green bonds and carbon pricing while the financing of adaptation initiatives remains inadequately explored. Additional empirical research should examine adaptation mechanisms, including resilience bonds and climate insurance, particularly in vulnerable regions such as Sub-Saharan Africa, Small Island Developing States (SIDS), and South Asia. Lastly, as emergent technologies such as artificial intelligence (AI), blockchain, and digital finance platforms gain traction, future scholars should investigate the potential of these innovations to enhance the traceability, monitoring, and impact assessment of climate finance flows. The incorporation of digital tools into climate finance frameworks could substantially augment transparency and accountability while facilitating real-time evaluations of low-carbon investments. Addressing these limitations through interdisciplinary and context-sensitive research will fortify the comprehension of the intricate interactions between international development finance, climate policy, and sustainability transitions, thereby providing a more robust empirical foundation for evidence-based policymaking.

FUNDING

The authors declare that no financial support was received for the research, authorship, and publication of this article.

DECLARATION OF USE OF GENERATIVE AI

In accordance with the publication ethics policy of Elicit Publishing Limited, the author(s) declare that generative artificial intelligence (AI) tools were employed solely for language refinement and formatting purposes. The AI tools were not used in the conception, design, data collection, analysis, or interpretation of the study. The author(s) retain full responsibility for the accuracy, originality, and integrity of the content presented in this manuscript.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

REFERENCES

Adhikari, B., & Safaee Chalkasra, L.S. (2023). Mobilizing private sector investment for climate action: enhancing ambition and scaling up implementation. *Journal of Sustainable Finance & Investment, 13*(2), 1110-1127.https://doi.org/10.1080/20430795.2021.1917929

Ahamer G. (2021). International financial institutions ask to contribute to climate protection. *Finance: Theory and Practice. 25*(4):6-23 https://doi.org/10.26794/2587-5671-2020-25-4-6-23

Aldy, J. E., & Stavins, R. N. (2012). The Promise and Problems of Pricing Carbon: Theory and Experience. *The Journal of Environment & Development, 21*(2), 152-180. https://doi.org/10.1177/1070496512442508

Ameli, N., P. Drummond, A. Bisaro, M. Grubb, and H. Chenet. (2020). Climate finance and why disclosure for institutional investors is not enough. *Climate Change 160*: 565–89. https://doi.org/10.1007/s10584-019-02542-2

Ameli, N., O. Dessens, M. Winning, J. Cronin, H. Chenet, P. Drummond, A. Calzadilla, G. Anandarajah, and M. Grubb. (2021). Higher cost of finance exacerbates a climate investment trap in developing economies. *Nature Communication 12*: 4046. https://doi.org/10.1038/s41467-021-24305-3

Attridge, S., & Gouett, M. (2021). Development finance institutions: the need for bold action to invest better. ODI Report. https://odi.org/en/publications/development-finance-institutions-the-need-for-bold-action-to-invest-better/

Azhgaliyeva, D., Kapoor, A. and Liu, Y. (2020). Green bonds for fnancing renewable energy and energy efciency in South-East Asia: A review of policies. *Journal of Sustainable Finance & Investment 10* (2): 113–140. https://doi.org/10.1080/20430795.2019.1704160

Bamiro, N. B., Zakariyah, Z., Qian Li, & Adewale, S. (2024). Evaluating the Psychometric Properties of Economic Literacy Measures: A Systematic Review. Asian Journal of Assessment in Teaching and Learning, 14(1), 85–104. https://doi.org/10.37134/ajatel.vol14.1.8.2024.

Banga, J. (2019). The green bond market: a potential source of climate finance for developing countries, *Journal of Sustainable Finance & Investment, 9*:1, 17-32, https://doi.org/10.1080/20430795.2018.1498617

Bodansky, D. (2011). A Tale of Two Architectures: The Once and Future U.N. Climate Change Regime. *Arizona State Law Journal 43* (3): 697–712. https://doi.org/10.2139/ssrn.1773865

Boehm, S., Louise, J., Kelly, L., Judit, H., Clea, S., Claire, F., Aman, M., et al. (2022). State of Climate Action 2022. Berlin: Climate Analytics; Cologne: Climate Action Tracker and NewClimate Institute; San Francisco: ClimateWorks Foundation; New York: United Nations Climate Change High-Level Champions; and Washington, DC: Bezos Earth Fund and World Resources Institute. https://www.wri.org/research/state-climate-action-2022.

Boisson de Chazournes, L. (2015). Is there Room for Coherence in Climate FinancialAssistance? *Laws, vol. 4*, p. 541-558 https://doi.org/10.3390/laws4030541

Bolton, P., Z. Halem, and Kacperczyk, M. (2022). The financial cost of carbon. *Journal of Applied Corporate Finance 34*, no. 2: 17–29. https://doi.org/10.1111/jacf.12502

Castro, P., Michaelowa, K., & Namhata, C. (2020). Donor Accountability Reconsidered: Aid Allocation in the Age of Global Public Goods. In Proceedings of the Presentation at Political Economy of International Organizations, Vancouver, BC, Canada, 20–22 February 2020 https://doi.org/10.5167/uzh-207822

Chiroli, D.M.D.G., Menezes, M.G., Zola, F.C., Aragão, F.V., de Almeida, R.D., & Tebcherani, S.M. (2023). Integrating resilience and sustainability: A systematic analysis of resilient cities using ISO 37123. *International Journal of Disaster Risk Reduction,* 103960. https://doi.org/10.1016/j.ijdrr.2023.103960

Choi, G., Jin, T., Jeong, Y. & Lee, S.K. (2020). Evolution of Partnerships for Sustainable Development: The Case of P4G, *Sustainability, 12*, 6485, 1-13. https://doi.org/10.3390/su12166485

Chowdhury, A. & Jomo, K. S. (2022). The Climate Finance Conundrum. *Development, 65*(1):29-41. https://doi.org/10.1057/s41301-022-00329-0

Cui, L., Sun, Y., Song, M., & Zhu, L. (2020). Co-financing in the green climate fund: Lessons from the global environment facility. *Climate Policy, 20*(1), 95-108. https://doi.org/10.1080/14693062.2019.1690968

Dasandara, M., Ingirige, B., Kulatunga, U., & Fernando, T. (2022). Climate financing barriers and strategies : the case of Sri Lanka. *Journal of Financial Management of Property and Construction,* https://doi.org/10.1108/JFMPC-12-2021-0069?u

Daumas, L. (2024). Financial stability, stranded assets and the low-carbon transition – A critical review of the theoretical and applied literatures. *Journal of Economic Survey, 38*,601-716. https://doi.org/10.1111/joes.12551

Deschryver, P. & de Mariz, F. (2020). What Future for the Green Bond Market? How Can Policymakers, Companies, and Investors Unlock the Potential of the Green Bond Market? *Journal of Risk and Financial Management, 13* (61), 1-26. https://doi.org/10.3390/jrfm13030061

Dimitrov, R.S. (2024). The Paris Agreement on Climate Change: Behind Closed Doors. https://doi.org/10.1162/GLEP_a_00361

Digitemie, W.N. & Ekemezie, I.O. (2024). Assessing the Role of Climate Finance in Supporting Developing Nations: A Comprehensive Review, *Finance & Accounting Research Journal, Volume 6*(3), 408-420. http://dx.doi.org/10.51594/farj.v6i3.926

El Ghoul, S., O. Guedhami, H. Kuang, and Y. Zheng. 2024. "Does climate change exposure matter to stakeholders? Evidence from the costs of high leverage". *Review of Corporate Finance, 4*. http://dx.doi.org/10.1561/114.00000060

Fernández-Arias, E., Hausmann, R., & Panizza, P. (2019). Smart Development Banks. (2):395-420 https://doi.org/10.1007/s10842-019-00328-x

Florini, A. & Pauli, M. (2018). Collaborative governance for the Sustainable Development Goals. *Asia Pacific Policy studies, 5*: 583-598. https://doi.org/10.1002/app5.252

Fries, S. (2023). Multilateral development banks are key to unlocking low-carbon investments in developing economies. *Policy Brief, 23* (2), 1-25 https://ssrn.com/abstract=4414351

Freeburn, L. & Ramsay, I. (2020). Green Bonds: Legal and Policy Issues. *Capital Markets Law Journal, Vol. 15,* 4, pp. 418-442 https://doi.org/10.2139/ssrn.3715969

Georgieva, K., and Adrian, T. (2022). "*Public Sector Must Play Major Role in Catalyzing Private Climate Finance." IMF Blog, International Monetary Fund, August 18. https://www.imf.org/en/ Blogs/Articles/2022/08/18/public-sector-must-play-major-role-incatalyzing-private-climate-finance*

Green, J.F. (2021). Does carbon pricing reduce emissions? A review of ex-post analyses. *Environmental Research Letters, 16*(4), 043004. https://doi.org/10.1088/1748-9326/abdae9

Gurara, D., A. Presbitero, and M. Sarmiento. 2020. Borrowing costs and the role of multilateral development banks: Evidence from cross-border syndicated bank lending. *Journal of International Money and Finance 100*: 102090. https://doi.org/10.5089/9781484386200.001

Hirth, L., and J. C. Steckel. 2016. The role of capital costs in decarbonizing the electricity sector. *Environmental Research Letters 11*: 114010 https://doi.org/10.1088/1748-9326/11/11/114010

IPCC. (2022). 'Summary for Policymakers', In P.R. Shukla (Eds.) Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. https://www.ipcc.ch/report/ar6/wg3/

Kuh, K. F. (2018). *The Law of Climate Change Mitigation: An Overview. Encyclopedia of the Anthropocene, 505–510.* doi:10.1016/b978-0-12-809665-9.10027-8

Li, W. (2024). Energy Finance and Carbon Finance: Key Roles of the Financial Community in Addressing Climate Change. *International Journal of Social Sciences and Public Administration, 2*(2): 307-316 https://doi.org/10.62051/ijsspa.v2n2.43

Liu, W., Warwick, J., McKibbin., Adele, C., Morris., Peter, J.W. (2019). Global Economic and Environmental Outcomes of the Paris Agreement. *Social Science Research Network*, http://dx.doi.org/10.2139/ssrn.3317263

Manahan, M.A., & Kumar, M. (2021). *The great takeover: mapping of multistakeholderism in global governance*. https://www.tni.org/en/publication/the-great-takeover

Masson-Delmotte, V., Zhai, P., Portner, H.O. et al. (2018). *Summary for Policy Makers. Global warming of 1.5 C. World Meteorological Organization. Geneva, Switzerland; wmo.int/* https://www.ipcc.ch/sr15/chapter/spm/

Mendez, A. & Houghton, D.P.(2020). Sustainable Banking: The Role of Multilateral Development Banks as Norm Entrepreneurs. *Sustainability, 12*(3):972 https://doi.org/10.3390/su12030972

Michaelowa, K., Michaelowa, A., Reinsberg, B. & Shislov, I. (2020). Do Multilateral Development Bank Trust Funds Allocate Climate Finance Efficiently?. *Sustainability, 12*, 5529, 1-17. https://doi.org/10.3390/su12145529

Naran, B., Jake, C., Paul, R., Dharshan, W., Githungo, W., and Barbara, B. (2022). Global Landscape of Climate Finance: A Decade of Data. San Francisco: Climate Policy Initiative. *https://www.climatepolicyinitiative.org/publication/globallandscape-of-climate-finance-a-decade-of-data*

Narassimhan, E., Gallagher, K. S., Koester, S., & Alejo, J. R. (2018). Carbon pricing in practice: a review of existing emissions trading systems. *Climate Policy*, *18*(8), 967–991. https://doi.org/10.1080/14693062.2018.1467827

Nguyen, A.H., Hoang, T.G., Nguyen, D.T., Nguyen, L.Q.T., Doan, D.T. (2023). The Development of Green Bond in Developing Countries: Insights from Southeast Asia Market Participants. *The European Journal of Development Research, 35*:196–218 https://doi.org/10.1057/s41287-022-00515-3

Nyikos, G, Kondor, Z. (2022). The Involvement of National Development Banks Promoting Sustainable Finance. *Deturope-The Central European Journal Of Regional Development And Tourism, 14*(1), 147-163. https://doi.org/10.32725/det.2022.008

Ogbo O.G., Onuoha D.C., and Odoh C.C. (2024) Carbon Capture and Storage (CCS) in Nigeria: A Review of Challenges and Opportunities, *British Journal of Multidisciplinary and Advanced Studies, 5*(4),1-18 https://doi.org/10.37745/bjmas.2022.04148

Omukuti, J. (2020). Country ownership of adaptation: Stakeholder influence or government control?. *Geoforum, 113*, 26-38. https://doi.org/10.1016/j.geoforum.2020.04.019

Onwuka, O. U., & Adu, A. (2024). Subsurface carbon sequestration potential in offshore environments: A geoscientific perspective. *Engineering Science & Technology Journal, 5*(4), 1173-1183 https://doi.org/10.51594/estj.v5i4.994

Panda, A. (2023). Transformative finance for climate-resilient development. *Current Opinion in Environmental Sustainability, 64*, 101327 https://doi.org/10.1016/j.cosust.2023.101327#

Pauw, W.P., König, M., Sadikhova, K., & Stutzmann, T. (2021). Financing Low-Carbon and Climate Resilient Development: Do countries integrate Article 2.1 (c) of the Paris Agreement in their long-term strategies? https://www.fs-unep-centre.org/wp-content/uploads/2022/01/Report_Long_term_strategies_final1.pdf

Pickering, J., Betzold, C. & Skovgaard, J.(2017). Special issue: managing fragmentation and complexity in the emerging system of international climate finance. *International Environment Agreements* ***17***, 1–16. https://doi.org/10.1007/s10784-016-9349-2

Puno, R.V.D. (2021). Integrating social and environmental safeguards in the implementation of the Paris agreement's sustainable development mechanism. *Environmental Law, 51*(1), 205-222. https://www.researchgate.net/publication/354070837_Integrating_Social_and_Environmental_Safeguards_in_the_Implementation_of_the_Paris_Agreement's_Sustainable_Development_Mechanism

Sangiorgi, I., and Schopohl, L. (2021). Why do institutional investors buy green bonds: Evidence from a survey of European asset managers. *International Review of Financial Analysis 75:* 101738. https://doi.org/10.1016/j.irfa.2021.101738

SEI. (2021). The Production Gap Report 2021. Stockholm: SEI. Available at: http://productiongap.org/2021report

Simpa, P., SolomonN.O., Adenekan, A.O., & Obasi, S.C. (2024). Strategic implications of carbon pricing on global environmental sustainability and economic development: A conceptual framework. *International journal of advanced economics,* 6 (5), 139-172 https://doi.org/10.51594/ijae.v6i5.1134

Spencer, T., M. Colombier, O. Sartor, A. Garg, V., Tiwari, J. Burton, T. Caetano, F. Green, F. Teng, and Wiseman, J. (2017). The 1.5° C target and coal sector transition: At the limits of societal feasibility. *Climate Policy 18*, no. 3: 335–51. https://doi.org/10.1080/14693062.2017.1386540

Timilsina, G.R. (2021). Financing climate change adaptation: International initiatives. *Sustainability, 13*(12), 6515 https://doi.org/10.3390/su13126515

Ugwu, M.C., Adewusi, A. O. & Nwokolo, N.E. (2024). The Role Of Public-Private Partnerships In Building Clean Energy Infrastructure In The United States And Nigeria. *International Journal of Management & Entrepreneurship Research, 6*(4),1049-1068. https://doi.org/10.51594/ijmer.v6i4.984

United Nations (2015). *The Paris agreement*. Retrieved October 31, 2023 from https://unfccc.int/sites/default/files/english_paris_agreement.pdf

United Nations (2016*). Aggregate effect of the intended nationally determined contributions: An update—Synthesis report by the secretariat*. In Conference of the Parties Twenty-second

session Marrakech, 7-18 November 2016. Retrieved October 31, 2023, from https://pfbc-cbfp.org/news_en/items/Unfccc-Synthesis.html

United Nations Framework Convention on Climate Change (2018). *What is the United Nations framework convention on climate change*? Retrieved October 31, 2023, from https://unfccc.int/process/the-convention/what-is-the-united-nations-framework-convention-on-climate-change

UNEP DTU CDM (2016). *Pipeline Analysis and Database. Available online: https://unepccc.org/publications/unep-dtu-cdm-ji-pipeline-analysis-and-database/*

Varadarajan, D.B. & Chitra, M. (2022). Global Climate Financing of Multilateral Development Banks- An Analysis. *Shanlax International Journal of Economics, 10*(2): 64-77. https://doi.org/10.34293/economics.v10i2.4747

Versal, N. and Sholoiko, A. (2022). Green bonds of supranational financial institutions: On the road to sustainable development. *Investment Management and Financial Innovations, 19*(1), 91-105. https://doi.org/10.21511/imfi.19(1).2022.07

Wang P, Robinson AJ and Papadokonstantakis S (2024), Prospective techno-economic and life cycle assessment: a review across established and emerging carbon capture, storage and utilization (CCS/CCU) technologies. *Frontiers Energy Resources 12*:1412770. https://doi.org/10.3389/fenrg.2024.1412770

Xie, L., Scholtens, B. & Homroy, S. (2023). Rebalancing climate finance: Analysing multilateral development banks' allocation practices. *Energy research and social science, 101*: 103127. https://doi.org/10.1016/j.erss.2023.103127

Zhang, H. (2020). Regulating green bond in China: Defnition divergence and implications for policy making. *Journal of Sustainable Finance & Investment 10* (2): 141-156. https://doi.org/10.1080/20430795.2019.1706310