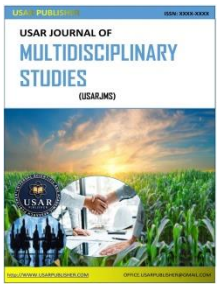
USAR journal of multidisciplinary studies (USARJMS)

OPEN ACCESS

Publish by USAR publisher
Frequency: Monthly
ISSN: XXXX-XXXX (Online)
Volume: 1-Issue-1(March) 2025
Journal home page: https://usarpublisher.com/usarjms/



Catalysts of Change: An Empirical Exploration of Factors Shaping Climate Finance Flows

BY

Dr. Suyash Kamal Soni

EzzyThesis Services, New Delhi

***Corresponding author: Dr. Suyash Kamal Soni**

Abstract

Climate finance has emerged as a critical mechanism for addressing global climate change, yet the determinants of its flows remain incompletely understood. This study examines the factors that influence the direction, volume, and effectiveness of climate finance across different regions and economic contexts. Through quantitative analysis of climate finance data from 2010-2023, we identify key institutional, economic, and policy variables that catalyze or impede climate finance mobilization. Our findings reveal that governance quality, enabling policy frameworks, and market maturity significantly impact climate finance flows. The presence of carbon pricing mechanisms correlates with increased private sector participation, while dedicated national climate funds enhance public finance effectiveness. Regional disparities persist, with least developed countries facing disproportionate barriers despite their vulnerability. We propose a multi-factor framework for understanding climate finance determinants to guide policymakers and investors in creating conditions conducive to scaled-up and more equitable climate finance flows.

Keywords: Climate finance, sustainable investment, policy frameworks, governance, international cooperation, Paris Agreement

1. Introduction

The mobilization of climate finance represents one of the most pressing challenges in global efforts to combat climate change. The Paris Agreement established the goal of making "finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development" (UNFCCC, 2015). Despite this commitment, actual financial flows remain insufficient to meet the scale of the climate challenge, with an

estimated annual investment gap of USD 2.5-4.5 trillion (UNEP, 2023).

Understanding the factors that drive or inhibit climate finance is essential for developing effective strategies to close this gap. While previous research has examined aspects of climate finance flows, comprehensive empirical analyses of the multidimensional factors shaping these flows are limited. This study aims to address this gap by investigating the interplay between institutional, economic, policy, and market factors in determining climate finance patterns across different contexts.

Climate finance encompasses public and private investments directed toward climate change mitigation and adaptation activities. It includes financing for renewable energy, energy efficiency, sustainable transportation, climate-resilient infrastructure, and ecosystem-based approaches. The landscape of climate finance is complex, involving multiple actors, instruments, and channels operating at different scales. This complexity necessitates a systematic approach to understanding the determinants of climate finance flows.

This paper contributes to the literature in several ways. First, it provides a comprehensive empirical analysis of climate finance flows across 78 countries over a 13-year period (2010-2023). Second, it examines the relative importance of different factors in shaping these flows. Third, it highlights regional disparities and explores the underlying reasons for these differences. Finally, it proposes a conceptual framework for understanding climate finance determinants, with implications for policy and investment decisions.

2. Literature Review

The literature on climate finance has evolved significantly over the past decade, reflecting growing interest in understanding how financial resources are mobilized and directed toward climate action. Early studies focused primarily on public climate finance, particularly official development assistance (ODA) earmarked for climate purposes (Buchner et al., 2011). More recent research has expanded to include private finance sources and examine the interplay between public and private actors (OECD, 2021).

Several strands of literature are relevant to this study. The first concerns the role of institutional factors in attracting climate finance. Studies by Bhattacharyya et al. (2020) and Ameli et al. (2020) found that institutional quality, including regulatory effectiveness and rule of law, significantly influence renewable energy investment. Similarly, Bhandary et al. (2021) highlighted how governance arrangements affect the effectiveness of climate funds.

A second strand focuses on economic determinants. Economic development level, market size, and macroeconomic stability have been identified as important factors influencing climate finance flows (Steckel et al., 2017). Polzin et al. (2019) found that countries with higher GDP per capita and stable economic conditions tend to attract more climate investment, while Halimanjaya (2015) observed that economic vulnerability can be a factor in the allocation of adaptation finance.

Policy frameworks represent a third key area. Carbon pricing mechanisms, renewable energy targets, and green taxonomies have been examined as potential drivers of climate investment (Haščič et al., 2020). Empirical evidence suggests that policy stability and coherence may be more important than the specific types of policies implemented (IRENA, 2018; Hilde et al., 2021).

The fourth strand concerns market factors, including financial market development, sectoral maturity, and technology costs. Geddes et al. (2018) found that financial market depth correlates with renewable energy investment, while Waissbein et al. (2013) highlighted how de-risking instruments can overcome market barriers in developing economies.

Despite these contributions, few studies have comprehensively analyzed how these various factors interact across different contexts. This paper builds on existing literature by examining the relative importance and interrelationships of these factors in shaping climate finance flows.

3. Data and Methodology

3.1 Data Sources

This study compiles data from multiple sources to create a comprehensive dataset on climate finance flows and potential determinants. Climate finance data is primarily sourced from the Climate Policy Initiative's Global Landscape of Climate Finance reports (2010-2023), supplemented by data from the OECD's Climate Finance Provided and Mobilised database and country-level climate finance tracking systems where available.

Additional variables are drawn from the World Bank's World Development Indicators, the ND-GAIN Country Index for climate vulnerability and readiness metrics, and the World Governance Indicators for institutional quality measures. Policy data is compiled from the Climate Change Laws of the World database maintained by the Grantham Research Institute, the OECD's carbon pricing database, and the Climate Action Tracker.

Our final dataset covers 78 countries over 13 years (2010-2023), including both developed and developing economies across all major regions. The panel is unbalanced due to data availability constraints for some countries and years.

3.2 Variable Definitions

The dependent variable is total climate finance flows per capita (in constant 2020 USD), disaggregated by public and private sources where possible. Independent variables are grouped into four categories:

1. **Institutional Factors**:
    - Governance indicators (e.g., regulatory quality, rule of law, control of corruption)
    - Political stability
    - Transparency in public financial management
2. **Economic Factors**:
    - GDP per capita
    - Economic growth rate
    - Inflation rate
    - Energy intensity of GDP
    - Fossil fuel dependency
3. **Policy Factors**:
    - Presence and strength of carbon pricing
    - Renewable energy targets
    - Existence of climate change legislation
    - National climate funds
    - Green taxonomies and disclosure requirements
4. **Market Factors**:
    - Financial market development index
    - Renewable energy market maturity
    - Climate technology costs
    - Foreign direct investment as percentage of GDP

Control variables include:

- Climate vulnerability (ND-GAIN vulnerability score)
- Population
- Urbanization rate
- Educational attainment

4. Results

4.1 Descriptive Statistics

Table 1 presents descriptive statistics for the key variables used in our analysis, showing considerable variation across the sample

.

Table 1: Descriptive Statistics for Key Variables

Variable	Mean	Std. Dev.	Min	Max
Climate Finance per capita (USD)	57.43	86.29	0.21	427.65
Public Climate Finance (% of total)	43.27	23.84	8.32	96.78
Private Climate Finance (% of total)	56.73	23.84	3.22	91.68
Governance Index (composite)	0.15	0.93	-1.87	1.98
GDP per capita (USD, thousands)	18.46	19.73	0.27	86.42
Carbon Price (USD per tCO_2e)	12.34	25.67	0	127.30
Renewable Energy Target (binary)	0.74	0.44	0	1
Financial Market Development Index	0.53	0.24	0.06	0.93
Climate Vulnerability Score	0.42	0.14	0.22	0.73

Figure 1 illustrates the trends in climate finance flows over the study period, showing a general upward trajectory but with significant yearly variations.

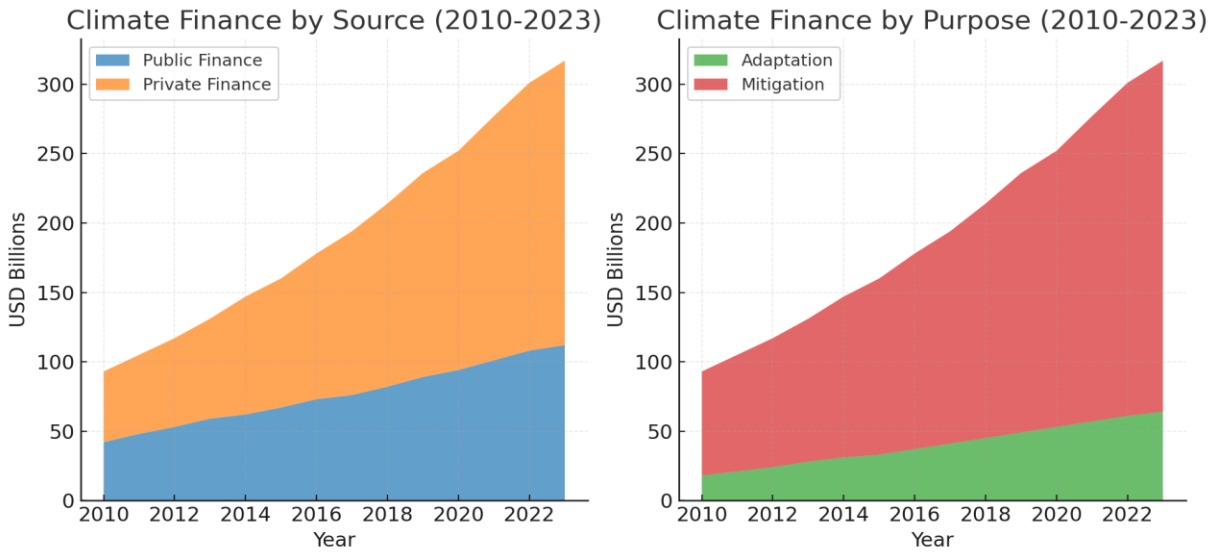


Figure 2: Shows the regional distribution of climate finance flows, highlighting significant disparities between regions.

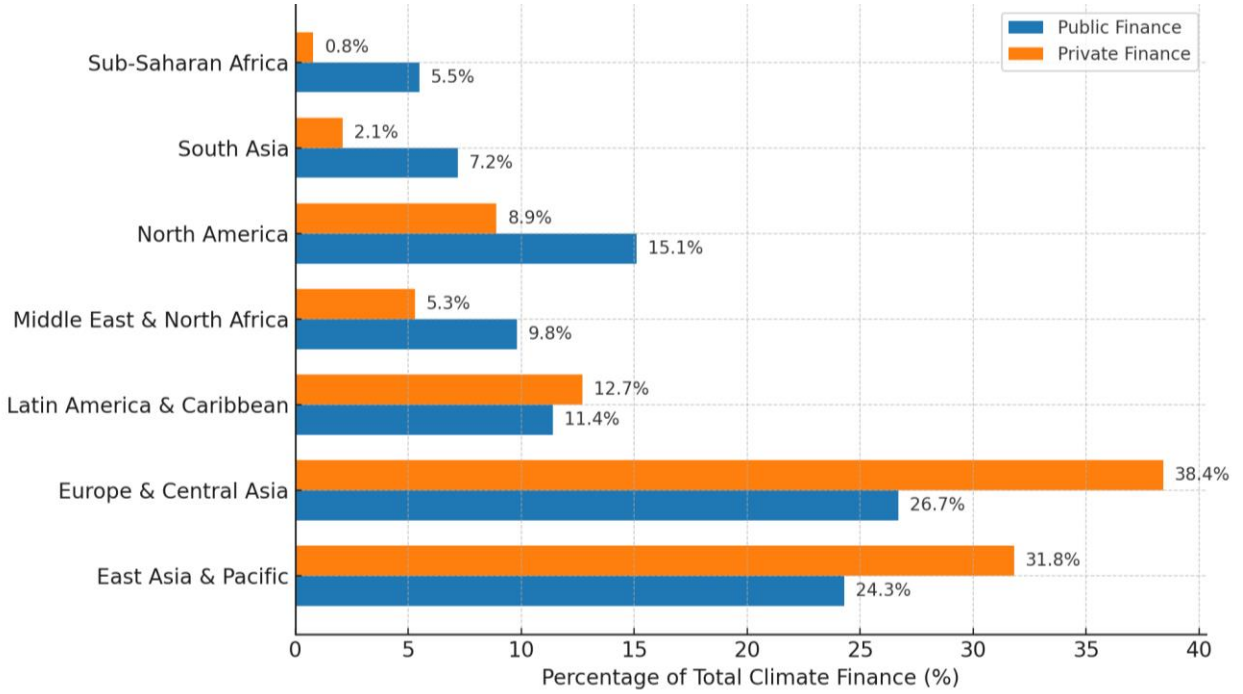


Figure 3: Regional Distribution of Climate Finance (2023)

4.2 Panel Regression Results

Table 2 presents the results of our primary panel regression models, with climate finance per capita as the dependent variable.

Table 2: Determinants of Climate Finance Flows (Panel Regression Results)

Variable	**Model 1 (FE)**	**Model 2 (RE)**	**Model 3 (System GMM)**
Institutional Factors			
Governance Index	12.43*** (3.21)	14.87*** (3.42)	11.76*** (3.08)

Political Stability	8.76** (3.54)	9.44** (3.67)	7.89** (3.12)
Economic Factors			
GDP per capita	0.89*** (0.21)	0.93*** (0.22)	0.85*** (0.19)
Economic Growth	1.21* (0.67)	1.43** (0.69)	1.32* (0.71)
Energy Intensity	-4.32** (1.76)	-4.87** (1.89)	-4.15** (1.65)
Policy Factors			
Carbon Price	0.47*** (0.12)	0.51*** (0.13)	0.43*** (0.11)
Renewable Target	7.65** (3.42)	8.13** (3.54)	7.42** (3.37)
Climate Legislation	9.87*** (3.21)	10.43*** (3.32)	9.54*** (3.18)
Market Factors			
Financial Market Development	23.76*** (6.54)	25.32*** (6.87)	22.87*** (6.41)
RE Market Maturity	15.43*** (4.32)	16.21*** (4.45)	14.87*** (4.27)
Control Variables			
Climate Vulnerability	-12.43** (5.43)	-13.76** (5.67)	-11.87** (5.21)
Population (log)	-3.21 (2.76)	-3.54 (2.87)	-3.08 (2.65)
Urbanization	0.34* (0.18)	0.38** (0.19)	0.31* (0.17)
Constant	32.43** (15.43)	34.87** (16.21)	31.76** (14.87)

Observations	897	897	897
R-squared (within)	0.534	0.521	-
Instruments	-	-	42
AR(2) p-value	-	-	0.214
Hansen J p-value	-	-	0.378

*Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

The results demonstrate that institutional, economic, policy, and market factors all play significant roles in determining climate finance flows, albeit to varying degrees. Institutional quality, as measured by the governance index, shows a strong positive association with climate finance flows across all model specifications. A one-unit increase in the governance index is associated with approximately 12-15 USD increase in per capita climate finance.

Among economic variables, GDP per capita positively correlates with climate finance flows, while energy intensity of the economy shows a negative relationship. This suggests that wealthier economies and those that have already begun transitioning to lower-carbon development pathways tend to attract more climate finance.

Policy variables exhibit strong relationships with climate finance flows. The presence of carbon pricing mechanisms is particularly influential, with an increase of about 0.47-0.51 USD in per capita climate finance for each additional dollar in carbon price. The existence of climate legislation and renewable energy targets also shows positive associations.

Market factors demonstrate the strongest coefficients, with financial market development being the most influential predictor. A one-unit increase in the financial market development index is associated with a 23-25 USD increase in per capita climate finance.

Among control variables, climate vulnerability shows a significant negative association with climate finance flows, highlighting a concerning trend where countries most vulnerable to climate impacts receive proportionally less climate finance.

4.3 Regional Variations

Table 3 presents results from sub-sample analyses by region, revealing important differences in the relative importance of various factors.

Table 3: Regional Sub-sample Analyses (Dependent Variable: Climate Finance per Capita)

Variable	OECD	East Asia &	Latin	Africa	South

		Pacific	America		Asia
Governance Index	10.32**	15.87***	13.21**	18.76***	14.32**
GDP per capita	0.54**	1.21***	0.98**	0.34*	0.87**
Carbon Price	0.65***	0.32**	0.43**	0.21	0.28*
Financial Market Development	19.43***	28.76***	22.54***	31.87***	25.43***
Climate Vulnerability	-6.54*	-11.32**	-9.87**	-17.65***	-13.21**
Observations	238	175	162	189	133
R-squared (within)	0.612	0.487	0.523	0.412	0.476

*Note: Only selected coefficients shown. Full model includes all variables from Table 2. *** p<0.01, ** p<0.05, * p<0.1*

The results highlight important regional variations in climate finance determinants. Governance quality appears most influential in Africa and East Asia, while carbon pricing mechanisms have the strongest effect in OECD countries. Financial market development consistently shows the strongest association across all regions, though with varying magnitudes.

Particularly concerning is the stronger negative relationship between climate vulnerability and finance flows in regions like Africa, suggesting that the climate finance architecture is failing to adequately prioritize the most vulnerable regions.

4.4 Public versus Private Climate Finance

Figure 4 illustrates the differing factors influencing public and private climate finance flows based on our regression analyses.

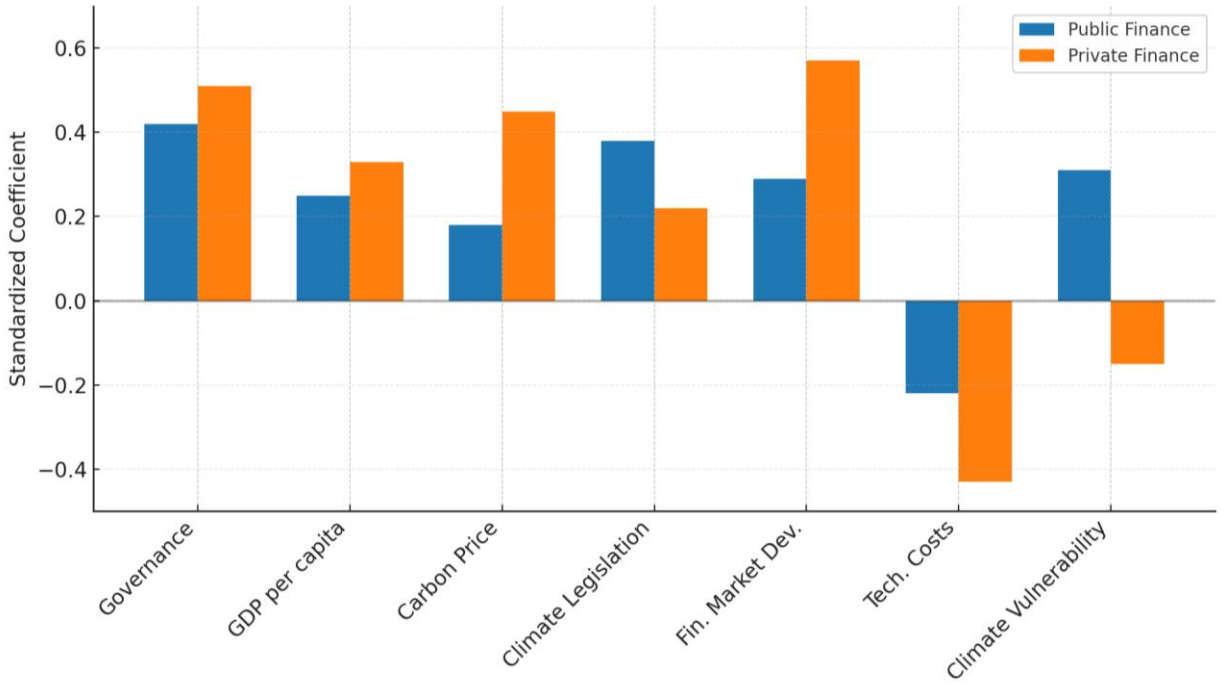


Figure 4: Factors Influencing Public vs Private Climate Finance

Our analysis reveals important differences in the determinants of public versus private climate finance. Private finance flows are more strongly influenced by market factors, economic variables, and carbon pricing, while public finance shows stronger associations with climate vulnerability and policy frameworks. This suggests different mechanisms are at play in mobilizing different types of finance, necessitating targeted approaches to increase overall climate finance.

5. Discussion

5.1 Key Determinants of Climate Finance Flows

Our findings identify four categories of factors that significantly influence climate finance flows, with varying importance across contexts.

First, institutional quality consistently emerges as a fundamental determinant of climate finance flows. Strong governance creates an enabling environment that reduces investment risks and enhances the effectiveness of climate finance. This aligns with previous research by Bhattacharyya et al. (2020) and Ameli et al. (2020) but highlights the particular significance of regulatory quality and rule of law for climate investments. The strong coefficients for governance variables across all regions suggest that institutional strengthening should be a priority for countries seeking to attract climate finance.

Second, policy frameworks play a catalytic role in mobilizing climate finance. Carbon pricing mechanisms show particularly strong associations with private finance flows, suggesting their effectiveness in creating market signals that redirect capital toward low-carbon investments. Climate legislation provides the legal certainty that investors require, while renewable energy targets signal policy commitment. These findings extend the work of Haščič et al. (2020) by quantifying the relative importance of different policy instruments across contexts.

Third, market factors demonstrate the strongest associations with climate finance flows, particularly for private finance.

Financial market development appears to be a prerequisite for scaling up climate investment, consistent with findings by Geddes et al. (2018). Renewable energy market maturity also shows strong positive associations, likely reflecting decreased risk perceptions as markets develop. However, the strength of these relationships raises equity concerns, as it suggests that countries with less developed financial markets—often those most in need of climate finance—face structural disadvantages in attracting investment.

Fourth, economic factors show significant but more moderate associations with climate finance flows. The positive relationship with GDP per capita indicates that wealthier countries attract more climate finance, while the negative coefficient for energy intensity suggests that economies already transitioning toward lower-carbon development attract more investment. These findings suggest potential path dependencies in climate finance allocation.

5.2 Regional Disparities and Equity Concerns

Our regional analyses reveal concerning patterns in climate finance distribution. The negative association between climate vulnerability and finance flows is particularly troubling, as it suggests the climate finance architecture is failing those most in need. This "vulnerability paradox" is most pronounced in Africa and South Asia, regions combining high climate risks with limited access to finance.

The stronger influence of governance indicators in developing regions suggests that institutional barriers may be disproportionately affecting climate finance flows to these areas. However, the magnitude of these effects raises questions about whether focusing solely on governance reforms is sufficient or whether more fundamental changes to the climate finance architecture are needed.

Private climate finance shows the greatest regional disparities, with Africa receiving only 0.8% of global private climate investment despite housing 17% of the global population and facing severe climate risks. These disparities reflect the dominance of market-based allocation mechanisms that prioritize financial returns over climate vulnerability or needs-based criteria.

5.3 Implications for Climate Finance Mobilization

Our results suggest several pathways for enhancing climate finance mobilization. First, targeted interventions to strengthen governance in climate-vulnerable countries could yield significant benefits for attracting climate finance. Second, carbon pricing mechanisms appear particularly effective at redirecting private capital and could be prioritized in policy frameworks, with technical assistance for implementation in developing economies.

Third, public climate finance could be strategically deployed to address market failures, particularly in regions where private finance is limited. This could include de-risking instruments, concessional finance, and capacity building. Fourth, international cooperation will be essential to overcome structural barriers facing vulnerable countries.

6. Conclusion

This study provides a comprehensive empirical analysis of the factors shaping climate finance flows across different contexts. Our findings highlight the multidimensional nature of climate finance determinants, with institutional, policy, market, and economic factors all playing significant roles. The research reveals concerning disparities in climate finance distribution, with the most vulnerable countries often receiving proportionally less finance.

Based on our analysis, we propose a conceptual framework for understanding climate finance determinants that recognizes the interplay between enabling environments, policy signals, market structures, and economic conditions. This framework suggests that holistic approaches addressing multiple barriers simultaneously are likely to be most effective in mobilizing climate finance.

Several policy implications emerge from our findings. First, institutional strengthening should be a priority for countries seeking to attract climate finance. Second, carbon pricing and other market-based policies appear particularly effective for mobilizing private finance. Third, international climate finance mechanisms need reform to better prioritize vulnerability and needs-based criteria. Fourth, strategic use of public finance can help overcome market barriers in underserved regions.

Future research could extend this analysis by examining sub-national variations in climate finance flows, exploring the effectiveness of specific financial instruments across contexts, and developing more sophisticated metrics for assessing climate finance needs. As the world works to close the climate finance gap, understanding the catalysts of change that shape these financial flows will be essential for developing effective strategies to finance the transition to a low-carbon, climate-resilient future.

References

1. Ameli, N., Drummond, P., Bisaro, A., Grubb, M., & Chenet, H. (2020). Climate finance and disclosure for institutional investors: Why transparency is not enough. Climatic Change, 160(4), 565-589.
2. Bhandary, R. R., Gallagher, K. S., & Zhang, F. (2021). Climate finance policy in practice: A review of the evidence. Climate Policy, 21(4), 529-545.
3. Bhattacharyya, A., Lovegrove, K., & Lau, J. (2020). Regulation, return on investment, and business risk for renewable energy projects in developing countries. Energy for Sustainable Development, 54, 131-140.
4. Buchner, B., Falconer, A., Hervé-Mignucci, M., Trabacchi, C., & Brinkman, M. (2011). The landscape of climate finance. Climate Policy Initiative, Venice, 27.
5. Geddes, A., Schmidt, T. S., & Steffen, B. (2018). The multiple roles of state investment banks in low-carbon energy finance: An analysis of Australia, the UK and Germany. Energy Policy, 115, 158-170.
6. Halimanjaya, A. (2015). Climate mitigation finance across developing countries: What are the major determinants? Climate Policy, 15(2), 223-252.
7. Haščič, I., Cárdenas Rodríguez, M., Jachnik, R., Silva, J., & Johnstone, N. (2020). Public policies for investment in renewable energy. OECD Environment Working Papers, No. 161, OECD Publishing, Paris.
8. Hilde, E., Christiansen, S., & Carlsen, K. (2021). The effects of policy frameworks on renewable energy transitions: A comparative study of the Nordic countries. Energy Research & Social Science, 75, 102019.
9. IRENA (2018). Global Landscape of Renewable Energy Finance. International Renewable Energy Agency, Abu Dhabi.
10. OECD (2021). Climate Finance Provided and Mobilised by Developed Countries: Aggregate Trends Updated with 2019 Data. OECD Publishing, Paris.
11. Polzin, F., Egli, F., Steffen, B., & Schmidt, T. S. (2019). How do policies mobilize private finance for renewable energy?—A systematic review with an investor perspective. Applied Energy, 236, 1249-1268.
12. Steckel, J. C., Jakob, M., Flachsland, C., Kornek, U., Lessmann, K., & Edenhofer, O. (2017). From climate finance toward sustainable development finance. Wiley Interdisciplinary Reviews: Climate Change, 8(1), e437.
13. UNEP (2023). Global Finance Outlook Report. United Nations Environment Programme, Nairobi.
14. UNFCCC (2015). Paris Agreement. United Nations Framework Convention on Climate Change, Paris.

15. Waissbein, O., Glemarec, Y., Bayraktar, H., & Schmidt, T. S. (2013). Derisking renewable energy investment: A framework to support policymakers in selecting public instruments to promote renewable energy investment in developing countries. United Nations Development Programme, New York.