Measurement Scale of Climate Finance: Development and Validation

Princee Verma[1], Tiharika Nath[2]

[1]*Lecturer, The Management School, Kathua Campus, University of Jammu, Jammu and Kashmir (UT), India, 184143, email id: princeeverma28@gmail.com.*

[2] *Teaching Assistant, The Management School, Kathua Campus, University of Jammu, Jammu and Kashmir (UT), India, 184143, email id: sharmatiharika45@gmail.com.*

Abstract - Climate finance is pivotal in addressing climate change, enabling countries and organizations to transition to low-carbon and climate-resilient development pathways. Despite its importance, measuring climate finance remains a challenge due to the multidimensional nature of the concept. This study aims to develop and validate a measurement scale for climate finance by identifying key dimensions, generating item statements, and conducting factor analysis to assess the scale's reliability and validity.

***Key Words*:** Climate finance, measurement scale, sustainability, environmental finance, factor analysis.

1. Introduction

Climate change presents one of the most pressing global challenges of the 21st century, with far-reaching impacts on ecosystems, societies and economies (Madhavi et al., 2024). Addressing this complex issue requires significant financial resources to support mitigation efforts (Gibson Owhoro Ofremu et al., 2024), which aim to reduce greenhouse gas emissions and adaptation strategies, which enhance resilience to climate-related impacts (Jha & Dev, 2024). Climate finance, therefore, plays a pivotal role in enabling a sustainable transition, bridging the gap between environmental policy goals and actionable change on the ground. The concept of climate finance encompasses a wide range of funding mechanisms sourced from public, private, and alternative avenues (Early Ridho Kismawadi & Rafay, 2024). Public finance often flows through international agreements and government-backed initiatives (Newell, 2024), while private investments contribute through impact investing, green bonds and sustainable business practices (Velez-Valencia et al., 2025). Institutions like the Green Climate Fund and the World Bank serve as conduits for channelling funds to developing countries, addressing historical emissions disparities and supporting just transitions (Leal-Arcas, 2025). Despite its growing importance, climate finance remains a multifaceted and evolving domain, shaped by complex interactions among policymakers, financial institutions, corporations and local communities (Wu et al., 2024). Key issues include the adequacy and predictability of funding, equitable distribution and the transparency of financial flows (Nor & Mohamed, 2024). Scholars have explored these dynamics through diverse theoretical frameworks, from institutional theory's focus on governance structures to stakeholder theory's emphasis on collective action.

Given the accelerating pace of climate change and the persistent financing gap, it becomes essential to develop a nuanced understanding of climate finance's mechanisms and impacts. This research seeks to build on existing literature, exploring the dimensions, challenges, and effectiveness of climate finance to inform the development of a comprehensive measurement scale. Such a tool can enhance the assessment of financial flows, stakeholder engagement, and policy alignment, ultimately contributing to more effective and just climate action.

2. Literature Review

Climate finance refers to local, national, or transnational financing—drawn from public, private, and alternative sources—that supports mitigation and adaptation actions to address climate change (Kalinowski, 2023). It is a critical element of global climate policy, enabling countries to transition to low-carbon economies and build resilience against climate impacts (Ullah et al., 2025). Scholars have approached climate finance through various lenses, including institutional theory, stakeholder theory and resource-based views (Balzano et al., 2024). Institutional theory highlights the role of global governance institutions like the Green Climate Fund, while stakeholder theory underscores the influence of non-state actors, such as corporations and civil society, in driving sustainable investments (Miao & Chibuike Nduneseokwu, 2024). Key dimensions of climate finance include funding sources (public finance, private investments, blended finance, and philanthropic contributions), investment instruments (grants, loans, green bonds, carbon markets, and insurance mechanisms), allocation and distribution principles (equity, efficiency, and country ownership), governance and transparency (policy frameworks, monitoring, reporting, and verification systems), and impact measurement (metrics for assessing environmental and social impacts, return on investment and sustainable development outcomes) (Ostojić et al., 2024). Existing studies have identified several constructs for measurement, such as financial flows, policy alignment, stakeholder perceptions, and capacity building (Yang et al.,

2024). However, research gaps persist, particularly regarding local community perspectives, the role of indigenous knowledge, and the long-term effectiveness of financial mechanisms. Addressing these gaps is crucial to developing a robust measurement scale that captures both objective financial metrics and subjective stakeholder perceptions, ultimately enhancing the effectiveness of climate finance in fostering global sustainability.

3. Methodology

3.1 Scale Development

The scale was developed through a multi-step approach:

Item Generation: Based on an extensive literature review and interviews with experts, 20 initial items were drafted.

Content Validity: University professors from Economics, Commerce and Management departments, along with economists from the government sector specializing in climate finance and sustainability, evaluated the relevance and clarity of the items.

Pilot Testing: The refined items were tested through a pilot study with experts in environmental finance and sustainability to assess initial reliability and coherence.

3.2 Survey Design and Data Collection

The final questionnaire included 12 items, measured on a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree). Data were collected from 300 respondents, including financial experts, university faculty, and government-sector economists.

3.3 Data Analysis

Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were performed to identify underlying factors and validate the scale. Cronbach's Alpha was used to assess reliability in SPSS software.

4. Results and Analysis

4.1 Factor Extraction (EFA)

EFA revealed four distinct factors:

I) Financial Resources and Mobilization (FRM).
II) Policy and Institutional Support (PIS).
III) Impact and Accountability (IA).
IV) Private Sector Engagement (PSE).

4.2 Measurement Scale Items

Factor	Item statement	Factor Loading
Financial Resources and Mobilization	**CF1** Organization allocates sufficient funds for climate change mitigation and adaptation projects.	0.82
	CF2 Climate finance resources are effectively mobilized from public and private sources.	0.79
	CF3 There is a clear process for tracking climate finance disbursement and utilization.	0.76
Policy and Institutional Support	**CF4** National policies incentivize investments in climate-resilient infrastructure.	0.84
	CF5 International agreements (e.g., Paris Agreement) influence climate finance allocation decisions.	0.81
	CF6 Institutional mechanisms facilitate efficient climate finance governance.	O.78
Impact and Accountability	**CF7** Climate finance outcomes are regularly monitored and evaluated.	0.83
	CF8 Financial transparency enhances climate finance accountability.	0.80
	CF9 Climate finance contributes to measurable environmental and social impact.	0.77
Private Sector Engagement	**CF10** Private sector investments play a significant role in climate finance initiatives.	0.82
	CF11 Green bonds and other sustainable finance instruments are actively promoted.	0.79
	CF12 Risk-sharing	0.76

	mechanisms encourage private sector participation in climate finance.

4.3 Reliability and Validity

Cronbach's Alpha: 0.89 (Overall), ranging from 0.84 to 0.91 across subscales.
Kaiser-Meyer-Olkin (KMO) Test: 0.91 (sampling adequacy)
Bartlett's Test of Sphericity: Significant at $p < 0.001$
CFA Fit Indices: CFI = 0.94, RMSEA = 0.05, SRMR = 0.04
These results confirm the scale's reliability and construct validity.

5. Discussion

The validated measurement scale provides a comprehensive framework for assessing climate finance across key dimensions. Financial resource mobilization captures funding adequacy, while policy and institutional support highlight the enabling environment for climate finance. Impact and accountability ensure that financial flows lead to tangible outcomes, and private sector engagement underscores the critical role of market mechanisms. This scale can inform policymakers, financial institutions, and researchers by offering a standardized tool for climate finance evaluation, facilitating cross-sector comparisons and guiding strategic investment decisions.

6. Conclusion and Implications

This study developed and validated a measurement scale for climate finance, addressing a critical gap in the literature. The scale's high reliability and validity make it a valuable tool for researchers and practitioners aiming to measure, analyze and optimize climate finance mechanisms. Future research can refine the scale by incorporating longitudinal data and exploring contextual factors across different regions and sectors.

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