Climate Health, Volume 1, Issue 2, Spring 2026: 52-59

Original Article

Evaluating Climate Finance Vulnerability in World, Asia, Middle East and Iran

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Article info:
Received: 18 December 2025
Revised: 12 January 2026
Accepted: 28 January 2026

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ABSTRACT

Background: Climate finance vulnerability has become an essential topic for understanding how countries can better prepare for a changing climate. As global climate risks intensify, ensuring that financial systems remain resilient and adaptation resources are directed effectively has gained critical importance. This study adopts a multi-scale approach to explore climate and financial vulnerability worldwide, across Asia, and in Iran, offering a clearer picture of where targeted climate finance can have the greatest positive impact.

Methods: Using the Climate Finance Vulnerability Index (CliF-VI), this research evaluates climate exposure, economic sensitivity, and financial conditions under current and future scenarios for 2050 and 2080. Global patterns are examined descriptively, followed by a focused assessment of Asia and a detailed case analysis for Iran. All indicators are standardized, normalized, and analyzed to highlight central tendencies and vulnerability trends.

Results: Findings show meaningful variation in climate-financial vulnerability across regions. Globally, moderate average scores mask substantial differences between countries. Asia demonstrates a diverse but generally improving profile, with several countries showing reduced vulnerability under optimistic pathways. Iran's CliF VI score varies across scenarios, indicating sensitivity to both climate pathways and time horizons. The highest vulnerability level appears in the 2050 pessimistic scenario (62.8), while the lowest value occurs in the 2080 optimistic scenario (52.1). Overall, Iran's scores remain above the global mean in several scenarios, suggesting a relatively elevated level of climate financial vulnerability compared with many countries.

Conclusion: By identifying priority regions and clarifying risk pathways, the CliF-VI framework provides a constructive foundation for designing more effective, equitable, and forward-looking adaptation and financial resilience strategies.

Keywords: CliF-VI index; Climate; Asia; Climate Resilience; Climate Adaptation

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Citation: Hatami Moghaddam P, Keighobadi E. Evaluating Climate Finance Vulnerability in World, Asia, Middle East and Iran. Climate Health. 2026;1(2):52-59.

https://doi.org/***

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Introduction

The anthropogenic climate change is one of the most pressing global challenges in our time. According to the United Nations Framework Convention on Climate Change (UNFCCC), climate change refers to a change of climate attributed directly or indirectly to human activity that alters the composition of the global atmosphere and is in addition to natural climate variability [1]. This alternation change transforms many climate extremes in frequency, severity, and duration therefore we are witnessing today [2]. These extreme weather and climate risks, including extreme events such as floods, wildfires, droughts, storms, and heatwaves. Have struggled regions [2, 3]. Many countries endure compound effects of climate-related disasters, and climate change also participates in health crises by creating suitable conditions for vector-borne diseases such as dengue and malaria to spread in vulnerable areas in tropic and subtropic regions, and worsening countries' human and economic costs [4, 5].

Low-income countries, especially in Africa, Southern and Western Asia, and Central and South America, are facing increasing risks [3, 6]. Between 1995 and 2024, as a result of 9,700 extreme weather events, over 832,000 deaths and up to USD 4.5 trillion in global economic losses were left behind. It is projected that by the year 2050, climate change will be associated with more than 14.5 million deaths and up to USD 12.5 trillion in economic losses. On the other hand, climate finance to address losses and damages and securing adequate climate adaptation in low-income countries will have reached USD 1.1–1.7 trillion annually by 2050 [2]. Yet, those countries least responsible for global warming are the most suffering from the consequences [2, 5, 7]. With their limited access to finance, they are not able to respond or recover completely or make progress toward mitigation and adaptation [5]. Kling et al. (2025) show that highly climate-vulnerable developing countries face substantially higher sovereign borrowing costs about 1.174% more on average which translated into USD 62 billion in extra interest payments for V20 members. The study also finds that social readiness and resilience investments significantly reduce yields, highlighting the role of adaptation in lowering climate-related financing costs [8].

In another study Zhang et al. (2025) show that climate vulnerability significantly increases financial risk across 111 countries, while macroprudential policies help mitigate this effect by strengthening financial system resilience. The study also identifies fiscal spending and rising public debt as key transmission channels linking climate vulnerability to financial instability [9]. Jalles (2023) shows that financial crises, particularly systemic banking crises, weaken climate resilience and increase climate vulnerability in the short term across 178 countries, with stronger effects in developing economies. The findings indicate that financial distress reduces the capacity to invest in adaptation and heightens exposure to climate risks during downturns [10].

Therefore, not only understanding the economic consequences of climate change is important, but also assessing climate vulnerability of each country along with their adaptation financing gap makes a comprehensive insight in order to enhance the targeting and provision of climate change adaptation financing [5, 7, 11]. Bingler and Colesanti Senni (2020) assess 16 climate transition risk tools and reveal significant inconsistencies in inputs, outputs, and asset coverage, undermining comparability and decision-relevance. They argue for standardized principles to build coherent and supervisory-ready climate-adjusted financial risk metrics, providing a theoretical foundation for integrated indices such as CliF-VI [12].

One of the recent indicators that uses a multidimensional, data-informed approach to illustrate a country's climate and financial vulnerability is the Climate Finance Vulnerability Index (CliF-VI). CliF-VI is introduced as a composite index focused on two critical factors that directly influence each other: climate risk and financial vulnerability. It also incorporates a supplementary governance index that shapes the modalities and conditions under which these interactions occur. This index attempts to illustrate the differences between the current and future risk in two optimistic and pessimistic scenarios along with variables representing access to finance. CliF-VI is a simple but effective tool for analyzing and planning, and with its ability to predict future climate risk and applying data from INFORM Risk, INFORM Climate Change, World Bank, UN Trade and Development, or International Monetary Fund, it can present a high-level overview of climate and financial vulnerability of each country [5, 13, 14].

CliF-VI is designed for better targeting and equitable opportunities aligning global adaptation finance toward priority areas and for adaptation investments, concessional loans, grants, guarantees, and investments to help vulnerable regions [3, 5]. Anjanappa and Singh (2025) propose a standardized MCDA framework to quantify climate-related financial risks in the built environment by integrating hazard exposure, vulnerability, adaptive capacity, and financial materiality. Their composite metrics identify sector-specific risk channels and provide a practical tool for climate-resilient investment and policy design, closely aligning with integrative approaches such as CliF-VI [15].

According to ND-GAIN findings and CRI results, the most affected countries by extreme weather events are African countries and Asia-Pacific countries with low human development. Asia, with 4.5 billion people—about 60% of the total world population has experienced

rising temperatures faster than the average rate on land and oceans across the globe in two recent sub-periods (1961–1990 and 1991–2023) [2, 16].Moreover, the population in Asia is projected to reach approximately 5.2 billion by 2050. According to the World Bank, the gross domestic product (GDP) per capita in Asia ranges from roughly US$500 (Afghanistan) to almost US$90,000 (Singapore) [17, 18].

Asia is facing different types of climate events, accompanied by rising temperature, resulting in adverse impact on human health, poverty, and security. From stronger, longer heatwaves in South and East Asia to continuous drying across the central Himalaya and extreme precipitation with related flooding in monsoon Asia, droughts are becoming longer, threatening agricultural and livestock systems and water security in West Asia, Central Asia, and the north of China. South Asia is the home of poor families, most of whom are occupied with the agriculture sector, and are quite vulnerable to climate-change effects because of the diversity of farming and cropping system dependence on climate [2, 16, 19]. Bangladesh, for instance with over 168 million population is one of the most vulnerable regions in the glob, is facing multiple climate risks and natural hazards including flood, cyclones, drought, heatwaves and storm [2].

In the west of Asia, Iran is a country dominated by an arid and semi-arid climate. Economic dependence on fossil fuel exports, combined with inflation and poverty has intensified Iran's climate vulnerability. Significant climate challenges in recent decades, including land subsidence, floods, droughts, dust storms, and wildfires have significantly affected ecosystems, human health, and environmental systems [20]. Each of these events is linked to extensive damages across area. Between 1970 and 2025, Iran faced numerous climate-induced events such as floods and prolonged droughts, wild fires. According to the World Bank's Hazard Management Report 2005, 14.3% of total area and 46.6% of Iran's population are exposed at two or more hazards over a 20-year period. The catastrophic flood of 2019 caused more than US $2.2 billion economic loss [21, 22].

These climate-related disasters are increasing worldwide, but negative impacts are more dominant in low- and lower-middle-income countries. They are intensifying preexisting vulnerabilities with billions of dollars of burden on health systems and infrastructure damages, forced migration, and food insecurity, along with consistently growing populations. It seems adaptation and mitigation are out of reach for many countries [5]. This study aims to evaluate climate and financial vulnerability at the global level, examine regional patterns across Asia, and analyze Iran as a case study using the Climate Finance Vulnerability Index (CliF-VI) under optimistic and pessimistic scenarios for 2050 and 2080.

Methods

Study Design

This study employs the Climate Finance Vulnerability Index (CliF-VI), developed by the Columbia Climate School with support from the Rockefeller Foundation. The index assesses the intersection of climate risk and financial vulnerability across 188 countries and is designed to bridge the gap between climate-related risk assessment and the allocation of financial resources [5]. In this study, no new primary data were collected and no modifications were made to the original index construction; instead, the pre-computed CliF-VI scores were analyzed to describe and compare patterns of climate financial vulnerability across different spatial scales and future scenarios. Table 1 summarizes the main dimensions and indicators included in the CliF-VI framework, grouped under the Climate Risk and Financial Vulnerability components.

Data Source and Extraction

All data used in this study were obtained from the official CliF-VI dashboard, which provides country-level scores and component values derived from the methodology developed by the Columbia Climate School. The dashboard reports composite CliF-VI scores and related sub-indices for a large set of countries under multiple climate and development scenarios.

For the purposes of this study, the following datasets were extracted from the CliF-VI dashboard:

Global dataset: CliF-VI scores for all countries available in the dashboard (188 countries)

Asia subset: CliF-VI scores for the subset of Asian countries included in the global dataset (47 countries)

Iran case: Country-specific CliF-VI scores for Iran, treated as a national case study

The extracted information corresponds to four future

Table 1: Dimensions and indicators comprising the Climate Finance Vulnerability Index (CliF-VI)

Domain	Dimensions	Scoring
Climate Risk	Baseline in Disaster Risk	Higher = Higher Vulnerability
Climate Risk(Future change)	Climate Change(Future change)	Higher = Higher Risk
Financial Vulnerability	Debt Sustainability	Higher = worse (without inversion)
Financial Vulnerability	Financial Integration	Higher = less Integration/ high Vulnerability
Financial Vulnerability	Financial Sophistication	Higher = weak financial market
Supplementary Governance Index	Governance	Higher = weak governance

scenarios combining different climate and development pathways:

2050 – Optimistic scenario
2050 – Pessimistic scenario
2080 – Optimistic scenario
2080 – Pessimistic scenario

In all cases, pre-calculated CliF-VI scores from the dashboard were used directly. The internal construction of the index (choice of indicators, normalization procedures, and weighting schemes) follows the original methodology of the Columbia Climate School and was not altered or recalculated in this study.

Units of Analysis

The analysis was conducted at three hierarchical scales:

Global level: all available countries in the CliF-VI dashboard (188 countries), used to characterize the overall distribution of climate–financial vulnerability worldwide.

Continental level – Asia: the subset of 47 Asian countries, used to explore regional patterns and to position Asia within the global distribution.

National level – Iran: Iran as a single-country case study, used to examine the country's relative vulnerability profile in comparison to regional (Asia) and global patterns across the four future scenarios.

Countries with missing or unavailable CliF-VI scores in the dashboard for any of the selected scenarios were excluded from the corresponding descriptive summaries.

Analytical Approach

For each of the four scenarios (2050 optimistic, 2050 pessimistic, 2080 optimistic, 2080 pessimistic), and for each spatial scale (global and Asia), standard descriptive statistics were calculated for the CliF-VI scores:

Mean (average)
Median
Minimum and maximum values
Standard deviation
Standard error of the mean (SEM)

These descriptive measures were used to characterize the central tendency, dispersion, and range of climate–financial vulnerability scores across countries under each scenario.

For Iran, the same descriptive indicators were summarized across the four scenarios to illustrate how the country's vulnerability profile changes from 2050 to 2080 under optimistic and pessimistic assumptions.

Results

Global Distribution of CliF-VI Scores

Table 2 presents the descriptive statistics of CliF-VI scores for 188 countries worldwide under four climate scenarios.

The global results indicate a moderate level of climatefinancial vulnerability across countries. Mean CliFVI scores range from 48.79 to 51.42 across the four scenarios, suggesting relatively stable global vulnerability levels despite different climate assumptions.

The highest average vulnerability appears in the 2050 optimistic scenario (mean = 51.42), while the lowest average score occurs in the 2080 pessimistic scenario (mean = 48.79). The median values, ranging from 49.0 to 52.65, are close to the mean values, indicating relatively balanced distributions.

The range of values is wide across all scenarios, with the minimum remaining constant at 5.30, while the maximum varies between 90.9 and 92.7, highlighting substantial heterogeneity in climatefinancial vulnerability among countries. Standard deviations between 16.79 and 18.05 further indicate considerable dispersion in countrylevel vulnerability scores.

ClimateFinancial Vulnerability in Asia

Table 3 summarizes the descriptive statistics of CliFVI scores for 47 Asian countries under the four scenarios.

Table 2: Global descriptive statistics of CliF-VI index scores under four scenarios (N = 188 countries)

statistics	Optimistic2050	Pessimistic2050	Optimistic2080	Pessimistic2080
Minimum	5.30	5.30	5.30	5.30
Median	52.65	51.35	50.30	49.0
Maximum	90.9	90.9	92.70	91.60
Mean	51.42	50.26	49.41	48.79
Std.Deviation	16.79	18.05	17.21	17.60
Std.Error of mean	1.22	1.32	1.25	1.28

Table 3: Asia descriptive statistics of CliFVI index scores under four scenarios (N = 47 countries)

statistics	Optimistic2050	Pessimistic2050	Optimistic2080	Pessimistic2080
Minimum	13.3	9.4	55.9	47
Median	63.9	60.8	64.6	56.9
Maximum	83.8	69.4	73.3	66.8
Mean	46.67	60.8	64.6	56.9
Std.Deviation	16.11	12.16	12.30	14.00
Std.Error of mean	2.15	1.8	1.25	1.28

The Asian region shows noticeable variation in vulnerability levels across scenarios. The mean CliFVI values range from 46.67 to 64.6, indicating that climatefinancial vulnerability may increase under certain future projections.

The highest median value (64.6) appears in the 2080 optimistic scenario, while the lowest minimum score (9.4) is observed in the 2050 pessimistic scenario. The maximum values range from 66.8 to 83.8, suggesting that some Asian countries experience substantially higher vulnerability levels compared with others.

The standard deviation values (12.16–16.11) indicate moderate variability among Asian countries. Compared with the global results, the Asian dataset reflects significant heterogeneity but slightly lower dispersion in some scenarios.

ClimateFinancial Vulnerability in the Middle East

Table 4 reports the descriptive statistics for 20 Middle Eastern countries. The Middle East demonstrates moderate to relatively high vulnerability levels compared with global averages. Mean CliFVI scores range from 49.74 to 53.17, indicating that several countries in this region may face notable climaterelated financial risks.

The highest mean score (53.17) is observed under the 2050 optimistic scenario, while the lowest mean (49.74) appears under the 2080 pessimistic scenario. The median values are relatively close to the mean, suggesting balanced distributions.

The maximum values reach up to 86.4, indicating that some countries within the region experience very high vulnerability levels. Standard deviations between 15.28 and 16.37 suggest moderate variability among countries.

National Case Study: Iran

Table 5 presents the CliFVI scores for Iran under the four scenarios. Iran's CliFVI score varies across scenarios, indicating sensitivity to both climate pathways and time horizons. The highest vulnerability level appears in the 2050 pessimistic scenario (62.8), while the lowest value occurs in the 2080 optimistic scenario (52.1).

Overall, Iran's scores remain above the global mean in several scenarios, suggesting a relatively elevated level of climatefinancial vulnerability compared with many countries.

Temporal comparison suggests a decrease in vulnerability from 2050 to 2080 under both optimistic and pessimistic conditions. The overall scenario range of 10.7 points indicates a notable spread between the lowest and highest projected vulnerability levels.

Discussion

This study provides a comprehensive assessment of climate financial vulnerability using the Climate Financial Vulnerability Index (CliFVI), integrating climate risk, financial vulnerability, and governance capacity across global, regional, and national levels. The results highlight considerable heterogeneity in vulnerability patterns across countries and regions and illustrate how financial and institutional conditions interact with climate exposure to shape overall vulnerability outcomes.

The global descriptive statistics reveal substantial disparities in climate–financial vulnerability across the 188 countries included in the analysis. The average CliFVI score ranges from 48.79 in the pessimistic 2080 scenario to 51.42 in the optimistic 2050 scenario, while the maximum values exceed 90 across all scenarios. These results indicate that a subset of countries faces extremely high levels of vulnerability, reflecting the combined effects of severe climate exposure, fragile financial structures, and limited institutional capacity.

The relatively small differences between optimistic and pessimistic scenarios suggest that structural economic and institutional characteristics play a dominant role in shaping vulnerability outcomes. Even under more favorable climate scenarios, countries with weak financial systems and limited governance capacity remain highly vulnerable. This observation aligns with

Table 4: Middle East descriptive statistics of CliFVI index scores under four scenarios (N = 20 countries)

statistics	Optimistic2050	Pessimistic2050	Optimistic2080	Pessimistic2080
Minimum	23.3	19.10	20.9	16.6
Median	52.9	52.10	50.6	47
Maximum	83.8	85.80	86.4	82.5
Mean	53.17	51.61	51.86	49.74
Std.Deviation	15.28	16.37	16.17	15.89
Std.Error of mean	3.33	3.57	3.53	3.47

Table 5: CliFVI index value for Iran under four scenarios

Scenario	CliF-VI(Iran)
Optimistic 2050	57.3
Pessimistic 2050	62.8
Optimistic 2080	52.1
Pessimistic 2080	59.1

the findings of Emmerling et al. (2024), who show that climate change exacerbates existing global inequalities and disproportionately affects countries with limited economic resilience. The results therefore support the argument that climate vulnerability is not determined solely by physical climate hazards but also by the financial and institutional capacity to respond to them [23].

The results for Asia reveal relatively high levels of climate–financial vulnerability compared with the global average. The median CliFVI score ranges from 56.9 to 64.6, indicating that a significant share of Asian countries falls within the higher vulnerability range. In particular, the maximum values reaching 83.8 suggest that some countries in the region face severe structural risks associated with climate exposure and financial fragility. These findings are consistent with previous research emphasizing the uneven distribution of climate risks and adaptation capacity across Asian economies. Carrozza (2016) argued that international climate finance allocation has historically been poorly aligned with countries' vulnerability levels in Asia, leaving highly exposed countries without sufficient financial support. More recently [24].

Masud et al. (2023) showed that climatevulnerable South Asian countries do not necessarily receive higher levels of climate finance, reinforcing the notion that climate finance mechanisms remain insufficiently responsive to vulnerability indicators [25]. The relatively high median values observed in the CliFVI results may therefore reflect the combined impact of climate exposure, rapid population growth, infrastructure deficits, and limited fiscal space in several Asian economies. These structural constraints can significantly reduce the capacity of governments to invest in adaptation and climate resilience.

The Middle East region also demonstrates substantial vulnerability, with average CliFVI scores ranging from 49.74 to 53.17 across scenarios. The relatively high standard deviation values indicate considerable variation within the region, suggesting that climatefinancial vulnerability is unevenly distributed among Middle Eastern countries. These results are consistent with the findings of Namdar et al. (2021), who used the NDGAIN framework to show that MENA countries face significant vulnerabilities related to water scarcity, food security, and ecosystem degradation. The CliFVI analysis extends these findings by incorporating financial and governance dimensions, revealing how economic structures and financial exposure can amplify climate risks.

Institutional and governance factors appear to play a critical role in shaping vulnerability in the region. Maboudi and D'Amico (2024) demonstrate that while many MENA countries have adopted climaterelated policies and regulations, these measures have often failed to translate into effective adaptation outcomes due to weak implementation and institutional constraints [26]. Similarly, Mignamissi and Tchinda (2026) show that financial development can reduce climate vulnerability only at lower levels of exposure, whereas highly vulnerable countries require broader institutional reforms and targeted adaptation strategies [27]. The CliFVI results support this perspective, indicating that financial development alone may not be sufficient to offset the structural climate risks faced by many Middle Eastern economies. In resourcedependent countries, fiscal volatility and limited economic diversification may further constrain the ability to invest in longterm climate adaptation.

Iran represents a particularly important case within the regional analysis. The CliFVI scores for Iran range from 52.1 in the optimistic 2080 scenario to 62.8 in the pessimistic 2050 scenario, indicating a relatively high level of climate–financial vulnerability compared with the regional average. The higher value observed under the pessimistic 2050 scenario suggests that nearterm climate risks may interact strongly with existing economic and financial vulnerabilities. Iran's economic structure, which includes fiscal constraints, limited financial integration, and exposure to external shocks, may amplify the impact of climate stress. These findings are supported by several empirical studies examining climate change in Iran. Hadei et al. (2024) documented widespread warming trends across Iranian cities between 1991 and 2020, accompanied by declining precipitation in central and southern regions and increasing wind intensity in several areas. Such climatic changes increase the likelihood of droughts, heatwaves, and environmental stress, which can negatively affect economic sectors such as agriculture, water management, and energy [28]. Similarly, Hatef et al. (2019) found that climatic vulnerability in Iran is particularly pronounced in very hot desert and semimountainous regions, where temperature variability and wind fluctuations significantly influence environmental stability. Their findings indicate that southern regions experience the highest levels of climatic variability, while northern and western regions exhibit relatively lower fluctuations [29].

In addition to environmental exposure, economic and institutional factors further intensify vulnerability in Iran. Amani et al. (2023) demonstrated that climate change negatively affects economic growth in Iran, while heightened operational risk and international sanctions reduce the country's economic resilience. These factors limit the availability of financial resources required for climate adaptation and increase the sensitivity of economic systems to climate shocks [30].

Urban vulnerability also represents an important dimension of climate risk. Jamali et al. (2023) highlighted the limited adaptive capacity of Tehran in the face of climate change, indicating that infrastructure limitations can significantly constrain urban resilience.

Taken together, these studies reinforce the conclusion that Iran's climatefinancial vulnerability results from the interaction between physical climate exposure, economic constraints, and institutional capacity [31].

The findings of this study suggest that reducing climatefinancial vulnerability requires integrated policy approaches that simultaneously address climate risk, financial resilience, and governance capacity. In many developing and climateexposed countries, strengthening financial institutions and improving fiscal resilience may enhance the ability to respond to climate shocks.

At the regional level, improving the allocation efficiency of international climate finance is particularly important. The evidence from Asia and MENA suggests that current climate finance flows do not always correspond to vulnerability levels. Aligning climate finance allocation with empirically measured vulnerability indices such as CliFVI could significantly improve the effectiveness of adaptation strategies.

For countries such as Iran, policy priorities should include strengthening economic diversification, enhancing financial market development, and investing in climateresilient infrastructure. Improving governance quality and institutional effectiveness is also essential to ensure that climate policies translate into tangible adaptation outcomes.

This study provides valuable insights into climate financial vulnerability; however, several limitations should be acknowledged. The analysis relies on secondary data from the CliFVI dashboard, which ensures standardized and comparable indicators across countries but limits the ability to adjust the underlying index structure. In addition, the study adopts a descriptive statistical approach that effectively highlights vulnerability patterns but does not establish causal relationships among climate risk, financial vulnerability, and governance factors. The nationallevel focus also means that potential subnational differences may not be fully captured, particularly in geographically diverse countries. Finally, as with any longterm climate assessment, scenariobased projections involve inherent uncertainty and should therefore be interpreted as indicative estimates of possible future vulnerability patterns.

Future research could expand this study in several directions. First, incorporating subnational data would provide a more detailed understanding of spatial variations in climatefinancial vulnerability within countries. Second, applying econometric or panel data methods could help identify causal relationships between financial development, governance quality, and climate vulnerability. Third, integrating dynamic climate scenarios with financial stresstesting frameworks may allow researchers to better evaluate the systemic economic risks associated with climate change. Finally, future studies could assess the effectiveness of specific climate adaptation policies and financial instruments in reducing vulnerability levels across countries and regions.

Conclusion

This study examined patterns of climate–financial vulnerability at the global, regional, and national levels using the CliFVI index. The findings indicate that vulnerability is unevenly distributed worldwide, with developing countries particularly in Asia and the Middle East experiencing higher levels of risk. At the global level, the average index ranges between 48.79 and 51.42, reflecting considerable variation among countries. In Asia and the Middle East, relatively higher index values indicate the combined effects of climate pressures and structural financial constraints.

For Iran, the CliFVI score ranges from 52.1 to 62.8 across different scenarios, with pessimistic scenarios showing higher levels of vulnerability. These results suggest that climate vulnerability is strongly influenced by countries' financial and institutional conditions. Overall, strengthening governance, improving access to and allocation of climate finance, and promoting economic diversification can play a crucial role in enhancing resilience and reducing vulnerability to climate change.

Acknowledgements

The authors wish to thank Tehran University of Medical Sciences for their support of this study.

Competing Interests

The authors declare that they have no known competing financial interests, personal affiliations, or professional relationships that could have appeared to influence the work reported in this paper.

Authors' Contributions

Parnia Hatami Moghaddam: Conceptualization, Formal analysis, Data curation, Investigation. Elham Keighobadi: Conceptualization, Methodology, Validation, Supervision, Writing original draft. & editing.

Ethical Considerations

Ethical issues (including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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