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Climate Finance and Adaptation Needs In Pacific Island Countries

Fabien Gonguet, Xuehui Han, Choonsung Lim, To-Nhu Dao and
Saraf Nawar

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WORKING PAPER

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Climate Finance and Adaptation Needs In Pacific Island Countries
Prepared by Fabien Gonguet, Xuehui Han, Choonsung Lim, To-Nhu Dao and Saraf Nawar*

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ABSTRACT: Pacific Island Countries (PICs) face acute and rising climate adaptation needs due to high exposure to sea-level rise, natural disasters, and structural vulnerabilities associated with small size and geographic remoteness. This paper develops a unified framework to produce the first region-wide, internally consistent estimates of climate adaptation financing needs for PICs. A metadata analysis harmonizes country-level assessments into comparable annual measures, while a complementary machine-learning approach generates synthetic estimates for data-deficient countries using economic, geographic, and climate-vulnerability indicators, subject to differences in sectoral definitions and coverage embedded in the underlying source studies. The results show that adaptation needs are large, highly uneven across countries, and exceptionally high relative to GDP, particularly for atoll nations where physical risks dominate. The paper also examines climate adaptation finance flows to PICs over the past decade, distinguishing between commitments and estimated disbursements, and finds that current financing levels fall well short of projected needs. Disbursement ratios vary substantially across financing channels, reflecting differences in institutional capacity and project implementation. Taken together, the findings highlight substantial adaptation financing gaps in PICs and underscore the importance of strengthening institutional capacity and improving the effectiveness and accessibility of climate finance mechanisms.

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Glossary

ADB	Asian Development Bank
CCDR	Country Climate and Development Report
DAC	Development Assistance Committee
EM-DAT	Emergency Events Database
GCF	Green Climate Fund
GDP	Gross Domestic Product
IMF	International Monetary Fund
MDB	Multilateral Development Bank
NDC	Nationally Determined Contribution
ND-GAIN	Notre Dame Global Adaptation Initiative
ODA	Official Development Assistance
OECD	Organisation for Economic Cooperation and Development
PIC	Pacific Island Country
PNG	Papua New Guinea
SIDS	Small Island Developing State
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
WB	World Bank

Executive Summary

Pacific Island Countries (PICs) face acute and rising climate adaptation needs, driven by exposure to sea-level rise, natural hazards, and structural vulnerabilities, including those inherent to small, remote island economies. A number of country studies and reports have attempted to quantify climate adaptation needs over the years; yet, the substantial variation in the methodologies, sectoral coverage, and time horizons of the existing assessments makes it challenging to develop a comprehensive and consistent view of these needs across the region. This paper develops a unified framework to address these challenges and provides the first region-wide, internally consistent set of adaptation needs estimates for PICs. A metadata analysis assembles information from the existing country reports and standardizes it into comparable annual measures of adaptation needs, while a complementary machine-learning approach helps address information gaps for a data-deficient country and offers an additional lens through which to interpret cross-country variations in reported estimates.

The results indicate large and uneven adaptation needs across the region. Physical risks—particularly from coastal inundation and sea-level rise—account for the bulk of identified needs, with the highest burdens falling on atoll nations. When expressed relative to GDP, adaptation needs are exceptionally high in most PICs, reflecting both the magnitude of required investments and the region’s relatively small economic base. Although differences in source material, potential overlaps in reported cost components, and the long time horizons used for some assessments introduce uncertainty and require caution in interpreting cross-country differences, the harmonized framework provides a coherent basis for comparative analysis.

The paper also examines adaptation finance flows to PICs over the past decade. Climate-related commitments to the region have increased in recent years, with adaptation as the predominant focus of climate finance providers. Nevertheless, the metadata analysis suggests current commitment and disbursement levels remain far below projected needs. Disbursement ratios vary significantly across financing channels—generally higher for bilateral partners and lower for multilateral institutions and climate funds—and reflect differences in project design, approval processes, and implementation capacity.

Finally, the paper explores factors associated with access to adaptation finance, drawing on both the empirical literature and patterns observed in PICs. Vulnerability to climate change remains a strong determinant of resource allocation, while institutional capacity and governance readiness also appear to influence financing outcomes. However, weak capacity continues to constrain implementation in several countries, and external factors—notably fiscal pressures in provider countries—may affect the availability of future climate finance. Taken together, the findings highlight the urgency of expanding and accelerating adaptation finance for Pacific Island Countries. Enhancing institutional readiness, strengthening public financial management for climate-related investments, and improving the effectiveness and accessibility of financing mechanisms—including emerging regional platforms such as the Pacific Resilience Facility—will be central to closing the region’s substantial adaptation-financing gaps.

1. Introduction

Pacific Island Countries (PICs) are among the most climate-vulnerable nations globally, facing existential threats from rising sea levels, intensifying natural disasters, and other climate-related shocks. Their geographic isolation, smallness, and high dependence on imports exacerbate these vulnerabilities, leading to elevated costs of living and significant adaptation challenges (World Bank, 2024; Fouad et al., 2021). For atoll countries such as Kiribati, Tuvalu, and the Marshall Islands, where the highest land elevation is only a few meters above sea level, projected sea-level rise of up to 0.5 meters by 2070–2110 could submerge large portions of urban areas, threatening livelihoods and economic stability (World Bank, 2024).

Climate adaptation needs in PICs are substantial and growing. Existing assessments, however, vary widely in scope, methodology, and time horizon, making it difficult to aggregate and compare estimates across countries. Previous studies—including the IMF’s *Fiscal Policies to Address Climate Change in Asia and the Pacific* (IMF, 2021), the World Bank’s *Pacific Atoll Countries Climate and Development Report* (World Bank, 2024), and the *Climate Change and Disaster Management* report (World Bank, 2016)—highlight the urgency of scaling up adaptation investments but differ in sectoral coverage and assumptions. The United Nations Environment Programme (UNEP) *Adaptation Gap Report* (2023) further underscores the global shortfall in adaptation finance, with small island states among the most affected.

To address these gaps, this paper develops a systematic framework to estimate adaptation financing needs for PICs. We employ a meta-data analysis approach to organize and standardize estimates from diverse sources, complemented by a machine learning model to generate synthetic estimates for a data-deficient country. In addition, the paper examines actual adaptation finance flows to PICs, assessing commitments, disbursements, and key drivers of mobilization using the Organization for Economic Cooperation and Development (OECD) Development Assistance Committee (DAC) climate finance flow data. This analysis provides insights into the effectiveness of current financing mechanisms and discusses patterns in disbursement.

By combining financing needs estimates (Section 2) with an assessment of actual financial flows (Section 3), the paper proposes an assessment of adaptation financing gaps in PICs (Section 4). The paper seeks to inform policy discussions on closing these gaps and improving resilience strategies in the region. These insights will also guide the design of regional initiatives such as the Pacific Resilience Fund, which seeks to pool resources and enhance access to climate finance for PICs.

This paper’s contribution to the literature is threefold: First, the paper develops a unified framework to organize and standardize climate adaptation needs drawn from diverse country reports, enabling consistent cross-country comparison despite differences in scope, methodology, and time horizons. Second, it complements the metadata analysis with a machine-learning approach that helps address gaps in the underlying literature—particularly for data-deficient countries—and provides an additional perspective to help interpret cross-country differences in the reported needs. Third, the paper brings together harmonized adaptation-needs estimates with detailed evidence on climate finance commitments and disbursements to PICs, offering a new assessment of adaptation financing gaps and the factors associated with effective access to climate finance in the region. Taken together, these contributions help fill important empirical and analytical gaps in the climate-finance literature for small island economies.

2. Estimating Climate Adaptation Needs

This section outlines the approach used to construct a consistent set of climate adaptation needs for PICs. A metadata framework is applied to extract sectoral estimates from diverse country reports, standardize them into comparable annual measures, and aggregate them across countries and risk categories. This involves identifying the sectors covered in each source, converting estimates into annual percent-of-GDP and 2024 USD values, and aligning time horizons for meaningful regional analysis. To address gaps where underlying assessments are sparse or uneven, a machine-learning model is used to generate synthetic annual needs and assess the internal coherence of the metadata-based estimates by leveraging economic, geographic, and climate-vulnerability indicators. Together, these steps produce a harmonized dataset of adaptation needs that underpins the subsequent analysis of adaptation financing gaps.

This approach relies on the definitions and scope of adaptation needs specified in the underlying source studies. Reported estimates are therefore conditional on assumptions regarding protection targets, time horizons, climate scenarios, and financing conditions.¹ In line with the objectives of this paper, the analysis does not seek to refine these underlying definitions, nor to assess the optimality of the implied investment levels. Instead, the reported estimates are leveraged to construct a standardized regional dataset of adaptation needs, subject to differences in underlying assumptions.

Table 2.1. Summary Statistics on Reports, Sectors, and Timeframes

Country	No. of Reports	No. of Sectors	End of Timeframe
Fiji	3	14	2060
Kiribati	4	20	2150
Marshall Islands	3	7	2150
Micronesia	4	13	2060
Nauru	1	1	2035
Palau	3	9	2060
Papua New Guinea	2	5	2030
Samoa	3	12	2060
Solomon Islands	4	10	2060
Tonga	4	15	2060
Tuvalu	4	13	2150
Vanuatu	3	28	2060

Source: authors.

Note: Within a given report, all countries and sectors share the same timeframe. Timeframes may differ across reports. For Nauru, there are a total of 9 sectors, but only 1 extends until 2035, while the others end in 2023.

2.1. Metadata Analysis

Assessments of climate adaptation financing needs for PICs reported in the literature and various analyses exhibit significant differences in sectoral coverage, time spans, and methodologies. To address the challenge of aggregating these diverse assessments, this study develops a matrix framework using a meta-data analysis approach.

A meta-data analysis approach refers to a research method that involves the systematic collection, categorization, and analysis of data characteristics ("metadata") across multiple studies or sources, rather than

¹ As emphasized in the literature, alternative approaches grounded in cost-benefit analysis, optimal investment under financing constraints, and country-specific preferences may yield different estimates of adaptation needs, reflecting both economic trade-offs and societal choices (Hallegatte et al., 2020; Bellon and Massetti, 2022a, 2022b; Bellon et al., 2022; Marto et al., 2018).

analyzing the results of those studies directly. The meta-data analysis has been initially and most commonly used in clinical and medical research, which helps to summarize the outcomes of different studies. The nature of the meta-data approach is well-suited to the climate adaptation needs analysis.

2.1.1. Methodology

Literature Searching

The conventional approach to meta-data searching yields limited results², indicating that for PICs, the analysis of climate adaptation financing needs is limited, particularly regarding the publication and communication of such analyses. A more fruitful result of the sources is derived from the team's country-specific knowledge and the expertise accumulated during the peer review process and institutional training related to Climate Finance. Table 2.1 provides summary statistics on the reports used, as well as the sectors and timeframes they cover. Annex I also provides a full list of country reports used as sources for the metadata analysis.

The analyses that this study cites directly regarding adaptation financing needs include: the IMF departmental paper on Fiscal Policy to Address Climate Change in Asia and the Pacific (Dabla-Norris et al. (2021)), which covers most of the PIC countries except for Nauru; the World Bank's Country Climate and Development Report (CCDR) for the Pacific Atoll Countries (World Bank (2024)), which covers Kiribati, Tuvalu, and the Marshall Islands; and the World Bank's Climate Change and Disaster Management (CCDM) report (2016), which addresses most PICs, except for Papua New Guinea and Nauru. Country-specific reports are listed in Annex. UNEP's Adaptation Gap Report (2023) presents aggregated estimates; however, since it is based on the country-specific reports previously mentioned, we do not cite the estimates directly from the report.

The Matrix Framework to Organize Data

² A search was conducted using the Library Search function on the IMF library website on November 5th, 2024, utilizing the keywords "adaptation financing needs for" in conjunction with "Pacific Island Countries" or one of the following twelve countries: Fiji, Kiribati, Marshall Islands, Micronesia (Federated States of), Nauru, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu. In total, thirteen non-overlapping outcomes were returned.

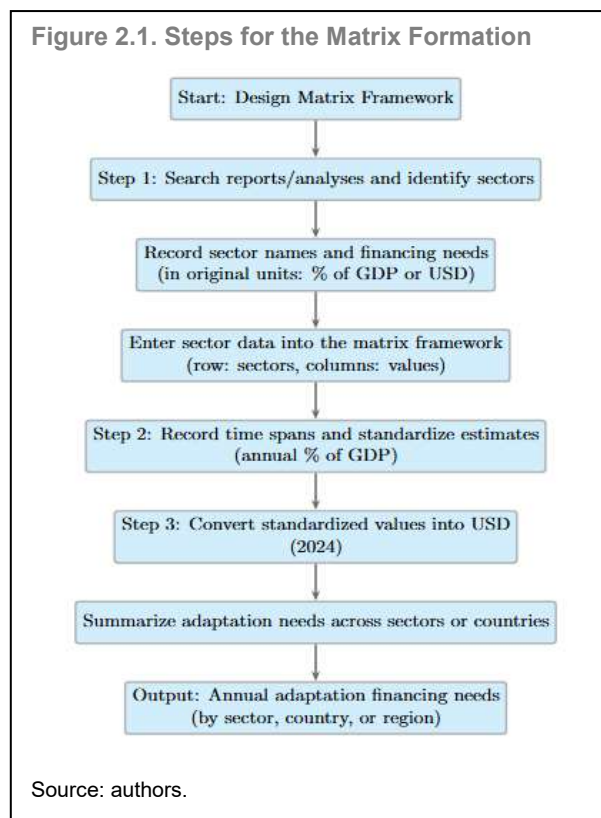
A matrix framework is designed to estimate adaptation needs for each country, sourced from different reports or analyses. The same matrix framework is used across different countries to enable the summation of the estimates for the region. The following steps are followed for the matrix entry:

Step 1: Search the reports or analyses and determine which sectors are assessed for financing needs. For each sector, record the name of the sector and exact amounts of needs reported in their original units, either as a percentage of GDP or in U.S dollar values. Enter these into the framework, with each sector represented as a separate row and the corresponding values recorded in the columns.

Step 2: Record the time span for each estimate from Step 1 and standardize the estimates in terms of annual percentage of GDP in one column.

Step 3: Convert the standardized annual cost from Step 2 into 2024 USD millions by applying the actual U.S. inflation rate to rebase estimates expressed in past years, and a 2 percent inflation assumption (U.S. long-run inflation target) to extrapolate estimates expressed in future years.³

Figure 2.1. Steps for the Matrix Formation



For each year covered in the matrix, an estimate of adaptation needs can be obtained by summing across different sectors (covered by various reports) or countries, depending on the aspect of interest.

Sector Classification

The sector classification is based on the original reports sourced. In total, there are 56 categories reported. While there may be cases of different names for the same sector, we adhere to the original terminology used in the source analysis. For instance, "education" and "social spending – education" are introduced separately, even though they might cover similar types of financing needs. To address this potential duplication of categorization, we pool the categories into two groups corresponding to the risks they are adapted to. A detailed list of sectors and their corresponding risks can be found in Annex II (Table 1).

In order to assess the adaptation needs in a more concise way, the detailed sectors are further summarized into two categories: primary sectors and secondary sectors. The primary sectors capture the largest adaptation needs arising from the direct exposure of physical capital to risks of natural disasters and rising sea levels,

² The conversion abstracts from uncertainty in future inflation, exchange rates, and financing conditions and is intended to provide order-of-magnitude estimates rather than precise projections.

such as coastal protection infrastructure and land reclamation to adapt to rising sea levels. All the other sectors are grouped into the secondary category. See Table 2.3 below.

A potential concern is whether some sectors currently categorized into the secondary sectors should instead be included among the primary sectors. However, the largest cost estimates reported in the IMF departmental paper on Fiscal Policy to Address Climate Change in Asia and the Pacific (Dabla-Norris et al. (2021)), the World Bank Group's Country Climate and Development Report (CCDR) for the Pacific Atoll Countries (World Bank Group (2024)), and the World Bank Group's Climate Change and Disaster Management (CCDM) report (World Bank Group (2016))—are entirely concentrated in the primary sectors as defined here. By contrast, sectors that could plausibly be reclassified involve relatively small cost components. As a result, alternative classifications of these secondary items would not materially affect aggregate adaptation cost estimates.

Caveats of the method include potential overlap or double counting of financing needs estimates, as well as the possibility of omitted literature. In addition, financing needs differ across sources in scope and methodology, ranging from incremental resilience upgrades to comprehensive adaptation; large GDP shares therefore do not imply full climate insulation and may reflect mixed levels of adaptation coverage. Finally, an important methodological limitation is that the cost of reallocating the entire population to a newly established site in another country lies beyond the scope of existing analysis and is therefore not captured in the estimates.

Table 2.2. Categories and Selected Examples of Sectors

Category	Selected Examples of Sectors
Physical Sectors - First Order: Activities aimed at adapting physical investments/capital to the direct impacts of natural disasters and rising sea levels.	Coastal Erosion Control
	Coastal Protection
	Coastal Protection Infrastructure
	Hazard Management
	Inundation and Flood Mitigation
	Meteorology and Climate Information Services
	Protect and Reclaim Land, and Internal Migration
	Protect Land, Raising Building, and Move Inland
Storm Impact Mitigation (Capital)	
Other Sectors – Secondary Order	Agriculture
	Tourism Resilience
	Biosecurity
	Ocean and Marine Protection
	Wetland Conservation
	Capacity Building
	Climate Policy
	Education
	Health Services
	Social Protection
	Water and Sanitation
.....	

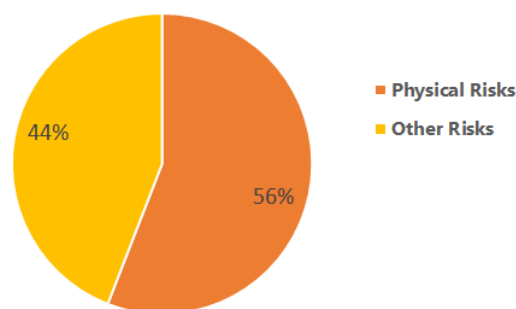
Source: Authors.

2.1.2. Findings: Annual Financing Needs

As a region, the Pacific Island Countries (PICs) have an annual financing need around USD 3.3 billion (at 2024 prices). Physical risks account for the largest share at 56 percent, and the other risks account for the remaining 44 percent (Figure 2.2).

Papua New Guinea has the largest annual needs at USD 868 million, followed by Fiji at 857 million. Samoa, Micronesia, Tonga, the Marshall Islands, and Kiribati have needs above 100 million and below 200 million. Nauru has only one study available for needs beyond 2023 and covers only other risks (Figure 2.3).

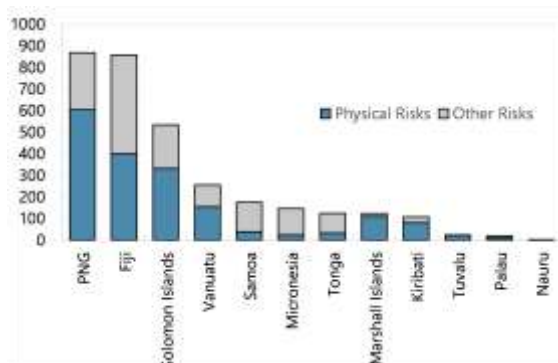
Figure 2.2. Future Climate Adaptation Annual Need Estimates by Risks (In percent)



Source: authors' estimates.

Countries exhibit diverse sectoral needs. In selected countries, physical risks account for the majority of identified needs—for example, Tuvalu (97 percent), the Marshall Islands (85 percent), and Kiribati, Solomon Islands, Palau, and Papua New Guinea (all above 60 percent). In contrast, other countries, such as Micronesia, Tonga, and Samoa, face needs primarily associated with other types of risks.

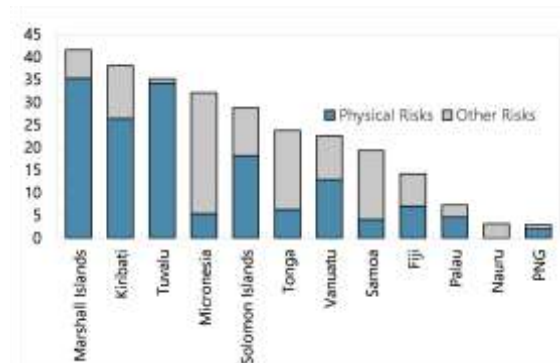
Figure 2.3. Future Climate Adaptation Annual Need Estimates (In 2024 USD million)



Source: authors' calculation.

Note: To address the potential double-counting of coastal protection costs, the WB CCCR for a 0.5-meter sea rise in 2070 is used if available; otherwise, the WB CCRM until 2040 is used. If both are unavailable, the IMF 2021 working paper is referenced.

Figure 2.4. Future Climate Adaptation Annual Need Estimates (In percent of GDP)



Source: authors' calculation.

Note: To address the potential double-counting of coastal protection costs, the WB CCCR for a 0.5-meter sea rise in 2070 is used if available; otherwise, the WB CCRM until 2040 is used. If both are unavailable, the IMF 2021 working paper is referenced.

The PICs, as a region, have average annual needs as a percentage of GDP of 22.5 percent⁴, including 13.1 percent for physical risks, and 9.4 percent for the other risks (Figure 2.4). When measured relative to GDP, the three atoll countries exhibit the highest financing needs related to physical risks, reflecting both their small economic size and the significant adaptation requirements posed by sea-level rise. These include investments in coastal protection, elevation of infrastructure, and planned relocations. Micronesia reports the highest financing needs associated with other risks, consistent with the broader scope of climate-related investments outlined in its Climate Change Policy Assessment (2019).

The time horizons covered by existing assessments of climate adaptation financing needs vary significantly, ranging from 10 to 125 years. Financing needs associated with *other risks* are generally assessed only over the medium term—up to 2050—whereas needs linked to *physical risks* are projected over much longer periods, extending in some cases to 2150. For the three atoll countries—Kiribati, the Marshall Islands, and Tuvalu—assessments explicitly consider the risk of a two-meter sea-level rise occurring beyond 2150. As a result, the time span used to estimate physical risk-related needs for these countries is 125 years.

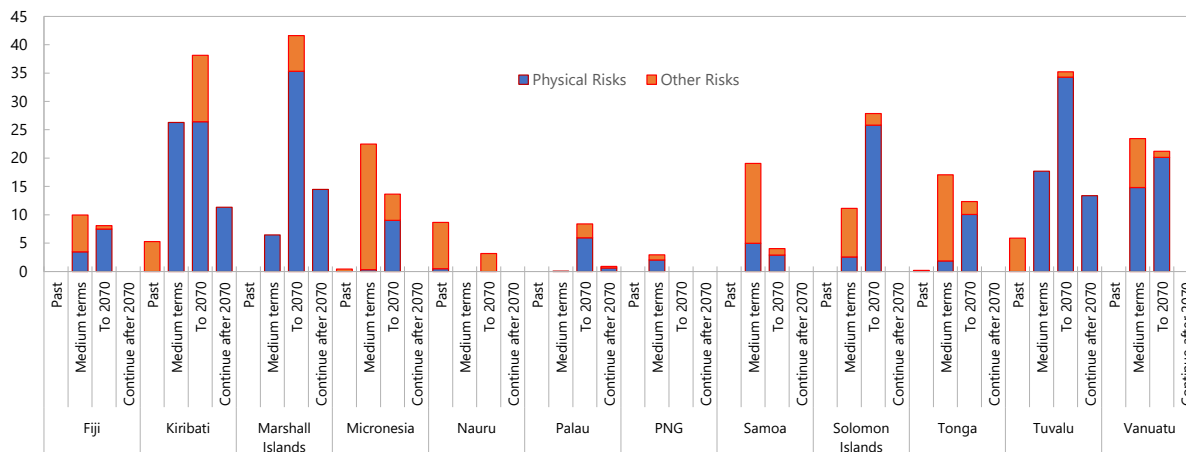
In non-atoll countries, the time horizon for physical risk-related needs, based on the World Bank's Climate Change and Disaster Management Assessment, is typically 40 years. This is divided into two phases: 2020–2040 and 2040–2060. By contrast, most other assessments adopt a shorter time horizon of approximately 10 years. For example, the IMF Working Paper on Fiscal Policies to Address Climate Change in Asia and the Pacific covers 2021–2030; the Kiribati Joint Implementation Plan for Climate Change and Disaster Risk Management spans 2013–2023; the IMF's Technical Assistance Report on Climate Change Policy in Tonga covers 2018–2028; and Fiji's Climate Vulnerability Assessment spans 2017–2027 (Figure 2.5).

⁴ This amounts to 24.5 percent of GDP when using the random-forest-estimated needs for Nauru, as reported in Section 2.2.3.

Several countries lack medium- or long-term assessments. In the case of Nauru, all identified financing needs end in 2023, with the exception of one analysis on water and sanitation extending to 2035. Similarly, Papua New Guinea does not have a financing needs assessment that extends beyond 2030.

Figure 2.5 Cross-Country Differences in Time Horizons of Climate Adaptation Need Estimates (in percent of GDP)

Estimates are constrained by the timeframes covered in available analyses.



Source: authors' calculation.

Note: To address the potential double-counting of coastal protection costs, the WB CCDR for a 0.5-meter sea rise in 2070 is used if available; otherwise, the WB CCDM until 2040 is used. If both are unavailable, the IMF 2021 working paper is referenced.

2.2. Machine Learning Approach for Data-Deficient Countries

Our metadata analysis in the previous section presents two caveats. Firstly, adaptation needs estimated through the metadata analysis exhibit significant differences in sector coverage, timespan, and methodologies, creating challenges in terms of comparability. Additionally, some countries encounter very limited availability of the literature. In particular, there is only a single study available for Nauru, leading to large uncertainty in estimating the adaptation needs.⁵

This section addresses these concerns using machine learning techniques. A model for the adaptation needs can be trained with various country characteristics. The identified relationships between the scale of adaptation needs and country characteristics could provide a more comprehensive understanding of adaptation needs estimates and suggest the reliability of the estimates derived from the metadata analysis. Additionally, the application of machine learning techniques can produce a synthetic estimate for data-deficient countries such as Nauru, based on the relationships observed within country characteristics.

⁵ Because of this large uncertainty, we did not present the estimate for Nauru in the metadata analysis.

2.2.1. Random Forest Model

We utilize a random forest model known to be relatively robust to small sample size. This model has been trained using data from only 11 countries, excluding Nauru from the training set. Due to the small sample size, we do not have the luxury to split the data into training and testing sets. Instead of testing the performance of the trained model with the out-of-bag data, we conducted a visual check for the relationship between the dependent variable and each independent variable deemed important for predicting the dependent variable. To address uncertainty, we average the results from 200 random forests, in the spirit of Bayesian estimation approach. Each forest comprises 1000 trees, with each tree trained on 4 independent variables that are randomly selected from a pool of 24 independent variables, allowing for unlimited depth.

Table 2.3 presents variables used in the model training.⁶ The dependent variable targeted for prediction is the annualized adaptation needs in a percentage of GDP, estimated in the previous section. We use 24 explanatory variables to encompass a range of factors, including economic indicators, geographic attributes, and climate-related vulnerability metrics.

⁶ Please refer to Table AII.2 in Annex II for sources and definitions of variables.

Table 2.3. Random Forest Model – Summary Statistics

Sources: IMF World Economic Outlook, IMF Asia-Pacific Department's Regional Economic Outlook, United Nations Conference on

Sector	Variable	N	Mean	Std. Dev.
Dependent Var.	Adaptation needs (% of GDP, annualized)	11	24.2	12.5
Economic	GDP per capita (US\$)	11	5012.3	3893.8
	Nominal GDP (US\$ mil.)	11	3207.4	7307.0
	Public debt (% of GDP)	11	36.9	26.6
	Population (thousands)	11	1354	3637
	Tourism, dummy	11	0.45	0.52
Geographic	Distance to economic centers	11	68.7	12.3
	Distance to nearest (non-SIDs) neighbor	11	57.2	28.5
	Distance to trading partners	11	50.5	7.8
	Liner Shipping Connectivity	11	24.5	13.8
	Freight costs of imports (% of good imports)	11	14.2	5.7
	Atoll, dummy	11	0.27	0.47
Vulnerability	Disaster Severity (% of population)	11	15.2	18.2
	Disasters Frequency, Flood	11	0.14	0.20
	Disasters Frequency, Storm	11	0.27	0.24
	Disasters Frequency, Total	11	0.50	0.42
	Expected Severity (% of population)	11	4.55	3.14
	Climate risk	11	3.73	0.70
	Climate risk, Hazard & Exposure	11	2.54	0.76
	Climate risk, Vulnerability	11	4.19	0.60
	Lack of Coping capacity	11	5.07	1.30
	Readiness	11	0.43	0.09
	Economic Readiness	10	0.44	0.14
	Vulnerability	9	0.55	0.06
	Exposure	11	0.54	0.06

Trade and Development, World Bank Group (2024), Emergency Events Database (EM-DAT), IMF Climate Change Dashboard, and authors' calculation.

2.2.2. Training Results

The results from our machine learning analysis indicate that adaptation needs are significantly correlated with most of our explanatory variables. Figure 2.6 illustrates the relative importance of each explanatory variable in predicting the size of adaptation needs. Eight variables are outstanding, while other variables still show that they are also relatively important⁷.

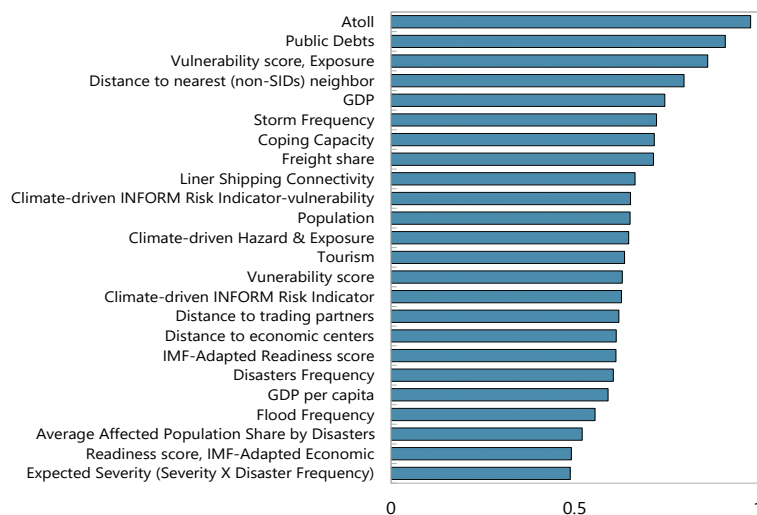
The relationships observed with these explanatory variables are broadly in line with expectations (Figure 2.7). Among economic indicators, nominal GDP exhibits a

strong negative relationship with adaptation needs, suggesting that the small size of economy could inflate the required investment in adaptation and/or its associated costs (panel 1). Public debt also appears to correlate negatively with adaptation needs (panel 2). A low public debt may reflect a country's limited borrowing capacity. Constrained access to financing may have limited the authorities' ability to mobilize resources to address climate-related risks, leading to higher unmet needs.

Regarding geographic attributes, factors such as remoteness and higher shipping costs⁸ could lead to increased adaptation investment costs (panels 3-4). We also observe a positive relationship between adaptation needs and climate-related vulnerabilities, such as exposure to natural disasters (panel 5). Additionally, atoll countries, highlighted in orange in Figure 2.7, appear to face substantial adaptation needs. This situation may reflect their fragility, driven by other factors such as small size, remoteness, high shipping costs, and greater exposure to disasters.

These expected associations observed in a visual assessment ensure that the estimates derived from the metadata analysis are not necessarily unreliable, despite challenges such as differing coverage, time horizon and methodologies across literature.

Figure 2.6. Relative Importance
(Ratio to the largest score)

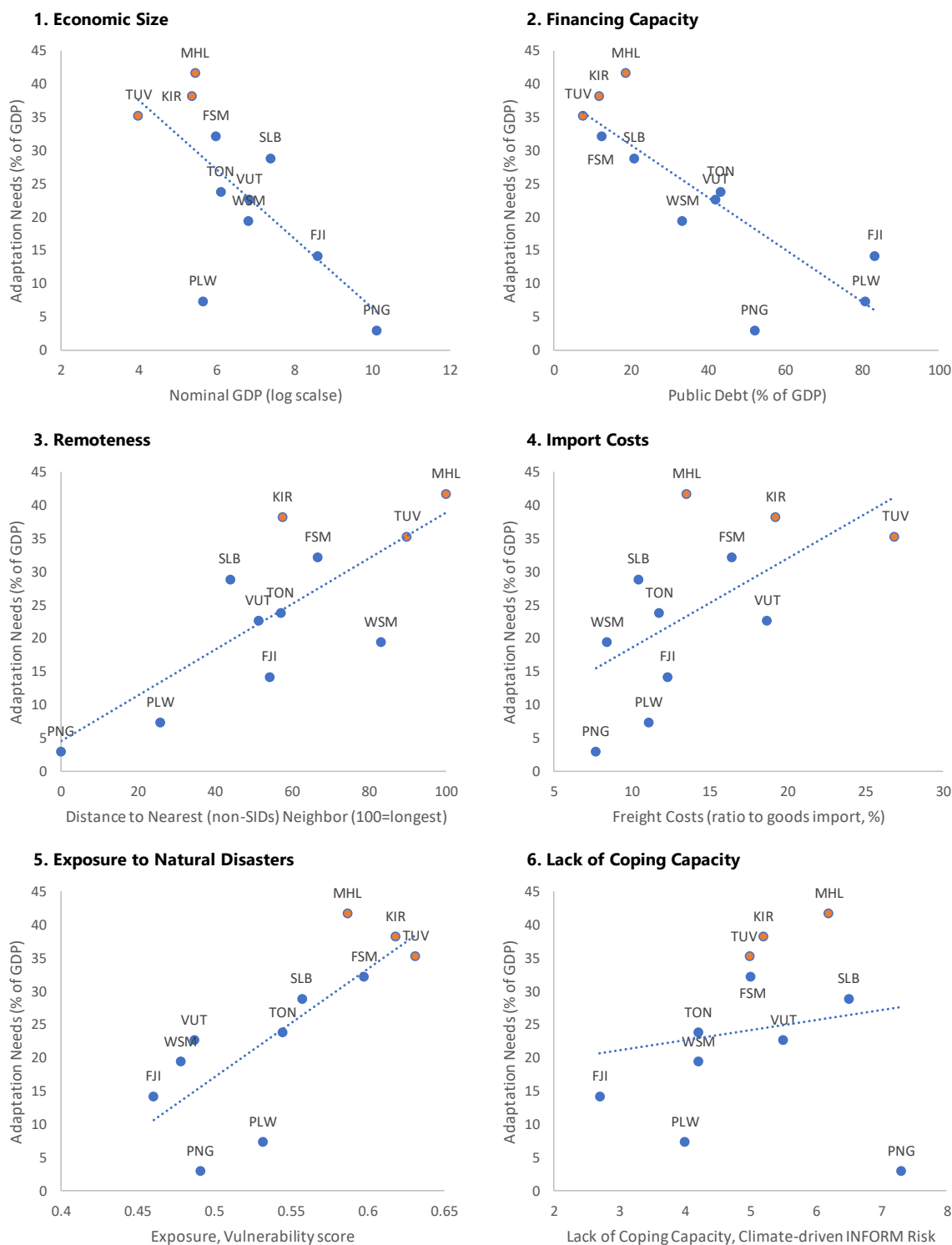


Source: authors' estimates.

⁷ While this suggests that most independent variable could be significant in predicting the dependent variable, this may also reflect the uncertainty in our estimation.

⁸ Domestic demands such as consumption and investment in Pacific Island countries generally show a high reliance on imports.

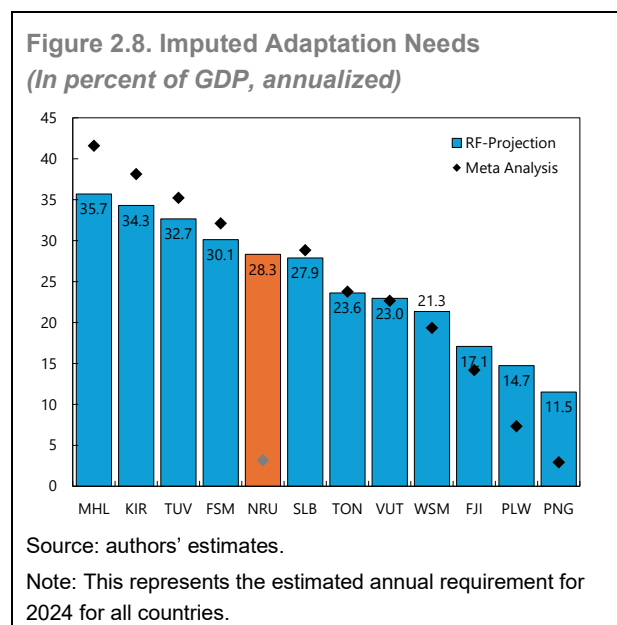
Figure 2.7. Relationship of Adaptation Needs and Country Characteristics



Source: IMF World Economic Outlook, IMF Climate Change Dashboard, and authors' calculation.

Note: Atoll countries in orange.

2.2.3. Prediction of Missing Annual Adaptation Needs



Based on our estimated random forest model, we can predict the adaptation needs for various countries, including Nauru, which was not included in our training dataset. Our analysis indicates that Nauru requires the fifth-largest adaptation investment as a percentage of GDP among the 12 PICs (Figure 2.8. orange). This size of investment needs is markedly higher than the estimates from a single available report (gray diamond).

While the true adaptation value remains unknown, Figure 2.8 suggests that mid-ranked countries demonstrate minimal discrepancies between the projections from the random forest model and those derived from the metadata analysis. Additionally, the rankings from the metadata analysis are preserved in the random forest projection. Founded on this

consistency, this paper uses the synthetic estimate of adaptation needs for Nauru.

An alternative approach is to use the synthetic estimates for all countries as the baseline measure of adaptation needs. This approach tends to generate lower needs for countries with the highest meta-analysis estimates and higher needs for countries with the lowest meta-analysis estimates, reflecting the shrinkage toward central tendencies inherent in the random-forest methodology.

3. Assessing Actual Adaptation Finance Flows to Pacific Island Countries

The objective of this section is to assess adaptation finance flows that have been committed to PICs and effectively disbursed over the past decade, by bridging existing data collection efforts on climate finance flows, and to highlight key drivers for successful climate finance mobilization. This section updates and expands on the findings of Fouad et al. (2021). We first analyze the size, composition and sources of adaptation finance commitments to PICs, based on data collected by the OECD-DAC (3.1), and then gauge adaptation finance that was actually disbursed to PICs (3.2). Lastly, we will provide an overview of key drivers of successful mobilization of climate adaptation finance for PICs (3.3).

3.1. Adaptation Finance Commitments

Climate finance commitments measure the intentions of donors to provide financial support to climate action in recipient countries. Commitment amounts are recorded at the time of project signature, and hence reflect full project costs, to be typically disbursed over several years, hence providing a sense of future flows. They give an indication about future flows.

Climate finance commitments data is formally reported to the United Nations Framework Convention on Climate Change (UNFCCC), and also collected by the OECD-DAC, integrated into its broader efforts to measure official development assistance (ODA) flows.⁹ This data is compiled on a yearly basis with an approximately 1.5-year lag, and covers the period 2010-2023, based on self-reporting from multilateral, bilateral and private sources.

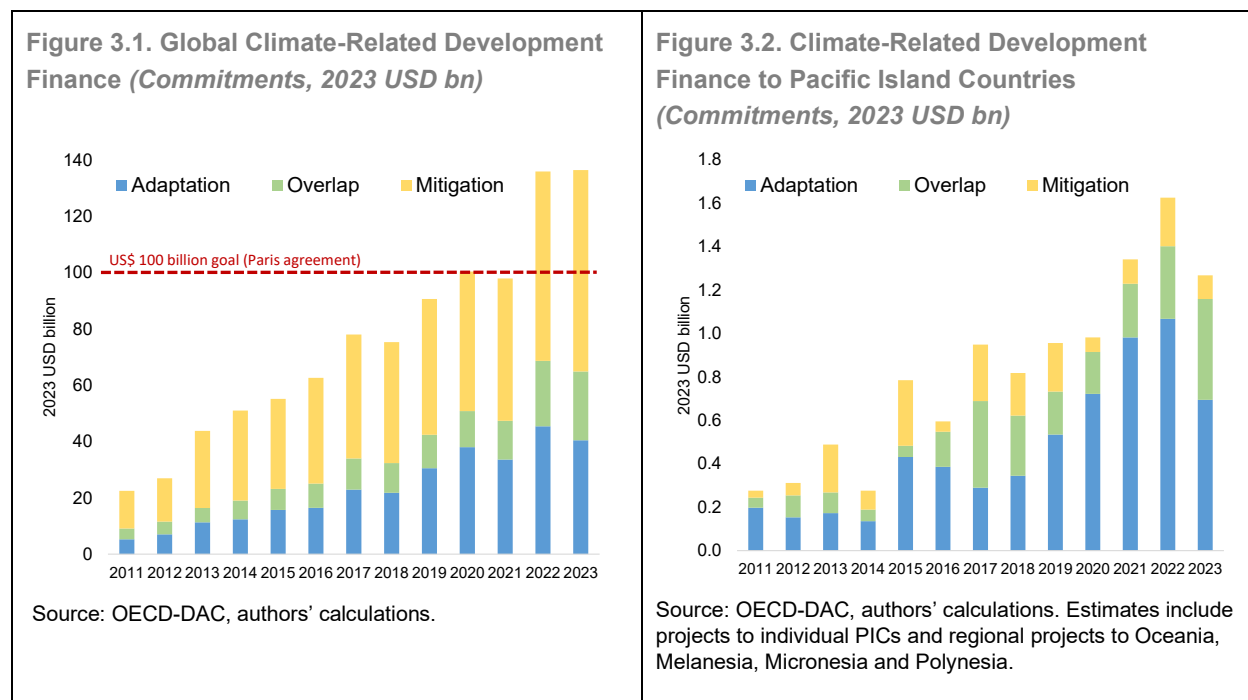
The data reported by bilateral finance providers to the OECD rely on the application of the “Rio markers” methodology. Introduced in 1998, these markers aim at providing a sense of how environmental and climate objectives are mainstreamed in donors’ development assistance activities. This means that while they are not meant to measure climate-specific finance flows *per se*, they are useful to assess whether each donor activity targets climate mitigation, adaptation, or both as either a principal objective or a significant objective. The data reported by most multilateral agencies, particularly multilateral development banks (MDB), are based on the application of the Joint MDB Methodology on Tracking Climate Finance, which identifies shares of each activity that support climate change adaptation or mitigation.¹⁰

2022 was an important milestone year for global climate finance. As part of the 2015 Paris agreement, developed nations made the commitment to mobilize an annual USD 100 billion for global climate finance flows towards emerging markets and developing economies by year 2020. While the objective was almost reached in 2020, it was actually achieved and surpassed for the first time in 2022 and confirmed in 2023, with global climate flows reaching USD 136 billion that year (Figure 3.1). Out of that total, slightly less than half (USD 65 billion) were commitments with adaptation as a principal or significant objective.

In PICs, adaptation is by far the most common objective of climate finance commitments, as 90 percent of all climate finance commitments to PICs had adaptation as a principal or significant objective in 2023 (Figure 3.2). Similar to global trends, adaptation finance commitments have accelerated over the past decade in the PIC region, with more commitments over the 2019-2023 period than over the eight years prior, indicating both successful mobilization efforts and the emergence of new funding sources in the second half of the 2010s, including the Green Climate Fund (GCF). PICs received about 2 percent of global adaptation finance commitments over the 2019-2023 period.

⁹ While the OECD does not have a formal climate finance monitoring role under the UNFCCC, developed countries tasked the OECD in 2015 to track progress against the goal of USD 100 billion of annual climate finance flows to developing nations.

¹⁰ Given they are self-reported and rely on tracking methodologies with a number of limitations (e.g. including projects with only a limited focus on climate), climate finance commitments data are likely to be inflated. For a comprehensive review of data collection and quality issues, see Ritchie (2024) and Kraus (2023).

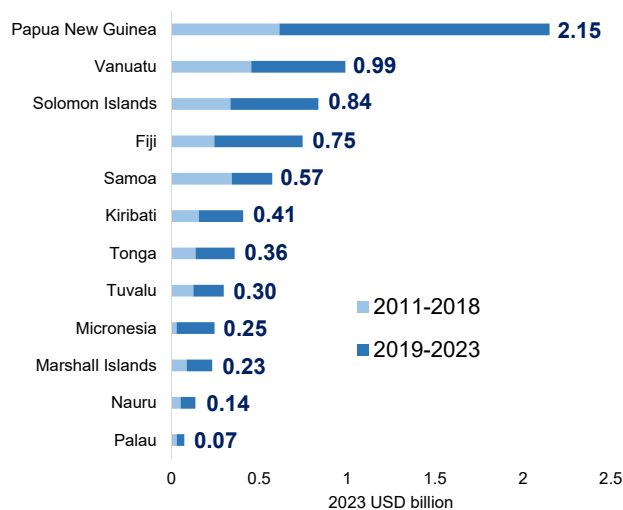


At the individual country level, similar trends also apply, with almost all countries—except Samoa—having recorded higher adaptation finance commitments over the 2019-2023 period than over the eight years prior (Figure 3.3). In 2023 US dollar terms, PNG, Vanuatu and Solomon Islands were the top three recipients of adaptation finance commitments over the 2011-2023 period, with PNG (73 percent of PICs' GDP and 79 percent of PICs' population) weighing for a third of all adaptation finance commitments to PICs.

Adaptation finance to PICs has been largely grant-based (Figure 3.4). Grants represented 84 percent of total adaptation finance commitments over the 2011-2023 period, with half of PICs relying solely or almost solely on grants, partly driven by PICs' weak debt carrying capacity, and, in some cases, high risk of debt distress. The four countries having relied the most on loans over the period are also the four larger economies in the region.

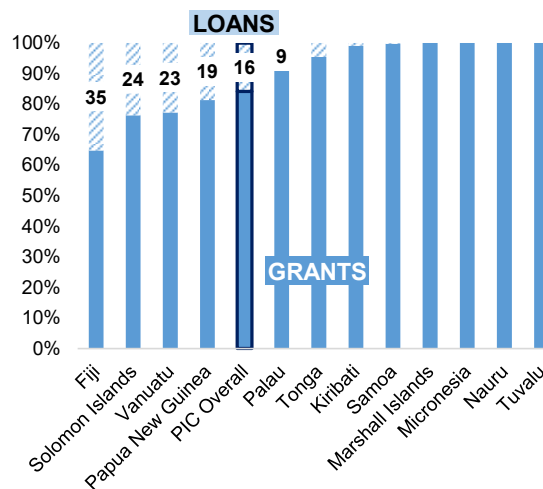
Sources of adaptation finance to the PIC region have been more diverse (Figures 3.5 and 3.6). Over the 2011-2023 period, 60 percent of adaptation finance commitments to the PIC region came from bilateral donors, while 40 percent came from multilateral donors—including about half from the World Bank, a third from climate funds and a fifth from the Asian Development Bank (ADB). There are however wide variations across countries, with half of the sample more reliant on multilateral finance, and the other half more reliant on bilateral finance. Finance from private foundations or nonprofit organizations represented a very limited share of adaptation finance flows.

Figure 3.3. Adaptation-Related Development Finance to Individual Pacific Island Countries (Commitments, 2023 USD bn)



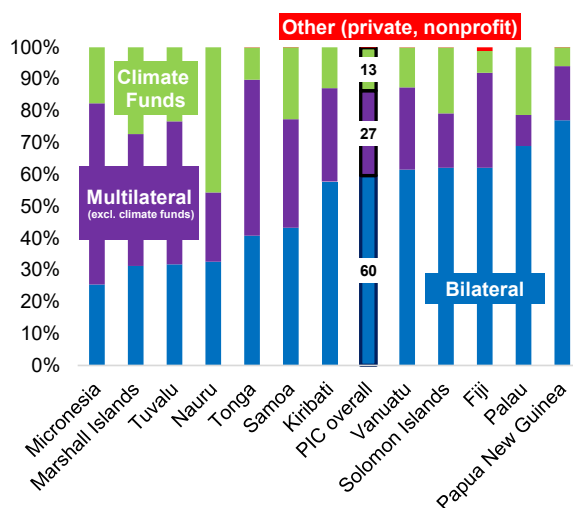
Source: OECD-DAC, authors' calculations. Estimates exclude regional projects.

Figure 3.4. Types of Adaptation-Related Development Finance to Individual Pacific Island Countries (Share of commitments, 2011-2023)



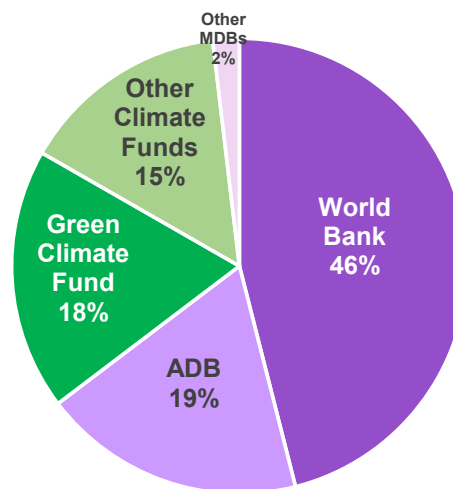
Source: OECD-DAC, authors' calculations. Estimates exclude regional projects.

Figure 3.5. Sources of Adaptation-Related Development Finance to Individual Pacific Island Countries (Share of commitments, 2011-2023)



Source: OECD-DAC, authors' calculations. Estimates exclude regional projects. The "Climate Funds" category includes Climate Investment Funds, Green Climate Fund, Adaptation Fund, Global Environment Facility and Global Green Growth Institute.

Figure 3.6. Multilateral Sources of Adaptation-Related Development Finance to Pacific Island Countries (Share of commitments, 2011-2023)



Source: OECD-DAC, authors' calculations. Estimates exclude regional projects. The "Other Climate Funds" category includes Climate Investment Funds, Adaptation Fund, Global Environment Facility and Global Green Growth Institute.

3.2. Adaptation Finance Disbursements

Climate finance disbursements correspond to actual payments made by donors and are a better description of climate finance flows from the recipient's standpoint than commitments. Disbursements are not directly comparable to commitments. In a given year, disbursements are often tranches of multiyear projects which were signed years ago, the full amounts of which were recorded as commitments at the time of signature. For that reason, a rapid increase in commitments, as was the case for adaptation finance, would typically only translate into higher disbursements after a few years.

Box 1. The Pacific Resilience Facility: Mandate, Capitalization, and Prospects

The Pacific Resilience Facility (PRF) is a Pacific-led, Pacific-owned regional financing mechanism designed to strengthen community-level resilience to climate change and natural disasters. It was formally endorsed by Pacific Island Forum members at the Special Forum Economic Ministers Meeting (FEMM) held in Tonga on March 25–26, 2025, establishing the Facility through a treaty-based framework. The PRF will be domiciled in Tonga and is expected to launch its first call for grant proposals in 2026, aligned with the 55th Pacific Islands Forum Leaders Meeting in Palau.

The Facility aims to mobilize an initial US\$500 million in grant resources, to be raised in two tranches of US\$250 million. To date, fifteen donors have pledged around US\$173 million, with Japan and Australia confirming that their contributions will be transferred to the PRF account at the Pacific Islands Forum Secretariat by August 2027. This leaves a sizeable fundraising gap of US\$330–343 million, underscoring the need for continued engagement with development partners.

The PRF's mandate reflects Pacific authorities' concerns that global climate finance has become increasingly scarce, fragmented, and difficult to access, with slow disbursement and complex application processes. By pooling resources under a single Pacific-governed platform, the PRF seeks to provide smaller, faster-disbursing grants targeted at locally identified resilience priorities, particularly at the community level. This approach is intended to complement—rather than duplicate—larger multilateral mechanisms, whose procedures and project sizes often do not match the needs and implementation capacity of small island communities.

Although the establishment of the PRF represents a significant step toward enhancing regional resilience, its overall firepower will depend critically on its ability to reach the US\$500 million capitalization target amid competing global financing priorities and fiscal pressures in donor countries. Fundraising challenges identified by Pacific authorities, as well as delays in pledged contributions becoming available for disbursement, suggest that achieving full capitalization may take time. Nonetheless, the Facility has generated strong political momentum within the region, with leaders emphasizing local ownership and predictable access to adaptation resources as central to the Pacific's long-term resilience strategy.

Estimating actual climate finance disbursements has been challenging. Contrary to commitment data, there is currently no comprehensive official reporting framework for climate finance disbursement data. Initiatives to better track disbursements have been launched by a number of non-governmental bodies, with various

degrees of comprehensiveness.¹¹ However, no current initiative fully fits the purpose of tracking climate finance disbursements of individual Pacific Island countries.

In this section, we attempt to produce estimates of actual adaptation finance disbursements in each Pacific Island country. Given the lack of complete data on disbursements, we make the following assumptions on disbursement ratios:

- For *multilateral climate funds*, we rely on data compiled by the Climate Funds Update initiative, which provides a granular and comprehensive breakdown of commitments and disbursements for individual recipient countries over the past two decades. This allows to compute country-specific disbursement ratios for each major climate fund.
- For *other multilateral (including multilateral development banks (MDBs)) and bilateral sources*, we rely on a comprehensive dataset of ODA commitments and disbursements received by PICs, collected by the Lowy Institute's Pacific Aid Map initiative, which allows us to compute country-specific disbursement ratios for each major donor. However, adaptation finance cannot be isolated from this dataset. We thus assume that disbursement ratios for projects with a principal or significant climate component are broadly equal to disbursement ratios for overall ODA.

Estimates of cumulative adaptation finance disbursements can be computed for each PIC by applying these disbursement ratios to the different sources of adaptation finance commitments over the 2011-2023 period (Figures 3.7 and 3.8). Overall, we estimate that about four fifths of all adaptation finance commitments to PICs have been disbursed. However, disbursement ratios for bilateral

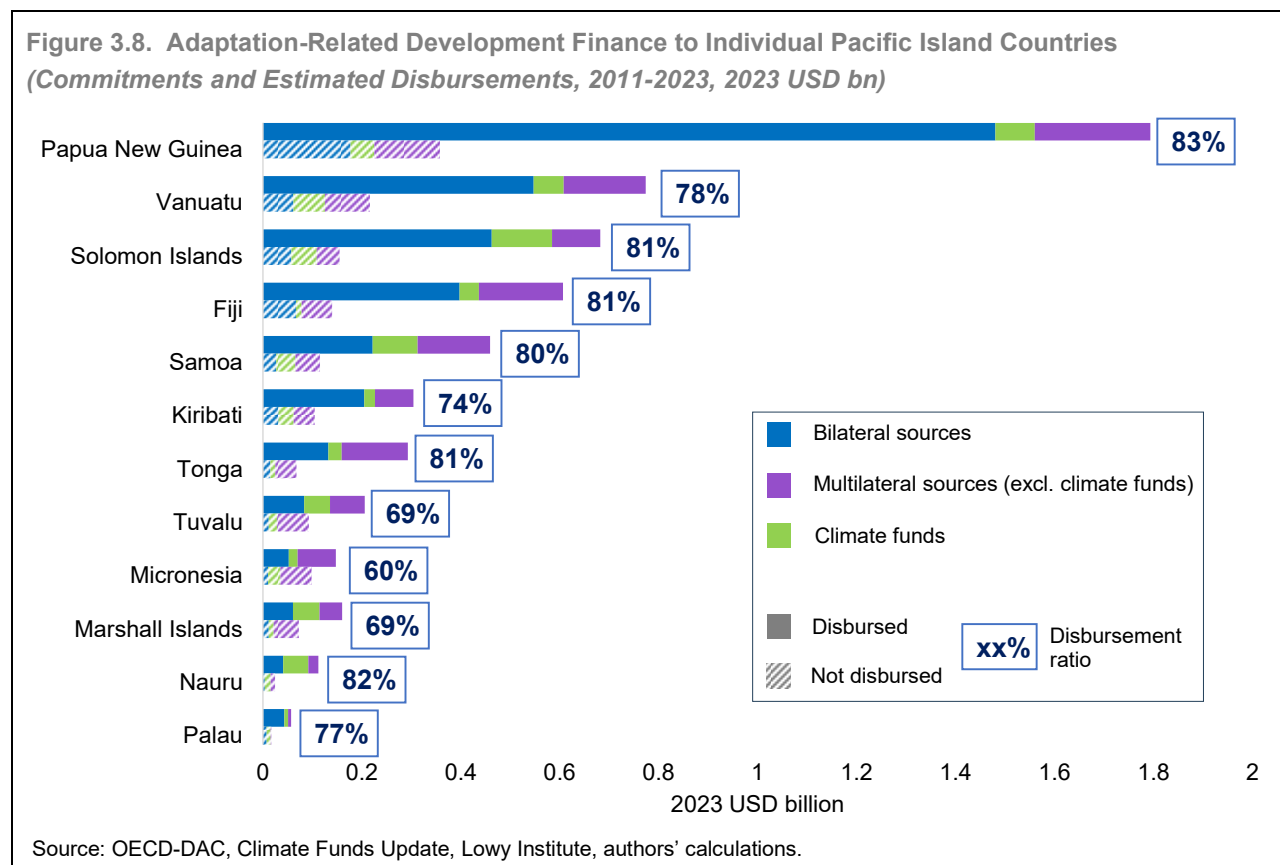
sources of finance (89%) are consistently higher than for multilateral sources (65%) and climate funds (66%). While part of this gap can be explained by the fact that MDBs tend to focus on larger-scale, multi-year projects and that access to some of the climate funds has only ramped up in more recent years, the effective disbursement of multilateral sources is often slowed by lengthy approval processes and delays in implementation, in part due to country-level capacity constraints (Fouad et al, 2021). Consequently, PICs which have been more reliant on multilateral sources for adaptation finance—such as Micronesia, Marshall Islands or Tuvalu—tend to display lower disbursement ratios.

Figure 3.7. Disbursement Ratios of Adaptation-Related Development Finance (percent, 2011-2023)

	Overall	Bilateral	Climate funds	Multilateral (excl. climate funds)
Papua New Guinea	83%	89%	62%	64%
Nauru	82%	91%	82%	69%
Solomon Islands	81%	89%	70%	68%
Fiji	81%	86%	77%	72%
Tonga	81%	90%	73%	76%
Samoa	80%	89%	70%	75%
Overall PIC	79%	89%	66%	65%
Vanuatu	78%	90%	49%	65%
Palau	77%	86%	48%	80%
Kiribati	74%	87%	42%	65%
Tuvalu	69%	88%	76%	52%
Marshall Islands	69%	84%	85%	47%
Micronesia	60%	83%	42%	55%

Source: OECD-DAC, Climate Funds Update, Lowy Institute, authors' calculations.

¹¹ ONE launched the Climate Finance Files in 2023, proposing a methodology to better account for actual climate finance disbursements, but country-level data is currently unavailable. Climate Funds Update focuses on tracking commitments and disbursements of multilateral climate funds for each country recipient.



3.3. Drivers of Climate Adaptation Finance Mobilization in Pacific Island Countries

Over the 2019-2023 period, PICs, which represent about 0.1 percent of the GDP of global climate finance recipients and 0.2 percent of their population, received about 2 percent of global adaptation finance commitments. This suggests some degree of success in accessing adaptation finance relative to other countries and regions.¹² However, as seen in previous subsections, access has been uneven across PICs. In this subsection, we provide pointers on the key drivers behind the mobilization of successful adaptation finance in PICs, leveraging existing empirical literature and our dataset on adaptation finance commitments and disbursements in PICs.

There is a wide range of empirical literature on the drivers of climate finance mobilization, particularly for adaptation which, while not specific to PICs, are helpful in understanding why some PICs have been more successful than others in accessing adaptation finance.¹³

¹² For instance, over the same period, Caribbean island countries received about 1.7 percent of global adaptation finance commitments, while weighing about 1.0 percent of the GDP and 0.6 percent of the population of global climate finance recipients.

¹³ Several papers focus on the more “vulnerable countries” (e.g. Garschagen and Doshi (2022), Betzold and Weiler (2017)), and a few on small island developing states (e.g. Tennant et al. (2024)).

Although it focused on bilateral aid flows, Weiler et al. (2018) proposes a useful categorization of the determinants of the allocation of climate adaptation finance: (i) recipient needs—essentially the countries' vulnerability, based on poverty and exposure to climate change; (ii) recipient merit—or countries' readiness for receiving adaptation aid (characterized for instance by an enabling business environment, good governance, and strong institutional capacity); and (iii) donor interest, which can be assessed through economic, historical and diplomatic proxies. We focus on the first two categories in the following.¹⁴

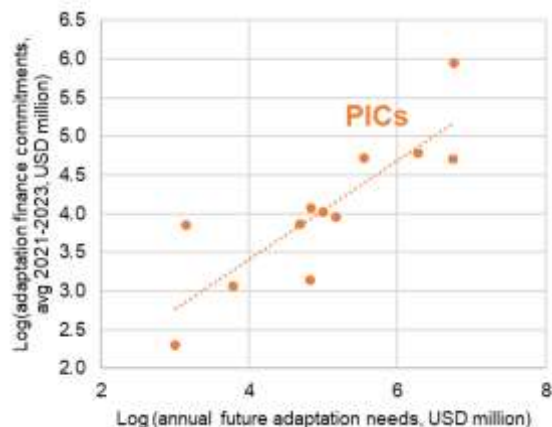
Many papers provide empirical evidence of **recipient needs** as a key driver for the allocation of adaptation finance. Physical exposure to climate change has had a strong and consistent influence on allocative patterns (Weiler et al. (2018)). More vulnerable countries in terms of (i) poverty levels and (ii) small-size or rapidly growing population also tend to receive more adaptation aid (Doku et al. (2021), Weiler et al. (2018), Betzold and Weiler (2017)). Evidence of the role of adaptive capacity is however more mixed. Correlations tend to also be weaker for multilateral aid flows. While Garschagen et Doshi (2022) finds that the GCF has been effectively on track in allocating funds to the country groups prioritized in its statuses (least developed countries, African countries, small island developing states), Michaelowa et al. (2020) finds that MDB trust funds with a focus on adaptation have failed to prioritize countries most strongly in need. Simple correlations suggest that exposure and vulnerability to climate change have been important drivers for adaptation finance commitments, both for all climate finance recipients and specifically for PICs (Figure 3.9, Panels 1 and 2).

Recipient merit—which can be proxied by measures of institutional quality, governance effectiveness, and broader readiness to implement adaptation interventions—is another driver of importance in the allocation of adaptation finance highlighted by empirical literature. Han and Cheng (2023) document that governance indicators are consistently associated with higher bilateral climate-related commitments, while Doku et al. (2021) report that institutional quality is among several recipient characteristics influencing climate finance flows to Sub-Saharan Africa. These findings suggest that good governance is susceptible to shape countries' ability to mobilize adaptation finance, even though weak institutional capacity can continue to constrain effective access and implementation—an eligibility versus allocation tension emphasized in Tennant et al. (2024). Data shows that better governance is associated with higher access to adaptation finance (Figure 3.9, Panel 3), both for adaptation finance recipients and for PICs. Countries displaying a weaker ability to cope with climate shocks through appropriate institutional, infrastructure and socio-economic means tend to receive higher adaptation finance commitments, although this does not seem to hold for PICs (Figure 3.9, Panel 4).

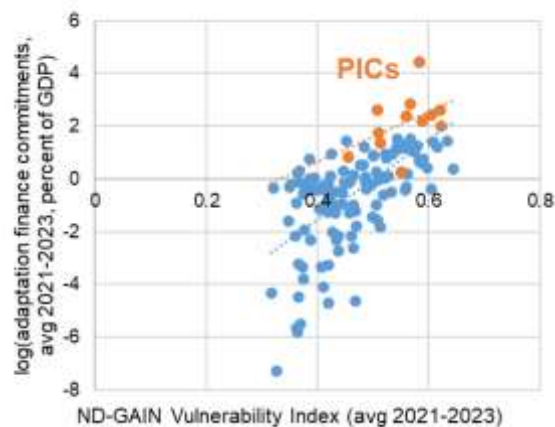
¹⁴ The role of donor interest factors in the allocation of bilateral adaptation finance to PICs could be explored in another paper. For their bilateral adaptation finance, PICs depend on a tight number of partners with which they have close historical or diplomatic ties—in every PIC, at least 80 percent of all adaptation finance commitments received over the past decade came from only three bilateral partners (more than 90 percent in half of the PICs). That said, bilateral aid is typically more concentrated in small island developing states, given more limited institutional bandwidth.

Figure 3.9. Adaptation Finance Commitments vs. Country Characteristics

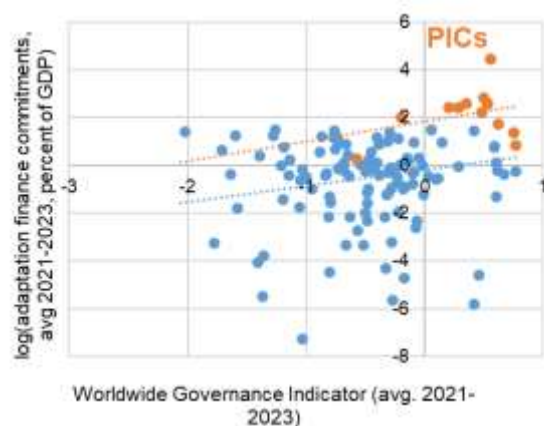
1. Annual future adaptation needs



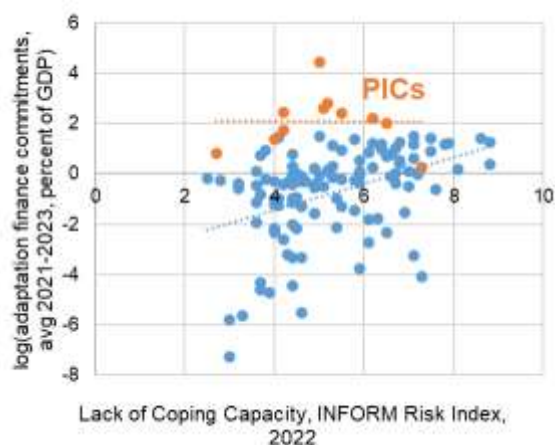
2. Vulnerability to climate change



3. Good governance



4. Lack of coping capacity



Source: IMF World Economic Outlook, OECD-DAC, ND-GAIN, INFORM Risk index, Worldwide Governance Indicators and authors' calculations.

In orange: PICs. The Worldwide Governance Indicator combines six dimensions equally weighted into a single index: corruption control, government effectiveness, political stability, rule of law, regulatory quality and voice and accountability.

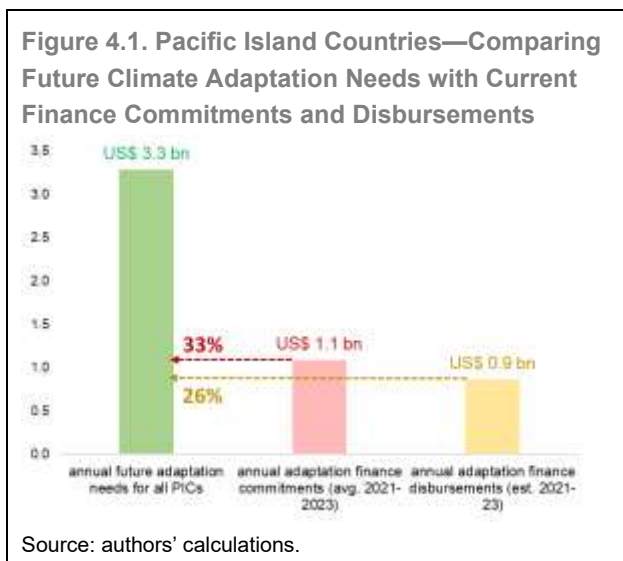
4. Adaptation Financing Gaps

In this section, we bring together the results of the meta-data analysis on future climate adaptation needs (Section 2) and the climate adaptation finance commitment and disbursement estimates (Section 3) and propose a novel assessment of current adaptation financing gaps in each PIC.

To do so, we create a new adaptation finance needs coverage ratio, which compares the average adaptation finance commitments (or disbursements) received in the most recent three years in the sample (2021-2023) with the annualized future adaptation finance needs. This measure allows us to gauge the extent to which future needs could be covered by current commitment/disbursement levels, were they to remain at the same level in the future. This ratio should hence be interpreted as a snapshot of the current coverage under the most

likely climate change scenarios; we refrain from making assumptions on future access to climate finance or on updated needs estimates.¹⁵

Looking at all PICs, the estimated adaptation needs coverage ratio is 33 percent—meaning that current annual adaptation finance commitments represent about a third of the region’s annualized future adaptation needs (Figure 4.1). If we compute the coverage ratio using disbursement estimates, it falls to 26 percent. This suggests that the current level of climate finance adaptation financial flows is largely insufficient to cover future adaptation needs. While they span a wide range, adaptation needs coverage ratios for individual countries confirm the finding that current adaptation financial flows are insufficient to cover future adaptation needs, in all PICs but one. This holds true when computing coverage ratios based on annual commitments (Figure 4.2) and, a fortiori, on annual disbursement estimates (Figure 4.3).



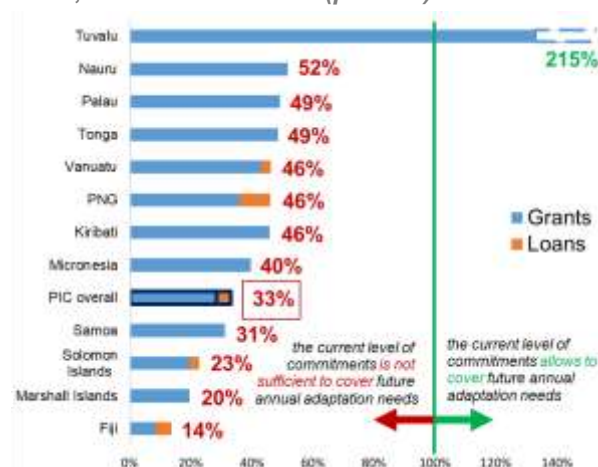
Tuvalu is the only PIC for which the adaptation needs coverage ratio is superior to 100 percent, meaning that future annualized adaptation needs would be more than fully covered by the current level of annual adaptation finance flows. This should however not be interpreted as overfinancing, but rather as an indication that Tuvalu may be able to cover its medium-term adaptation needs faster, were the current level of annual adaptation finance commitments maintained.¹⁶

All other countries would see less than half of their future adaptation needs covered by financial flows if commitments / disbursements stayed at levels similar to those of recent years. Countries can be placed in two buckets depending on their coverage ratios (when computed on a disbursement basis, Figure 4.3): (i) those with ratios over 33 percent—Nauru, Tonga, Papua New Guinea, Palau, Vanuatu and Kiribati; and (ii) those with ratios under 25 percent—Samoa, Micronesia, Solomon Islands, Marshall Islands and Fiji. For both buckets though, current flows fall significantly short of meeting adaptation needs.

¹⁵ The rapid increase in access to adaptation finance in recent years and expected improvements in disbursement ratios for multilateral funds could lead to higher coverage ratios. However, this would hinge on the continuation of climate aid flows from bilateral and multilateral sources, which depends on strategic, diplomatic and budget priorities in donor countries and agencies. In addition, under more rapid or severe climate change scenarios, adaptation needs may increase, which, all other things equal, would play negatively on coverage ratios.

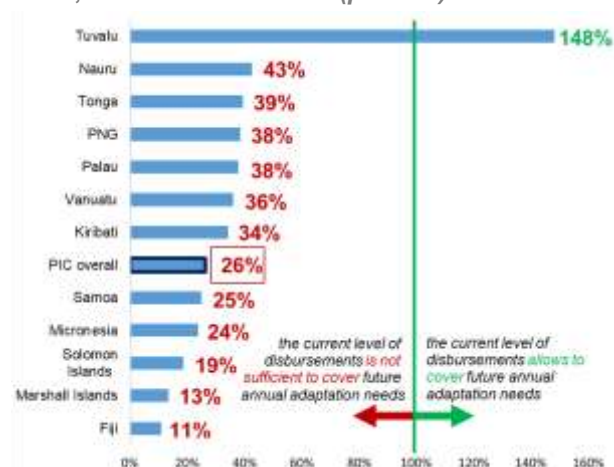
¹⁶ This includes three large World Bank adaptation grants related to adaptation projects in the transportation sector, committed in 2021-2023, and representing 100 percent of Tuvalu’s GDP. The 2021-2023 average level may not be representative of the adaptation flows to be expected in coming years.

Figure 4.2. Climate Adaptation Needs Coverage Ratio, Commitment Basis (percent)



Source: Authors' calculations. Coverage ratios are computed as the ratios of annual adaptation finance commitments (2021-23 average) to annualized future adaptation needs based on the authors' metadata analysis.

Figure 4.3. Climate Adaptation Needs Coverage Ratio, Disbursement Basis (percent)



Source: Authors' calculations. Coverage ratios are computed as the ratios of annual adaptation finance disbursement estimates (2021-23 average) to annualized future adaptation needs based on the authors' metadata analysis.

5. Conclusion

This paper presents an integrated assessment of climate adaptation needs and financing flows in PICs, drawing on a harmonized metadata framework and a complementary machine-learning approach. The results highlight the substantial scale of adaptation needs across the region, with physical risks—particularly those linked to sea-level rise—driving the largest estimated costs. Although the underlying literature varies widely in sectoral coverage, methodological choices, and time horizons, the standardized framework used in this paper allows for a coherent comparison across countries and a more systematic understanding of cross-country differences. The synthetic estimates generated for data-deficient countries help address gaps in the available evidence, though they remain subject to the usual limitations of model-based extrapolation, including small sample size and model uncertainty.

On the financing side, the analysis shows that climate adaptation commitments to PICs have increased over the past decade, with adaptation now representing the dominant share of climate-related finance to the region. Nonetheless, current commitments and estimated disbursements fall well short of estimated future annual needs. Disbursement ratios differ markedly across financing sources, reflecting variations in approval processes, implementation readiness, and country capacity. These gaps underscore the need to enhance both the scale and the effectiveness of adaptation finance, while recognizing that data limitations—particularly on disbursements—introduce uncertainty into cross-country comparisons.

The discussion of factors that shape adaptation finance mobilization suggests that vulnerability, institutional readiness, and governance quality all play roles in influencing access to climate finance. While improvements in public financial management and administrative capacity appear to support greater mobilization of resources, weak institutional capacity can still constrain countries' ability to fully benefit from available financing. External

factors, including fiscal pressures in provider countries, may also influence the landscape of future climate finance, adding another layer of uncertainty for small, highly exposed economies such as PICs.

Overall, the findings point to the urgency of securing larger, more predictable, and more accessible adaptation finance for PICs. At the same time, several caveats should be kept in mind. Differences in methodology and scope across source reports, potential double counting in sectoral estimates, the difficulty of comparing needs estimated over very different time horizons, and limitations in the measurement of climate-related finance flows all suggest that the results should be interpreted with caution. Moreover, neither the metadata analysis nor the machine-learning approach captures the full range of long-term adaptation challenges—such as the potential need for large-scale relocation—which lie beyond the scope of existing assessments.

Despite these limitations, the combined approach used in this paper offers a structured basis for understanding adaptation needs and financing gaps in PICs. As climate impacts intensify, strengthening institutional readiness, improving project implementation capacity, and enhancing the effectiveness of emerging regional mechanisms—such as the Pacific Resilience Facility—will be central to boosting resilience in the region.

Annex I. List of Country Report Sources Used In Metadata Analysis

Country	Report	No. of Reports
Kiribati	World Bank's Pacific Atoll Countries CCDR (2024)	4
	World Bank's Climate Change and Disaster Management (2016)	
	IMF Working Paper on Fiscal Policy to Address Climate Change (2021)	
	Kiribati's Joint Implementation Plan on Climate Change and Disaster Risk Management (2014)	
Micronesia	World Bank's Climate Change and Disaster Management (2016)	4
	IMF Working Paper on Fiscal Policy to Address Climate Change (2021)	
	Micronesia's Climate Change Policy Assessment from the IMF (2017)	
	Readiness Proposal GCF 2023	
Solomon Islands	World Bank's Climate Change and Disaster Management (2016)	4
	IMF Working Paper on Fiscal Policy to Address Climate Change (2021)	
	Solomon Islands' NDC (2021)	
	IMF Selected Issues Paper 2022 on Spending Needs for Achieving SDGS with Climate Resilience	
Tonga	World Bank's Climate Change and Disaster Management (2016)	4
	IMF Working Paper on Fiscal Policy to Address Climate Change (2021)	
	Tonga's Joint Implementation Plan on Climate Change and Disaster Risk Management 2018-2028 (2018)	
	IMF Technical Assistance Report on Climate Change Policy Assessment for Tonga (2020)	
Tuvalu	World Bank's Pacific Atoll Countries CCDR (2024)	4
	World Bank's Climate Change and Disaster Management (2016)	
	IMF Working Paper on Fiscal Policy to Address Climate Change (2021)	
	Tuvalu's National Strategic Action Plan: 2012-2016	
Fiji	World Bank's Climate Change and Disaster Management (2016)	3
	IMF Working Paper on Fiscal Policy to Address Climate Change (2021)	
	Fiji's Climate Vulnerability Assessment (2017)	
Marshall Islands	World Bank's Pacific Atoll Countries CCDR (2024)	3
	World Bank's Climate Change and Disaster Management (2016)	
	IMF Working Paper on Fiscal Policy to Address Climate Change (2021)	
Palau	World Bank's Climate Change and Disaster Management (2016)	3
	IMF Working Paper on Fiscal Policy to Address Climate Change (2021)	
	Palau's Selected Issues on Climate Change by the IMF (2023)	
Samoa	World Bank's Climate Change and Disaster Management (2016)	3
	IMF Working Paper on Fiscal Policy to Address Climate Change (2021)	
	Samoa's Technical Assistance Report on Climate Macroeconomic Assessment Program from the IMF (2022)	
Vanuatu	World Bank's Climate Change and Disaster Management (2016)	3
	IMF Working Paper on Fiscal Policy to Address Climate Change (2021)	
	Vanuatu's NDC (2021)	
Papua New Guinea	IMF Working Paper on Fiscal Policy to Address Climate Change (2021)	2
	Papua New Guinea's Second NDC (2020)	
Nauru	Nauru's NDC (2022)	1

Annex II. Definitions of Variables and Sectors Used In Adaptation Needs Analysis

Table II.1. Sector Classification

Sector	Corresponding Broader Sector
Coastal Erosion Control	Physical Risks
Coastal Protection	
Coastal Protection Infrastructure	
Hazard Management	
Inundation and Flood Mitigation	
Meteorology and Climate Information Services	
Protect and Reclaim Land, and Internal Migration	
Protect Land, Raising Building, and Move Inland	
Storm Impact Mitigation (Capital)	
Agriculture	Other Sectors
Building and Housing	
Energy Infrastructure Upgrades	
Financial Services and Climate Finance	
Fisheries Management	
Fisheries Revenue Loss Mitigation	
ICT (Information and Communication Technology)	
Infrastructure Development	
Livestock Management	
Maintenance	
Pooled Funding Mechanisms	
Private Sector Greening	
Renewable Energy Promotion	
Risk Management	
Tourism Resilience	
Transport Infrastructure	
Biosecurity	
Environmental Protection	
Forestry	
Land Management	
Ocean and Marine Protection	
Wetland Conservation	
Capacity Building	
Climate Policy	
Contingency Planning	
Decentralization	
Disability Inclusion	
Early Warning Systems	
Education	
Gender Equality	
Governance	
Health Services	

Human Rights Advocacy
 Indigenous Rights
 Knowledge and Information Sharing
 Planning and Policy Development
 Population Relocation
 Social Protection
 Social Spending - Education
 Social Spending - Health
 Social Spending - Health and Education
 Sovereignty Maintenance
 Storm Impact Mitigation (Population)
 Youth Engagement
 Waste Management
 Water and Food Security
 Water and Sanitation

Source: authors.

Table II.2. Sources and Definitions of Variables for Random Forest Model

Sector	Variables	Source	Note
Economic	GDP per capita	WEO	2019
	Nominal GDP	WEO	2019
	Public debt	WEO	Public debt to GDP ratio (2023)
	Population	WEO	2019
	Tourism	APD REO	1=tourism country
Geographic	Distance to economic centers	UNCTAD	2019
	Distance to nearest (non-SIDs) neighbor	UNCTAD	2019
	Distance to trading partners	UNCTAD	2019
	Liner Shipping Connectivity	UNCTAD	2024Q4
	Freight costs of imports	Staff Calculation	Percent of good imports (2018)
	Atoll	World Bank CCDR	1=atoll country
Vulnerability	Disaster Severity	EM-DAT	Average Affected Population Share (2000-2023)
	Disasters Frequency, Flood	EM-DAT	2000-2023
	Disasters Frequency, Storm	EM-DAT	2000-2023
	Disasters Frequency, Total	EM-DAT	2000-2023
	Expected Severity	EM-DAT	Severity X Disaster Frequency (2000-2023)
	Climate risk	Climate-driven INFORM Risk Indicator	Climate-driven INFORM Risk Indicator (2022)
	Climate risk, Hazard & Exposure	Climate-driven INFORM Risk Indicator	Sub-index for Hazard & Exposure (2022)
	Climate risk, Vulnerability	Climate-driven INFORM Risk Indicator	Sub-index for vulnerability (2022)
	Lack of Coping capacity	Climate-driven INFORM Risk Indicator	Sub-index for coping capacity (2022)
	Readiness	IMF-adapted ND-GAIN index	Readiness score (2021)
	Economic Readiness	IMF-adapted ND-GAIN index	Readiness score sub-index, Economic (2021)
	Vulnerability	IMF-adapted ND-GAIN index	Vulnerability score (2021)
Exposure	IMF-adapted ND-GAIN index	Vulnerability score sub-index, Exposure (2021)	

Source: authors.

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