Pacific Region
Infrastructure Facility

Infrastructure Risk Management and Insurance in the Pacific

Consultant's report

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Abbreviations

ADB	Asian Development Bank
CAR	Contractors All Risk (insurance, also known as Builder's All Risk, Contract Works, Construction All Risk, etc. insurance).
OECD	Organisation for Economic Co-operation and Development
PBD	Performance-based design
PDH	Pacific Data Hub
PICs	Pacific Island countries
PNG	Papua New Guinea
PPP	Public-Private Partnership
PRDC	Pacific Region Uniform Building Code
PRIF	Pacific Region Infrastructure Facility
RVI	Remote Virtual Inspection
SIDS	Small Island Developing States
SIF	Sustainable Infrastructure Foundation
SPC	Pacific Community (formerly the South Pacific Commission)

Executive Summary

Contractors tendering for Pacific Region Infrastructure Facility (PRIF) partner projects in the Pacific Island countries (PICs) are struggling to access the insurances and related risk engineering services required to deliver quality construction infrastructure projects funded by donors. The situation is gradually worsening as larger insurers reduce their positions in the region.

The challenge is particularly hard for the smaller countries and smaller projects, where a sustainable local insurance solution will be difficult to achieve without the adoption of some form of federated approach. The continued, gradual, reduction of local construction insurance capacity from the region seems likely, given the vulnerability of many of the countries, particularly with respect to climate change and natural catastrophe exposures.

The inability to access project insurance is particularly pronounced for small local contractors based within individual countries. These tenderers are already at a disadvantage when competing for PRIF partners projects, as they are unable to access the same international insurance resources available to larger "fly-in / fly-out" contractors.

A new and transformative model is clearly called for that will support localization and help drive the national/local construction capability mandate. A differentiated approach is required if PRIF and its development partners intend to have a meaningful impact in the provision of insurance for construction projects under the Blue Pacific and related initiatives. **It is therefore proposed that PRIF and the respective donors form an insurance pooling facility whose use is mandated for all PRIF and related party construction projects, large and small, in all PICs, including Papua New Guinea.** Creating a single facility pool with a large, guaranteed, project pipeline will be attractive to local, regional, and international contractors, insurers and other relevant market participants, and ensure international best practice risk reduction.

It is critical that such a facility is designed to be complementary to the existing international and locally owned insurance players in the region. By carefully designing the mandate and mechanism, local and regional insurance sector companies can be encouraged to grow and expand. At the same time, access for international players can be widened on commercial terms. However, it will be critical for PRIF and donors to accept that the most challenging smaller projects, particularly those where a differentiated approach emphasizing localization is adopted, will require an ongoing injection of donor funded insurance capacity into the pooling mechanism. Otherwise, the smaller projects, and the potential for these to be delivered by local contractors, will remain effectively uninsurable.

It cannot be overstated that the risk of a poorly designed facility is that it competes with existing successful providers in the regional insurance sector. It would be highly counterproductive if the proposed pooling mechanism accelerates the exit of regional and international commercial insurance players from the Pacific area. It must therefore be inclusive in nature and designed in a way that aligns with existing and future sustainability initiatives whilst avoiding moral hazard.

It is important to recognize that providing affordable construction/contractor insurance in the region is a critical need now, and not only a solution that will be needed in the future. Therefore, consideration of how existing regional bodies might be repurposed to deliver the recommendations in this report investigations should be fast tracked. **The front runner in the potential solutions would**

be to consider the expansion and redirection of the Pacific Catastrophe Risk Insurance Company to focus on construction-related indemnity risk, in addition to its current mandate of catastrophic parametric risk.

The Blue Pacific area is not alone in experiencing these issues, which are occurring in other vulnerable jurisdictions. Regional or federated solutions in Africa and the Caribbean are already implemented, or under trial, and can serve as models for a Blue Pacific solution. The broader issues of insurability rely on the new pooling vehicle addressing underlying risk engineering and construction issues, as well as the provision of insurance coverage itself. There are several international sustainability initiatives explored in this report, some of which have current and future mandates and funding. These can be leveraged as the building blocks of the proposed pooling vehicle to expedite rapid implementation. Innovative use of technology and the application of international best practice can help smaller communities to make dramatic improvements in risk management capability and help embed these for the long term.

It will be important that procurement teams from donors, multinational development banks, and implementing governments understand their vital role in finding a solution for insurability issues in the region. Procurement teams need to collaborate to structure and support the new facility in a way that information can be easily accessed by relevant parties in the construction process at as early a stage as possible. The current highly fragmented and severely risk adverse approach to construction procurement, evident across the region, seems to be pushing untenable construction risk into the hands of insurers. Perhaps not surprisingly, this is decreasing international insurance sector appetite in the Blue Pacific region. The requirement for unviable levels of insurance coverage compounds the challenges for local contractors in particular, who face a last-minute dash to secure insurance before tender due dates, and increasingly decline to bid as a consequence of their failure to secure compliant protection. Intervention in the form of the design and implementation of a mandatory insurance pooling facility will give smaller, local contractors a level playing field so that they can demonstrate improved risk engineering practices and secure effective insurance protections when tendering for PRIF partners projects.

1 Introduction

1.1 Key findings

This is the final report on the Pacific Region Infrastructure Facility (PRIF) Infrastructure Insurance Project, a 6-month project whose objective was to explore measures and provide recommendations to improve the cost-effective management of infrastructure project lifecycle risks in the Pacific.

This project was implemented by a three-person team (Sr. Insurance Specialist, Insurance Specialist and Risk Management Specialist) to consider solutions for medium-sized transportation, energy and similar projects, broadly in the range of $5 million to $50 million.

1.1.1 The recommended next steps can be summarized as follows:

Proposed for short term:

It is recommended that in the immediate future PRIF should investigate the potential of modifying the Pacific Catastrophe Risk Insurance Company (PCRIC), or consider an alternative solution to provide cost-effective insurance solutions accessible to local contractors in the Pacific Island countries (PICs). Among other factors, this should consider the following:

1. Incorporating many of the risk engineering improvements proposed.

2. Structuring the pooling mechanism in a way that mandates use for all PRIF projects without undermining existing commercial solutions.

3. Addressing comprehensively the geopolitical issues and associated approvals that will be required to establish a vehicle of this nature in as expedient a manner as possible.

4. What short term stop gaps can be implemented that level the playing field for local contractors whilst the facility is established.

Proposed for midterm:

Formalize the structure of the pooling vehicle and set the parameters for appointing a partner(s) who can manage and deliver the full potential of the solution, investigating and delivering on the remaining actions set out in the report below.

1.1.2 The report findings include the following significant points:

1. Anecdotal evidence indicates that some contractors cannot get insurance coverage or can only get it at inflated prices for infrastructure projects in the Pacific region.

2. Solutions to the problem will require re-evaluation and amendments of donor procurement strategies.

3. The regional goals of localization of development projects and greater use of local contractors presents a different and higher risk profile to insurers.

4. Most of the jurisdictions have at least some local insurers and there are more insurance options available in the larger jurisdictions. However, construction sector professional services (risk engineering, quality assurance, loss assessment and adjusting) and regulatory support is poor or non-existent in the smaller jurisdictions leading to challenges for comparatively small projects and for projects undertaken in the smaller countries.

5. Insurer capacity (the ability/appetite to underwrite and accept insurance risk) for contractors is limited and has declined over recent years (prices increasing, scope of coverage reducing, restriction of available geographic locations).

6. For some projects, donors appear to mandate levels of coverage that are shaped by the commercial and legal situations that exist in developed economies. These are deemed to be unfeasible in some of the Pacific jurisdictions.

7. Procurement entities appear to prioritize the protection of funds supplied by donors, and this approach results in strategies to transfer more risks to contractors, irrespective of a contractor's ability to financially meet this or acquire insurance in some PICs.

8. Procurement processes result in late engagement with the insurance sector on the insurability, terms and conditions and cost of insurance for projects. Changes in this engagement model can give insurers more time to evaluate projects.

9. In some markets where coverage is not commercially available, self-insurance, a form of guaranteed mechanism, and de-risking actions, can enable infrastructure projects to move forward. An insurance pooling mechanism mandated for all PRIF projects would be one potential solution.

10. Insurance and reinsurance capacity is sometimes limited for standard perils coverage (fire, lightning, explosion, etc.) but is normally available at a price, particularly for the larger contractors and projects. A competitive insurance market operates for this coverage.

11. Natural catastrophe perils coverage (cyclones, storm surge, tsunami, earthquake, etc.) is more problematic to obtain and international reinsurance markets are sometimes used by more sophisticated tenderers. This option is not available for smaller contractors.

12. Some insurers lack the expertise to effectively underwrite construction projects, and some do not have any appetite to take these projects.

13. The PCRIC provides parametric insurance to governments for natural catastrophe perils and can look at options to develop products and adjust its business model and insure PRIF-funded infrastructure projects.

14. An international risk pooling solution (insurance facility) could be designed to cater for multiple types of infrastructure projects, from several countries.

15. A conceptual structure for a pooling mechanism has been supplied, using PCRIC, local insurers and international reinsurance markets to share risk.

16. The issue of green investment bonds that could be purchased by insurers should be investigated by PRIF on behalf of ADB and others.

1.2 Project background

PRIF is a multi-partner coordination and technical assistance facility for improved infrastructure in the Pacific. Member countries are Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Nauru, Niue, Palau, Republic of the Marshall Islands, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu. Papua New Guinea (PNG) is an associate member. In its projects, PRIF has found that several donor-funded infrastructure projects in the Pacific have recently experienced delays because of difficulty in accessing commercially viable insurance coverage. This can result in significant financial burden, with parties having to accept significant insurance risk if the insurance is not secured. A limited survey of contractors active in the Pacific was conducted and the results revealed the experiences of some contractors who also operate outside the Pacific suggests they believe they are paying increased insurance premiums due to less competition and scaled back operations of Australian and New Zealand insurance companies in the Pacific.

Insurers shared perceived riskiness of infrastructure projects in the Pacific due to remoteness of project location, challenges in sourcing quality materials, long delays in project completion, regulatory issues, and increased catastrophe exposure. In addition, projects are considered relatively small, so contractors struggle to secure insurance coverage, particularly disaster risk insurance. Similar trends have also been identified in the Pacific Construction Insurance Market Recap 2020.

A review of the PRIF project pipeline as of 2021 indicated that PRIF partners have roughly $1.5 billion worth of infrastructure projects in various sectors in several Pacific countries. If treated collectively as a portfolio, insurance companies may be encouraged to provide more affordably priced insurance coverage and provide opportunities for enhanced regional risk pooling. PRIF partners have recognized the need and urgency to address these infrastructure project insurance issues in the Pacific. The availability of construction insurance is a key issue for the implementation of infrastructure projects to support the post-coronavirus disease (COVID-19) recovery process.

The Lowy Institute (see references) estimated that the Pacific needs at least $2.3–3.5 billion over 3 years in additional external assistance to recover from the pandemic. If the economic recovery is to be stimulated through investment in infrastructure, it is vital that the risk profile of projects is reduced so projects can be accessible by a wider range of local contractors and will be insurable and delivered in a timely and cost-effective manner.

1.3 Project purpose

To address the above situation, PRIF has established an infrastructure insurance project ("the project"), the objective of which is to explore measures and provide recommendations to improve the cost-effective management of infrastructure project lifecycle risks in the Pacific.

In this context, infrastructure includes roads, bridges, tunnels, ports and terminals, waste and water plants, civil engineering projects, urban / commercial real estate, power and utility projects, telecommunications and technology investments. This inception report sets forth the plan for the project.

The project has explored options including (i) involving the insurance industry early in infrastructure project design and preparation (risk management and risk transfer aspects), to take advantage of their expertise in risk management, (ii) risk pooling to diversify risks, (iii) creating a facility backed by a consortium of the insurance industry (including brokers, insurers and reinsurers) to offer adequate risk management services and coverage from project design, construction, operation and maintenance phase across the region to bring down the cost of insurance and avoid protection overlaps and gaps, and (iv) the potential to expand the scope of the PCRIC.

The project has looked at (i) project lifecycle risks, (ii) identified the types of risks in each project cycle, (iii) considered model options and economic costs vs benefits to mitigate risks, and (iv) identified residual risks which remain after risk reduction measures have been applied and risk transfer solutions to enhance project investment sustainability have taken place.

The main risks that could impact the delivery of this project have been set out in Appendix B.

1.4 Project principles

In its search for solutions, the project team followed the following principles:

1. **Regional application** – Regional solutions that have access by all PRIF members and allow for regional decisions on risk pooling and bundling of projects.
2. **Risk reduction first** – Approaches and technologies that reduce risk have priority over products that simply transfer risk.
3. **Whole of market participation** – Approaches that promote wider insurance market participation are preferred.
4. **Promote knowledge sharing and capacity building** – The project increases understanding of information on the drivers of capacity and affordability issues.
5. **Achieve long-term sustainability** – The project aims for solutions that are sustainable for all stakeholders in the long term. Insurance is sensibly underwritten, fairly priced, and helps address insurance cycle volatility.
6. **Sector-led** – The project uses insights from end users to drive discussions on product innovation to ensure solutions cater to the real needs of the infrastructure sectors involved.
7. **Promote closer private sector/public sector connections** – This project can support ties between private sector (insurers) and public sector (development partner) disaster risk financing solutions and enhance cross-sector collaboration.
8. **Building long-term resilience** – This project can help discussions with other parties, to optimize and extend the use of insurance and its risk management related capabilities to build greater resilience.

In all ways, the project team sought solutions consistent with PRIF's overall goals and programs.

1.5 Project team and management

The Project team was composed of three leading experts:

- Team Leader/International Insurance Specialist: Mr. Steve Tunstall
- Insurance Specialist: Mr. Michael Carr
- Risk Management Specialist: Dr. Charles Scawthorn

Project management included regular meetings with the PRIF Coordination Office Project Officer on progress with implementation, emerging issues/risks and their management.

Project coordination was undertaken by the PRIF Coordination Office Project Officer Ms. Jane Romero (PO). A resource person, Mr. David Traill (TIA) gave support and inputs on the regional context. The project is championed by Thomas Kessler (PDRI), Principal Disaster Risk Insurance & Finance Specialist at Asian Development Bank.

The team would like to take this opportunity to thank all those interviewed or who completed surveys as part of the preparation process for this report. Without the support of these individuals and the organizations they represent this report would not have been possible to compile.

2 Infrastructure Projects Insurance – Current Status

This section focuses on the status of infrastructure construction projects and their insurance in the Pacific Region.

2.1 Risk landscape

2.1.1 Pacific Island countries and their risk landscape

A landscape is a view of an environment; in this case, a view of the risk environment affecting PICs' infrastructure.[1] PICs are among the most vulnerable countries to disasters (Figure 1) whose impacts are exacerbated by the impacts of climate change. PICs are typically dispersed and remote, with sensitive environments and small and scattered populations. They are thus more fragile countries and societies, lacking the resilience of larger countries.

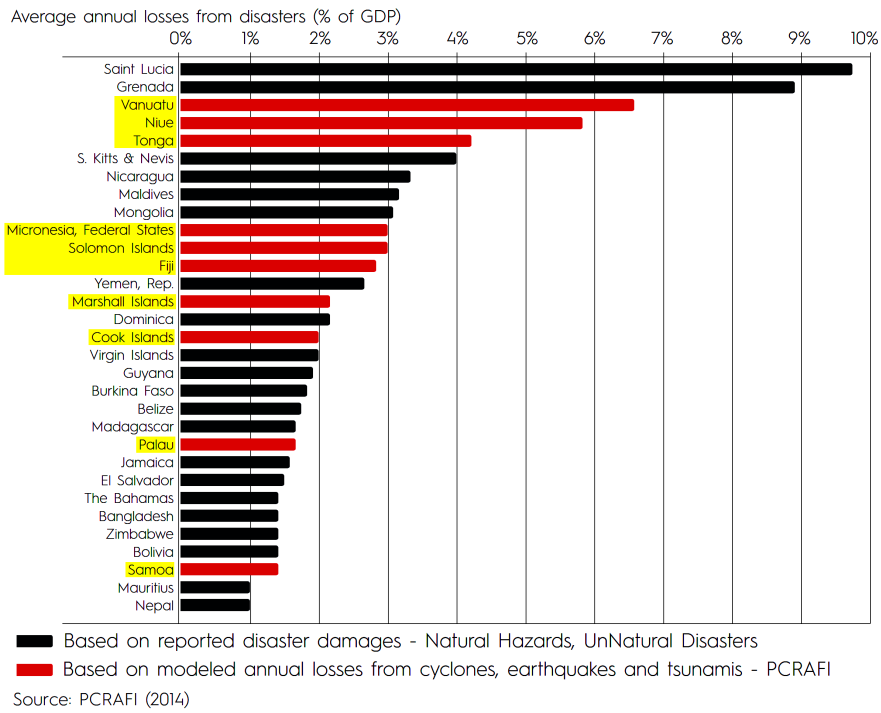


Figure 1: PICs (red bars, yellow highlighted) Are Among the Most Vulnerable Countries in The World
Source: (GFDRR, 2018)

[1] This section provides an overview of the PIC infrastructure risk landscape – more detail appears in Appendix C.

2.1.2 Infrastructure and the risk landscape

Infrastructure such as transportation, energy, water and communications systems is crucial to reducing disaster losses and adapting to climate change. Infrastructure is the physical systems necessary for a functioning society. However, PICs are often without the resources of larger countries to assure well-designed and constructed infrastructure.

The infrastructure life cycle is shown in Figure 2 and proceeds from project initiation through planning, design, construction, its service life and finally decommissioning. During this life cycle, risk is generally greatest during the construction stage, ranging from construction accidents[2] to shoring and structural collapses (structures are only partially built and may be less stable than when completed), to construction errors, delays in payment, supply chain risks and many others, as detailed in Table 1.

Risk is the uncertain potential for loss due to the occurrence of perils, examples of which are shown in Table 1. Loss is often measured in terms of the "three D's" (deaths, dollars and downtime), which cannot be predicted with certainty.

Risk bearer	Risks	Life cycle	Risk Management
Owner	• Cancellation	**Initiation**	• Advocacy
Planner	• Change of scope • Regulatory...	**Planning**	• Client management • Regulator relations • Insurance
Designer	• Change in requirements • Inaccurate data • Errors and omissions...	**Design**	• Client relations • Contract terms • Design standards • Peer review • Construction inspection • Operating Manuals • Insurance
Builder	• Accidents • Natural hazards • Delays...	**Construction**	• Client/designer relations • Contract terms • Construction management, QA/QC • Construction inspection • Insurance
Owner/ Operator	• Accidents • Natural hazards • Inadequate maintenance ...	**O&M**	• Standard Operating Procedures • Maintenance program • Security • Regulator relations • Insurance
Owner	• Regulatory • Hazardous waste...	**End of life**	• Regulator relations • Demolition plan / contractor • Demolition and disposal QA/QC

Figure 2: The Infrastructure Life Cycle
Source: Authors

[2] For example, about 20% of all worker fatalities in private industry in the US in calendar year 2019 were in construction, see https://www.osha.gov/data/commonstats.

Table 2.1: Selected Perils, Organized by Stage of the Infrastructure Life Cycle

Planning and design	Construction/Management
• Technical feasibility	• Labor productivity
• Economic viability	• Strikes and unions
• Inadequate statement of work (scope)	• Work ethics
• Project complexity	• Wage scales
• Sole source of material or services providers	• Labor disputes
• Constructability	• Delay in possession of site
• Program of works	• Underground conditions or differing site conditions (soil conditions, water, utilities, archeological findings)
• Design completeness and standards	• Inclement weather
• Inadequate selection of contract types (e.g., lump sum, unit price, cost plus, etc.)	• Hazardous wastes
• Inadequate selection of contract delivery methods (e.g., traditional, design and build, management, etc.)	• Noise, fume, and dust
	• Defective materials and workmanship
	• Contractor reliability (e.g., capacity, capability, etc.)
	• Subcontractors' inefficiency
	• Delayed drawings or instructions
	• Errors in design and drawings
	• Incomplete and inefficient supervisory staff
	• Poor planning and management
	• Poor communication and coordination
	• Scope changes and claims
	• Too much Owner involvement

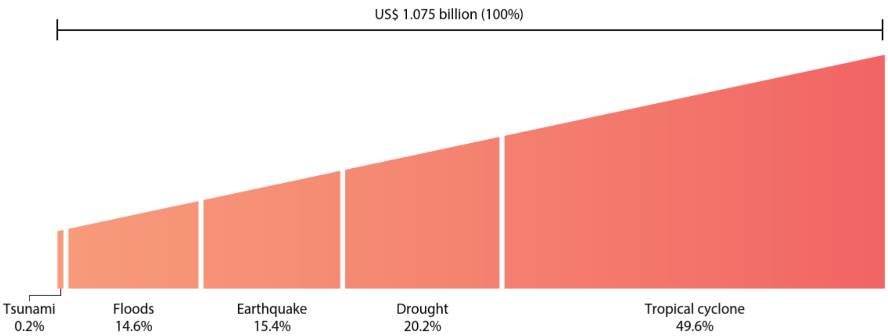
Table 1.2: Selected Perils, Organized by Stage of the Infrastructure Life Cycle

Regulatory	Operations and Maintenance
• Environmental regulations and requirements	• Natural hazards (e.g., storms, earthquake, floods, etc.)
• Taxes and duties	• Ground, structural or equipment failure
• Health and safety regulations	• Operator error
• Corruption	• Inadequate maintenance leading to early obsolescence or sudden failure
• Political risk	• Supply-chain failure
	• Malicious acts (e.g., vandalism, cyber-attack)
	• Accidents
	• Unforeseen demand
	• Climate change

As explained in Appendix C, PICs currently have about $26 billion in total infrastructure at risk, with infrastructure needs increasing at $3 billion per annum, although only perhaps half of this need is being met. Much of this investment is in the transport sector, which often is very close to coastlines and therefore particularly at risk both to flooding due to tropical cyclones or tsunamis, as well as sea-level rise.

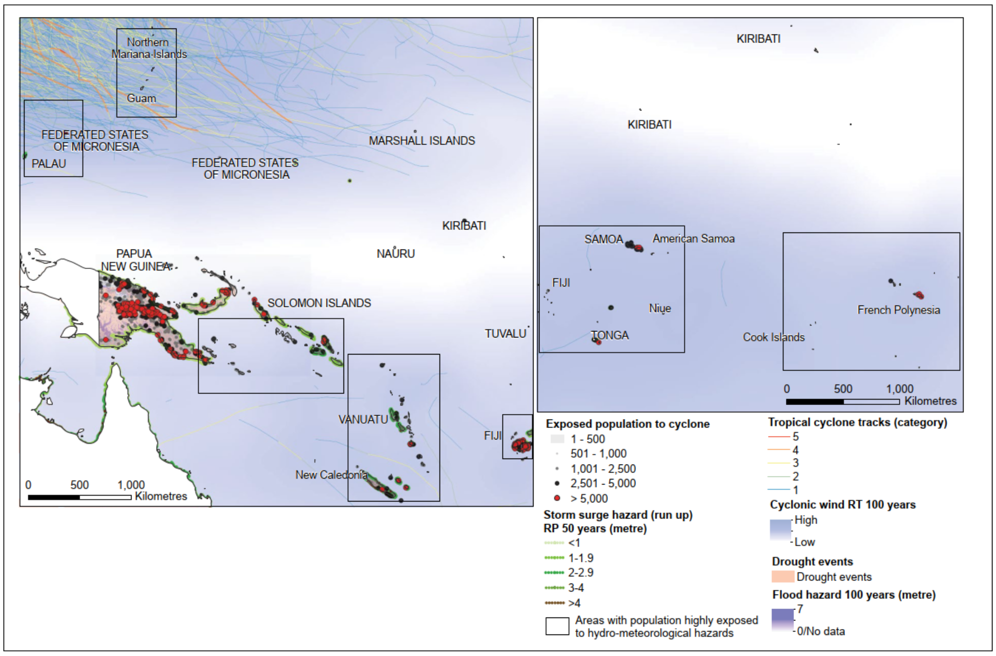
2.1.3 Natural hazards

PIC infrastructure is threatened by many natural hazards and perils, particularly hydro-meteorological (e.g., tropical cyclone) and earthquake, which cause on average about $1 billion in property loss (not just infrastructure) in PICs (Figure 3). The prevalence of these perils is shown in Figure 4 and Figure 5.



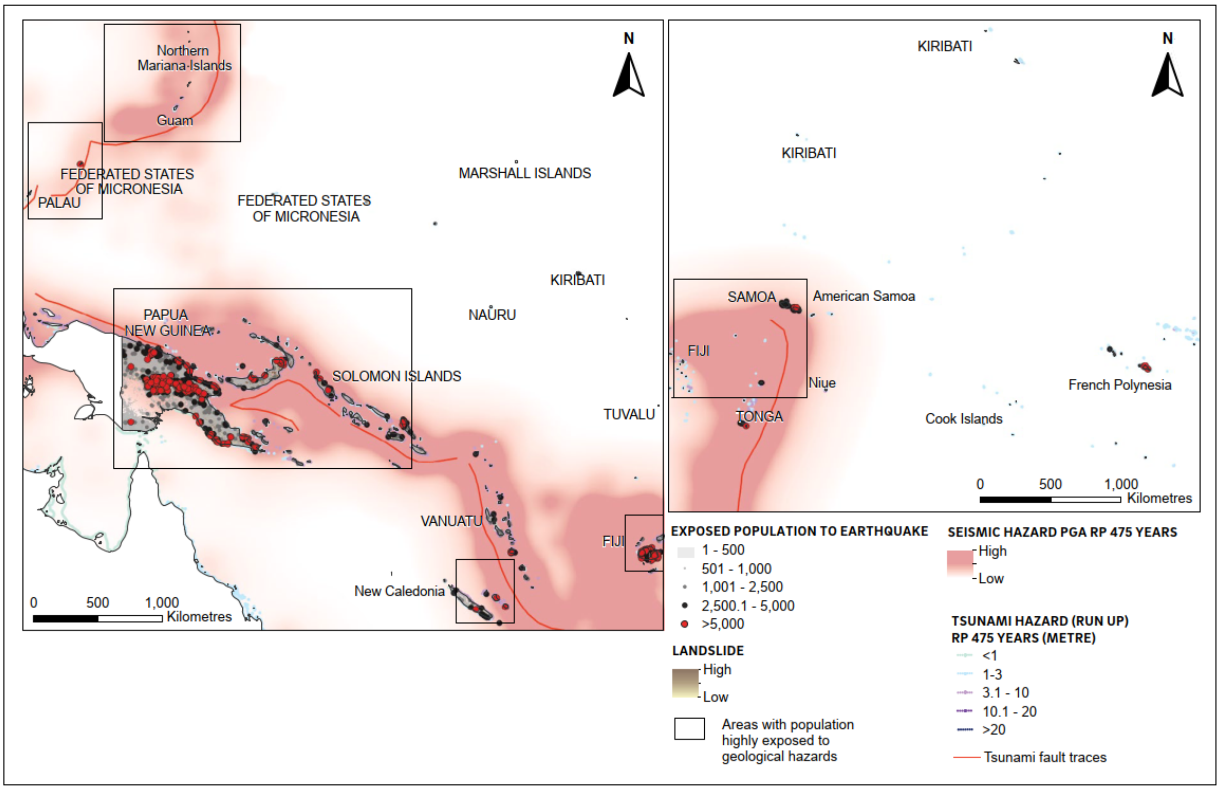
Source: ESCAP based on probabilistic risk assessment.
Note: Volumetric analysis is a measurement by volume (impacted population, geographic area and economic losses)

Figure 3: Natural Hazards Average Annual Losses for Pacific Small Island Developing States.
Source: ESCAP, 2020



Sources: ESCAP, based on Global Assessment Report on Disaster Risk Reduction (GAR) Risk Atlas, 2015; Global Risk Data Platform, 2013.
Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.
Note: Cyclone data consist of all cyclone wind categories with a return period of 100 years and an intensity of 119 km/h to more than 252 km/h.

Figure 4 Distribution of Pacific Island Countries Population vs. Hydro-Met Hazards



Sources: ESCAP, based on Global Assessment Report on Disaster Risk Reduction (GAR) Risk Atlas, 2015; Global Landslide Hazard Distribution v1, 2000.
Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.
Note 1: Peak Ground Acceleration (PGA) Return Period (RP) 475 years is the seismic hazard with a return period of 475 years expressed in peak ground acceleration. This means that a level of ground shaking is expected to occur once in 475 years. Tsunami hazard RP 475 years is a tsunami hazard run-up height with a return period of 475 years.
Note 2: The value of PGA 475 years used in this quantification is from 90 to 334 cm/s².

Figure 5: Distribution of Pacific Island Countries Population vs. Seismic Hazards

2.1.4 Climate change

Climate change is an increasingly important contributor to infrastructure risk, especially in PICs, who are facing the greatest impacts of climate change due to rising sea levels, warming oceans, drought, coral ecosystem destruction, ocean acidification, and extreme weather. The effects of these physical phenomena then extend to the socioeconomic arena, causing pressure on water and food, human health risks and migration, and displacement.

In the extreme, climate change threatens the very existence of entire atoll island nations such as Kiribati, Tuvalu, and RMI. These states are only 1 to 3 meters above sea level and thus are threatened by projected sea level rises of about 60 cm or more by 2100. Climate change is negatively affecting PICs' economies by changing patterns affecting the agriculture and fisheries sectors, water resources and the population's health. Some illustrative impacts of climate change on various infrastructure sectors are shown in Table 2.

Table 2: Illustrative Impacts of Climate Change in Different Sectors

	Temperature changes	Sea-level rise	Changing patterns of precipitation	Changing patterns of storms
Transport	– Melting road surfaces and buckling railway lines – Damage to roads due to melting of seasonal ground frost or permafrost – Changing demand for ports as sea routes open due to melting of arctic ice	– Inundation of coastal infrastructure, such as ports, roads or railways	– Disruption of transport due to flooding – Changing water levels disrupt transport on inland waterways	– Damage to assets, such as bridges – Disruption to ports and airports
Energy	– Reduced efficiency of solar panels – Reduced output from thermal plants due to limits on cooling water temperatures – Increased demand for cooling	– Inundation of coastal infrastructure, such as generation, transmission and distribution	– Reduced output from hydropower generation – Disruption of energy supply due to flooding – Insufficient cooling water	– Damage to assets - e.g. wind farms, distribution networks – Economic losses due to power outages
Telecoms	– Increased cooling required for datacenters	– Inundation of coastal infrastructure, such as telephone exchanges	– Flooding of infrastructure – Damage to infrastructure from subsidence	– Damage to above ground transmission infrastructure, such as radio masts
Urban development	– Increased cooling demand – Reduced heating demand	– Inundation and increased flood risk – Changes in land use due to relocation of people living in exposed areas	– Risk of drought – Flooding	– Damage to buildings – Deaths and injuries
Water	– Increased need for treatment – Increased evaporation from reservoirs	– Inundation of coastal infrastructure – Salinisation of water supplies – Decreased standard of protection offered by coastal defences	– Increased need for water storage capacity – Increased risk of river embankments being overtopped	– Damage to assets – Decreased standard of protection offered by flood defences

Note: This table provides an illustration of the impacts that could occur in some sectors and in some regions. The impacts faced by a given infrastructure asset will depend on a range of factors, including location: for example, storms are projected to increase in some regions and decrease in others. A more comprehensive analysis can be found in the IPCC's Fifth Assessment Report.

Source: OECD, 2018.

2.1.5 Building codes and compliance

Building codes are the primary tool for managing the risks of constructed works. They typically require a minimum level of design intended to protect life safety, while allowing owners and designers to exceed to the minimum as they wish. Relatively few designers or owners opt for designs exceeding the minimum standards; those that do are typically more sophisticated, and also intend to own and occupy the building for the foreseeable future. The protection of life safety is simple consumer protection: when a building changes owners, the new owners and occupants typically have no idea as the level of design that was employed and rely on the assurance that the building code provides. Building codes typically prescribe certain loadings, either prescribe design values or performance (the latter approach termed *normative*) and refer to multiple standards for specifics of materials and components.

Buildings must comply with the code to obtain permits from the authority having jurisdiction to permit the planning, construction, and occupancy of buildings. Such authorities for buildings are usually the local municipality, county, province, or other jurisdiction. Writing an entire building code with associated materials standards is however typically too large a task for local jurisdictions so that in many countries a national building code is promulgated, and compliance with the building code is overseen by the local jurisdiction. Table 10 in Appendix D shows the status of building regulations and national building codes for PICs, from which it can be seen that three of the 13 countries (representing 6% by population) lack any building code at all, and four countries have national building codes more than 20 years old which have not been reviewed or updated since publication (or have had only a limited review). Moreover, many of the building codes refer to Australian/New Zealand (A/NZ) standards that can be difficult and costly to access in some PICs.

Infrastructure differs from ordinary buildings however in that, while infrastructure may include some buildings, most infrastructure are typically non-building structures or constructions (e.g., pavements, pipelines, towers, tanks, etc.), which are typically not addressed in the prevailing building code. While in some cases they may be addressed in other codes and standards, the prevailing building code is often not relevant or applicable to infrastructure, and local authorities and jurisdictions often will not have the expertise (or, in many cases, the authority) to oversee the work and assure compliance with at least minimum standards. Rather, the design of infrastructure is often left to the professional competence of the designers, without much oversight.

While infrastructure designs may comply with whatever codes and standards may be applicable or referred to by the designers, including specifying quality materials, compliance during construction to assure that construction and materials meet the designs can be problematic. As noted by Gwilliam:[3]

- Many Pacific countries have no national building board or central agency mandated to administer and manage building control.
- In most Pacific countries, legislation does not set out guidelines for regulating or providing technical management of the national building codes.
- In most Pacific countries the procedures for obtaining a building permit involve input from a variety of institutional bodies and is cumbersome and time consuming.
- In all Pacific countries there are insufficient building inspectors to manage the building permit process and enforce compliance.
- In all Pacific countries, building inspectors have not received any or only limited training on national building code compliance procedures.
- Building inspectors based in the provinces do not have funds for logistical support.

[3] R. Gwilliam. 2021. *Regional Diagnostic Study on the Application of Building Codes in the Pacific*. Sydney: Pacific Region Infrastructure Facility.

- Many private sector architects and engineers do not understand the national building code permit application process.
- Pacific countries governments have not prioritized allocating resources to manage the national building codes.
- Most Pacific country regulatory authorities do not have the skills or resources to technically assess complex building permit applications, such as high-rise commercial buildings or hospitals.

2.1.6 Construction risk

The construction stage of infrastructure projects has the greatest risk, particularly physical risk such as accidents, which to a great extent are borne by the construction contractor. To cover these risks, contractors typically buy Contractors All Risk (CAR) insurance policy.[4] The CAR policy is intended to provide broad coverage related to the construction project but of course does not cover all risks. CAR coverage typically includes fire, accident, vandalism, water damage, construction faults, and negligence. Depending on the insurer and project, CAR coverage may or may not include natural hazards such as flood, wind, and earthquakes. CAR coverage typically does not cover normal wear and tear, willful negligence, or poor workmanship. Any CAR policy can be negotiated to cover additional items. While good practice is the first and best resort for managing risks during the construction stage, most projects cannot be executed without a CAR.

2.2 An overview of risk management

Risk management is a very broad term used in different ways by different people, so that it is worth briefly reviewing what the term actually involves. While risk itself ranges from natural hazards to accidents on the jobsite to market risk to foreign exchange risk to reputational risk etc., the focus of this report is on the variety of risks that affect contractors building infrastructure. Even within this constraint, the span of risks is still quite broad but can generally be considered as those risks covered by the typical CAR insurance policy (see the Construction/Management section of Table 1.1 above).

These risks are managed in many ways, which may be organized into four very broad categories:

- **Structural** risk management techniques include designing and building sufficient strength and ductility into structure to withstand loads (during construction as well as for the life of the structure), adopting shapes that reduce loads (e.g., roof configuration against high winds), constructing flood barriers, landslide reduction or other protective measures to prevent or reduce the occurrence of a peril, or providing fire protection features such as onsite water supply and/or sprinklers. In essence, structural risk management involves *building* something to *withstand* unwanted events.

[4] Also variously known as Construction Works, Builders All Risk, Erectors All Risk, etc., although each of these policies may vary somewhat as to coverage.

- **Locational** techniques, on the other hand, involve *avoiding* unwanted events by for example limiting building in mapped flood plains or areas of seismically poor soils, or elevating property or structures to be above expected flood or tsunami heights.

Structural and locational techniques are typically “built-in” or permanent to the project and last for the duration of the project or, in the contractor’s case, the duration of construction.

- **Operational** techniques consist of improving ordinary operations to reduce the likelihood of accidents (e.g., operator training to reduce human error), overall professional education to assure quality of planning, design, construction and operations, and emergency operations. Emergency operations are typically shorter-term measures (relative to a project life – recovery operations, however, can last years following a disaster) that change the normal pattern of operations for a limited period prior, during and after the unwanted event. In fact, most operational techniques are simply short-term applications of structural (covering windows and roofs against wind and rain, lashing down objects against high winds, removing flammables as fires approach, etc.) or locational (evacuation from flood, wind, fire, moving furniture to upper stories for flood, moving boats to open water for tropical cyclones or tsunamis, etc.) measures. A crucial aspect of this is having thought through, planned for, and exercised these measures beforehand, i.e., emergency planning.
- **Risk transfer** is the last broad category of risk management and differs from the prior three approaches in that while structural, locational and operational measures seek to reduce the loss, risk transfer rather seeks to do what it says, i.e., transfer the loss, not reduce it. If the risk can be spread to many others, it can generally be reasonably borne and, in the individual sense, managed. In fact, by spreading risk to bearable levels, consequential losses (such as bankruptcy) can be avoided, so that risk transfer can reduce the ultimate (although not the immediate) risk. Risk transfer can sometimes be tangible (e.g., use a rental car rather than one’s own) but more typically is transferred through legal (e.g., contract terms) and financial (e.g., insurance or hedges) means. Indeed, *insurance* and *risk transfer* are sometimes used synonymously, but it should be borne in mind that insurance is only one type, albeit a very important type, of risk transfer.

This framework is reflected in, for example, the Organisation for Economic Co-operation and Development’s (OECD) approach to adaptation measures for energy infrastructure as shown in Table 3.

Table 3: Examples of Adaptation Measures for Energy Infrastructure Source: (OECD, 2018)

	Climate impacts on infrastructure	Management measure	Structural Measure
Generation	– Inundation of coastal infrastructure, such as generation plants – Reduced efficiency of solar energy – Insufficient cooling water – Temperature of cooling water before and after use – Reduced output from hydropower generation	– Model climate impacts on existing and planned assets in collaboration with meteorological service – Revise maintenance schedules – Update hydropower operating rules	– Fortify coastal, off-shore and flood-prone infrastructure against flooding – Increase cooling system capacity for solar energy – Locate new facilities outside high-risk zones
Transmission and distribution	– Flooding of electricity substations – Damage to transmission lines from climate extremes	– Implement program for pruning and managing trees near transmission and distribution lines – Create disaster mitigation plans – Train emergency response teams for quick repair and restoration actions	– Adjust design criteria for transmission lines, e.g: – Increase transmission tower height – Bury distribution lines – Use stainless steel material to reduce corrosion from water damage
Consumption	– Change in energy demand patterns (e.g. increased demand for cooling and reduced demand for energy for heating)	– Undertake load forecasting using climate information – Promote behavioural change measures to reduce peak consumption	– Improve building and industrial energy efficiency

Source: (IEA, 2015; World Bank, 2016).

Considering the above four approaches, true loss reduction is, at its core, structural, locational, or operational. However, in implementing structural, locational or operational techniques, the question arises (or should arise) *how much risk reduction is acceptable* (e.g., how high should a flood barrier be)? Rationally, the appropriate level of risk reduction can be determined through benefit-cost analysis, which involves comparing the costs of reducing the risk (e.g., the cost of building a higher flood barrier) with the disaster costs avoided due to the risk reduction measure (e.g., fewer floods due to a higher barrier).[5] However, in many projects, just complying with the building code is seen as being appropriately diligent and is often preferred since it results in the lowest possible initial capital expenditure (although not lowest total project lifecycle cost).

This built-in flaw of building codes, i.e., that they typically only protect life safety and do not optimize project total cost, has long been recognized by building professionals (but not the public, nor even non-technical public decision-makers). In recent decades, a more sophisticated approach has emerged termed *performance-based design* (PBD). PBD is not so much a technique as it is a process, in which the design professionals discuss with the owner or project decision-maker how the project will perform under varying levels of design (i.e., for minimal code compliance, the losses will be such and such, for a higher level of design the losses will be this much less). This discussion inevitably includes the consequences, including financial costs, of each level of design. In many projects, PBD results in better design, in terms of much improved

[5] J. Peterson, and M. J. Small. 2012. Methodology for Benefit–Cost Analysis of Seismic Codes. *Natural Hazards* 63(2): 1039–1053. https://doi.org/10.1007/s11069-012-0204-7

performance for only modest initial capital outlay. A PBD design is the better design not in terms of being cheapest, but in terms of being wisest.

The point is that, to the extent structural, locational, operational, PBD and selected risk transfer (e.g., contract terms) measures can reduce the risk of infrastructure projects, then the residual risk, which is covered by insurance, is reduced, and the project is more attractive to insurers. In this manner, many specifically non-insurance measures are critical to ensuring sustainable insurance options are available for infrastructure construction in PICs.

The next section discusses the status of some of these non-insurance aspects that bear on the overall problem of lack of insurance for infrastructure projects.

2.3 PIC risk management practices

This section summarizes current PIC risk management practices with a focus on areas that offer opportunities for improvement. Those opportunities are addressed in Section 3.

2.3.1 Risk identification and quantification

Quantifying the many kinds of risks for infrastructure construction in PICs is a first step toward managing them, as well as being the basis of rationally priced insurance.

Currently, quantification of risks in infrastructure construction in PICs varies considerably depending on the nature of the risk. Availability of statistical data for the more frequent risks in infrastructure construction such as worker injuries or construction collapses vary by country, thereby increasing the difficulty (and price) of underwriting a CAR policy.

One of the most important risks typically covered by CAR policies is that of natural hazards—a large tropical cyclone or earthquake can result in a total loss. Statistical data and risk quantification for natural hazards in PICs are relatively widely available, due to several factors:

a) Most natural hazards are of global interest, so that relatively complete international collation of data has occurred for over a century for earthquakes for example and since at least World War 2 for tropical cyclones in the Pacific.
b) These data have been the basis for probabilistic modeling by the insurance industry for several decades.
c) Beginning in 2012 with the Pacific Catastrophe Risk Assessment and Financing Initiative, a regional data hub and modeling capability was developed, now currently residing in the Pacific Data Hub (PDH). PDH is led by the Pacific Community (SPC) and is a central repository of the most comprehensive collection of data and information about the Pacific and from the Pacific, including data on population, economic, climate change, natural disaster, public health, food security and human rights. PDH is a regional public good and authoritative point of entry that serves as a vehicle for investment in sustainable data infrastructure for the Pacific region.

2.3.2 Donor risk guidance

While major multilateral and international donors assess projects for climate and disaster risk (as well as equity, gender and other factors), these assessments are largely for internal purposes and do not persist through the project lifecycle, particularly the project procurement, design and construction phases. In other words, once funded, risk management typically devolves to the project level, i.e., sometimes donors provide advisors who enhance management of risks during the early phases, but often management of risks becomes minimal with only mere compliance with local building codes and practices. As discussed above, mere compliance with building codes results in substantial residual risk, making such projects less attractive to insurers.

2.3.3 Building codes and standards

Each of the PICs has its own building code, which is commendable in many ways, allowing local needs to be addressed and cultures to be respected. On the other hand, developing and maintaining a comprehensive modern building code is a major undertaking, typically beyond the resources of smaller countries,[6] so that many of the PICs' building codes lag recent technical developments. To avoid this, some PICs' building codes borrow significantly from a building code of a larger more advanced economy, most typically the Australian-New Zealand building standard (AS-NZS 1170). Even while borrowing from AS-NZS 1170, there is still wide variation in building regulations/codes and practice across the region, with building codes outdated or even lacking in some countries (see section 2.1.5 above). Variation in building standards is a burden for designers serving the region, thus increasing costs and complicating insurance underwriting.

Compounding this situation is that building codes typically are meant for what the title says, i.e., the design of buildings, and not the design of infrastructure such as roads, flood barriers, tanks and other non-building constructions. Even in advanced economies, design of infrastructure is often left to professional committees or even simply the infrastructure owners, with little or no oversight of structural design or reliability. The PICs, sometimes lacking the necessary depth for professional committees, either leave design to the infrastructure owners or variously borrow from practices in other countries. The resulting wide variation in infrastructure standards and design (if they exist at all) again increases costs and complicates insurance underwriting. Indeed, the resulting uncertainty as to infrastructure design sometimes results in insurers declining infrastructure business at all.

While some of the advanced economies' building codes that are heavily borrowed from in some PICs (e.g., AS-NZS 1170) are normative (i.e., performance-based), this concept has not been widely adopted by donors nor propagated to some countries in the region. Moreover, such performance-based design is typically applied to only the larger projects.

[6] For example, all 30 European Union countries have only one set of codes, with appendices for the specifics of each country. Similarly, the United States has only one "model" code, again modified in minor ways for each state.

Another aspect of building codes, applicable everywhere but particularly in the Pacific region, is that the design levels of climate-related natural perils such as tropical cyclone and flooding, have largely been determined based on historical data, and do not reflect the rapidly changing effects of climate change. That is, the codes are retrospective not prospective. This gap has been recognized and is starting to be filled in some advanced economies[7] but much remains to be done. Building codes of PICs are currently not, but need to be, based on foreseeable climate change conditions.

2.3.4 Construction quality management

A significant issue that comes up in discussions with insurers regarding infrastructure projects in PICs is the quality of construction. Assuring construction quality is a complex issue that involves governance, constructor organization culture, quality assurance (QA) and quality control (QC).[8] At its most basic for a small to medium construction project, QA/QC can be as simple as providing independent inspection and materials sampling to assure compliance with design documents. Many infrastructure construction sites in PICs however are remote, so that on-going inspection is problematic. Moreover, materials testing laboratories are only available in a few PICs, further increasing the problem. Recognizing these issues, insurers are dubious and applications for infrastructure insurance less favorably.

2.4 Approaches to insuring Small Island Developing States

There are several examples of disaster / catastrophe insurance schemes that have been put in place in different regions. These include the PCRIC and the Caribbean Catastrophe Risk Insurance Facility.

PCRIC deals with sovereign catastrophe risk transfer instruments to reduce the financial vulnerability of PICs to natural disasters, such as tropical cyclones. The vehicle mandate is owned at central government level in each jurisdiction. Arguably, it is insuring some infrastructure projects indirectly, because a part of insurance claims payments to governments could be rerouted to critical infrastructure and State Owned Enterprises to help cope with repairing or rebuilding damaged infrastructure for example. PCRIC policies are in force with, the Cook Islands, Samoa, and Tonga. Marshall Islands, Vanuatu and Fiji are also member countries on the Council of Members that controls the Pacific Catastrophe Risk Insurance Foundation that owns PCRIC.

Appendix C provides examples of Natural Disaster Insurance Schemes and gives a high-level summary of the features of several disaster / natural catastrophe insurance schemes. This includes, details of the perils covered, the amounts, the basis of claims payouts and the parties

[7] See for example recent US efforts already affecting some projects although not without controversy.

[8] QA and QC are often confused and are parts of a large quality system – see https://asq.org/quality-resources/quality-assurance-vs-control for an explanation.

involved. It is notable that key donors have experience of funding such an initiative in the PIC region already, and that innovative solutions can be designed if the right incentives and parties are involved. Clearly a suitable funding mechanism is also required and government support also needs to be forthcoming. In the case of the Pacific region, a clear intent by governments, donors and other partners to utilize local contractors should incentivize the adoption of a scheme that facilitates such an approach.

Leaving the private sector to provide insurance for losses and damages resulting from natural catastrophes in some situations, in every jurisdiction, is not feasible. This is because insurers lack the detailed understanding of every jurisdiction, and/or the appetite, capacity, ability or willingness to assume these types of potential exposures. Therefore, alternative solutions, championed by key stakeholders in the region and with support from international reinsurers, to address this type of challenge needs to be considered if infrastructure projects that are not able to obtain insurance, are to become insurable.

2.5 Insurance practices and availability

2.5.1 Data collection process and findings

During the project, the team engaged extensively with contractors, insurance brokers, insurers, reinsurers, construction design specialists, development partners, procurement agencies and several government teams and representatives across the region and beyond. The views were collected in a series of 38 separate bilateral calls and from 29 online surveys. The findings are summarized by category in the following section and specific anonymized quotes from these discussions are added throughout the report were helpful.

On 9 August 2022, the team held an Infrastructure Insurance Workshop via zoom with the following participants:

Asian Development Bank Thomas Kessler **PRIF** Jane Romero Steve Tunstall Michael Carr Charles Scawthorn David Traill **Munich re** Marion von Achten Michael Roth Stefan Schuessele **Swiss Re** Andrew Davidson Christian Wertli **SIF - Source** Christophe Dossarps	**Willis Tower Watsons** Rowan Douglas David Simmons **Lockton** Ged McCombie Jessica Schade **Hannover re** Friederike Scheel Timm Walker **PCRIC** Aholotu Palu **QBE** Jason Thomas **Renaissance re** Jeff Manson **IDF & Global Risk Modelling Alliance** Nick Moody

The workshop participants were encouraged to collectively work in trying to conceptualise and operationalize the solutions that have been started elsewhere and consider their application in the PICs. To provide some theoretical ideas or some concepts, have the Pacific as a pilot or a laboratory to make it happen for the construction sector and to collaborate in trying to strengthen the drive to look for solutions. It was noted that whilst there is a huge financing gap, there is an opportunity for the insurance industry to offer its full range of value propositions and services in the region.

The discussion focussed on support for the three pillars of a Resilient Infrastructure Insurance Facility for PRIF. These are (i) the insurance industry would be involved early in any PRIF projects through a risk advisory service, (ii) the consortium would then assume the identified risks by offering comprehensive insurance products as a one stop shop approach across the life cycle of the project, and (iii) to leverage the assets of the insurance industry and invite insurers and reinsurers as investors mobilizing private sector financing in infrastructure.

The findings and inputs from the workshop have been incorporated into this report. In due course, there will be further approaches to participants to seek concrete feedback and volunteers for allocation of resources to work out details that can make the project happen. Participants were thanked for their support and encouraged in conclusion to look at the region both as a business opportunity, and as a chance to be more Paris aligned, and deliver on their own board level sustainability targets.

2.5.2 Overview of Pacific Insurance markets

Table 4: Overview of Pacific Insurance Markets Including Identified Regulators, General Insurers and General Insurance Brokers

						Insurance							
Country		Population	Regulated	Regulator	Logical Lead	QBE	Tower	Capital	Federal	Pac MMI	Pac Re	PCRIC*	Other
COO	Cook Islands	18,000	Y	CI FSC	Tower/Federal/Exemption		Y		Y			Y	AIA, Chubb
FIJ	Fiji	919,000	Y	RBF	QBE	Y	Y	Y				Y	New India, Sun, Fijicare
FSM	Federated States of Micronesia	102,000	Y	FSM Insurance Board	Exemption								
KIR	Kiribati	100,000		TBC	Exemption								Kiribati Insurance Company (Govt)
NAU	Nauru	11,000		MoF/FIU (No Supervisor)	Exemption								
NIU	Niue	2,000		FIU (No Supervisor)	Exemption								
PAL	Palau	18,000		FIU (No Supervisor)	Exemption								
PNG	Papua New Guinea	8,587,000	Y	Insurance Commission	QBE	Y	Y1	Y		Y	Y		INSPAC, WPI, Various
RMI	Republic of Marshall Islands	54,000		None	Exemption							Y	
SAM	Samoa	199,000	Y	Central Bank of Samoa / CIFA	Tower/Federal/Exemption		Y		Y			Y	Lloyds (via brokers)
SOL	Solomon Islands	635,000	Y	CBSI	QBE	Y	Y	Y					Pacific Assurance Group
TON	Tonga	110,000	Y	NRBT Prudential Supervisory team	Tower/Federal/Exemption		Y	Y	Y			Y	Insurance Corp of Tonga (Dominion Fiji)
TUV	Tuvalu	11,000		TBC	Exemption								Colonial Insurance
VAN	Vanuatu	288,000	Y	VFIU / RBV	QBE	Y	Y	Y				Y	

		Brokers					
Country		Aon	Marsh	Willis	Lockton	Other	Comments
COO	Cook Islands			Y	Y		
FIJ	Fiji	Y	Y	Y* (IHL)			
FSM	Federated States of Micronesia					Micronesia Insurance Brokers	Has Captive regulation focused on supporting overseas captive needs
KIR	Kiribati						Originally only KIS legislated to operate, but was repealed in 2008
NAU	Nauru						
NIU	Niue						
PAL	Palau					5 intermediaries that deal with Guam based insurers	Households (and small businesses) served by bank model (Guam and Hawaii)
PNG	Papua New Guinea	Y	Y			Various local	
RMI	Republic of Marshall Islands					2 Intermediaries	
SAM	Samoa	Y	Y	Y	Y	Platinum	
SOL	Solomon Islands		Y		Y	United Risk Services	
TON	Tonga			Y	Y		Comment that some other brokers from NZ managed small accounts
TUV	Tuvalu					Pacific Prime	
VAN	Vanuatu	Y* (VIB)	Y	Y	Y		

Source: Authors

Table 4 provides a summary of the known participants in the Pacific region showing the identified regulator and known general insurance companies and brokers that directly participate in that market. Due to limited information in some PICs on their insurance market, guaranteeing the complete accuracy of the table is difficult and some reliance has been placed on insurer and broker survey responses, information in the countries' mutual evaluation reports on anti-money laundering, and existing literature.

Key points:

- Most major brokers have experience in offshore placements across the region beyond just the countries the directly operate in.
- PCRIC is regulated only in the Cook Islands, but has six member countries with involvement in the Pacific Catastrophe Risk Insurance Foundation, meaning these countries could access solutions immediately without needing to join the foundation first.

In general, the region can be broken into three main sub-regions from an insurance market perspective:

- Established markets with a strong Construction Insurance Lead (PNG/Fiji/Solomon Islands/Vanuatu) – QBE Insurance Group is domiciled in each of these countries and is the clear market leader on construction insurance.
- Established markets without a strong Construction Insurance Lead (Cook Islands/Tonga/Samoa) – These markets have established participants like Tower and Capital, but these firms lack strong construction capability or capacity to support larger projects.
- Less established or unregulated markets (Kiribati/Nauru/Niue/Palau/RMI/Tuvalu) – These markets do not have strong regulation around their insurance markets or recognized participants that could lead a facility and reliance on overseas markets would be expected.

Each of the three regions requires a different approach to support the goals of greater access to construction insurance with the first expected to involve QBE Insurance Group as a lead provider and the other two needing to identify a local lead if possible but generally expected to rely on directly engaging overseas construction insurance markets.

2.5.3 Contractor views of the insurance situation

- Insurance availability

A significant number of contractors noted that insurance is not always available when needed, and when it is, it can be unexpectedly costly. Overall, contractors are discontented with both the availability and pricing applied to projects the in the Pacific region. Several smaller contractors based within the country where the project was tendered were unable to find insurance solutions at all. Even when insurance solutions were identified, it was often perceived as prohibitively expensive. One example quotation from a large international contractor is the following:

> "… we are typically seeing 1% to 1.5% of the contract value as the premium cost for Contract Works (compared to 0.6% in Australia, on average). Cyclone cover will add 45% to the premium, with a claims excess of around A$1M for a cyclone claim. There is low interest by underwriters in the Pacific region due to the high risk in a hardened insurance market. For example, in Kiribati, we would need to find at least four underwriters to take a 25% share in an insurance policy, the local insurers do not have the capacity to insure infrastructure projects over A$5M. It can be a major problem."
>
> - Experienced International Contractor

For local in-country contractors, the challenges are even more extreme. In many cases, these smaller companies have limited expertise in insurance procurement and often find they are unable to tender in a compliant manner without the required coverage.

- Insurance procurement

Contractors typically use brokers to source insurance. However, they do not always know which broker to choose in different jurisdictions. Furthermore, the knowledge and expertise across the broking community came across as at best, fragmented and at worst poorly informed. Contractors are sometimes struggling to comply with the insurance requirements stipulated in tender documents, and this prevents some from submitting bids. As one, small, in-country contractor who has operated in the region for several years noted:

> "… I had no way to get the insurance required through my existing broker. Someone suggested I speak to XXXX and they were very helpful, otherwise I would not have been able to submit."
>
> \- *Small local contractor*

These issues are also faced by international contractors:

> "This has been a challenge we have faced since late 2020. At first, we simply could not get insurance for a reasonable rate, we saw a jump in premium of 2500%. More recently insurers and brokers we are working with are finding it very difficult to put a policy together for us on projects that it was straightforward to get insurance in the past."
>
> \- *Medium-sized New Zealand-based contractor*

- Insurance products

The general suite of insurance products that a contractor would typically need for an infrastructure project are usually available, especially for large projects delivered by large international contractors in the bigger territories, for example PNG and Fiji. However, the breadth of coverage is sometimes lacking, and the policy limits and sub limits given, can be lower than contract requirements for natural catastrophe coverage. Insurance products are sometimes not available at all in the smaller, remote PICs.

2.5.4 Insurance broker views of the insurance situation

- Insurance practices and availability

Several brokers identified the limited capacity and willingness of local and international insurers to support construction projects, particularly in jurisdictions where there is limited or no insurance regulation. The capabilities of local insurers are limited in many respects and so is the capacity available. Large placements require more than one insurer (co-insurance) to complete a placement. For cyclone coverage, insurers have a finite amount of capacity to support multiple projects and spread their risk across geographical locations.

Brokers feel that there will be a decrease in the breadth of coverage and capacity over the next 3 years, accompanied by further price increases for contract works and infrastructure projects.

In terms of contract types, it is more difficult to place transport projects, i.e., roads, bridges and port infrastructure, etc., because of flood and natural catastrophe exposure. Insurer practices can also create barriers to obtaining insurance.

Key barriers to obtaining a quote include:

- insufficient information;
- lack of understanding of the risk or the physical location; and,
- the size of the insurance transaction is too small.

In these cases, then, terms will not be given if the data are insufficient. In many cases, smaller contractors are unwilling or unable to provide the information requested. Contractors repeatedly mentioned the limited time frames in which tenders must be prepared and brokers confirmed that this often led to unexpectedly high pricing or no terms at all.

> "Expertise for securing proper insurance or risk management varies country to country. If the financiers or consultants can develop a framework that will lay down minimum insurance requirements (rather than vague reference to requirement of insurance), streamline the information collection and align the local insurers as well to idea of approaching relevant reinsurance markets (only) for distinct projects, we believe we can generate more interest amongst reinsurers and thereby bankable insurance programs."
>
> - *Medium-size insurance broker with 20 years' experience*

Crucially, brokers believe that having an accurate pipeline of projects to be undertaken in the Pacific would help insurers and reinsurers to arrange the needed reinsurance and encourage further supply of reinsurance into the region.

Generally, brokers prefer to work with locally licensed insurers, but they often lack appetite, especially for windstorm and earthquake perils. Brokers often need to use overseas insurance markets to get the needed amount of coverage. They typically access the London; Singapore; Hong Kong, China; and Australia insurance markets. However, international markets are only interested when the projects are large, and if the contractors have an international reputation.

- Insurance procurement

In terms of contract types, it can be more difficult to procure insurance for projects in the transport sector – roads, bridges and infrastructure, because of flood and natural catastrophe exposure. One broker confirmed:

> "Works in tidal waters are particularly difficult to place especially where cyclone cover is required. New or emerging technologies will always be difficult, especially for large scale solar construction. This is because contractor experience may be low and the technology relatively untried and tested".
>
> - *Broker for medium-sized insurance firm*

Insurance regulation in individual PICs also limits the ability to procure insurance, due to the complexity of having different requirements, and the added costs of compliance in different

PICs. Some PICs prohibit or limit access to offshore insurers and impose fees (Non-Resident Insurer Tax) when they are used.

2.5.5 Insurance Company views of the insurance situation

- Insurance practices and availability

Most insurers based in the PICs have comparatively modest capitalizations. This means that the availability of reinsurance is particularly important. Some insurers use “facultative” insurance where each individual case is looked at, and cover, terms and pricing are agreed with reinsurers. However, the largest insurance company in the region does not use facultative reinsurance as directed by Head Office company policy. Reinsurance can also be provided on non-facultative “Treaty” basis, where a pre agreed share of each risk of a certain type, is automatically ceded to the reinsurer, from the insurer, either on an “excess of loss” basis (where all losses in excess of an agreed amount are picked up by the reinsurer) or on a “proportional” basis where the insurer and reinsurers share the cost of a claim (and the premium) on an agreed ratio. Typically, Excess of Loss is preferred as it utilizes reinsurance capacity mainly for the larger events and protects the reinsurance program from volatility in smaller losses. An insurer’s size, risk appetite, the high cost of reinsurance, and the lack of insurance licenses held in widely across various PICs, are all factors that act to inhibit provision of insurance.

Natural Disaster Risk limits are generally driven by the available capacity in the market. Some insurers indicated that both insurer capacity and reinsurance capacity have reduced over the last three years.

> “If approved and quoted on, then the price and excess is typically substantially high for a very limited coverage, not to the full contract value”
>
> - *Medium-sized regional insurer*

A minority of insurers seek out infrastructure business and have the expertise and capacity to provide insurance programs. During this project, one of the larger insurance players in the region further reduced their operations, withdrawing from one country.

Insurers cite the regulatory landscape as a barrier to business and find it difficult to operate effectively across the region. There are different rules applying in different jurisdictions. Some jurisdictions have no local insurance regulator and effectively no local market. In some locations, the use of offshore insurance markets is banned or heavily conditional, and added costs and complexity apply. They also confirm that infrastructure contracts are often delayed beyond their original contract period. This further reduces their appetite for this type of placement. Delays can stem from unfavorable weather, a shortage of raw material, labor issues, contractual disputes and regulatory situations, among other issues.

> “We provided extension to delayed projects, but at a cost. The clients are not willing to pay the costs, and this becomes a challenge.”
>
> - *Small local insurer*

All insurers interviewed agreed that providing sufficient CAR insurance is an issue for the industry.

- Insurance procurement

Insurers sometimes see that the breadth of cover required, as set out by the procurement agency or others, as too wide. Feedback indicated there is a lack of time to underwrite the risk, or insufficient information provided. Also, if the project falls outside of the scope of the insurer's reinsurance treaties, then terms cannot be given.

There is also a view that insurance requirements for contractors have become more demanding and onerous over recent years. Project risk is being pushed down onto contractors and from there onto the insurance sector. The insurers have little appetite to accept the increased risk and are withdrawing cover accordingly. This will potentially jeopardize the localization agenda of donors unless investment is made in ensuring local contractors have appropriate support and capability and projects risks are well managed.

- Insurance products

The full range of insurance products that are typically required by contractors to cover the infrastructure projects are available in the major jurisdictions, but usually some restrictions exist:

- CAR coverage. Some insurers remove some elements of coverage, e.g., the exclusion of loss or damage due to vibration or landslip.
- Surety bonds. The maximum value of bonds that can be supplied is limited, and insurers outside of the region are sometimes used.
- Special coverages. Some insurers cannot underwrite pollution liability coverage.

Insurers are selective and limit their exposure in several ways. Some will not give natural perils on contract works cover across the region, while in Fiji, coverage for flooding is hard to obtain as most towns and cities are located near rivers and are frequently flooded.

2.5.6 Donor partner views of the insurance situation.

- Insurance practices and availability

Donors have also recognized the importance of contractors obtaining insurance and the challenges increasingly faced, particularly in the smaller jurisdictions. One respondent noted,

> "In the region, many of the infrastructure projects are not sustainable. Generally, contractors are finding it difficult to obtain the necessary insurance for the work to be undertaken, due to the high risk involved and the vulnerability of the Pacific Islands to climate hazards."
>
> \- *Major international donor representative*

Most respondents said that smaller projects (indicative range: $1 million to $10 million) face difficulties. From the data collected, it can be seen that smaller projects usually take place in the smaller jurisdictions. There is limited, if any, insurance availability, and because local contractors are smaller, they have limited if any access to international insurance expertise.

- Insurance procurement

In terms of deciding the content of insurance clauses in infrastructure projects, feedback suggests that standard bidding documents are used to define the scope of insurance requirements, using guidelines and standard clauses for insurance. Internal technical experts can becontracts with smaller local providers, this seems to conflict with the mandate of some donors as the following quotations show:

> "The process for deciding the content of insurance clauses in infrastructure projects, and the parties that are involved in this process is usually defined by … standard terms for insurance contained within their suite of loan documents."

> "We have standard insurance provisions in our contracts … The final provisions are of course subject to negotiation, but some aspects of this are typically either non-negotiable or constrained."

From the anecdotal information collected, it would seem that donors and others in the procurement space have been slow to respond to the challenges faced by contractors in the hardening and shrinking insurance market in the region.

> "Process is lengthy with lots of requirement - standard in terms of what is stipulated in the policy guidelines of the countries is what driving the trends, e.g., contractors not wanting to accept as much project risk, or development agencies wanting to ensure that all risks are fully covered to better protect the interests of donors and / or recipients of grants and loans."

The inevitable result is the inability of contractors to successfully tender for work packages:

> "We are also aware of at least one major infrastructure project that is on hold due to inability to obtain insurance with sufficient coverage levels and certainty of coverage throughout the asset term."

One development partner was candid enough to admit:

> "Donors tend to have no risk element and push it directly to the Implementing Agency. We tend to rely on contractors to manage the risk through their insurance requirements."

and

"Risk is best managed by the party who controls the risk. taken to rebalance risk sharing in contracts. So, it appears that donors believe contractors should accept most or all of the project risk, due to their position in the procurement chain. It is also apparent that development partners view natural disaster risk as something the contractor should be responsible for, which may be impractical or impossible for small local contractors."

- Insurance products

A development partner said that:

> "Contractors are expected to provide risk mitigation plans for insurance, and that underwriters increase costs or refuse to give cover when risk mitigation plans are inadequate. Over the last eighteen months, insurance requirements have been forced onto contractors, and so a few contractors would not sign contracts due to these clauses."

Development partners acknowledge that there is a high risk and vulnerability in the Pacific to climate hazards, seasonal weather events, and low contractor capacity to present risk mitigation plans to insurers, and that this affects the ability to get insurance coverage.

2.5.7 The current situation according to Procurement Agencies

- Insurance practices and availability

Development partners and procurement agencies are often highly conservative in de-risking a project for the donor and recipient nation. They often look to ensure that the insurance market is taking most of the project risk. They require contractors to have extensive insurance coverage to minimize the risk of the contractor not being financially able to guarantee the project. They also use a policy of replicating insurance requirements from similar projects that have taken place earlier. There does not appear to be a considered appreciation of the local context where a project will be delivered, in terms of the actual insurance risk, the level of risk retention, and the level of risk transfer needed.

- Insurance procurement

Various forms of contracts are used for engineering, procurement and construction for example. The Standard Contract Terms typically used for procurement of infrastructure projects are from the World Bank, Australian Department of Foreign Affairs and Trade, European Union and the New Zealand Ministry for Foreign Affairs and Trade. The EU says procurement is a lengthy process with lots of requirements, standard terms, and policy guidelines, and countries must follow EU rules unless derogation or prior approval is sought.

The process from publication of a tender until the date of contract award for infrastructure projects usually take 3–6 months and the period to change infrastructure projects is between 6–8 months.

- Insurance products

One procurement agency confirmed that the insurance market has been tightening, and insurance policies and terms are no longer being supported by insurers to the same extent they had been previously, so creating an issue with contract works and natural disaster coverage. Tellingly, one agency stated:

> "There are aspects of our standard insurance provisions that were previously acceptable but are no longer acceptable or obtainable in the market."

3 Opportunities for Improvement

This section explores what opportunities for improvement may exist.

3.1 PIC risk management practices

3.1.1 Risk identification and quantification

As discussed in section 2.3.1, relevant to infrastructure construction and insurance, the current situation in risk identification and quantification varies; some aspects such as construction injuries and accidents need considerable improvement, while other aspects, such as natural hazards and climate change modeling, are relatively good.

Regarding quantification of natural hazards risk in PICs, it has already been noted that PDH is the regional leader in this field, with relatively up-to-date data and methods. Nevertheless, while already doing a good job, PDH can improve. Areas for improvement would include:

a) Supporting PDH to collect more detailed geospatial data in all PICs. Such data would include, for example, detailed information on soils (relevant to land sliding, flooding and earthquake ground failure), drainage, land cover, vegetation and so on. Collection of some of this data can be a one-time effort (e.g., soils) while others should be repetitive (e.g., soil moisture, land cover, drought indices, etc.). All such data should be collected on a consistent basis for all PICs.

b) Enhancing PDH's in-house capability to perform probabilistic natural hazards modeling in a timely manner using state-of-the-art methods. This requires acquisition and maintenance of state-of-the-art hardware and software, and adequate provision and training of technical staff.

c) PDH's modeling of probabilistic natural hazards modeling should also be enhanced to include effects of climate change. PDH already does this to some extent, but consideration of climate change effects should be built-in to all PDH analyses and reports. Infrastructure projects should not be based on estimates of natural hazards frequency and severity derived from past data, but rather infrastructure should be based on what the frequency and severity will be in future decades.

d) A particularly relevant area for PDH improvement would be regarding the performance of infrastructure. Currently, PDH collects very little information on infrastructure and does not have a satisfactory capability for modeling such performance, especially regarding natural hazards.[9] Collection of existing transportation, energy, water and sanitation, communications and other infrastructure should be relatively easy, and the ability to model it would have great benefits such as for emergency management. Collection of data on planned and under construction infrastructure would require a bit more effort, but such effort would be rewarded if for example probabilistic estimates of the performance of such infrastructure could be provided on a timely basis to for

[9] PDH, personal communication.

example insurers. Having such objective data would significantly improve underwriters' ability and willingness to quote infrastructure insurance.

e) Lastly, while PDH's website and dissemination of results is good, it can always be improved and, moreover, competes with estimates provided by other international agencies and research centers to the extent that PIC government officials are confused as to the content and meaning of data they receive.[10] Therefore, efforts should be made to enhance (i) PDH's standing as the premier regional source for risk information, (ii) PDH's ability to disseminate this information in a timely manner, and (iii) user's ability to comprehend and use such information. This latter capability will require significant training of such officials in the meaning and use of PDH results, with ongoing maintenance.

A sensible step toward improving risk identification and quantification of construction injuries and accidents is the development of a good database of such unwanted events. The database should cover all PICs consistently, collecting the same exposure and loss information in each PIC in the same manner. Here, exposure means information on all construction projects, such as the nature, location, duration, number of workers and other overall data for each project, what tasks are being performed (e.g., equipment operator vs welding vs. casting concrete) by which workers, and so on.

Complementing the exposure data collection is the collection of data on all injuries and accidents. Injury data to be compiled should include not only information on the person(s) injured, date, time, location, activity while injured and so on, but also medical data on the nature and severity of the injury. Compilation of the relevant medical data is straightforward and should accord with the injury schema either currently prevalent in PICs or any other widely used scale, such as the Abbreviated Injury scale.

With both exposure and occurrence data available, estimation of *frequency and severity* of injuries and accidents can become possible. Besides being very relevant to infrastructure insurers, this data of course can be used by PIC public health officials to identify and regulate unacceptable construction practices.

3.1.2 Donor risk guidance

The lack of consistency during the project lifecycle, particularly the early phases of projects, by major multi-lateral and international donors regarding day-to-day, climate and disaster risks has been discussed above. A standardized risk assessment process should be developed and employed by all major multi-lateral and international donors, that follows the project through its entire lifecycle. In effect, major multi-lateral and international donors should be participating in and supporting a consistent regional asset management practice. This is not to say that major multi-lateral and international donors should be managing assets in PICs. Rather, as major multi-lateral and international donors participate in initiating and funding projects, good asset management practices should be part of their internal processes. Then, as the projects are built and taken over by client countries in the region, that asset management should be handed off

[10] PDH, personal communication.

to those owners. This approach is reflected to some extent in OECD's recommendations for incorporating climate resilience into the public-private partnership (PPP) process, as shown in Table 5.

Table 5: Recommendations for incorporating climate resilience into the PPP process
Source: (OECD, 2018)

	Potential measures by PPP phase
Project Identification & PPP Selection Phase	Examine whether the risks from climate change affect the appropriate choice between PPPs and other mechanisms for providing infrastructure services
Project Preparation Phase	Ensure that the technical and service standards applied to the project consider climate resilience
	Design the tender specification to provide room for innovative approaches to climate-resilient infrastructure provision
PPP procurement phase	Ensure that the process of evaluating tenders accounts for resilience benefits, including by considering net benefits over the life of the asset, rather than the term of the contract
Implementation and contract management phase	Identify, analyse and clearly allocate the potential climate risks (and resulting contingent liabilities) resulting from climate change in the contract. Key terms include "uninsurability" provisions, "force majeure" clauses
	Use insurance, or proof of financial capacity, to ensure that the concessionaire is able to bear the risks allocated in the contract
	Encourage disclosure of climate-related risks, and transparency about risk management, throughout the life of the contract
	Collaborate throughout the contract to facilitate adaptive management in light of changing climate conditions

Source: Adapted from (PPIAF, 2016).

This requires coordination by major multi-lateral and international donors so that the same asset management processes are employed by them and client countries, on a consistent basis. This degree of coordination may sound beyond current reach but in fact a vehicle for this is already in operation. Termed SOURCE, it is an online infrastructure project preparation and management software for both traditional procurement and PPPs led and funded by multilateral development banks (MDBs) supporting:

- development of well-prepared sustainable projects to bridge the infrastructure gap
- government's digitalization agenda
- comprehensive mapping of all aspects of sustainable infrastructure governance, technical, economic, legal, financial, environmental and social issues (it uses sector-specific templates covering all the stages of the project cycle, spanning from project definition to operation and maintenance as well as allowing the definition of specific targets to fulfil the SDGs and Paris Agreement).

While SOURCE is regularly updated with the latest international best practices, it can be likewise adapted to national regulatory contexts and connected to existing country-specific information technology systems.

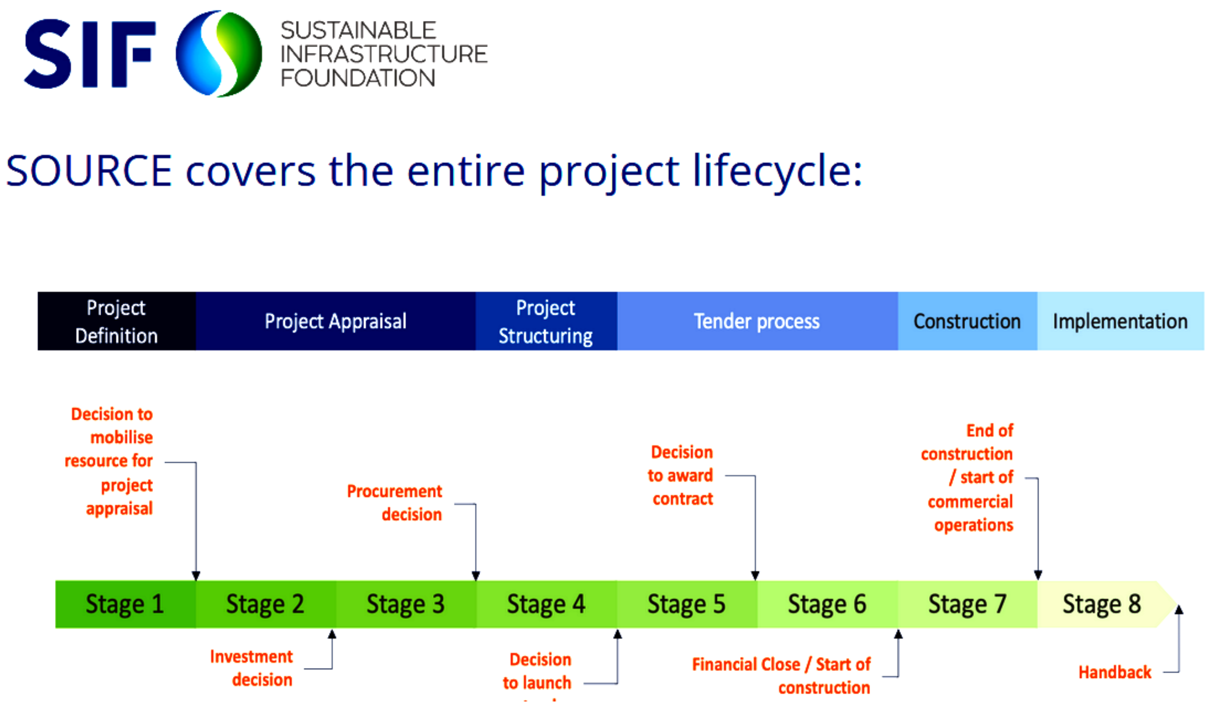


Figure 6: SOURCE Covers The Entire Project Lifecycle
Source: https://public.sif-source.org/source/

The use of a tool like SOURCE could also support efficient exchange of project information to the insurance market, allowing for automatic population of underwriting proposals so that initial discussions can commence about barriers to insurability or indicative pricing for simpler/standardized projects.

3.1.3 Building codes and standards

As noted earlier, there is a wide variation in building regulations/codes and practice across the Pacific region; in some cases, building codes are outdated or even lacking. This situation can be improved by the development of a Pacific Region Design Code (PRDC). The PRDC does not have to reinvent the wheel. Rather it can follow current practice (which however is uncoordinated) by borrowing an existing building code such as AS-ANZ 1170 but adopting it at the same time in all PICs, modifying it as needed with national appendices similar to the practice in the EU.

The PRDC can be maintained by a regional committee under the SPC comprised of cognizant agencies from all PICs, perhaps coordinated by SPC or PRIF.

If a PRDC is instituted, it should cover not only building codes but also infrastructure. Again, much of this does not need re-invention, rather adoption of best practices.

Lastly, the PRDC should allow for PBD throughout the region (already accommodated in AS-NZS 1170). In PBD, the design is not dictated by prescriptive requirements from the building code but rather those requirements are typically exceeded to result in a more satisfactory design, in the sense that, while the project may have a bit higher initial capital cost, the lifecycle cost (including costs of potential damage) is significantly lower, in effect a wiser design responding to the old adage "a penny wiser but a pound foolish".

Adoption of this unified approach will provide many benefits: for infrastructure it will lower costs of design and construction as well as insurance, since designers, builders and insurers will now have to deal with only design code.

3.1.4 Construction quality management

To address the variability across the region of construction quality and how it affects insurability, a promising opportunity is the improvement of construction inspection, including materials testing. In most countries, construction inspection including materials testing is typically performed by an on-site independent inspector who observes construction materials and methods and takes samples of construction materials to assure their quality. However, independent inspection and materials testing is very difficult to not possible on some PIC projects due to their remoteness, lack of qualified inspectors or materials testing facilities, and/or expense in bringing these capabilities from other locations.

Technology may offer a solution for this problem, via *remote virtual inspection* (RVI), for which the first Recommended Practices have recently been published.[11] The Practices note that:

> "Hand-held devices such as smartphones and tablets have capabilities for real time, online communication of videos and photos. Use of advanced tools and technologies, combined with the power of such hand-held devices, has made it possible for anyone to observe the construction activities of a jobsite from any location, near or thousands of miles away. Using Remote Virtual Inspection (RVI) allows construction projects to continue without impediment and allows the Authority Having Jurisdiction (AHJ) to continue to provide the vital services needed for construction of safe buildings."

Several companies now offer RVI services[12], which offers many benefits, Figure 7, and RVI technology is now accepted by several jurisdictions, such as the City of Los Angeles, Figure 8.

Briefly put, RVI for a PIC construction site might include:

[11] ICC. 2020. Recommended Practices for Remote Virtual Inspections (RVI). Washington, DC: International Code Council.

[12] See, for example:

- https://blog.ftq360.com/blog/virtual-construction-inspections
- https://www.blitzz.co/blog/how-to-conduct-an-on-site-remote-video-inspection-for-commercial-and-residential-buildings
- https://www.modular.org/2021/10/28/the-growth-of-remote-virtual-inspections/
- https://www.cloudvisit.com/maintenance-inspection-software/construction-software/
- https://icwhatuc.com/blog/remote-virtual-inspections
- https://www.nfpa.org/News-and-Research/Publications-and-media/Blogs-Landing-Page/NFPA-Today/Blog-Posts/2021/06/02/As-remote-inspections-become-more-common-NFPA-to-host-one-hour-session

- **24/7 video camera** coverage of the jobsite: this allows remote monitoring of materials delivery and placement as well as construction methods. Such coverage should be from several angles by a network of cameras that have zoom capability. Such coverage may already be in place, for security purposes, or if installed also provides that benefit.
- **Test monitoring** of selected materials inspections and tests via close-up video: a slump test, for example, is a very simple procedure and can be performed by virtually any construction worker after a few minutes of training. Performance of the slump test can be observed remotely. What is important in slump testing is assurance that the material sample is representative of the concrete batch, which can be assured by observation (via the 24/7 camera network) of the sampling of the test materials from the ready-mix truck or concrete mixer. Such remote virtual monitoring can be performed for several simpler tests. For more complex tests that must be performed at a certified materials testing laboratory, materials samples can be taken on-site with their provenance certified by observation including sealing of the sample.
- **Random inspection** via a roaming videographer directed by a remote inspector (which could also include drone usage). The videographer can be a typical construction worker with no more training than any amateur shooting video of their children or pets. However, when directed to go to certain locations and observe underway electrical, pipe, welding or other activities, the expert inspector at a remote location in a few minutes can observe/inspect the work.
- **Associated documentation**: this is no different than for on-site inspection, although the documentation can be quickly captured on-camera, thereby decreasing the administrative burden.

The net result is that a comprehensive record of construction can rather easily be compiled by RVI. This record serves to assure quality construction in real time, can be reviewed at any time by insurers as well as the authority having jurisdiction, and can even serve as evidence in the event of construction or insurance claims.

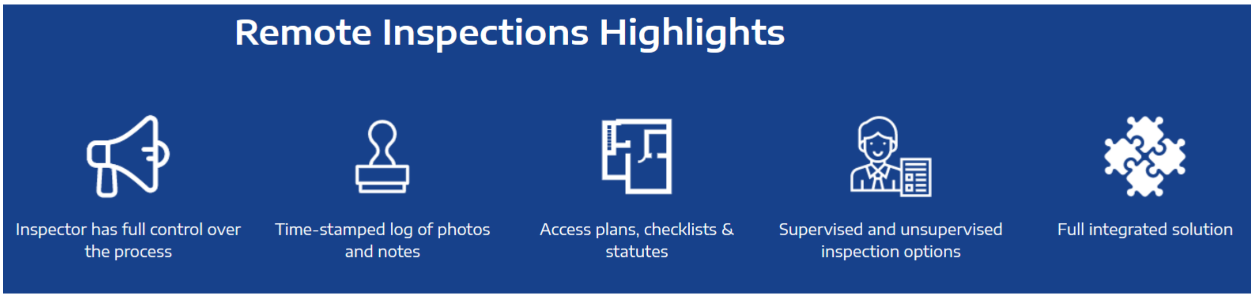


Figure 7: Benefits of RVI

Source: https://spatialdatalogic.com/products/remote-inspections

Figure 8: City of Los Angeles Virtual Inspection option
Source: https://www.ladbs.org/services/core-services/inspection/virtual-inspection

Figure 9: Fire System Piping Being Photographed on a Tablet in a Building Stairwell.
Source: NFPA.

3.2 Insurance procurement

3.2.1 Tendering timelines

In a traditional tendering process using most of the international standard forms, the contractor is rarely involved in the construction process until the tender documentation is issued. At that point, the contractor is essentially facing a ticking clock to marshal all the necessary resources in order to compile and submit a compliant tender document.

Large contractors have professionally trained and experienced procurement teams whose only role is to estimate and produce responses to tenders. Smaller contractors are much less likely to have a dedicated specialist team.

Part of the tender process will require consideration of the insurances required for the project. Larger, international contractors are likely to have sophisticated multi-project insurance programs which are renewed on an annual basis. Adding another project to their tender portfolio is likely to be relatively straightforward with little or no impact on their annual premium, in many cases. Smaller contractors are more likely to buy insurance on a project-by-project basis. If the project is something new or unexpectedly large or complex, existing insurance partners may be unable to support or will require a long and complex data collection process to become comfortable with the change in risk profile. This naturally puts smaller local contractors at a major disadvantage when tendering.

It is possible to involve the insurance supply at an earlier stage in the procurement process. Insurance brokers and insurance companies have a wealth of expertise in construction insurance and are present in most PICs. Involving them early in the procurement process to give inputs on the risk management and underwriting aspects of a project will potentially help in the design of the tender. That will improve the probability of the contractor obtaining the needed insurance. As we have seen, a reluctance on before of procurement teams to change processes that might provide this in a traditional tendering cycle, perhaps the same effect can be achieved through a pooling system in the way that is proposed in this report.

3.2.2 Risk-averse insurance specifications

Donor project "rightsizing" and localization is not being done effectively in all cases. Donors pursue their "localization" mandate and make greater use of local contractors, who may lack the experience and resources of international contractors. This is being done without adjustments being made to the procurement process, in terms of a) engaging with the insurer community early in the process to consider de-risking / redesigning infrastructure projects, or b) amending insurance clauses in tenders and contract awards, so that they better reflect the actual need for certain insurance cover, and the ability to obtain that cover. If donors are wanting to use smaller contractors, with poorer standards, working on small contracts, in smaller PICs, then insurers need to be involved at an early stage before project designs are fixed and tenders issued. Insurers can then share their risk management and underwriting input, to influence changes to the project design.

Donors typically expect contractors to bear the insurance burden and so, by inference, expect insurance companies to provide the cover that is stipulated by the contract. This is not happening in some cases. Donors can act to improve matters. This can include a) supporting risk engineering and other risk improvement measures for projects, b) financially and technically supporting an innovative insurance facility of pooled risks in the region, c) mandating that all projects financed by PRIF members use the insurance facility to obtain the needed insurance, and d) donors collectively deciding to retain some risk, on an insurance pooled basis.

Donor procurement practices do not appear to be sufficiently sensitized to local insurance market conditions. Benchmarking exercises do not take place to gauge what insurance markets will supply. Expectations of what risks can be placed and at what price are not always realistic. “Substandard risks”, from an insurer’s viewpoint can be declined, attract loaded insurance premiums, curtailed coverage or have lower limits of liability imposed. Donor expectations of what insurers will do need to be revised.

3.2.3 Pooling Mechanisms

A common donor approach to the way that project procurement works would be beneficial. Current procurement processes for infrastructure projects can be looked and wider use of the SOURCE online management software tool for infrastructure projects, as mentioned in the sections above, could also be considered. Having a common format for projects will assist insurers in assessing infrastructure projects, their risks, the risk mitigation factors that should be used, and contribute to identifying the optimal way to underwrite the risks.

Establishing a mechanism to pool infrastructure insurance risks will ease insurance supply in the region. Potential vehicles include a Protected Cell Company / Segregated Cell Company (perhaps under PCRIC.org), a captive insurance company, or a mutual insurance company.

An insurance facility is an arrangement with one or more insurers with agreed policy wordings, pricing, and acceptance criteria. Alternatively, insurers may bid on each risk within the facility using their own policy wording and prices. Facilities can allow the local insurance market to spread risk (diversify) by using coinsurance arrangements where each insurer takes an agreed portion of the risk. It may also be done with a single insurer who might rely more heavily on reinsuring excess risk out to international reinsurance markets.

A captive facility is commonly used by large companies to retain risk internally, and place excess risk in the insurance or reinsurance market. A Segregated Cell Company operates in a similar way. The PCRIC is a cell company and could contain a dedicated cell, which could be used purely for infrastructure risks in the region.

To be successful, a regional facility would need to gain the support of local insurers, especially the major providers and if major international insurers were involved (and perhaps providing insurance wordings, setting rates, providing risk assessments and recommendations etc.), it would make it easier for insurance companies in the region to take a following line on their terms. Involving Pacific Re. and PCRIC would help in gaining political support in the region. Capacity is needed for natural disaster coverage, and non-natural catastrophe coverage. A Pacific-domiciled facility would garner more political support in the region, and its domicile would need to be carefully considered.

Most development partners feel that if a facility were set up that could pool different types of infrastructure projects - transport, energy, water, etc., to facilitate insurance acquisition, then development partners would be prepared to provide funding for this type of arrangement.

3.3 Insurance products

3.3.1 Operating a pooling mechanism

There are several examples available that show how innovative Natural Disaster Insurance Schemes can be designed and implemented. Appendix C1, Table 12 lists some cases outside the Pacific region, illustrating the importance of collaboration between donors, reinsurers and governments.

Properly designed, funded and supported, an insurance facility could provide a sustainable solution to the provision of insurance for infrastructure projects. It would need to meet some conditions.

- Support the "localization" policy used by development partners etc. to build up the usage and expertise of local contractors.
- Be integrated into existing risk pool structures and capabilities, so as not to disrupt the existing private sector insurance industry and ability to give cover and also allow for growth and scale in regional disaster risk pools (like PCRIC, African Risk Capacity Group and the Caribbean Catastrophe Risk Insurance Facility).
- Balance indemnity-based insurance and of parametric insurance.

When looking at the design of a facility, and the types of insurance products that need to be available, it is important to understand how exposures change over time as a project progresses, and so how any layered structure would need to work regarding an insurance facility, especially for Natural Catastrophe cover.

In Figure 10, as the project evolves, the value at risk increases as materials and plant and equipment are brought on site and the component parts of the build are erected.

If insurance excesses are high (as per current cyclone cover) then the initial period of the project is in essence self-insured Asset Values at risk over the lifetime of a project.

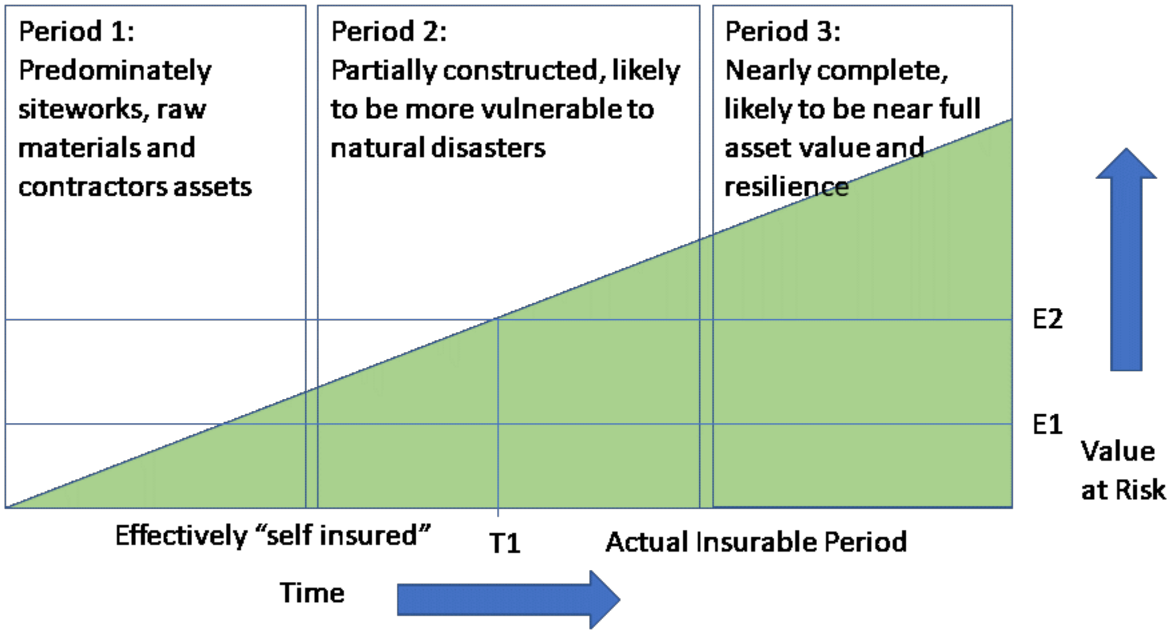


Figure 10: Construction Phases and Insurability
Source: Authors

Key:
E1 – Contractor's excess / liability
E2 – Insurers excess / attachment point
T1 – Time where insurance starts to respond

3.3.2 Potential pooling structures

Different concepts can be presented to illustrate how an insurance facility could be designed that utilizes both existing private sector insurers and regional risk pools.

a) Fire / Standard Structure

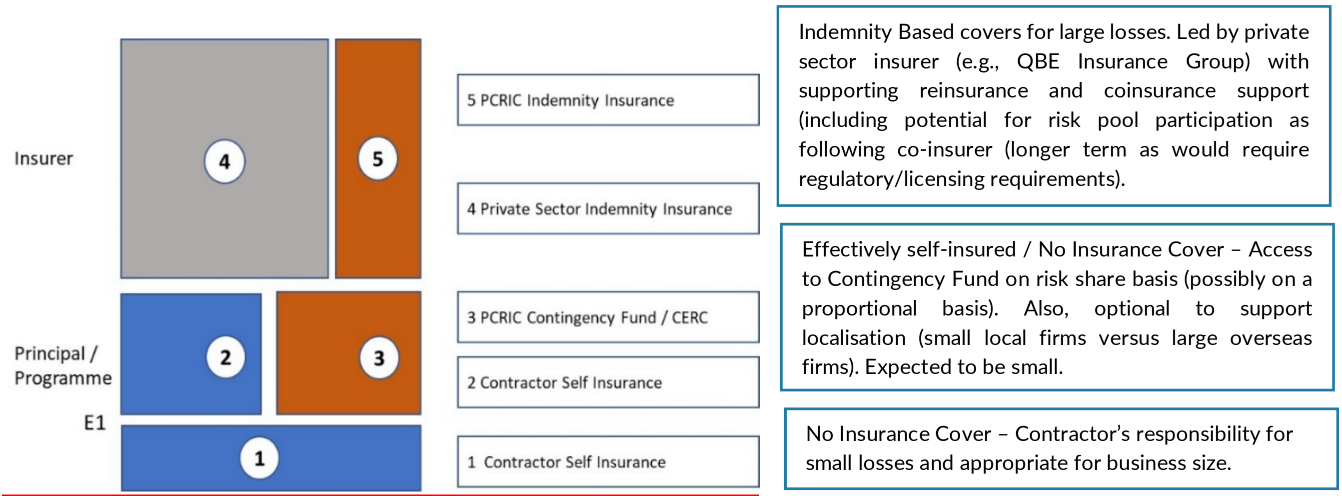


Figure 11: Fire / Standard Structure Facility
Source: Authors

Note: excess levels for Natural Catastrophe and Standard perils will be different.

In Figure 11, as coverage is on an indemnity basis for fire- and accident-related perils, i.e., events not caused by a natural disaster, it is intended to put the insured back into the position that existed before the insured event took place, claims pay-outs reflecting the sums insured, and the amount of loss at the time of claim.

This model is private sector-led. The largest insurer in the region could play a lead role, setting terms, conditions, prices and risk improvement requirements. Coinsurance and reinsurance, backed by a panel of insurers and reinsurers increases the ability to give cover.

A facility can help to avoid issues of selection, whereby only the better-quality projects, and larger projects can get insurance.

As PCRIC is well established and has regional reach, its presence as part of the facility could make support from PIC governments, and participation of private sector insurers more probable and allow for governments to take on some exposure for non-disaster losses in order to increase available capacity and retain some risk across the portfolio. PCRIC's own exposure can be capped by arranging a reinsurance program and is expected to be a small component compared with the natural disaster covers they are currently better structured for.

b) Natural Catastrophe Peril Structure

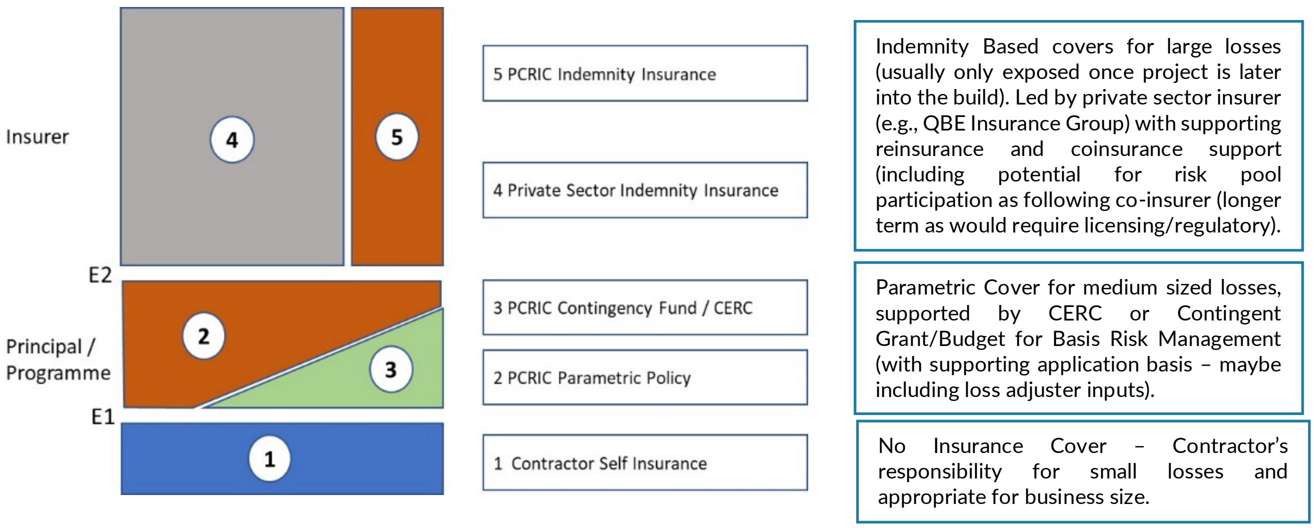


Figure 12: Natural Catastrophe Peril Structure Facility
Source: Authors

Figure 12 shows how different entities work together to ensure sufficient coverage is delivered. Parametric cover is designed to pay out a fixed sum quickly if a certain trigger is met, such as a cyclone of a certain strength, at a certain location. Parametric cover could be used on medium- and smaller-sized projects where traditional indemnity cover is hard to place or on larger projects to support the level of an insurance deductible or excess (the amount that an insured is responsible for should there be a claim). It would need to be supported by a contingency fund to better manage "basis risk" where damage occurs but the trigger is not reached (for example, a cyclone that has low windspeeds but causes significant damage in a localized area), as sufficient reserves would not have been built up in the short term, and there must be a guarantee of rapid claims settlements for insured events, it is important to ensure there are mechanisms to ensure repairs can be financed fully should a natural disaster occur. PRIF could look at the question of mandating that the projects that it funds are insured via the insurance facility.

Crucially, if insurance market regulation was changed and an exemption on insurance regulatory requirements that affect PRIF-funded infrastructure projects in the region was obtained, then the difficulties, costs, and timescales faced in obtaining insurance would ease and access to specialist construction insurers could improve, without overly impacting the more traditional general insurance markets in a country (domestic insurance, business insurance, life insurance, etc.). Clearly the potential of these mechanisms and the mandate and ownership needs to be considered further. It is recommended that a detailed investigation is carried out to manage the review, development, design and implementation of a pooling structure for construction risks in the PICs.

4 Recommended Improvements

4.1 Risk advisory recommendations

Recommendation 4.1.1 The Pacific Region should institute a regional database of construction activity

The database should cover all PICs consistently, collecting the same exposure and loss information in each PIC in the same manner.

Timing: 12 to 24 months

Recommendation 4.1.2 Regional risk models

While the region has done a good job in modeling natural hazards, data and models need to be maintained at the state of the art and enhanced to fill gaps.

Timing: 0 to 12 months

Recommendation 4.1.3 Donor risk guidance

Major multi-lateral and international donors should develop a standardized risk assessment process that follows projects through their entire lifecycle using SOURCE.

Timing: 12 to 24 months

Recommendation 4.1.4 Building codes and standards

The Pacific Region should move toward developing a PRDC, with consistent design practices and standards throughout the region. Requirements specific to each nation such as earthquake and wind loading in a regional PRDC would be addressed by national appendices similar to the practice in the EU.

Timing: Over 24 months

Recommendation 4.1.5 Construction quality management

The Pacific Region should implement a program and systems for regional improvement of construction quality, based on consistent inspection and materials testing using the latest technology.

Timing: Over 24 months

4.2 Recommendations to improve insurance procurement

Recommendation 4.2.1 Project work to improve insurance and insurability

PRIF, or another organization suitably empowered to act on behalf of donors / PRIF members should coordinate a project to consider and implement the recommendations contained in this report.

Timing: 0 to 12 months

Recommendation 4.2.2 Existing activities to improve project risk

Map the current actors and programs in the region that are engaged in improving the design and quality of infrastructure projects and see the follow-on project can complement their work. In particular, the role of CDRI/IRIS and PRIF projects in the region is critical in understanding where risk engineering synergies could be identified.

Timing: 0 to 12 months

Recommendation 4.2.3 Donor vehicle structure and business model

Assess the optimal modality of how donors can best deliver technical and financial support, in order to de-risk infrastructure projects.

Timing: Over 12 months

4.3 De-risking recommendations

Recommendation 4.3.1 Visibility with regional financial supervisors

Work with financial services supervisors in the region to agree a roadmap that creates a more enabling insurance landscape that facilitates insurance supply.

Timing: 0 to 12 months

Recommendation 4.3.2 Enhancing capability: acquiring advisory services

Appoint an insurance broker to assist in tailoring the insurance clauses of infrastructure projects, so that they are more suitable to the realities of insurance provision in the region.

Timing: 0 to 12 months

Recommendation 4.3.3 Insurance pool: donor support

Donors to agree the modality to support a regional insurance pool facility to be used for PRIF donor-funded infrastructure projects. Obtain services to carry out feasibility studies of the options.

Timing: Over 12 months

Recommendation 4.3.4 Insurance pool: organizational structure

Assess the various structures, vehicles and domiciles that could be used for a pooled insurance model, to include Captives, a Mutual Insurer, Facilities, a Protected Cell Company, and the use of third-party administration services.

Timing: Over 12 months

Recommendation 4.3.5. Capacity in the region: international reinsurers

Sign memoranda of understanding with leading international reinsurers to bring additional capacity to PIC insurers, that covers Non-Natural Catastrophe Perils and Natural Catastrophe Perils.

Timing: 0 to 12 months

Recommendation 4.3.6. Insurance Pool: Positioning and using regional reinsurers

Sign memoranda of understanding with the PCRIC and with Pac Re. and evaluate how they may act as providers of indemnity or parametric based insurance for PRIF funded infrastructure projects.

Timing: 0 to 12 months

4.4 Quality infrastructure investment recommendation

Recommendation 4.4.1 During a workshop held with global insurance players in August 2022 it was evident that there is appetite to extend global insurers investment portfolios to cover sustainable long-term investments in the Pacific Region.

The consensus was that the best methodology to achieve participation would be through the issue of green investment bonds that could be purchased by insurers.

Timing: 12 to 24 months

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Appendices

APPENDIX A. Infrastructure at risk

Current Infrastructure: Summary data on the Pacific Island countries (PICs) are shown in Table A1 from which the total population at risk in the 13 PICs not including Papua New Guinea (PNG) was about 2.3 million in 2011, with another 6.4 million population in PNG. The total gross domestic product (GDP) of 13 PICs in 2011 was about $6.4 billion, with PNG having a GDP of about $9.5 billion. Total value of infrastructure for the 13 PICs was about $5.4 billion, with PNG having about another $6.6 billion. The table also shows the estimated loss for tropical cyclones and earthquakes occurring with 0.01 probability per annum. These values apply to all values in the built environment (i.e., including buildings). Loss rates vary from zero to about 11% for the 0.01 probability per annum event, with tropical cyclone by far the largest contributor.

Greater detail for the value of infrastructure assets in the PICs from the same project is shown in Table A2. From this table, about two-thirds of all current infrastructure value is in the transport sector and about 28% in the energy sector, with 5% in the water sector.

Using the same data, the exposure of built infrastructure assets to sea-level rise for 12 PICs found "57% of the assessed built infrastructure for 12 PICs is located within 500 m of their coastlines…Eight of the 12 PICs have 50% or more of their built infrastructure located within 500 m of their coastlines. In particular, Kiribati, Marshall Islands and Tuvalu have over 95% of their built infrastructure located within 500 m of their coastlines."[13]

Infrastructure in the pipeline: A review of PRIF project pipeline for 2021 indicated that PRIF partners have roughly $1.5 billion worth of infrastructure projects in various sectors in PICs that are the subject of this study. Four projects are over $100 million, and two projects between $50–100 million. The majority are between $15–30 million and six are below $10 million. The period over which this investment will occur is difficult to estimate, and the PRIF project pipeline is only a portion of overall infrastructure investment in PICs.

Future Needs: PICs are estimated to need a total of about $3 billion in infrastructure investment per year through 2030.[14] While this amount is a small fraction of needed infrastructure investment in Asia, PICs lead the investment need at percentage of GDP, at 8.2%, which increases to 9.1% of GDP if adjusted for climate change impacts. Current investment is lagging far behind what is needed however, with estimates of actual investment being about a third to a half of what is needed.

[13] L. Kumar, and S. Taylor. 2015. Exposure of Coastal Built Assets in the South Pacific to Climate Risks. *Nature Climate Change* 5(11): 992–996. https://doi.org/10.1038/nclimate2702

[14] ADB. 2017. *Meeting Asia's Infrastructure Needs*. Manila: ADB.

Summary: PICs had about $15 billion of infrastructure at risk in 2011. Investment in new infrastructure during this period has averaged about $1 billion per annum, so that the total infrastructure at risk may now be about $26 billion.[15] Infrastructure in the pipeline is about $1.5 billion. Investment needs to increase to as much as $3 billion per annum.

Much of this investment is in the transport sector, which often is very close to coastlines and therefore particularly at risk both to flooding due to tropical cyclones or tsunamis, as well as sea-level rise.

Insurance market implications: There is a substantial amount of infrastructure in need of insurance. If only a small fraction of existing infrastructure requires insurance, the exposure is at least several billions of dollars. Infrastructure typically requires insurance while under construction, which adds several more billion dollars, so that the total infrastructure exposure seeking insurance cover each year may be on the order of $5 billion or more. Some of this risk is due to natural hazards, which the Pacific Catastrophe Risk Insurance Company (PCRIC) may be able to cover. However, construction risk, accidents, fire and explosion, and other non-cat risks are covered by the broader market.

Table A1: PICs Summary Data
Data: Country Risk Profiles, 2011,
Pacific Catastrophe Risk Assessment and Financing Initiative

		COO	Fiji	FSM	Kiribati	Marshalls	Nauru	Nieu	Palau	PNG	Samoa	Solomons	Tonga	Tuvulu	Vanuatu	PIC excl PNG	PIC Incl PNG
General Information:	Population (ca 2010, ths)	20	847	112	101	55	11	1	21	6,406	183	548	103	10	246	2,257	8,663
	GDP Per Capita (ths USD):	$ 12.3	$ 3.6	$ 2.6	$ 1.5	$ 2.8	$ 3.2	$ 10.7	$ 8.3	$ 1.5	$ 3.1	$ 1.2	$ 3.5	$ 3.2	$ 3.0	$ 2.8	$ 1.8
	Total GDP (billion USD):	$ 0.2	$ 3.0	$ 0.3	$ 0.2	$ 0.2	$ 0.0	$ 0.0	$ 0.2	$ 9.5	$ 0.6	$ 0.7	$ 0.4	$ 0.0	$ 0.7	$ 6.4	$ 15.9
Asset Counts:	Residential Buildings (ths)	8.4	241.0	28.2	24.9	11.4	2.3	0.9	4.7	2,261	42.0	157.0	30.2	2.6	90.7	644	2,906
	Public Buildings (ths):	0.5	8.2	1.3	1.1	0.6	0.2	0.1	0.3	43	1.7	4.6	1.6	0.2	3.3	24	67
	Comml. / Indl. / other Bui	1.7	17.0	2.5	1.6	0.9	0.3	0.1	0.7	89	5.2	7.5	3.0	0.2	6.8	47	136
	All Buildings (ths):	11	266	32	28	13	3	1	6	2,393	49	169	35	3	101	715	3,109
	Hectares of Major Crops (	6.4	169.7	7.7	18.6	8.6	0.1	1.6	3.6	1,351	35.6	84.0	36.0	1.9	78.4	452	1,803
Cost of Replacing Assets (billion USD):	Buildings:	$ 1.3	$ 18.9	$ 1.7	$ 1.0	$ 1.4	$ 0.4	$ 0.2	$ 1.3	$ 39.5	$ 2.1	no data	2.53	0.23	2.86	$ 33.98	$ 73.49
	Infrastructure:	$ 0.1	$ 3.1	$ 0.3	$ 0.2	$ 0.3	$ 0.0	$ 0.1	$ 0.2	$ 6.6	$ 0.5	no data	0.26	0.04	0.42	$ 5.43	$ 12.07
	Crops:	$ 0.01	$ 0.2	$ 0.01	$ 0.01	$ 0.01	$ 0.00	$ 0.00	$ 0.00	$ 3.1	$ 0.0	no data	0.032	0.001	0.025	$ 0.33	$ 3.40
	Total:	$ 1.4	$ 22.2	$ 2.0	$ 1.2	$ 1.7	$ 0.5	$ 0.2	$ 1.5	$ 49.2	$ 2.6	no data	2.82	0.27	3.30	$ 39.75	$ 88.96
Total Government Fiscal Data:	Revenue (billion USD)	$ 0.09	$ 0.65	$ 0.15	$ 0.09	$ 0.10	$ 0.01	$ 0.02	$ 0.07	$ 2.2	$ 0.2	no data	0.082	0.045	0.174	$ 1.66	$ 3.87
	(% GDP):	36%	22%	53%	62%	67%	39%	99%	39%	23%	30%	no data	23%	142%	24%	26%	24%
	Expenditure (billion USD)	$ 0.08	$ 2.73	$ 0.16	$ 0.11	$ 0.10	$ 0.01	$ 0.02	$ 0.07	$ 2.8	$ 0.2	no data	0.099	0.043	0.179	$ 3.83	$ 6.65
	(% GDP):	32%	91%	55%	72%	67%	39%	103%	42%	30%	40%	no data	28%	134%	25%	60%	42%
Est. loss (million USD) 0.01 annual probability	Tropical Cyclone	$ 125	$ 1,026	$ 185	$ 1	$ 81	$ -	$ 28	$ 42	$ 532	$ 165	no data	$ 155	$ 2	$ 384		
	Earthquake and Tsunami	$ -	$ 27	$ 6	$ 1	$ 3	$ -	$ -	$ 1	$ 749	$ 116	no data	$ 179	$ 5	$ 212		
Est. loss (%) 0.01 annual probability	Tropical Cyclone	8.8%	4.6%	9.0%	0.04%	4.8%	0%	11.1%	2.8%	1.1%	6.3%		5.5%	0.6%	11.6%		
	Earthquake and Tsunami	0%	0.12%	0.28%	0.08%	0.18%	0%	0.00%	0.05%	1.52%	4.40%		6.36%	1.94%	6.42%		

Data: Country Risk Profiles, 2011, Pacific Catastrophe Risk Assessment and Financing Initiative

[15] Ibid.

Table A2: Value of PICs' Infrastructure

Source: AIR Worldwide, 2011

Infrastructure	CK	FJ	FM	KI	MH	NI	NR	PG	PW	WB	TL	TO	TV	VU	WS	TOT
Airport	$21	$54	$41	$40	$44	$13	$12	$204	$12	$22	$25	$29	$8	$37	$23	**$585**
Bridge	$3	$180	$23	$12	$1			$139	$23	$19	$152	$1		$7	$13	**$574**
Bus station		$0						$0							$0	**$0**
Communications	$0	$0		$0	$0		$0	$0	$0	$0		$0		$0	$0	**$1**
Dam		$300						$400								**$700**
Dock	$3	$3	$10	$1	$3	$0	$1	$6	$4	$4	$0	$6	$0	$2	$1	**$43**
Generator	$0	$0						$0		$0		$0		$0	$0	**$0**
Helipad					$1											**$1**
Mine								$2,210		$100	$10					**$2,320**
Oil & gas		$40						$200		$100	$20			$20	$20	**$400**
Port	$10	$482	$85	$24	$182	$1	$5	$641	$27	$101	$15	$25	$5	$65	$30	**$1,698**
Power plant	$14	$339	$41	$21	$29	$5	$10	$685	$15	$62	$19	$17	$10	$35	$76	**$1,375**
Water intake	$1	$1				$1		$0		$0		$7		$0	$0	**$11**
Storage tank	$2	$5	$1	$1	$2	$0	$2	$3	$0	$1	$0	$2	$0	$1	$1	**$21**
Sub-station	$4	$3						$3		$1	$5		$8	$5		**$28**
Water treatment		$20			$2		$2	$10	$2	$6	$4			$4	$4	**$54**
Rail		$32														**$32**
Roads	$61	$1,635	$113	$66	$24	$54	$11	$2,137	$76	$5	$1,911	$172	$8	$244	$300	**$6,814**
Total	**$118**	**$3,094**	**$313**	**$164**	**$286**	**$74**	**$42**	**$6,639**	**$160**	**$420**	**$2,161**	**$259**	**$40**	**$420**	**$467**	**$14,657**

A1 Perils

This section discusses perils most relevant to PIC infrastructure at different stages of the asset life cycle. First considered are natural hazards, which affect infrastructure throughout the life cycle, then perils during the planning and design stages, followed by construction risk and lastly the O&M stage.

A1.1 Natural hazards

Natural hazards refer to naturally occurring (as opposed to anthropogenic) perils. There are several schemas for categorizing and defining natural hazards, a useful example of which is shown in Figure A1. Of these, the most relevant for PICs' infrastructure are:

- Hydro-Meteorological ("hydro-met"), particularly tropical cyclone, flooding including for both mass movement and coastal erosion, drought and extreme temperature.
- Geophysical, particularly earthquake and volcanic activity including for both tsunami, but also mass movement;

Table A3 is a list of natural hazards, deaths, and damages for the period 1975–2022, from which it can be seen that the PICs have sustained over 5,000 deaths and almost $4 billion[16] during this period from natural hazards.

Figure A2 is a breakdown of Average Annual Losses (AAL)[17] by the most significant natural hazards for Pacific Small Island Developing States (SIDS),[18] estimated by the United National Economic and Social Commission for Asian and the Pacific (ESCAP). As can be seen hydro-met, particularly tropical cyclone, drought and flooding, represent 85% of AAL for the region, with geophysical, particularly earthquake, representing the remainder. The AAL for the region is estimated to be about $1 billion or about 5% of the regional GDP.

The distribution of population vis-à-vis hydro-met hazards is shown in Figure A3, and vis-à-vis seismic hazard in Figure A4. Figure A5 and Figure A7 show other breakdowns of natural hazard risks. Figure A8 shows sectoral impacts for selected recent natural hazards for six PICs, while Figure A9 shows an increasing trend for natural hazards losses in the Pacific.

[16] The EM-DAT compilation is dollars in year of the disaster and is not present-valued, so the sum is of mixed years/valuations.

[17] Average Annual Losses are the mean losses expected to occur each year, for perils considered.

[18] SIDS considered by ESCAP are the PICs considered in this study as well as American Samoa, French Polynesia, Guam and New Caledonia.

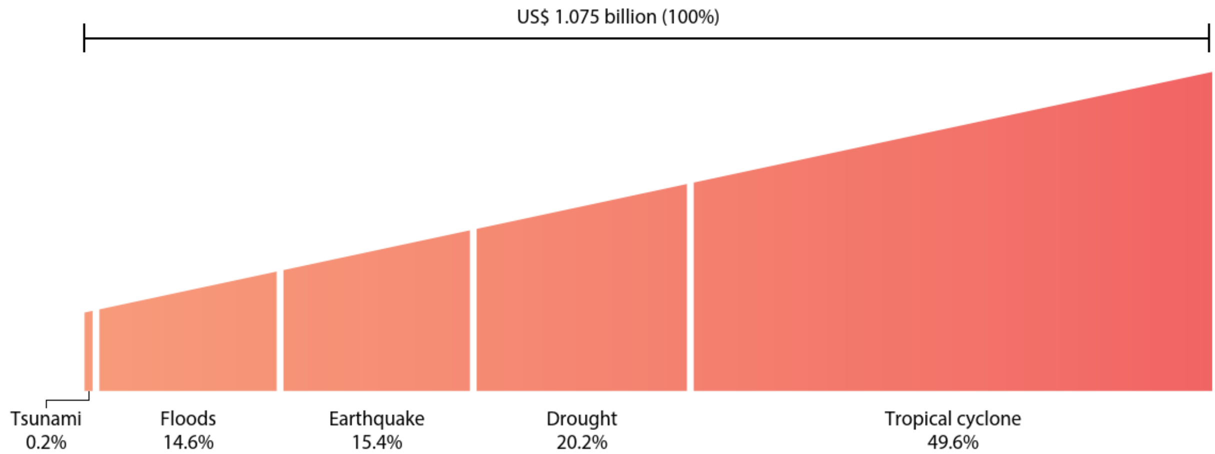
Figure A1: Classification of Natural Hazards Perils Per Family, Main Event and Peril Levels. Note: The association of perils with main events is solely a suggestion and is non-exhaustive. Some perils may change their association based on the actual event and loss trigger.

Source: IRDR, 2014.

Table A3: List of Deaths and Damages PICs, 1975–2022

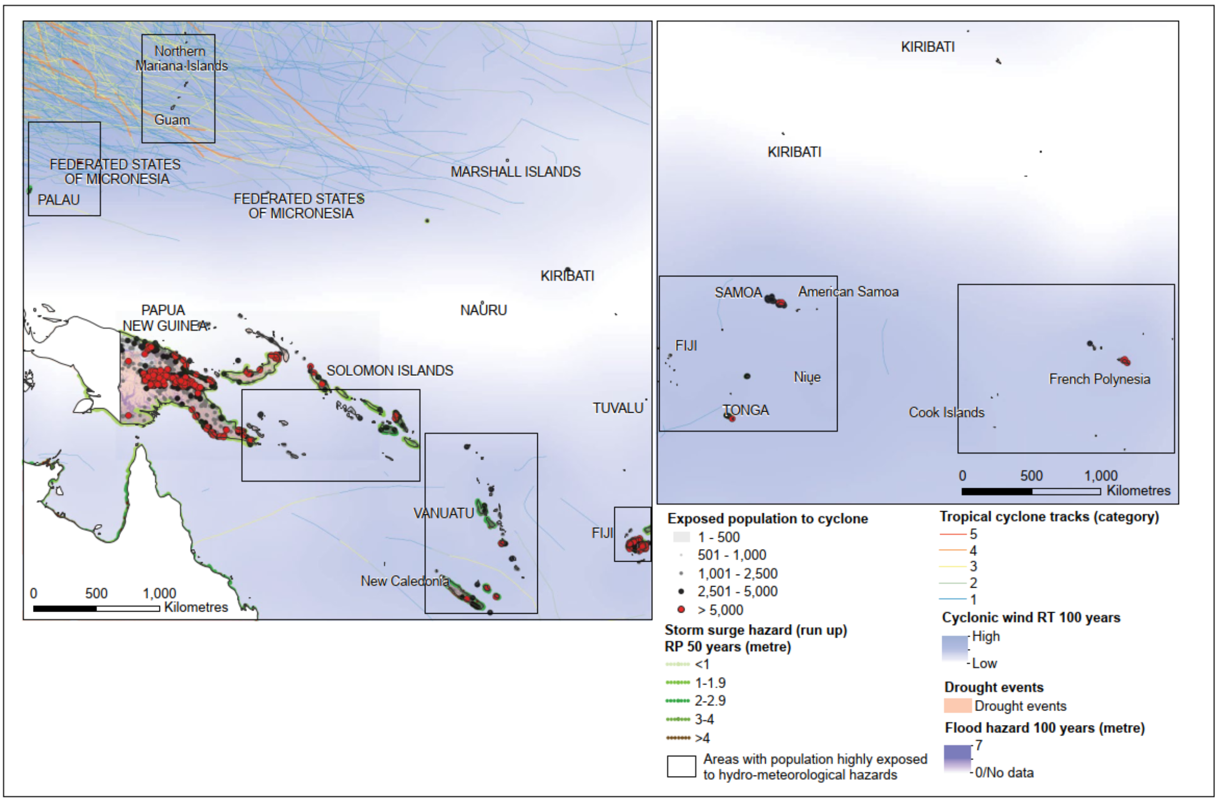
Source: https://www.emdat.be/database

	Sum of Total Deaths								Sum of Total Damages (USD millions)								Tot Deaths	Tot Damages (USD millions)
PIC	Drought	EQ	Epid.	Flood	Landslide	Storm	Volc	Wildfire	Drought	EQ	Epid.	Flood	Landslide	Storm	Volc	Wildfire		
Cook Islands (the)			7			25								$25	-	-	32	$25
Fiji				70		291			$30			$185		$1,127	-	-	361	$1,342
Kiribati			17												-	-	17	$0
Marshall Islands (the)			6						$5						-	-	6	$5
Micronesia (Federated States of)			19			58								$18	-	-	77	$18
Niue			1			1								$40	-	-	2	$40
Northern Mariana Islands (the)						5									-	-	5	$0
Palau															-	-	0	$0
Papua New Guinea	84	2435	448	86	427	219	9		$60	$95		$85		$2	110	-	3708	$351
Samoa		148	83			43				$124		$2		$658	-	32	274	$815
Solomon Islands		297	8	70		164				$2		$26		$22	-	-	539	$50
Tonga		10				9	4			$11				$222	125	-	23	$358
Tuvalu															-	-	0	$0
Vanuatu		12	12		1	125								$656	-	-	150	$656
Grand Total	**84**	**2902**	**601**	**226**	**428**	**940**	**13**	**0**	**$95**	**$232**		**$297**		**$2,770**	**235**	**32**	**5,194**	**$3,660**



Source: ESCAP based on probabilistic risk assessment.
Note: Volumetric analysis is a measurement by volume (impacted population, geographic area and economic losses)

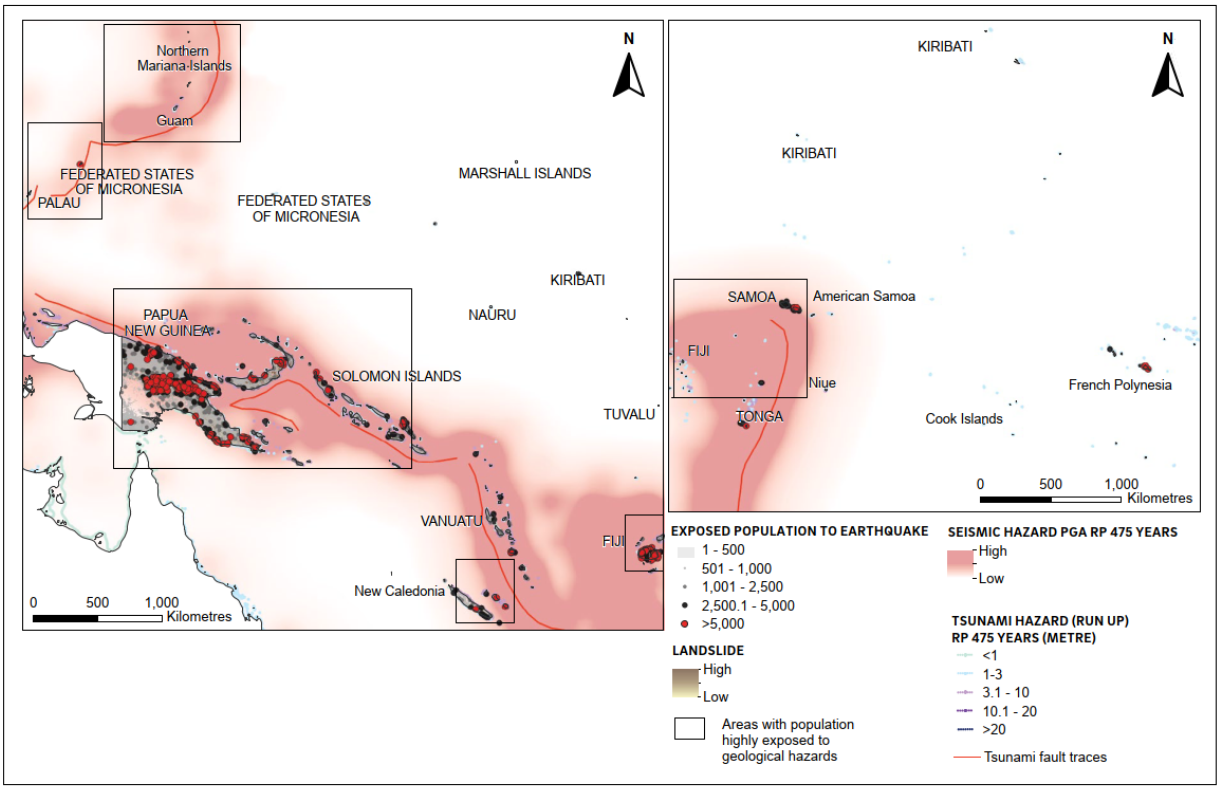
Figure A2: Natural hazards Average Annual Losses for Pacific Small Island Developing States. Source: ESCAP, 2020



Sources: ESCAP, based on Global Assessment Report on Disaster Risk Reduction (GAR) Risk Atlas, 2015; Global Risk Data Platform, 2013.
Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.
Note: Cyclone data consist of all cyclone wind categories with a return period of 100 years and an intensity of 119 km/h to more than 252 km/h.

Figure A3: Distribution of PICs Population vs. Hydro-Met Hazards.

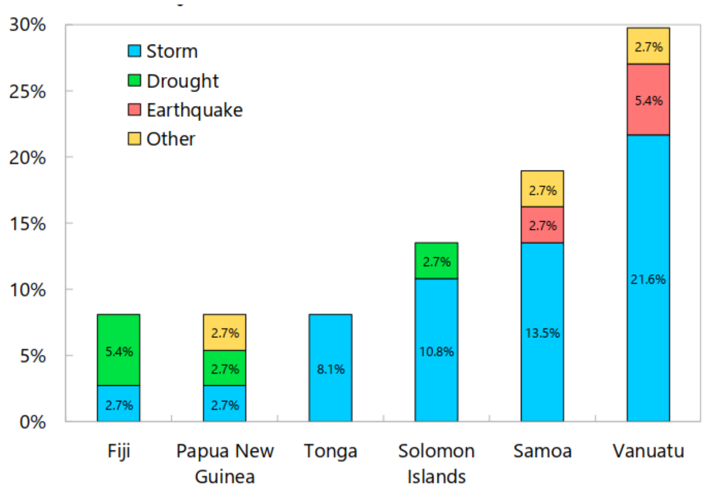
Source: ESCAP, 2020.



Sources: ESCAP, based on Global Assessment Report on Disaster Risk Reduction (GAR) Risk Atlas, 2015; Global Landslide Hazard Distribution v1, 2000.
Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.
Note 1: Peak Ground Acceleration (PGA) Return Period (RP) 475 years is the seismic hazard with a return period of 475 years expressed in peak ground acceleration. This means that a level of ground shaking is expected to occur once in 475 years. Tsunami hazard RP 475 years is a tsunami hazard run-up height with a return period of 475 years.
Note 2: The value of PGA 475 years used in this quantification is from 90 to 334 cm/s².

Figure A4: Distribution of PICs Population Vs. Seismic Hazards.

Source: ESCAP, 2020.



Note: "Others" includes volcanic activity, epidemic, landslide, mass movement, and wildfire.

Figure A5: Probability Per Year by Type of Severe Natural Disasters in PICs
Source: Lee et al., 2018.

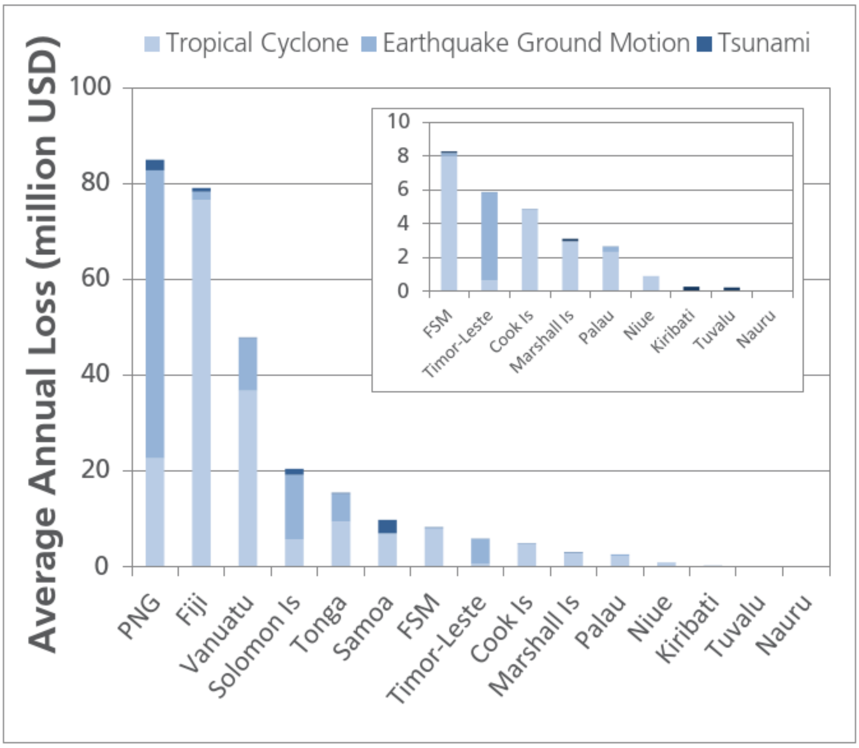


Figure A6: Average Annual Loss for All the 15 Pacific Island Countries

Source: PCRAFI, 2011

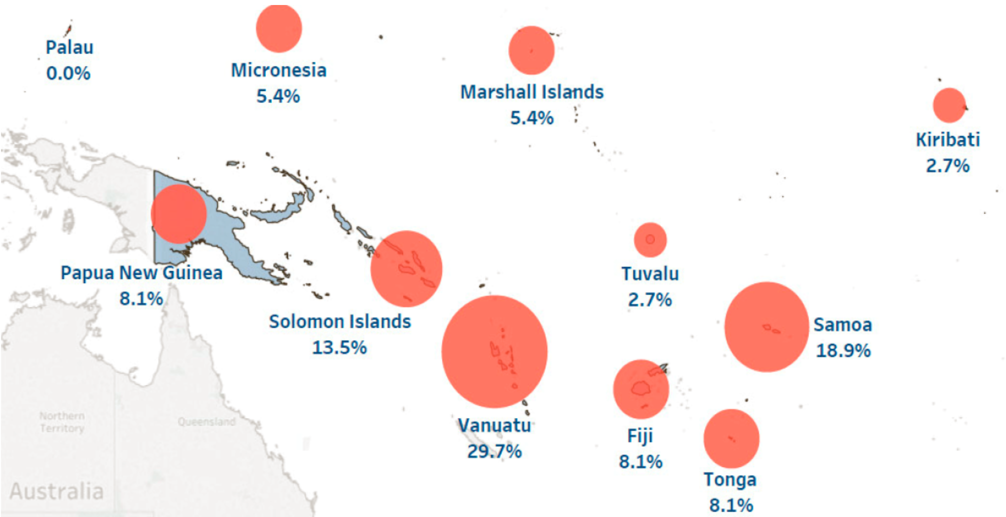
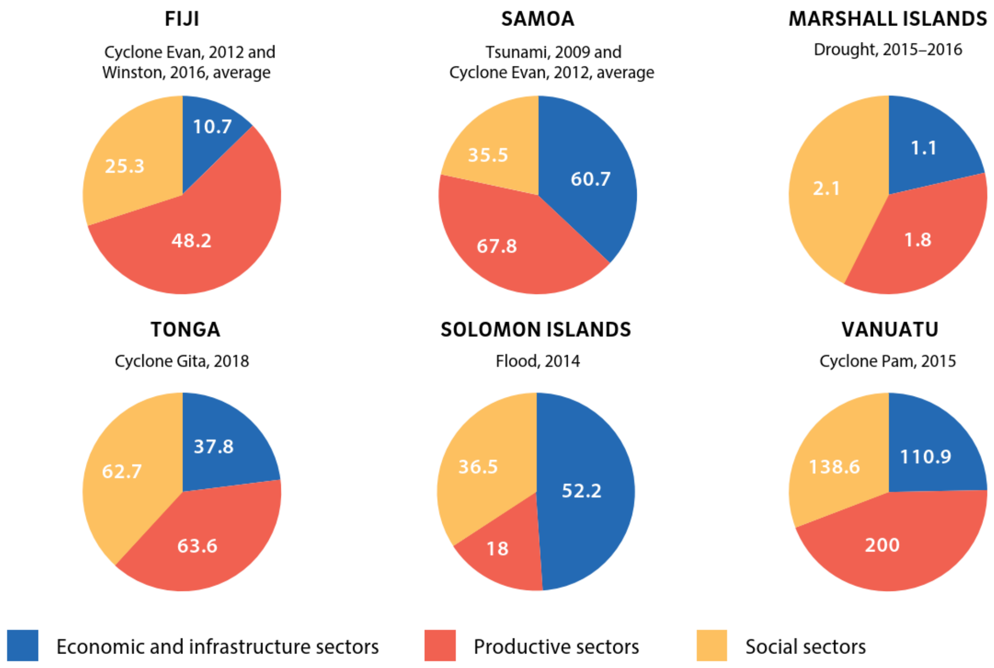


Figure A7: Probability per year of Severe Natural Disasters in PICs

Note: The size of circle denotes the probability that each country is hit by a severe (above 75th percentile) natural disaster.

Source: Lee et al., 2018



Source: ESCAP, based on Global Facility for Disaster Risk Reduction, 11 Post Disaster Needs Assessment reports available for last 10 years in the Pacific.

Figure A8: Sectoral Impacts of Selected Natural Hazard Events, Six Pacific Island Countries.

Source: ESCAP, 2020.

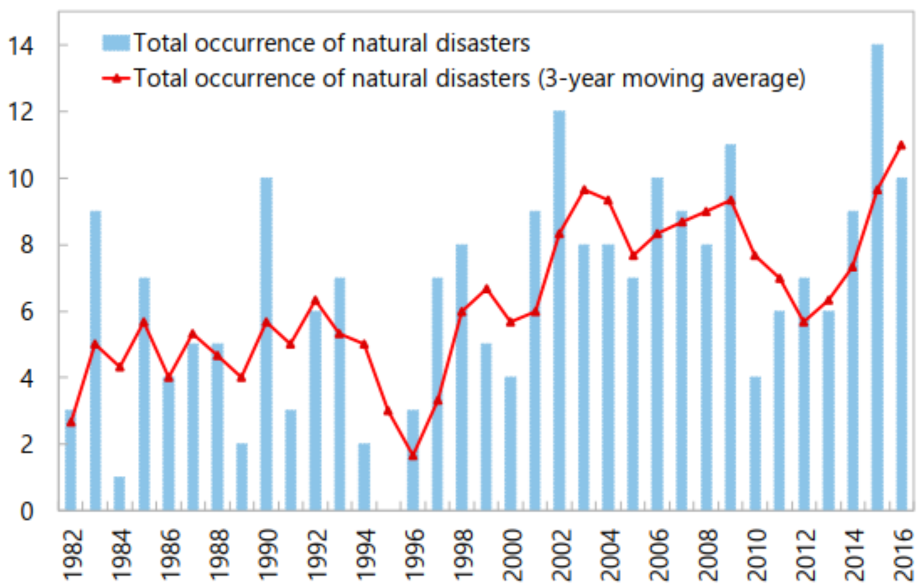


Figure A9: Natural Disasters are Increasing in Pacific Island Countries

Source: Lee et al., 2018

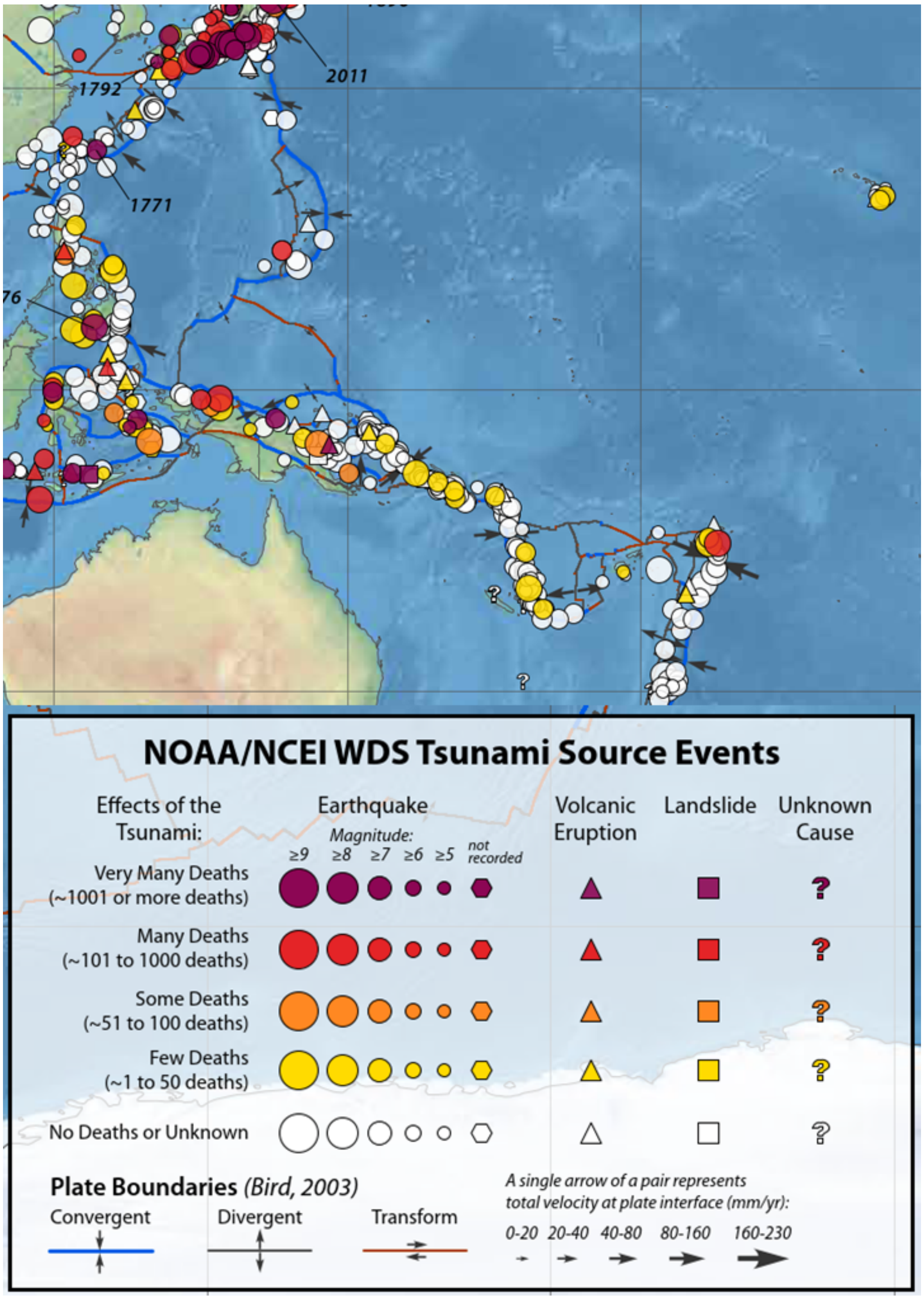


Figure A10: Tsunami Source Events 1610 BC to AD 2022

Source:

http://itic.iocunesco.org/images/stories/awareness_and_education/map_posters/2022_tsu_poster_20220606_a2.pdf

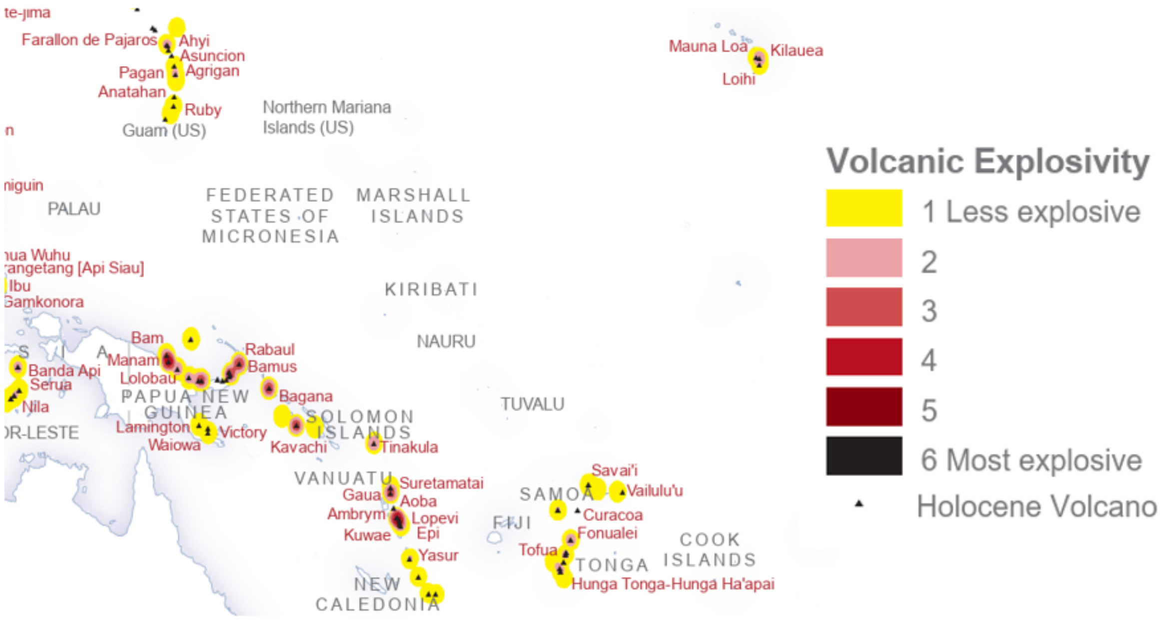


Figure A11: Volcano Hazard Map, Asia-Pacific

Source: https://reliefweb.int/map/world/asia-pacific-regional-hazard-map-holocene-eruption-and-selected-volcanoes

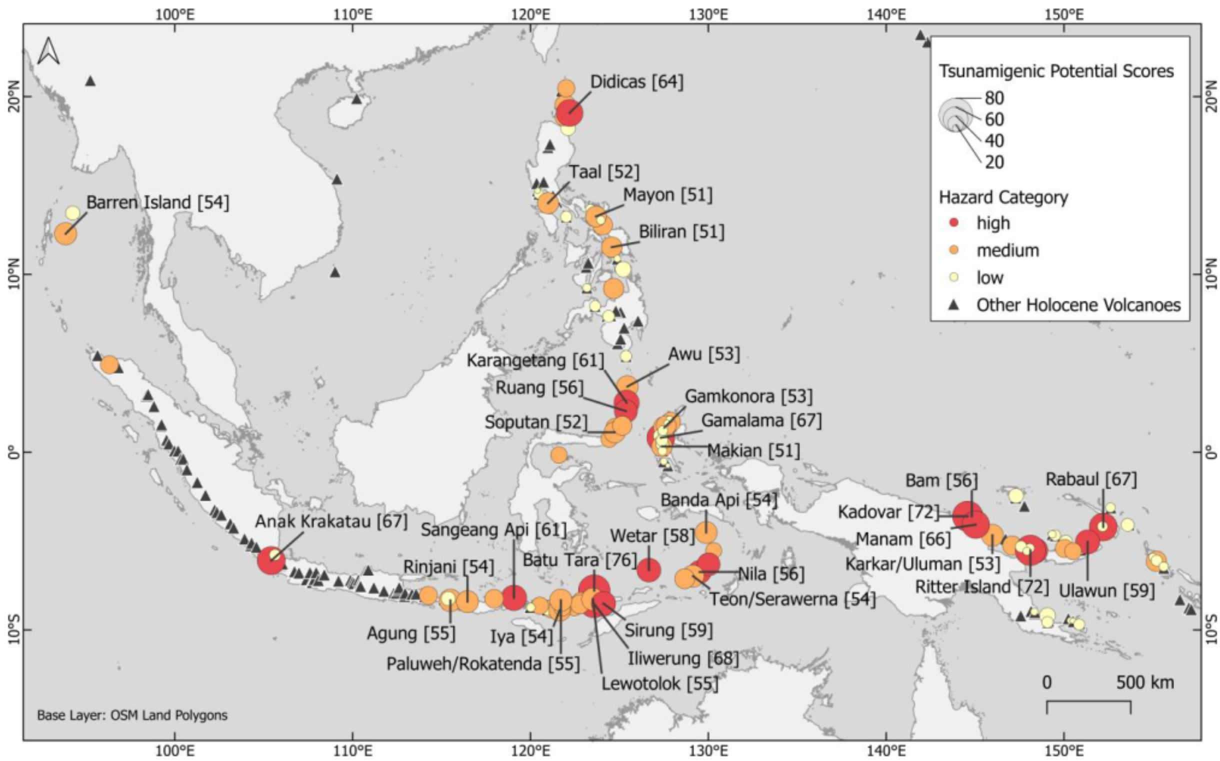


Figure A12: Map of Tsunamigenic Volcanoes from a Study Focused on Southeast Asia

Source: Zorn et al., 2022

It should be noted that there is significant uncertainty regarding natural hazards. Both the 2004 Mw9 Indian Ocean and 2011 Tohoku (Japan) earthquakes and tsunamis were largely unforeseen but had precedents that were uncovered afterwards. The Hunga Tonga-Hunga

Ha'apai volcanic eruption of 15 January 2022 caused an estimated $90 million in Tonga representing about 18% of the country's GDP.[19] A recent study of tsunami-genic volcano hazard for Southeast Asia found several volcanoes in PNG that could generate tsunamis potentially affecting many PICs (Figure A12).

A1.2 Climate change

Climate change is an increasingly important contributor to infrastructure risk. Moreover, it has more uncertain but potentially very significant impacts on PICs. The IPCC's 6th Assessment is currently in the process of being released and is not yet fully available, but initial releases conclude (IPCC, 2021) that "*It is unequivocal that human influence has warmed the atmosphere, ocean and land.*" and "*Global warming of 1.5°C and 2°C will be exceeded during the 21st century unless deep reductions in CO2 and other greenhouse gas emissions occur in the coming decades.*"[20] It also indicates that impacts on PICs have less agreement and data than impacts for other regions.

The Pacific Island region accounts for only 0.03% of the world's total greenhouse gas emissions but is one of the regions that is facing the greatest impacts of climate change from rising sea levels, warming oceans, drought, coral ecosystem destruction, ocean acidification, and extreme weather.[21] For PICs, some the more salient climate change impacts for infrastructure include:[22]

- Sea-level rise
- Changing weather patterns and extreme events
- Pressure on water and food
- Human health risks
- Impacts on wildlife and ecosystems
- Migration and displacement

In this regard, climate change threatens the existence of entire atoll island nations such as Kiribati, Tuvalu, and RMI. These states are only 1 to 3 meters above sea level and thus are

[19] GFDRR. 2022. *The January 15, 2022 Hunga Tonga-Hunga Ha'apai Eruption And Tsunami, Tonga, Global Rapid Post Disaster Damage Estimation (Grade) Report*. Global Facility for Disaster Reduction and Recovery. Washington, DC: World Bank Group.

[20] IPCC. 2021. Summary for Policymakers. In: *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Geneva: Intergovernmental Panel on Climate Change.

[21] https://www.theguardian.com/news/datablog/2011/jan/31/world-carbon-dioxide-emissions-country-data-co2

[22] For more detail on these impacts see ADB. 2017. *Implementation of the Strategic Program for Climate Resilience: Pacific Region*, Main Report (Project Number: 46449-001; p. 1008). Financed by the CIF Strategic Climate Fund, Prepared by the Secretariat of the Pacific Regional Environment Program (SPREP) Apia, Samoa, particularly Linked Document E, *Pacific Risks, Vulnerabilities, and Key Impacts of Climate Change and Natural Disasters.*

threatened by projected sea level rises of about 60 cm or more by 2100. Climate change is negatively affecting PICs' economies by changing patterns affecting the agriculture and fisheries sectors, water resources and the population's health.

Climate has less to little effect on geophysical perils[23] and is much more likely to exacerbate hydro-met perils. However, due to this, climate change is significantly increasing the risk for PICs. Tropical cyclones, the primary natural hazards peril for PICs, are expected to increase in intensity, though perhaps not frequency, in the future. Coastal erosion and flooding will increase due not only to more intense storms but rising sea levels. Climate change is also increasing ocean and land temperatures, causing shifts in patterns of rainfall and increasing saline intrusion.[24]

A1.3 Risk during Planning and Design stages

The planning and design stages of infrastructure projects bear relatively little direct risk but can plant the seeds for very significant risk. That is, planning and design are mostly professional activities occurring largely in offices often far removed from project sites, although there will be various site investigations. Physical risk to planners and designers is thus quite limited. The investment in these activities is only a small fraction of the total project cost, and the risk to this investment will be borne to varying degree by project owners and by professionals performing the planning, design, financing and other services. Risks to owners are largely the investment made during this phase, which is often borne directly by the investors without insurance or other risk transfer. Risks to the professionals involved are mostly of two types: (a) non-payment by owner, particularly if project fails at this stage, and (b) professional liability for Errors and Omissions. These risks, who bears them, the primary strategies taken to limit and manage these risks, and what insurance may be employed at this stage, are shown in Table A4.

Table A4: Risks during the Planning and Design Stages

Risk-bearer	Risk	Primary risk management strategies	Insurance, if employed
Owner	Costs of financing, planning, design, permitting, land acquisition and other pre-construction activities.	• Early government / agency commitments • Risk-sharing with financiers	Refer to Table 11

[23] There can be some effects: for example, one peril of a volcanic eruption are lahars (a hot or cold mixture of water and rock fragments that flows down the slopes of a volcano and typically enters a river valley), which may be modified by varying precipitation patterns due to climate change. Another example is seismic liquefaction, which occurs in areas of high-water tables, whose height might be affected by climate change. Generally speaking, however, these effects are less significant than climate effects on hydro-met perils.

[24] IPCC. 2021. Summary for Policymakers. In: *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Geneva: Intergovernmental Panel on Climate Change.

Risk-bearer	Risk	Primary risk management strategies	Insurance, if employed
Planner/ Designers	• Non-payment by owner • Liability for E&O	• Contract with legal remedies • Payment schedule • Internal QA/QC	Refer to Table 11

However, at this stage and in the context of the PICs, risks for designers are particularly exacerbated by the situation regarding building codes, including compliance during construction. Table A5 shows the status of building regulations and national building codes for PICs, from which it can be seen that three of the 13 countries (representing 6% by population) lack any building code at all, and four countries have national building codes more than 20 years old which have not been reviewed or updated since publication (or have had only a limited review). Moreover, many of the building codes refer to Australian/New Zealand (A/NZ) standards that are difficult and costly to access.

More worrying still is that while designers may correctly specify materials, compliance during construction assuring these materials is problematic. As noted by (Gwilliam, 2021):

- "Many Pacific countries have no national building board or central agency mandated to administer and manage building control.
- "In most Pacific countries, legislation does not set out guidelines for regulating or providing technical management of the national building codes.
- "In most Pacific countries the procedures for obtaining a building permit involve input from a variety of institutional bodies and is cumbersome and time consuming.
- "In all Pacific countries there are insufficient building inspectors to manage the building permit process and enforce compliance.
- "In all Pacific countries, building inspectors have not received any or only limited training on national building code compliance procedures.
- "Building inspectors based in the provinces do not have funds for logistical support.
- "Many private sector architects and engineers do not understand the national building code permit application process.
- "Pacific countries governments have not prioritized allocating resources to manage the national building codes.
- "Most Pacific country regulatory authorities do not have the skills or resources to technically assess complex building permit applications, such as highrise commercial buildings or hospitals."

Table A5: Status of the Building Regulations and National Building Codes for Each of the 13 Pacific Countries

Source: Gwilliam, 2021.

	Cook Islands	FSM	Fiji	Kiribati	Nauru	Niue	Palau	Marshall Islands	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
Population (Asian Development Bank mobile statistics, 2020)	17,379	104,937	898,760	114,395	11,347	1,624	21,503	53,066	195.125	599,519	107,122	11.097	270.402
Questionnaire received workshop completed	email	Yes	Yes	Yes	Yes	email	email	Yes	Yes	Yes	email	email	Yes
National building code exists (original date)	Yes (1990)	No	Yes (1990)	Yes (2000)	No	Yes (1990)	No	Yes (1987)	Yes (1990)	Yes (1990)	Yes (2001)	Yes (1990)	Yes (1990)
National building code is legislated (date legislated)	Yes	.	Yes (2004)	Yes (2017)	...	Yes (1992)	...	Yes (1987)	Yes (2002)	No	Yes (????)	No	Yes (2017)
Latest building code update (date)	(2018)	...	None	Limited (2010)	...	(2019)	...	(2019)	(2017)	Limited (2016)	(2018)	(2019)	Limited (2000)
Building code update enacted (date)	Before Cabinet	...	...	...	...	Before cabinet	...	Before cabinet	(2019)	...	Before cabinet	Before cabinet	...
Construction manual targeted at local builders exists (name and date)	Home builders manual (HBM) (1990)	None	HBM (1990)	National sanitation guidelines (Draft)	None	Acceptable solutions handbook (2019) HBM	None	None	HBM (1992) 5 no national building code handbooks (2017)	HBM (1990)	Tie down systems (2004)	HBM (1990)	HBM (1990)
Construction handbook targeted at home owners exists (name and date)			Fiji Shelter Handbook 2019	None in regular use				Climate change, disaster and energy handbooks	Residential guidelines (2017)	None in regular use			
Legislation exists to control building materials standards	No	No	1992	No	No	No	No	No	No	No	No	No	No
Agency (s) responsible administering and maintaining the national building code	ICI	...	MOH MOITT	MISE QCIU	...	MOI	BOPW	MWIU	MWTI	MID	Moi	PWD	MOIA MOIPU
Agencies responsible for approving building permits enforcing compliance and issuing completion certificates	ICI	...	MOLAHE (Councils and Provinces)	QCIU	...	MOI	...	MWIU. NBC is not enforced on non-gov bldgs	MWTI	MID, Honiara Council, Provincial Gov.	MOI	PWD	MOIPU Municipal & Local Gov Councils.
Organizations representing building profession		None	CIC, SPEA FAA, FBDA, FIE, FMBA	None	None	None	None	None	IPES SPEA	SIBPEA			None
Technical and vocational Institutes where construction technology is taught		FSM College of Micronesia	FNU, APTC, Trade Colleges	KIT APTC	USP TVET			College of the Marshall Islands	APTC, NUS	SINU, RTC			VIT VRDTCA
Materials testing Labs exist	No	No	Yes	Yes	No	No	No	No	Yes	Yes	Yes	No	Yes

... = not xxxx, FSM = Federated States of Micronesia.

GOVERNMENT: BOPW = Bureau of Public Works, HBM = Home Builders Manual, MWTI = Ministry of Works Transport and Industry, MID = Ministry of Infrastructure and Development, MWIU = Ministry of Works, Infrastructure and Utilities, MISE = Ministry of Infrastructure and Sustainable Energy, MOITT = Ministry of Industry Trade and Tourism, MOLAHE = Ministry of Local Authority, Housing and Environment, MOH = Ministry of Health, QCIU = Quality Control and Inspection Unit, MOIA = Ministry of Internal Affairs, MOIPU = Ministry of Infrastructure and Public Utilities, ICI = Infrastructure Cook Islands, DTCI = Department of Transportation, Communications and Infrastructure, MOI = Ministry of Infrastructure, PWD = Public Works Department.

CONSTRUCTION AND INDUSTRY: CIC= Construction Industry Council, IPES = Institute of Professional Engineers of Samoa, SIBPEA = Solomon Islands Building Professionals and Engineering Association, SPEA = South Pacific Engineers Association, FAA = Fiji Association of Architects, FBDA = Fiji Building Designers Association, FIE = Fiji Institute of Engineers, FMBA = Fiji Master Builders Association.

TEACHING INSTITUTIONS: SINU = Solomon Islands National University, RTC = Rural Training Centre, APTC = Australia Pacific Training Coalition, NUS = National University of Samoa, FNU = Fiji National University, TVET = Technical and Vocational Education Training, USP = University of the South Pacific, KIT = Kiribati Institute of Technology, VIT = Vanuatu Institute of technology, VRDTCA = Vanuatu Rural Development & Training Centre Association

A1.4 Construction risk

The construction stage of infrastructure projects has the greatest risk, particularly physical risk such as accidents. The investment at this stage ramps up quickly to a large fraction of the total project cost, and the risk to this investment will be borne to a significant degree by project owners, to some extent by professionals performing the planning, design, financing, and other services, but to a great extent by the construction contractor.

The first line of defense against any risk should be good practice, examples of which are shown in the Table A6 column under "Primary risk management strategies". In many cases, the first resort is to the agreement or contract between the parties. A contract form often employed in the PICs are the FIDIC suite of contracts,[25] which address most of the risks discussed above.

Risks to owners and professionals include poor performance by the construction contractor, which as a last resort are typically covered by a surety bond.

Risks to the construction contractor are manifold, as shown in Table A6, where "CAR" denotes Contractors All Risk insurance policy (also known as Construction Works, Builders All Risk, Erectors All Risk, etc.). The CAR policy is intended to provide broad coverage related to the construction project but does not cover all risks of course. CAR coverage typically includes fire, accident, vandalism, water damage, construction faults, and negligence. Depending on the insurer and project, CAR coverage may or may not include natural hazards such as flood, wind, and earthquakes. CAR coverage typically does not cover normal wear and tear, willful negligence, or poor workmanship. Any CAR policy can be negotiated to cover additional items.

While good practice is the first and best resort for managing risks during the construction stage, most projects cannot be executed without a CAR.

A1.5 Operations and Maintenance risk

Following takeover of the completed project by the Owner, the project enters the O&M stage, which for infrastructure will have a duration of many decades, with the value at risk now at its maximum. Many of the same risks that exist during the Construction stage will also exist during the O&M stage, albeit in some cases at a reduced per annum level. Due to the long life of infrastructure however, these per annum risks accumulate over decades, so that some risks, particularly natural hazards risk, are quite significant over the duration of this stage.

Key to managing risks during this stage is good maintenance of the physical infrastructure. Previous studies have identified this as a challenge in the PICs.[26]

[25] FIDIC (International Federation of Consulting Engineers, www.fidic.org) publishes a standard series of contracts known by the color of the cover – the most relevant in this context is the FIDIC "Red Book" *Conditions of Contract for Construction for Building and Engineering Works Designed by the Employer*. FIDIC contracts are preferred by most MDBs.

[26] PRIF. 2013. *Infrastructure Maintenance in the Pacific: Challenging the Build-Neglect-Rebuild Paradigm*. Sydney: Pacific Region Infrastructure Facility.

While good maintenance is necessary for managing risks during the O&M stage, a property insurance policy for damage due to fire, accident and other ordinary risks is good practice. Moreover, a catastrophe cover for natural hazards perils is wise.

Table A6: Risks during the Construction Stage

Risk-Bearer	Risk	Primary risk management strategies	Insurance, if employed
Owner	Contractor error Contractor insolvency Force majeure (war…)	Contractual protection ditto ditto with financiers	Surety Bonds / Performance Bonds / CAR [27]
Planner / Designer / Financier	Contractor errors Contractor claims	Contractual protection	Professional liability; Errors & Omissions
Contractor	Delay in possession of site	Contractual protection	Delay in Start Up
	Differing conditions	Ditto	Difference in Conditions; Difference in Limits; CAR
	Labor disputes	Contractor agreement with labor	CAR
	Inclement weather	Allowed for in construction schedule	CAR
	Noise, fume, and dust	Allowed for in construction planning	CAR; Pollution Liability
	Defective materials and workmanship	on-site QA/QC, independent inspection	-
	Subcontractors' inefficiency	Contractual protection / construction planning	-
	Design E&O	Ditto	Errors & Omissions
	Design changes	Ditto	Errors & Omissions
	Natural hazards (e.g., storms, earthquake, floods, etc.)	Allowed for in design and construction planning	CAR
	Vandalism	Site security	CAR

[27] A typical requirement is that the CAR policy protects the owner and design professionals as well as the contractor.

	Accidents	Construction management	Workers Compensation / Employers Liability
	Supply-chain risk	Allowed for in construction planning	Business Interruption / Consequential Loss
	Delay in payments	Contractual protection	A
	Inflation	Allowed for in construction financing	B
	Owner insolvency	Contractual protection	C
	Foreign exchange risk	Allowed for in construction financing	D

Note
A Contingent financing arrangement possible
B Asset value / contract values sums insured can be periodically increased
C Performance Bonds used if Contractor becomes insolvent
D Contingent financing arrangements possible / hedging

A Summary

A review of the risk landscape for infrastructure in the PICs shows:

1. PICs are among the most vulnerable countries in the world.
2. Infrastructure is crucial to reducing this vulnerability and improving PICs' standard of living.
3. Current PIC infrastructure value at risk is currently about $26 billion, about equal to PICs annual GDP
4. PICs are estimated to require about $3 billion in infrastructure investment per year through 2030, representing about 9.1% of GDP if adjusted for climate change impacts.
5. Current investment is lagging far behind what is needed however, with estimates of actual investment being about a third to a half of what is needed.
6. Much of current infrastructure investment is in the transport sector, often is very close to coastlines and therefore particularly at risk both to flooding due to tropical cyclones or tsunamis, as well as sea-level rise.
7. A broad range of natural hazards perils to infrastructure exists, dominated by tropical cyclone and flooding although geophysical risks due to earthquakes and volcanic eruption are also significant.
8. The average annual loss for the region due to natural hazards is estimated to be about $1 billion or about 5% of the regional GDP.
9. These risks are not uniform across the PICs but rather vary substantially.
10. Climate change is an increasingly important contributor to and disproportionately borne by PICs infrastructure risk – PICs contribute about 0.03% of the world's total greenhouse gas emissions but are among the regions facing the greatest impacts of climate change from rising sea levels, warming oceans, drought, coral ecosystem

destruction, ocean acidification, and extreme weather. In fact, climate change is an existential threat to entire atoll island nations such as Kiribati, Tuvalu, and RMI.

11. Beyond natural hazards and climate change, risk to PICs infrastructure include all the mundane risks of the built environment, extending across the planning, design, construction and O&M stages of the infrastructure life cycle.
12. Infrastructure values at risk during the planning and design stages are moderate relative to overall project value and are largely managed through ordinary mechanisms such as contractual terms and good practice, with professional liability insurance as the last resort.
13. A significant constraint on design in the PICs however is the heterogeneity of building codes, building standards access and paucity of quality control infrastructure (e.g., materials testing laboratories).
14. Infrastructure values at risk during the construction stage build toward total project value and can be managed through ordinary mechanisms such as contractual terms and good practice. However, a CAR insurance is necessary for most projects.
15. The O&M stage of the infrastructure life cycle extends over many decades, during which maintenance is key to good performance. However, PICs maintenance practices require improvement.
16. Property damage insurance to cover fire, accident and other ordinary risks during the O&M stage is good practice. Moreover, a catastrophe cover for natural hazards perils is wise.

APPENDIX B. Insurance

B1 Examples of Natural Disaster Insurance Schemes

Table B1: Examples of Natural Disaster Insurance Schemes

		Features	Parties
1	Pacific Catastrophe Risk Insurance Company (PCRIC)	Sovereign risk transfer Earthquake and Tsunami Five PICs insured Insurance over $40m	World Bank International Donors Willis Towers Watson
2	Caribbean Catastrophe Risk Insurance Facility (CCRIF)	Sovereign risk transfer Hurricane and Earthquake, Excess Rainfall Maximum aggregate limit $100m 16 countries Deductible $7m Swiss Re. cover $35m Started as a parametric scheme, evolved to a Modelled Loss basis after 3 years and more modelling work	World Bank Treasury Swiss Re. Guy Carpenter
3	Mexico Multi Catastrophe	Hurricane and Earthquake Parametric Cat Bond $315m A hybrid scheme. Includes: - A parametric element for immediate post disaster payment - Indemnity based insurance to cover local government assets	World Bank Treasury Swiss Re. FONDEN (Mexico) Agroasemex SA
4	Japan Flood Disaster	Disaster risk finance solution Riverine and coastal floods Toyama area Earthquake and cyclone cover under discussion (indemnity and parametric)	City Government of Toyama Swiss Re.
5	China. Multiperil disaster insurance	Heilongjiang Provincial government Flood, Excess Rain, Drought, Temperature Parametric solution Annual contract. Sum Insured $360m Swiss Re 80% Quota Share reinsurance	Swiss Re. Sunlight Agro Mutual Insurance China Meteorological Agency

Source: Swiss Re Global Partnerships. 2017.

B2 Insurance Market Development

The reach of insurers in the region is mixed. Table B1 shows where insurers and insurance brokers are present. It is clear that different countries have developed at different speeds and are at different stages. Pacific Island countries (PICs) may be categorized into groupings, reflecting the presence of insurance regulation, and the existence of actors from other parts of the insurance ecosystem such as brokers, risk engineers, property valuers, claims assessment and adjusters etc.

- Area 1

PICs: Papua New Guinea, Fiji, Vanuatu, Solomon Islands

Availability of insurance for construction projects: Strong lead insurers are present, such as QBE Insurance Group, Tower Insurance and Capital Insurance. Established construction insurance markets exist.

Pacific Regional Infrastructure Facility (PRIF) project pipeline: 70% to 80% of projects can fall into this area.

- Area 2

PICs: Samoa, Tonga, Cook Islands

Availability of insurance for construction projects: There are limited lead insurers are present, examples would be Tower Insurance / Federal Insurance. Established insurance markets exist but construction insurance markets are limited.

PRIF project pipeline: 10% to 20% of projects can fall into this area.

- Area 3

PICs: Tuvalu, Niue, Nauru, Kiribati, Palau, Federated States of Micronesia, and the Marshal Islands.

Availability of insurance for construction projects: There are no lead insurers present, local insurance provision is limited as is regulation, and coverage for construction insurance is reliant on overseas insurers.

PRIF project pipeline: 5% to 15% of projects can fall into this area.

This situation shows that the issue is complex and that the solutions need to reflect this reality.

APPENDIX C. Contributors

The authors acknowledge and would like to thank the following individuals and organizations who contributed to the data collection process during the production of this report whose contribution has been invaluable.

Table C1: Contributors

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Source: Authors

Pacific Region
Infrastructure Facility

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ADB Australian Aid NEW ZEALAND FOREIGN AFFAIRS & TRADE European Union European Investment Bank JICA WORLD BANK GROUP