A Blue Transformation for Pacific Maritime Transport

OVERARCHING REGIONAL REPORT

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Foreword

The report titled *A Blue Transformation for Pacific Maritime Transport* - Overarching Regional Report gathers the research and analysis that has been prepared under the World Bank's A Blue Transformation for the Maritime Transport program. The program developed a broad understanding of what the key maritime issues are in the Pacific at a regional and national level. Likewise, it identified gaps where technical assistance can move forward and drive second-generation maritime transport investments with a solid analytical underpinning. The regional report balances the presentation of deep analyses from the program's various technical assessments and highlights its key findings.

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Executive summary

Pacific Island countries are a diverse set of island states, but face similar constraints on opportunities to grow their economies and reduce poverty.

The complexities of moving small numbers of people and goods around a vast ocean lies at the heart of the issue. The region's unique geography creates barriers to economic sustainability and growth.

The Blue Transformation for Pacific Maritime Transport program is looking for solutions. It aims to identify opportunities for significant change and investment that could improve services, facilitate economic activity, reduce poverty, and improve resilience and safety for Pacific Island communities.

For this to happen, sea transport needs to be appropriate, affordable, reliable, accessible, sustainable, and safe, within and between countries, now and in the future. Across the Pacific, this means supply chain security for essential imports and better connections with overseas export markets. Within a country, it will ensure people can access essential services and local markets, and maintain social ties, whether they live in major urban areas or on remote outer island communities.

Long-term benefits

The program aims to contribute to long-term benefits for Pacific Island countries: improved maritime safety; reduced maritime transport costs; initiatives to reduce ports' energy and resource consumption, waste, and environmental impacts ("green port" initiatives); increased resilience to climate change and natural disasters; greater capacity and capability in national and regional maritime institutions, and a decarbonized maritime sector ("blue shipping" initiative).

A fundamental truth underpins this report and influences its findings. The Pacific region has a unique economic geography that defines its maritime transport systems. That means solving the challenges for maritime connectivity in the Pacific requires an exclusive approach—the answers do not lie in what works in other parts of the world.

This report is a synthesis of several thematic assessments by the World Bank, including connectivity, vulnerability, institutions, and green ports assessments. Its intent is to create a shared understanding of where things are working quite well, where they are evolving and would benefit from further support, and where there are distinct gaps that require the attention of Pacific Island governments and regional agencies, supported by development partners and private enterprise. And that this will lead to better targeted and more coordinated programs with prioritized actions.

Structure of the Report

This report has eight chapters. Following the introduction (Pacific Peoples and the Sea), the next six chapters each focus on a separate significant component of Pacific maritime transport, analyzing the major influences and challenges, and, where relevant, key areas for future attention. The topics are:

- International shipping
- Gateway ports
- Domestic maritime transport
- Four related sectors—cruise ship tourism, tuna fisheries, fossil fuel imports, and bulk shipping
- Natural disasters and climate resilience
- Sector governance and institutions

The final chapter, *Transforming Pacific Maritime Transport—Ways Forward*, distils the report's findings into the most significant and far-reaching opportunities to transform maritime transport in the Pacific. These are grouped into three broad themes—infrastructure, services, and governance and capacity building. Ways Forward comes at the end and, for readers unable to view the whole report, is a good place to begin.

The rest of this executive summary explains why the Pacific is a special case for investment and provides a summary of the main chapters and findings. But first, it describes which Pacific Island countries contributed to the study.

Countries in the Blue Transformation Study

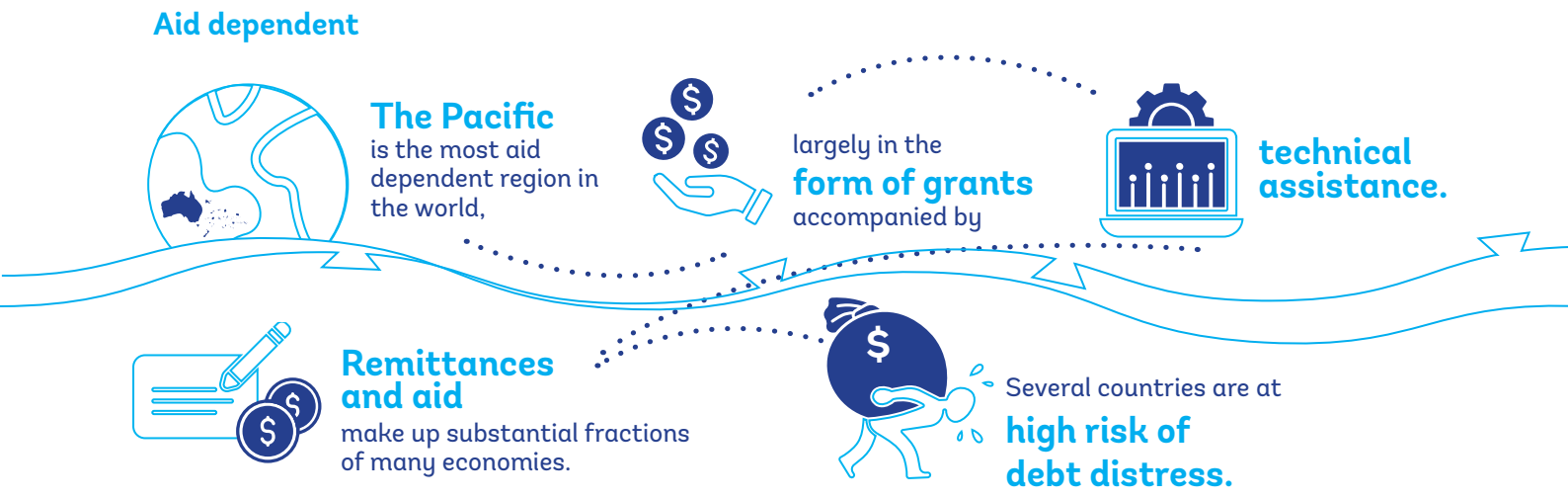
While maritime transport is fundamental to the lives and livelihoods of all Pacific Island states and dependencies, this report draws largely on the experiences of 12 World Bank member countries, referred to as the "PIC12 countries". These are the Melanesian countries of Papua New Guinea (PNG), Solomon Islands, Vanuatu, and Fiji; the Polynesian countries of Samoa, Tonga, and Tuvalu; and the Micronesian countries of the Marshall Islands (RMI), the Federated States of Micronesia (FSM), Palau, Kiribati, and Nauru.

The Melanesian countries have the largest land areas, populations, and resources, occupying 98.9 percent of the Pacific landmass and making up about 96 percent of its total population. Micronesian and Polynesian countries, atolls, and micro-states are smaller, and have a relatively tiny pool of people, but are collectively responsible for almost two-thirds of the PIC12 countries' vast oceanic exclusive economic zones.

Why the Pacific is a Special Case

The nature of Pacific Islands—tiny parcels of land dispersed across an ocean expanse—shaped the region's peoples, their cultures, their economies, and how they travel throughout their regions.

This geography creates huge barriers to economic growth—a narrow undiversified productive base, small populations scattered across vast areas, and fragmented infrastructure and services.



Strategies typically applied to grow the economies of developing countries—increasing the value of exports—are unlikely to work in PICs given their geography [and others] that restricts economic growth. An exclusive and unique set of solutions is required.

What we have today

Maritime transport for the PIC12 countries is a complex set of intertwined systems relating to international trade and shipping, infrastructure and assets, institutional and governance arrangements, local culture, and workforce capability and capacity. These are in turn influenced by interactions with and between governments, regional agencies, development partners, and the private sector.

Some challenges are unlikely to change in the short to mid-term. The countries are geographically remote and dispersed, shipping distances are vast, transport costs are high. Supply chains are long, low volume, and slow. Ship calls are less frequent and transit times longer relative to Pacific Rim countries. Most countries have small populations, small land areas, and lack economies of scale. Trade is imbalanced due to a reliance on imports. Countries are environmentally fragile, and vulnerable to climate change, natural disasters, and economic shocks (think pandemics and fuel price surges). Networks are vulnerable and susceptible to disruption. The atoll nations of Kiribati, RMI, and Tuvalu may become submerged by 2100.

Some challenges can change. A culture of safety can be built, and governance oversight improved. Holistic transport systems can be designed, that integrate all aspects of sea travel—from routes to vessels to jetties to up-to-date marine navigation charts—ensuring that the system supports vibrant urban areas and the viability of outer island life. A whole-of-life approach to infrastructure planning, design, build, and maintenance can be adopted. Fleets can be renewed with fit-for-purpose vessels able to be retrofitted as low-carbon technologies come on stream. Greenhouse gas emissions and varied types of pollution from ports can be curbed.

While there is significant room for improvement in the Pacific, much about the existing maritime transport systems works well. They are multipurpose, adaptive, and have multiple attributes that create resilience in the system. It is important that countries and development partners acknowledge and build on these resilient attributes, while making dedicated efforts to address the opportunities for improvement.

A Snapshot of the Brightest Opportunities for Transformation

The most transformational opportunities for improving maritime transport in the Pacific lie in infrastructure, services, and the safety of domestic shipping. Five actions identified by this study will help deliver these opportunities:

» **Action 1:** Invest in maritime infrastructure for life.

A whole-of-life approach to building and maintaining infrastructure will help ensure maritime assets, including ports, last their designed life and are appropriate, cost-effective, enduring, and safe.

» **Action 2:** Improve planning to make maritime transport future-proof.

In a future framed by fast-moving climate change, creating resilient maritime transport systems is all about planning. Maritime services and infrastructure planned with inbuilt resilience will reduce the Pacific's vulnerability to economic and environmental shocks and help build economic growth and stability.

» **Action 3.** Enhance maritime services to better connect communities.

Pacific economies rely on connected communities. Connected communities need reliable and affordable maritime transport services. Social and economic benefits accrue from investment in safe, affordable, reliable maritime transport that leaves no one behind. Poverty will reduce. Economic resilience will increase. Communities will prosper.

» **Action 4.** Improve safety through leadership, commitment, and investment.

Safety doesn't happen by accident, but lack of safety leads to tragic accidents. Safety in the Pacific needs leadership, commitment, and investment in fit for purpose domestic maritime transport systems (vessels, infrastructure, maintenance), education, and safe practices.

» **Action 5.** Enhance governance to improve efficiency and deliver better outcomes.

Leadership and good governance at the right level, in the right place, will lead to better outcomes. Getting institutional governance right at both regional and national levels is a precursor to effective policy development and delivery in the Pacific.

The five actions are intertwined, which is a strength. Delivering on any one of them will enable and foster achieving the others.

Rethinking some Goals

The *Blue Transformation* study findings suggest that four ambitious goals for Pacific Island countries may require a rethink. Specifically, whether heavy investment in maritime infrastructure and port facilities will boost an accelerated growth in cruise ship tourism; whether maritime transportation and infrastructure is a critical constraint for revenue capture in tuna industry in the Pacific; whether better logistics arrangements in the maritime sector can reduce the large proportion of empty containers and current trade imbalance; and whether decarbonization targets set for the maritime sector in the Pacific can be practically achieved?

Chapter Summaries

International Shipping

The volume of international trade for Pacific Island countries is small compared to larger developed countries or Pacific Rim countries. The frequency, routing, ship size, and pricing have adjusted to form a commercially sustainable model.

Imports determine PIC needs for international shipping

Imports are dominated by food, fuel, manufactured goods, motor vehicles and equipment, and building materials. Papua New Guinea (PNG) is the only member of the PIC12 that is not a net food importer.

Exports for most PICs are minimal. Significant export volumes, primarily from the larger countries, center on a few key commodities, such as timber, palm oil, and sugar. Low export volumes mean containers arrive full but leave empty—exports of empty containers are an unavoidable characteristic of Pacific trade.

Potential to increase exports are modest. Constraints come mainly from issues around cost of production and internal supply chains. The current capacity and frequency of international shipping is adequate to support an increase in exports.

Along with long distances and small volumes, the import: export imbalance contributes to the higher cost of shipping to PICs.

Low-volume PIC routes can sustain a limited number of carriers

Imports and exports are carried by a reasonably small mature network of private sector shipping lines and ship operators. In general, good quality, appropriately sized ships are deployed to match trade volumes, service frequency, and port settings. Most carriers have multiple vessels, which provides some redundancy and resilience to supply chains.

The long-standing experience of carriers is critical to the effectiveness and efficiency of operations because they understand the nature of port capabilities and can implement measures to mitigate constraints to port operations.

Shipping routes are generally well-established and reasonably well optimized to carry relatively small volumes of cargo over long-distances. On-island storage and stock levels match the levels of shipping.

The 25 scheduled international shipping routes in the Pacific form three distinct patterns:

- Shorter haul shuttle services linking Pacific Rim ports and larger PIC gateway ports
- Milk run services connecting multiple PICs to Pacific Rim ports on longer scheduled routes
- Intraregional services between PIC ports only.

Shipping prices are relatively high, due to small volumes, long distances, high empty container returns, and inefficient ports. The limited competition raises the question of how PICs can be assured they receive fair prices and service levels.

Because they have fewer economic resources, PICs are vulnerable to sustained price increases and sudden price shocks (such as global fuel price rises), and the logistics constraints experienced during the COVID-19 pandemic.

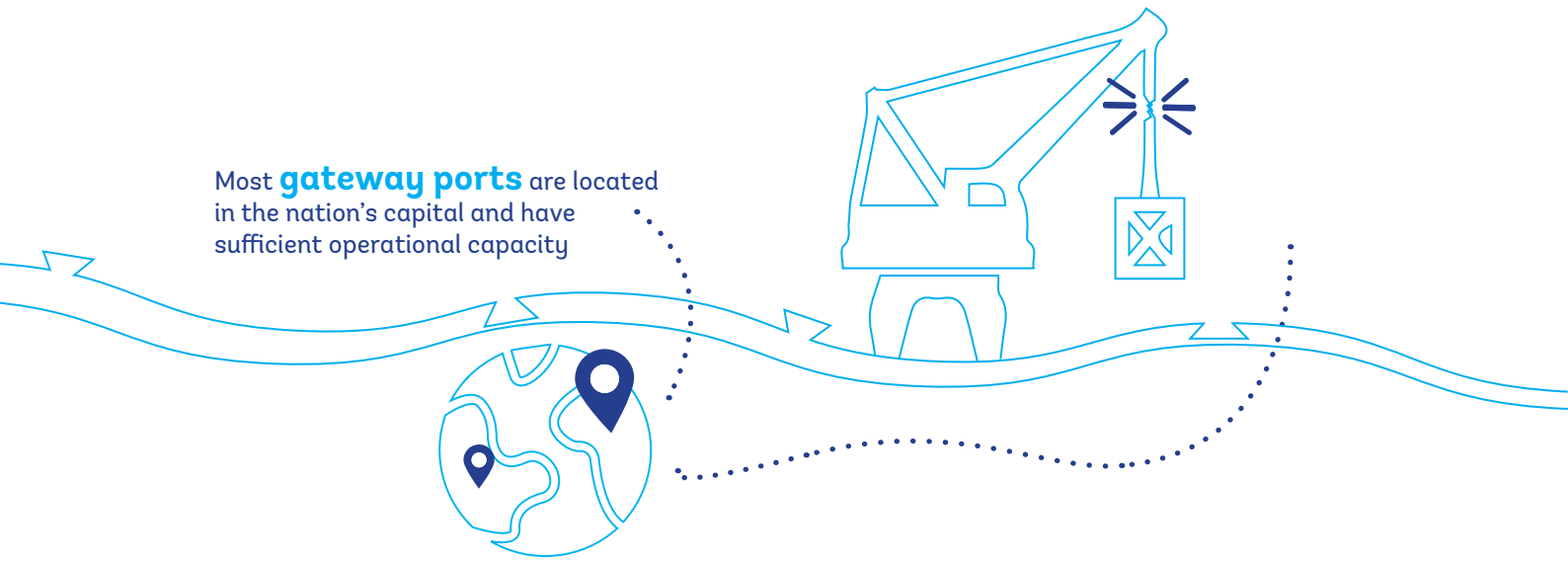
While most receive adequate services, the remote micro-states of Nauru and Tuvalu, and Kiritimati in Kiribati, struggle with the frequency, reliability, and comparative cost of services. More dependable long-term shipping solutions are needed for these islands.

Key areas for attention in international shipping

The overall aim for international shipping is to maintain consistent, reliable, cost-effective services of the appropriate type, capacity, frequency, and affordability to ensure resilient and secure supply to PICs. The main opportunities to improve current services are: independent oversight to monitor, examine, and influence pricing and service levels; improving services to remote micro-states and islands; and exploring opportunities for Pacific states to benefit more from the economic activity shipping generates by providing services, such as ship repairs, and ship provisioning.

Gateway Ports

In Pacific Island countries gateway ports are multifunctional and provide a hub of local economic activity. This differs from the global trend towards specialized, high efficiency ports.



Low traffic volumes mean most gateway ports are not overly congested. Exceptions are ports in the larger economies of Fiji, PNG, and to a lesser degree, the Solomon Islands.

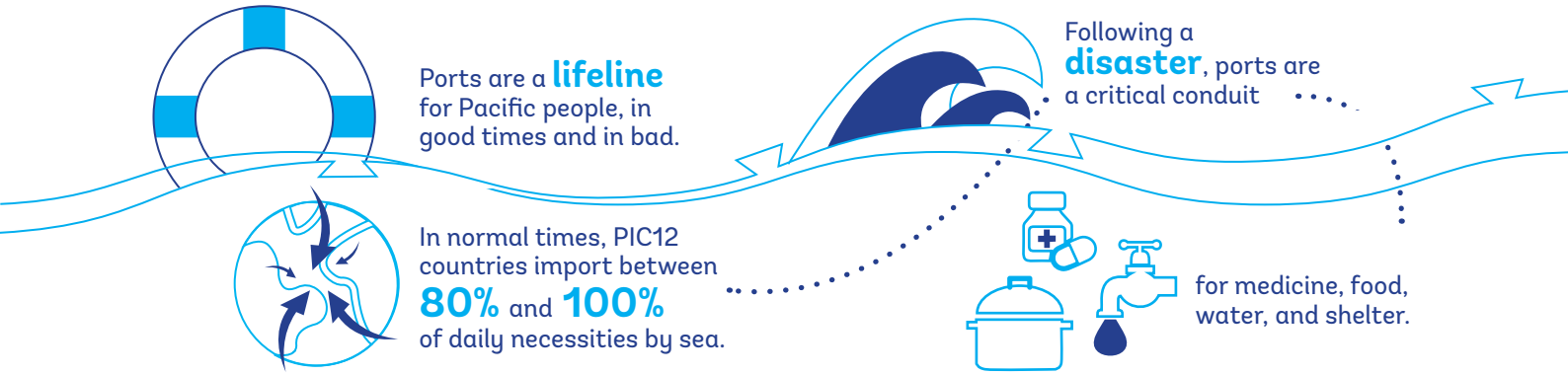
Gateway ports vary in their need for infrastructure investment to expand, rehabilitate, or improve their resilience to the impacts of natural hazards. From time-to-time renewal, reconfiguration, and design changes are needed to respond to changing demand, ships, and cargoes. Legacy issues related to the original site selection and design of Pacific Island ports can constrain options—such as the marine navigation limits, landside geography and the urban areas that have grown up around them.

Investment decisions need to be carefully assessed to ensure they address both current issues and long-term needs—they need to be fit-for-purpose and realistically scaled to meet expected demand and the changing environment over the 50-year build life of major port infrastructure.

Port master planning is critical to ensure this. Future planning for energy storage and supply should be part of long-term master plans, along with building in resilience to natural hazards and the impacts of climate change.

Whole-of-life asset management is needed

Recurrent themes in Pacific Island ports are the variable effectiveness of management and preventive asset maintenance for major infrastructure and superstructure at the gateway ports—a "build–neglect–rebuild" paradigm prevails. Lack of maintenance reduces the life of the asset and increases the overall cost. A major reason for the degradation of infrastructure and superstructures is because inadequate or no budget is allocated to preventive maintenance. This undermines ports' role as a lifeline for Pacific people. Action 1 in this Blue Transformation study is focused on embedding whole-of-life asset management as business as usual in the Pacific. Ongoing support from development partners across the life cycle of port infrastructure and equipment is needed, along with better governance and oversight.



Green ports

"Green Ports" describes a range of infrastructure and operational measures that reduce ports' energy and resource consumption, and environmental impacts. There is considerable opportunity for Pacific ports to advance their green port credentials by drawing on technical advisory support, guidance, and oversight from regional organizations. PNG, Fiji, and the Solomon Islands have begun the journey.

Financially unsustainable

Most gateway ports have low utilization and are not financially self-sustaining. Port charges are attached to legacy tariffs and do not reflect true costs—they are generally low compared to peer ports in other regions. Pacific gateway ports will require ongoing financial support from development partners.

Port governance and management

After 30–40 years, ports authorities are still maturing in their governance and management arrangements. There is room for improvement, including greater board oversight of financial management, including debt ratios, and the need for financial controllers to have tighter fiscal management and systems. Continued technical support is appropriate.

Key areas for attention for gateway ports

Two significant opportunities to improve gateway ports are:

- Master planning for resilience, capacity, and sustainability—looking at future demand, possible revenue sources, location and land use conflict, maintenance capability and resources, and expected impacts of climate change
- Strategic whole-of-life asset management, with budgeting certainty and planned maintenance.
- Involvement of private sector participation in the port operations and cargo services

Other opportunities include: improving governance; developing management capacity; improving cost recovery by adopting modern principles for port pricing formulas and a collective regional approach to determining port fees; encouraging private sector involvement to improve management capacity and financial management; and supporting environmental management and green ports.

Domestic maritime transport

Providing safe, reliable, affordable domestic shipping services is one of the most difficult challenges for Pacific Island countries. It is the lifeblood of their communities, providing a vital service, especially for the viability of outer island communities. But it is difficult and expensive to provide. Domestic shipping requires significantly increased attention from development partners.

Action 3 in the *Blue Transformation* study works in this space. It aims to enhance maritime services to better connect communities and deliver social and economic benefits by providing affordable and equitable access to goods and services, supply chain security, and employment opportunities.

The character of domestic shipping

Domestic shipping involves both public and private shipping fleets and infrastructure. Many routes cover long distances, have low passenger volumes, and low-value traded goods. Many routes to outer islands are not commercially viable, and those communities are underserved with infrequent, unreliable services, and ongoing safety issues.

The lack of financial viability creates serious safety issues—cheaper overaged vessels are purchased end-of-life, poorly maintained, and often sail overloaded and in poor weather. Many outer islands lack appropriate docks and jetties to safely unload cargo or disembark passengers.

Franchise shipping schemes have shown promise on unprofitable routes, but these have been canceled or scaled back due to budget constraints. Franchise schemes need permanent subsidies to provide outer islands with safe reliable services over the long term.

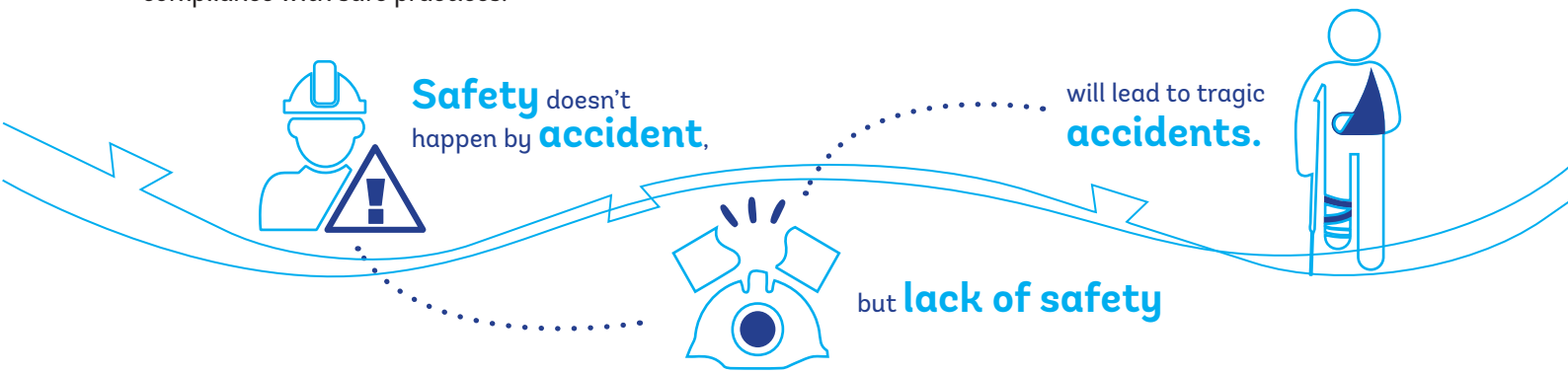
Safety

Significant safety issues have led to major domestic shipping disasters involving many deaths. And every year there are groundings, collisions, and other accidents causing damage to ships, environmental pollution, injury, and death.

Two fundamental issues underpin Pacific maritime disasters—a lack of a safety culture and of effective regulations and compliance around safe practices. This results in a myriad of safety issues.

Governments suffer from the perennial problem of failing to plan for maintenance, including setting aside funds for maintenance and repair costs. This has resulted in even brand-new donor–funded vessels degrading to the point of being unserviceable within only a few years. Many vessels operate outside normally accepted safety limits.

Action 4 in the *Blue Transformation* study focuses on helping to improve safety in two ways—by fostering leadership and commitment to creating a culture of safety that flows through the entire maritime transport system; and by investing in it, to make it happen. Fundamental to safety are fit-for-purpose vessels, improved outer island infrastructure, accessible and affordable maintenance facilities, training and education, and compliance with safe practices.



Key areas for attention in domestic shipping

Most PICs need to improve domestic connectivity between urban hubs and outer island communities to ensure social and economic integration and resilience. Opportunities exist, but solutions are not simple—it will take sustained effort and investment over a long period to build the required culture of safety. Of utmost importance is improving the safety of domestic shipping through regulation, improved ship condition, and access to appropriate maintenance facilities throughout the region. Other opportunities include:

- Creating a domestic shipping system based on how interconnected parts of the domestic shipping system work together (routes, vessel design, infrastructure) to best meet the needs of all communities—urban and remote.
- Improving outer island infrastructure to make shipping safer and more frequent
- Improving vessel design and selection—for example, it is essential that new vessel builds incorporate fuel efficiency technology today, and are able to be retrofitted with low-carbon technologies when these become available
- Providing sustainable financing mechanisms for outer island services
- Improve training and workforce development.

Key related sectors

Four sectors sit outside the purview of this report, but impact and influence Pacific maritime transport infrastructure and operation. Pacific Island countries need to account for these sectors when developing their port master plans, to ensure these plans consider any need for space, facilities, proximity to processing or storage facilities, and intermodal transport connections. In brief:

Cruise ship tourism—International cruise ships are economically significant to only two Pacific Island countries—Fiji and Vanuatu. Its potential for others should be assessed for net economic, environmental, and social benefits. Two prevailing assumptions about cruise ships need to be challenged. One is that building dedicated terminals will attract more cruise ship port calls. Pacific cruise ship itineraries are determined by proximity to their seasonal markets (New Zealand and Australia), and the preferred cruise length—the global average is 5–7 days. The second assumption is about the income from cruise passengers. This is modest compared to tourists that arrive by air because cruise passengers spend limited time ashore and do not use local accommodation

and other services. Air visitors generate 14-times more economic benefits to Fiji, and 36-times more benefits to Vanuatu. On the other hand, costs can be high. Pacific Island countries have limited capacity to effectively develop environmental regulations for cruise ship visits and ensure compliance—this needs to be supported in any efforts to develop cruise ship tourism. Countries also need support to set fair, regionally–consistent port fees and charges to cover the costs of hosting cruise ships, which place significant demands on ports for safety and security services. However, public-private partnerships could be utilized to increase passenger flow onto land while keeping costs down. Thus, creating win-win economic benefits for the cruise companies and client countries through increased tourism spend and satisfaction.

Tuna fisheries—The benefits of tuna fisheries are significant for some Pacific Island countries—several economies are "tuna dependent". In the last decade, improved regional governance of the tuna fishery significantly increased revenue from access fees. In 2019, the industry brought USD 1.4 billion to Pacific Island countries. Value is captured in several ways, including license fees for foreign fishing vessels, participation by Pacific-owned fishing vessels, and onshore processing. Most tuna is transshipped offshore. Opportunities exist to further develop the small number of niche markets for onshore processing to increase value capture in local economies. The volume of transshipment at tuna ports varies from year to year as fish stocks migrate, influenced by the El Niño Southern Oscillation conditions. Both the size and location of these fish stocks will be increasingly affected by climate change. The main implication for Pacific ports is that, if more economic benefits from tuna fisheries are wanted, such as by increasing onshore processing or providing fishing services (for example, net repairs, or refueling) then port master planning needs to consider what would be required and whether the activity is feasible. Ports also have to address congestion at gateway ports, caused when large tuna fleets and cargo ships demand space at the same wharves with finite capacity.

Fossil fuel import supply chains—Pacific Island countries critically depend on imported fuel—land and maritime transport are almost 100 percent fossil fuel driven, and account for more than half of fuel use. Electricity is mostly diesel powered. The security and resilience of the fuel supply chain is therefore critical. While small in scale, international shipping of fuel into Pacific Island countries is generally fit-for-purpose, with a variety of suppliers, ship sizes, and routes. However, small-scale storage facilities in countries, and their long distances from refineries, means they are very vulnerable to disruptions in the fossil fuel supply chain. High-level response plans in the case of disruption to the main supply route are important for energy security and resilience. This includes holding sufficient stocks in country, and within the supply chain. Improved energy security is a key driver in the move toward renewables. Current demand for imported fuel is expected to increase, then decrease with decarbonization efforts. Probably the key issue is the safe handling of fuel on domestic routes—bringing in suitable stowage on vessels, fit-for-purpose landing facilities, and appropriate decanting systems and fuel storage containers.

Bulk commodity shipping—Bulk shipping handling dry bulk and liquid bulk operates outside the merchandise trade sector and is generally fit-for-purpose. Bulk cargo handling and storage at ports does impact on the available land space and needs to be included in the master planning process.

Natural disaster and climate resilience

The World Risk Report identifies the Pacific as a hotspot for climate change and disaster risks. Six countries—Vanuatu, Tonga, Solomon Islands, PNG, Fiji, and Kiribati—are listed among the globe's 20 most vulnerable countries. Natural hazards include tropical cyclones, regional storms, coastal flooding, earthquakes, tsunamis, and volcanic eruptions. Climate change is expected to exacerbate these risks.

Location, location, location

Assets are typically located on open coasts, at or near sea level. Climate change is raising sea levels and increasing the frequency and severity of storms. Infrastructure is often poorly constructed and maintained, in part because of the cost.

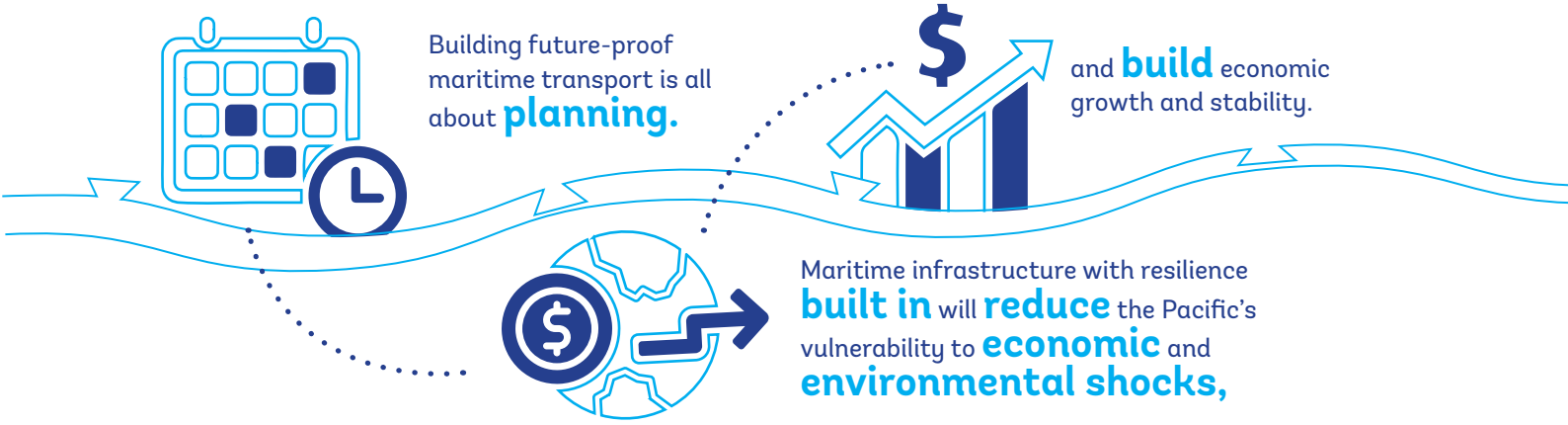
Decision-makers may not have access to information about how to adequately plan for and manage the risks and impacts of natural hazards and climate change on maritime transport systems. Following disasters, maritime operations and systems have limited ability to bounce back, largely due to a lack of contingency and business continuity planning, and a general shortfall of government capacity in building maritime sector resilience.

Ports are a lifeline

Many Pacific ports were built in the 1970-80's when trade began to expand and are reaching the end of their economic lives. Much of the critical infrastructure in the region is due for an upgrade to adapt to risk from cyclones, floods, storm surges, and sea level rise.

The vulnerability of Pacific maritime assets has a direct bearing on the regional network's susceptibility to the impacts of natural hazards, and the extent to which its peoples and economies are negatively affected.

Natural hazard and climate change risks must be a key consideration for all maritime transport system planning and asset management. Port designs must consider how port facilities can withstand the impacts of a natural disasters so that they remain operational in the aftermath of such events.



Challenges

The challenges are huge. Costs are many, varied, and can be very high. There is a lack of detailed climate and disaster risk information, and climate resilience planning tools. Climate risk does not inform port master planning. Institutions are not set up to enable action on resilience, and there is a shortage of people with necessary knowledge and skills. Strategic asset management and maintenance regimes are inadequate to cope with disasters. Donor funding is relied on.

Key areas for attention to manage natural disasters and enable climate resilience

There is little that small island nations can do to stop natural hazards or climate change impacts. The aim is to build resilience in the region's maritime sector and Action 2 in this Blue Transformation study is critical to that outcome. Its purpose is to improve how transport systems are planned, so their design will deliver resilient and future-proofed services and infrastructure.

Other elements of this work are: integrating natural hazard and climate change risk into port master planning; ensuring redundancy is built into networks; developing emergency response plans; and preparing for supply chain disturbance. Greater collaboration between port authorities at the regional level could share limited resources. Finally, priorities for disaster risk management and risk reduction need to be agreed between governments and the private sector, within and between countries.

Sector governance and institutions

"The global development community needs to move beyond asking 'What is the right policy?' and instead ask 'What makes policies work to produce life-improving outcomes?'" (World Development Report, World Bank 2017).

A large part of the answer is effective, fit-for-purpose governance. Especially for Pacific Island countries, whose economies are challenged by their responsibilities to secure, protect, and ensure safety across huge maritime areas of responsibility.

Until relatively recently, governance support to Pacific Island countries focused on their international obligations relevant to international shipping. International obligations can be an outsized burden on Pacific countries and distract attention from pressing issues in domestic inter-island shipping. As a result, governance for regional and domestic maritime transport has fallen behind.

Today the highest priority is to strengthen the regulations, institutions, and services needed to improve governance at both regional and national levels. Action 5 in the Blue Transformation study is about just this—enhancing governance to improve its efficiency and deliver better outcomes.

Governance at regional level

Limited legal, technical, and financial resources in the maritime sector stretch individual Pacific Island countries. There is a well-established regional architecture for some things, with a long history of successful cooperation and regional solidarity. This is not the case for the maritime sector. There is a large gap between legislation and implementation. Further, donor support is not always well-matched to regional planning and objectives and is often poorly coordinated.

A regional governance layer is imperative to lead on maritime issues and reduce the legal and technical burden on national governments, allowing them to focus resources on regulation and service provision.

Maritime governance at national level

In an ideal world, governments are provided with independent policy advice by well-resourced experts in maritime regulatory and operational functions. In the real world, dedicated national policies for the maritime sector are lacking. Regulation for domestic shipping (including safety) is a critical gap. There are problems in implementation, compliance, and enforcement of existing regulations, particularly given the difficulty of getting local fleets to meet new standards (a problem compounded by aging domestic fleets).

Pacific Island governments differ in the degree to which they choose to separate their executive, regulatory, and service functions. The result is regulators operating under varying levels of integration, independence, and funding. The most serious risks are a lack of role clarity and conflicts of interest. Where PICs absorb most regulatory functions within ministries, close to government, substantial institutional reform is required.

Key areas for attention in the governance sector

Of highest priority is strengthening governance at the regional and national levels to better deliver outcomes for maritime safety, security, environmental protection, and efficiency. This means improving regional and domestic policy, legal, and planning frameworks, and governance arrangements. The following actions will help achieve this:

- Prioritizing regional solutions. This should free up resources to enable countries to focus on their national priorities
- Pooling regional resources to achieve economies of scale, and harmonizing regulatory requirements across Pacific Island countries to facilitate regional traffic
- Addressing gaps in regulations for domestic shipping—notably safety and environmental control
- Strengthening the role of technical experts in regulatory and operational functions and supporting them with appropriate independence, funding, and training
- Coordinating support from partners and donors, ensuring this focus on longer-term, sustainably resourced initiatives.

Abbreviations

ADB	Asian Development Bank
CBD	Central business district
EEZ	Exclusive economic zone
FFA	Forum Fisheries Agency
FSS	Franchise Shipping Scheme
GDP	Gross domestic product
GHG	Greenhouse gas
IFC	International Finance Corporation
IMO	International Maritime Organization
MOU/MoU	Memorandum of understanding
MOWCA	Maritime Organization for West and Central Africa
MPV	Multipurpose vessel
NDC	Nationally determined contributions
NPDL	Neptune Pacific Direct Line
NSL	Nauru Shipping Line
PIC/s	Pacific Island country/countries
PNG	Papua New Guinea
PPP	Public private partnership
PRIF	Pacific Regional Infrastructure Facility
ROCRAM	Red Operativa de Cooperación Regional de las Autoridades Marítimas de las Américas
SLR	Sea level rise
SPC	Secretariat of the Pacific Community
SPREP	Pacific Regional Environment Programme
TEU	Twenty-foot equivalent unit; 20-foot equivalent unit
UN	United Nations
UNCTAD	United Nations Conference for Trade and Development

All dollar amounts are US dollars unless otherwise indicated.

Introduction

Purpose

Safe, efficient, reliable, and affordable sea transport services are essential to basic economic and social functions in Pacific Island Countries (PICs), and to achieving national development aspirations and environmental objectives. **The Blue Transformation for Pacific Maritime Transport** study aims to identify where there are opportunities for significant change and investment that could improve services, facilitate economic activity, and improve resilience and safety for Pacific Island communities.

This report builds on several key studies in recent years, reflecting increased attention from development partners to the challenge of improving maritime transport in the Pacific. It also includes additional insights drawn from detailed studies commissioned by the World Bank under the *Blue Transformation for Pacific Maritime Transport* project. This report recommends a step up in resourcing support from development partners, focusing on sustained investments in people and institutions, and better long-term planning, policy, and governance, to build on and broaden the traditional focus on developing resilient and effective infrastructure.

The fundamental aim for maritime transport across the Pacific is to provide appropriate, affordable, reliable, accessible, sustainable, and safe sea transport for people and goods, within and between countries, now and in the future. At regional level this will deliver supply chain security for essential imports and improve connectivity to overseas export markets. At the domestic level, it will ensure people can access essential services and local markets, and maintain social ties, whether they live in major urban areas or on remote outer island communities.

The opportunities to achieve these aims are encapsulated in five actions, woven into this report. Delivering on any one action will enable and foster achieving the other actions:

- Investing in a whole-of-life approach to building and maintaining infrastructure—Action 1
- Improving how maritime transport systems are planned to ensure they are resilient and future-proofed—Action 2
- Enhancing maritime services to better connect communities and leave no one behind—Action 3
- Improving maritime safety through leadership, commitment, and investment—Action 4
- Enhancing governance at regional and national levels to deliver better outcomes—Action 5.

By reading this report, the reader may:

- Gain an appreciation of how maritime transport systems in the Pacific are defined by the unique economic geography of the region
- Orient towards the broad challenges for maritime connectivity in the region, which are distinct from those in other regions and require a tailored approach
- Understand critical areas for attention and prioritized options to improve maritime transport.

The aim is that a shared understanding of issues will help form common ground for conversations between governments, regional agencies, development partners, and private enterprise. And that this will lead to better coordination of programs designed to improve maritime transport in the Pacific.

Scope

The report focuses largely on 12 diverse World Bank member countries in the Pacific (PIC12)—the Melanesian countries of Papua New Guinea (PNG), Solomon Islands, Vanuatu, and Fiji; the Polynesian countries of Samoa, Tonga, and Tuvalu; and the Micronesian countries of the Marshall Islands (RMI), the Federated States of Micronesia (FSM), Palau, Kiribati, and Nauru.

Maritime transport for these islands is a complex set of intertwined systems relating to international trade and shipping, infrastructure and assets, institutional and governance arrangements, local culture, and workforce capability and capacity. These are in turn influenced by interactions with and between governments, regional agencies, development partners, and the private sector.

This *Blue Transformation* study has explored these complexities to identify where things are working quite well, where they are evolving and would benefit from further support, and where there are distinct gaps that require the attention of Pacific Island governments, supported by development partners.

Structure of this Report

This report begins by providing context about how today's maritime transport systems evolved. It then analyses the main components of maritime transport, the major influences on it, and the challenges it faces. Several chapters identify key areas for attention by Pacific governments, development partners, regional agencies, and private enterprise. The eight chapters (and what they cover) are:

Pacific Peoples and the Sea describes what shaped maritime transport in the Pacific and discusses the major trends and drivers that affect it today.

International Shipping discusses PICs' reliance on imports and focuses on the key characteristics and challenges for international shipping.

Gateway Ports are critical nodes for moving goods in and out of PICs. This chapter highlights key areas where sustained attention is required, including asset management, governance, and planning.

Domestic Maritime Transport poses some of the biggest challenges for PICs, including safety and the financial viability of both shipping and port infrastructure.

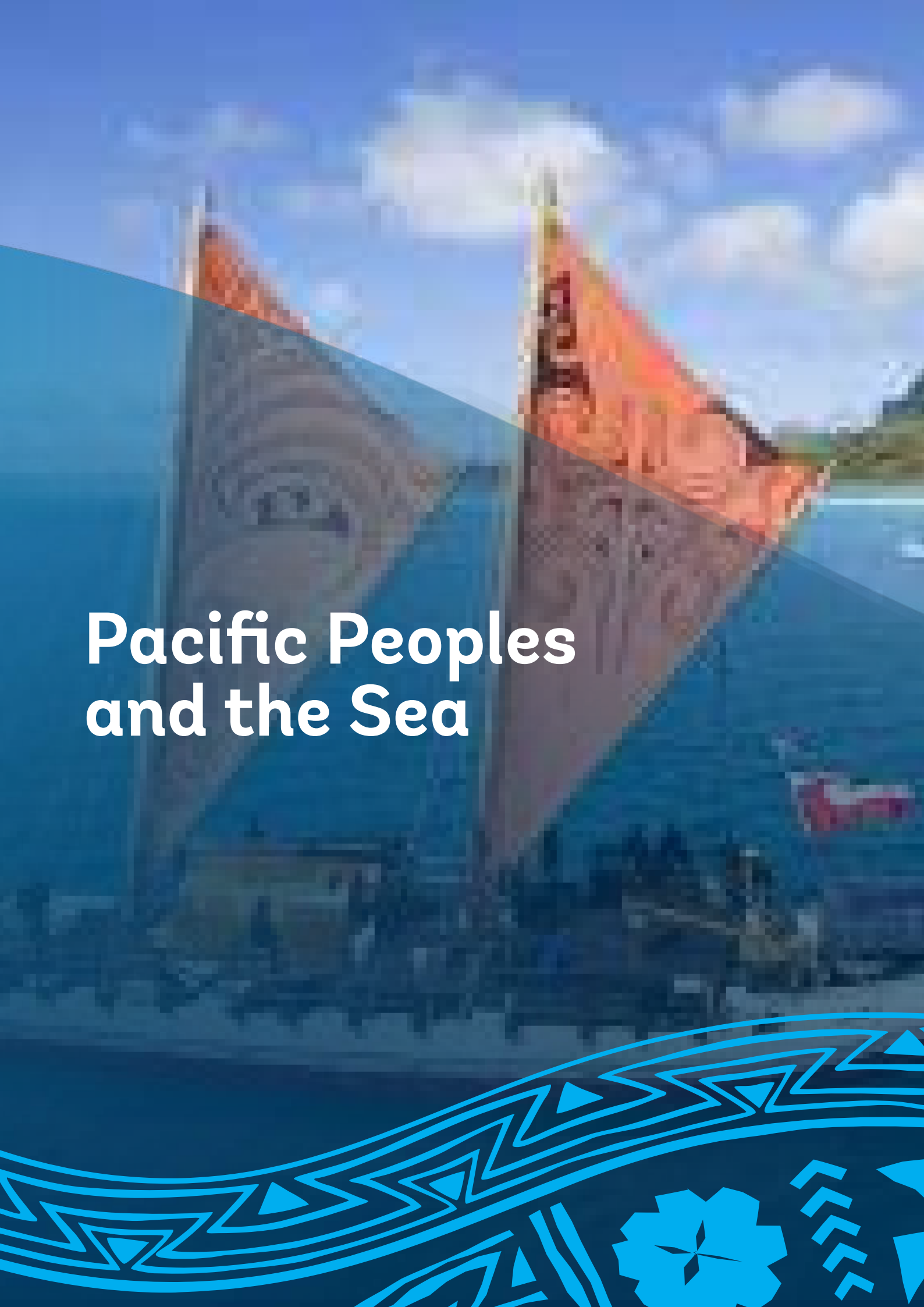
Key Related Sectors looks at four sectors that are separate but related to the core maritime transport activities already discussed—cruise ship tourism, tuna fisheries, fossil fuel import supply chains, and bulk shipping of commodities. Each has implications for the future of Pacific maritime transport.

Disaster and Climate Resilient Maritime Transport looks at the risks natural hazards and climate change pose for Pacific maritime transport systems and explores key responses to enhance resilience.

Sector Governance and Institutions focuses on how improved governance at regional level can support better national outcomes in PICs.

Transforming Pacific Maritime Transport—Ways Forward collates the most significant opportunities for improvement, as a basis for further discussion.

Superscript notes within the body of the text refer to endnotes at the end of each chapter.



Pacific Peoples and the Sea

Overview

The very nature of Pacific Islands—small areas of land with limited resource endowments dispersed across a vast ocean—is fundamental to how maritime transport evolved in the region.

This evolution is framed by the region's history, and its unique economic geography. To lay the foundation for a shared understanding of the constraints and opportunities identified in this report, this chapter briefly describes how today's maritime transport arose, and the trends and drivers that influence what may happen next.

From Canoes to Containers: A (very) Brief Maritime History

The form and function of sea transport in Pacific Island countries (PICs) has been shaped by history. Their economies, societies, governing systems, cosmologies, and cultures are inextricably entwined with maritime transport networks—from first settlement by long-distance voyagers' tens of thousands of years ago, through the era of European colonization, to the modern-day world of globalization.

The first master mariners

Pacific Islanders have voyaged and traded across vast oceans for thousands of years, braving ever longer and more treacherous voyagers as they colonized Micronesia, Melanesia, and Polynesia. They used highly refined boatbuilding, seafaring, and navigation technologies, but two centuries of colonization and globalization interrupted traditional islander seafaring. Traditional sailing vessels and locally adapted technologies have now largely been displaced by motorized watercraft and a greater reliance on imported equipment and fossil fuels.

The nineteenth century: European trade and colonization

Europeans arrived in the nineteenth century to establish Christian missions and trading posts. Chiefs from several islands acquired European vessels, with their larger cargo capacity and equipment, and participated in trade. However, by around 1860, merchant trade was controlled by foreign traders with larger vessels and larger volumes. Towns grew up around trading ports, and foreign governments began to establish a presence. The adoption of steamships began in the 1850s and '60s. Ports were developed to cater for these larger ships, and to provide facilities for both passengers and freight (Halter, 2021).

The twentieth century

During World War II, militarization in the Pacific brought large motorized 10,000 tonne Liberty class ships, road traffic, and aircraft, to transport personnel, equipment, and supplies. Larger ports were needed.

By the 1950s and '60s several trading and shipping firms were established in the Pacific. Ports with timber structures were replaced with concrete decks and piles, up to 150 meters long. Loose general cargo remained dominant—loaded and unloaded by ships crane and derricks.

Perhaps the most important event in modern transport history was the introduction of containerization in the late 1950s with global trades adopting them as the standard from the mid 1970's. Containers protect cargoes from weather and pilferage and could be transported by ship, train, or truck, allowing the integration of sea and land transport and made large dockside warehouses mostly redundant. Pacific island trade routes have been slower to transition to full containerized operations—many wharves needed to be widened and strengthened to enable ships with cranes to load and unload containers to shore.

Modern-day Pacific ports

From the 1980s, as colonial gov ernments withdrew and ships aged, foreign merchants also withdrew from local Pacific shipping. Local banks and overseas aid now finance shipping, with many ships purchased secondhand after an already–long life of service. Effective maintenance for vessels and infrastructure is not widely practiced. Development aid continues to contribute to the displacement of traditional sailing vessels, although a cultural renaissance of boatbuilding, navigation, and traditional ocean voyages has begun. Pacific Island countries are today focused on improving maritime transport systems to enable viable economies, resilient communities, and good environmental outcomes. A major challenge for all is the impact of climate change.

The Influence of Geography on Pacific Economies

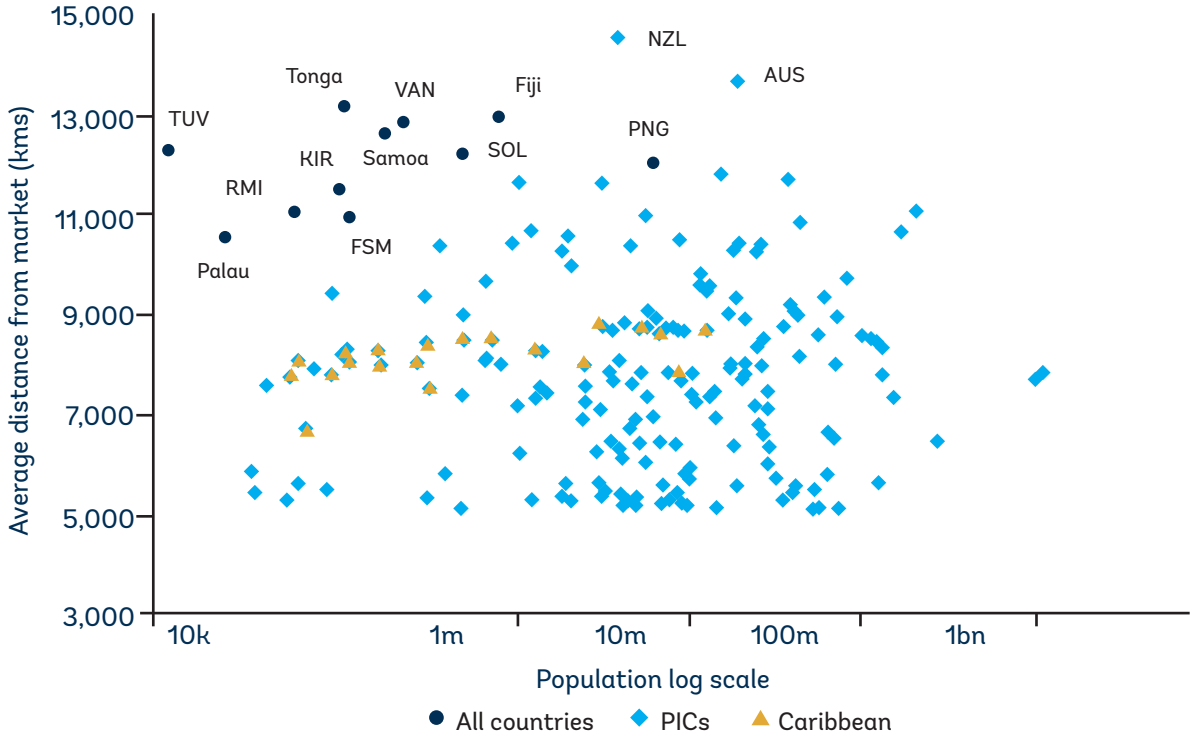
The 12 Pacific Island countries in this report (PIC12) can be broadly split into two groups:

- The Melanesian countries—Vanuatu, Solomon Islands, Fiji, and Papua New Guinea (PNG)—have the largest land areas, populations, and resources, including agricultural production. Together they occupy 98.9 percent of the Pacific landmass and make up about 96 percent of its total population. PNG is by far the largest of all PICs, with almost 80 percent of the total Pacific population.
- The remaining mid-sized countries (Tonga, Samoa, and the Federated States of Micronesia (FSM)) and the small atolls and micro-states (Palau, Marshall Islands (RMI), Kiribati, Tuvalu, and Nauru) have a relatively tiny pool of people but are collectively responsible for almost two-thirds of the vast exclusive economic zones (EEZ) of the PIC12.

Small, remote, dispersed, and fragile

Their geography means that Pacific Island countries face well-recognized barriers to economic growth (Figure 1) (World Bank, 2017). Their predominantly small land areas[1] correlate to a narrow undiversified productive base. Many PICs have highly dispersed populations scattered across a vast area, which fragments infrastructure and services and makes it even harder to scale economic activity (World Bank, 2017).

Figure 1 Pacific Islands are Uniquely Small and Remote



Source: World Bank, World Development Indicators and CEPII, GeoDist4

[1] PNG is distinct enough by population size, land area, proximity to market, and broader resource base to be considered a special case from other PICs. However, it does share the challenges of a fragile institutional environment with some of the smaller states.

Remoteness from international markets and the lack of economies of scale mean low trade volumes, where the costs of inputs are more expensive, as is the cost of exporting goods to the rest of the world. PIC exports from the smaller island states therefore tend to be uncompetitive, and manufacturing industries are very small in scale. Table 1 provides an economic and geographical snapshot of the PIC12 countries.

Table 1 Small islands dispersed over large ocean areas, dependent on imports

Country	Population ('000) 2022[a]	Land Area (km2)[b]	Exclusive Economic Zone (EEZ) Area ('000 km2)[c]	Ratio ocean area/ land	Number of islands and/ or atollsd	GDP per Capita (2021, current USD)[e]	Net trade in goods (millions) (Balance of Payments, current USD)[f]	Net trade in goods as percentage of GDP
PNG	8934	452,860	2,865	6	over 600	2,916	6,990 (2018)	29%
Fiji	895	18,270	1,301	71	320 islands, 106 inhabited	5,086	-947 (2021)	-21%
Solomon Islands	712	27,990	1,618	58	~1000 islands, 350 inhabited	2,337	-25 (2020)	-2%
Vanuatu	295	12,190	663	54	over 80 islands, 65 inhabited	3,127	-208 (2020)	-23%
Samoa	57	2,830	131	46	10 islands	3,939	-248 (2020)	-31%
Kiribati	119	810	3,443	4,251	32 atolls, one island	1,514*	-98 (2020)	-54%
Tonga	100	720	660	917	176 islands, 35 inhabited	4,625*	-198 (2021)	-39%
FSM	106	700	2,997	4,281	607 islands	3,476	-66 (2014)	-21%
RMI	55	180	1,990	11,056	29 atolls and 5 islands (over 1200 islands)	4,171	-33 (2018)	-15%
Palau	18	460	604	1,313	596 islands, 12 inhabited	14,243*	-144 (2017)	-50%
Nauru	12	20	309	15,450	single island	12,252	-49 (2018)	-40%
Tuvalu	11	30	750	25,000	9 atolls	5,219	-36 (2019)	-66%

Source: World Bank

Notes: a SPC Population Dashboard, b World Bank Databank, c Wikipedia, d ADB (2021), e World Bank Databank, f IMF Balance of Payments Yearbook latest year available, * 2020

The Pacific Island nations are the most aid dependent region in the world

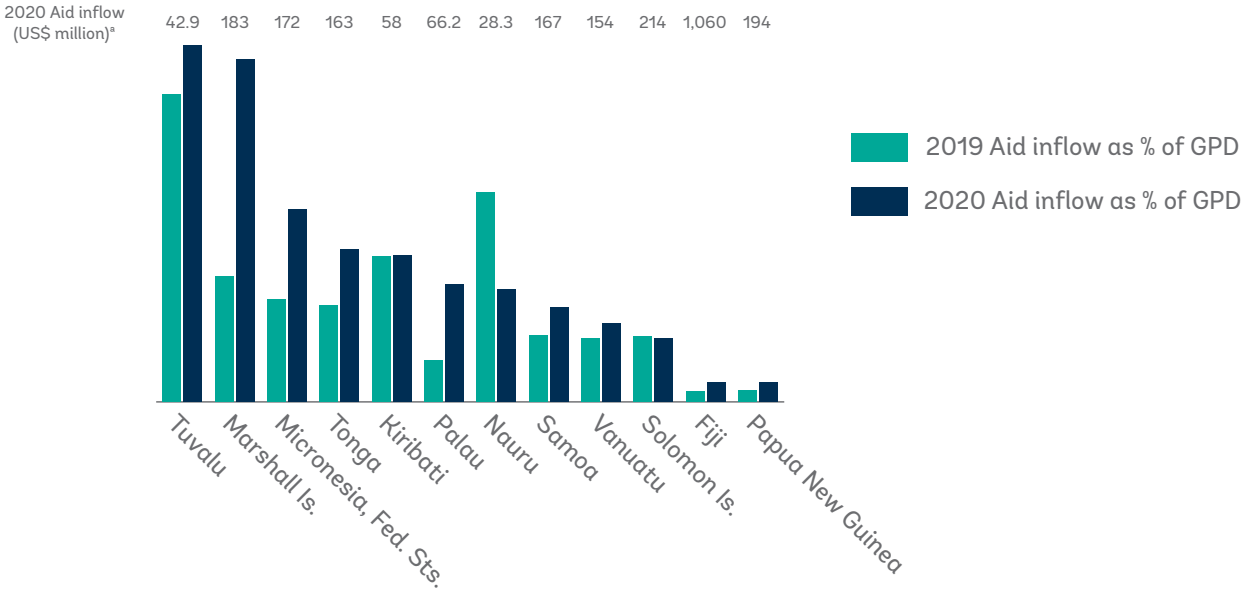
The World Bank's *Pacific Possible* (2017) study identified that the economic and capacity constraints imposed by PICs' geography are so severe that: "…even with an optimal environment for private sector activities—infrastructure, regulation, supportive macroeconomic policies—the range of viable economic opportunities will still be narrow".

As a result, remittances and aid make up substantial fractions of many PIC economies, which are vulnerable to external shocks, such as surging fuel and food prices, and natural disasters, which can take several years to recover from. Several countries are at high risk of debt distress.

Today the Pacific is the most aid dependent region in the world, largely in the form of grants accompanied by technical assistance. Figure 2 shows aid as a proportion of the PIC12 countries' gross national income. Nine of the PIC12 countries are ranked among the top 15 of the world's most aid dependent countries (Surandiran, 2020). In addition to being "Small Island Developing States", Kiribati, the Solomon Islands, Timor-Leste, and Tuvalu are categorized as "Least Developed Countries" by the United Nations (UN). Those classified as "Fragile and Conflict Affected States" by the World Bank, due to their high levels of institutional and social fragility, include Kiribati, Marshall Islands, Federated States of Micronesia, Solomon Islands, Tuvalu, and Papua New Guinea (World Bank, 2021).

The World Bank's *Pacific Futures* work (2009–2013) concluded that feasible paths to economic growth and development are therefore not likely to follow the typical strategy for other developing countries—that is, increasing the value of exports. Reforms to the business environment are unlikely to make PICs competitive within international markets, given the costs arising from their small size and remoteness.

Figure 2 Aid as proportion of Gross National Income in Pacific islands



Source: World Development Indicators

Note: a – aid inflow measures net inflows of ODA and official aid to PICs as provided by the World Development Indicators

The geography of PICs determines the character of the maritime transport sector

The geography of the Pacific, and the economic constraints this imposes, determine the character of Pacific maritime transport as follows (ADB, 2007):

- Vast distances mean transport costs are high, increasing the costs of imports and exports
- Shipping service frequency is lower and transit times longer relative to Pacific Rim countries
- The use of smaller multipurpose vessels matches the scale and type of service needed
- Networks are vulnerable and susceptible to disruption
- Natural monopolies have arisen in ports and some shipping services.

In turn, these characteristics affect how effectively and efficiently maritime transport functions in the Pacific. For example:

- There are only small pools of qualified people, and training above certain levels is difficult to access. Retention of qualified people in PIC's is often difficult.
- Port facilities have inadequate funding for maintenance and repairs
- Accessing materials and equipment is difficult.

Building on what works

These conditions are stark in their contrast to those of larger Pacific Rim countries, which have rapidly growing broad-based economies and proximity to trading partners. Strategies for developing the maritime transport of these large countries cannot be assumed to work in PICs.

While there is significant room for improvement in the Pacific, much about the existing system works well, given that it has evolved over time under these conditions. Pacific maritime transport systems are multipurpose, adaptive, and have multiple attributes that create resilience in the system. Many of these are discussed in the following chapters.

It is important that countries and development partners acknowledge and build on these resilient attributes, while making dedicated efforts to address the opportunities for improvement.

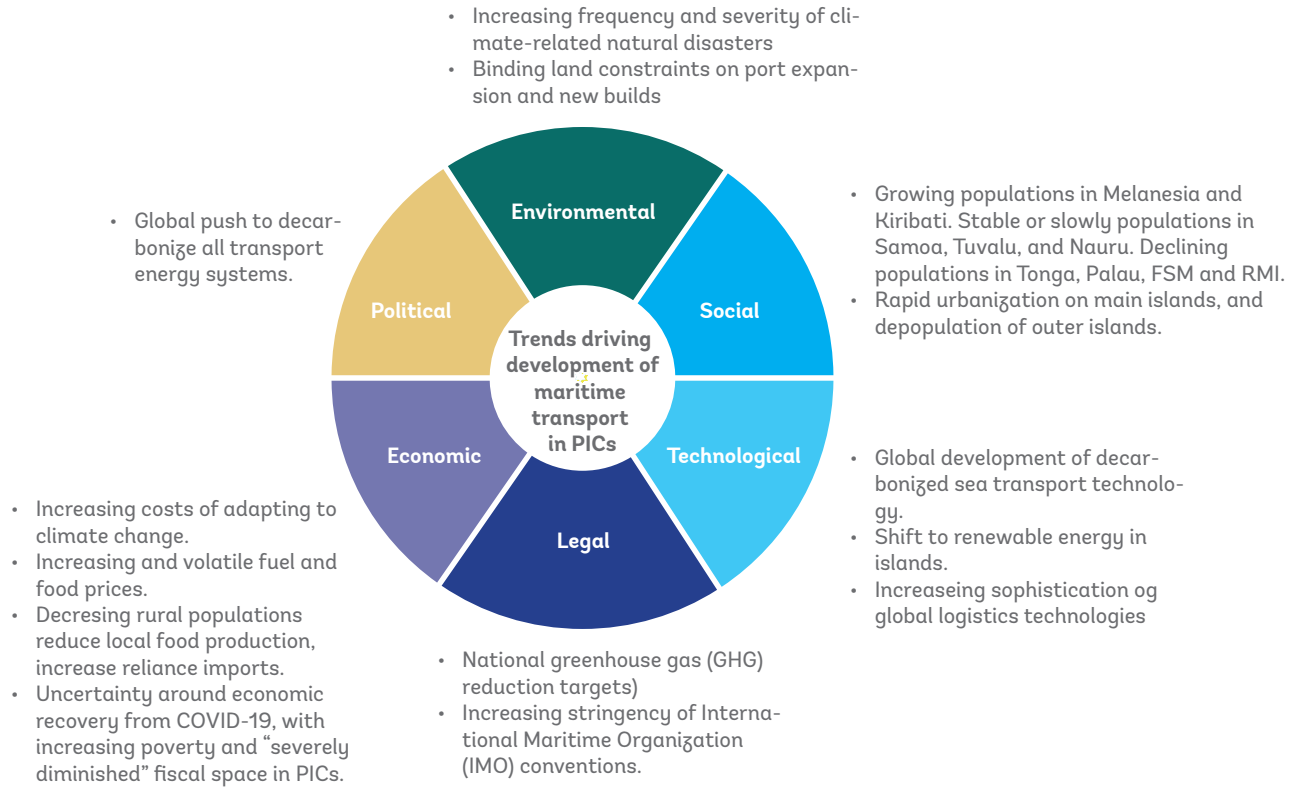
Trends and Drivers for Maritime Transport in the PIC12

Significant factors that influence the future of maritime transport in the Pacific fall into six categories (Figure 3). These have a large bearing on the opportunities for improvement identified in the remaining chapters.

- **Social:** Whether a population is growing (as in the larger Melanesian countries) or declining (as in Tonga, Palau, FSM, and the Marshall Islands) and static, being less than one percent growth (as in Tuvalu, Fiji, Nauru and Samoa) affects the overall demand for maritime transport. The rapid rates of urbanization and depopulation of outer islands in PICs (UN Habitat, 2015) challenge the viability of shipping services as volume and patronage decline, but operating costs remain largely unchanged. Decreasing rural populations reduce the capacity for subsistence farming and fishing, increasing demand for imports. Increasing regional and international mobility of Pacific Islanders for employment is a major contribution to gross domestic product (GDP) in several countries. However, this mobility can reduce the pool of sector experts—for example, Kiribati seafarers are sought after for international maritime work due to their skill and training, leading to a smaller pool of competent seafarers in Kiribati's domestic shipping sector.
- **Economic:** Increasing costs of adapting to climate change, increasing and volatile fuel and food prices, and surge prices in other commodities are having a negative impact on PICs. Public debt has increased significantly during the pandemic and there is a great deal of uncertainty around the rate of recovery from COVID-19, with increasing poverty and "severely diminished" fiscal space in PICs (IMF, 2021). Fiscal deficit is projected to increase from 0.2 percent of GDP in 2020 to 3.3 percent in 2022 (IMF, 2022).

- **Environmental:** The increasing frequency and severity of climate-related disasters are increasing the risk to supply chains and maritime transport systems, making the need to build resilience into these systems a critical priority.
- **Technological:** The global push to decarbonize shipping, the shift to renewable electricity, and the increasing sophistication of global logistics technologies will drive significant change in the islands of the Pacific.
- **Political:** Some PICs are active in the global push to decarbonize shipping through the forums of the United Nations Framework Convention on Climate Change and the International Maritime Organization (IMO).
- **Legal:** Several PICs have made binding commitments to reduce greenhouse gases (GHG) through nationally determined contributions (NDCs). Achieving these will require a concerted effort to decarbonize domestic maritime transport. Another key legal aspect is the increasing stringency of IMO conventions and the degree to which these are to be applied in PICs.

Figure 3 Trends Affecting Maritime Transport in PICs



Source: World Bank

International Shipping

Overview

The volume of international trade for Pacific Island countries (PICs) is very small compared to larger developed countries or Pacific Rim countries. Imports dominate this volume and determine PIC needs for international shipping. Exports for most PICs are minimal. Exports of empty containers, often approaching 50 percent of total throughput, are an unavoidable characteristic of Pacific trade.

In general, good quality, appropriately sized ships are deployed by private sector participants, resulting in consistent and reliable commercial shipping services. Network arrangements have evolved and adjusted over decades and are reasonably well optimized to carry relatively small volumes of cargo over long distances. While most PICs receive adequate services, the remote micro-states of Nauru and Tuvalu, and Kiritimati in Kiribati, struggle with the frequency, reliability, and comparative cost of services. Enhancing regional maritime services to increase supply chain security and improve their connectivity to overseas export markets is the focus of Action 3 in this *Blue Transformation* study.

Pacific economies rely on **connected communities.**

Connected communities need **reliable** and **affordable** maritime transport services.

The limited number of shipping providers is a natural consequence of the Pacific market's small size. Limited competition does raise the question of how PICs can be assured they receive fair prices and service levels.

This part of the report describes:

- The international *freight patterns* that determine the shipping needs of PICs
- The *shipping companies* that operate in the Pacific, their *network arrangements*, characteristics of *ship size and configuration*, and *service levels and pricing*.
- *Key areas for attention*—opportunities to strengthen international shipping.

(Note that this chapter focuses on merchandise shipping via containers and break-bulk. Fuel and dry bulk cargo are discussed in the chapter on Key Related Sectors.)

International Freight Patterns—Imports and Exports

PICs are critically dependent on imports

Due to their small size and limited natural resources, PICs rely heavily on imports. Imports are dominated by foodstuffs (processed food, fresh produce, and meats), fuel, manufactured goods, motor vehicles and equipment, and building materials. Most imports—80–100 percent—arrive by sea (SPC, 2022).

Food imports supplement traditional methods of food production. Papua New Guinea (PNG) is the only member of PIC12 that is not a net food importer. Growth in imports has been dominated by rice, wheat, and highly processed foods. Most food and beverage imports by weight are from Australia (primarily wheat and wheat flour), New Zealand, and East and Southeast Asia (primarily rice).

Other major imports are manufactured goods and construction materials. The latter includes cement, bitumen, structural steel, timber, and bricks. Some, notably the atoll states, import sand and aggregate for major projects, such as road construction.

Most imports end up in the principal cities and main towns where PIC urban populations are concentrated, and international ports are located. Goods imported to the outer islands are mainly staple foodstuffs, building materials, and utility goods. The nature and volume of imports determine PIC needs for international shipping.

Pack types

Since the late 1970s containerization has become the standard for merchandise trade in the Pacific, including temperature–controlled foodstuffs and consumer goods. Due to the nature of port services, payloads, and road networks, around 80 percent of containers are 20-foot equivalent units (TEU). This contrasts with the global trend where the greater capacity of 40-foot containers has meant they now dominate major trade routes.

Some frozen whole fish and loined tuna is exported in refrigerated 40-foot containers that are generally imported empty.

Export potential is modest, existing maritime transport arrangements will suffice

Significant export volumes, primarily from the larger PICs (PNG, Solomon Islands and Fiji), center on a few key commodities including bulk minerals, liquified natural gas, timber, palm oil, and sugar. These high-volume commodities are shipped in dedicated bulk carriers which are deployed as needed to meet the needs of integrated supply chains, and often use separate dedicated port facilities.

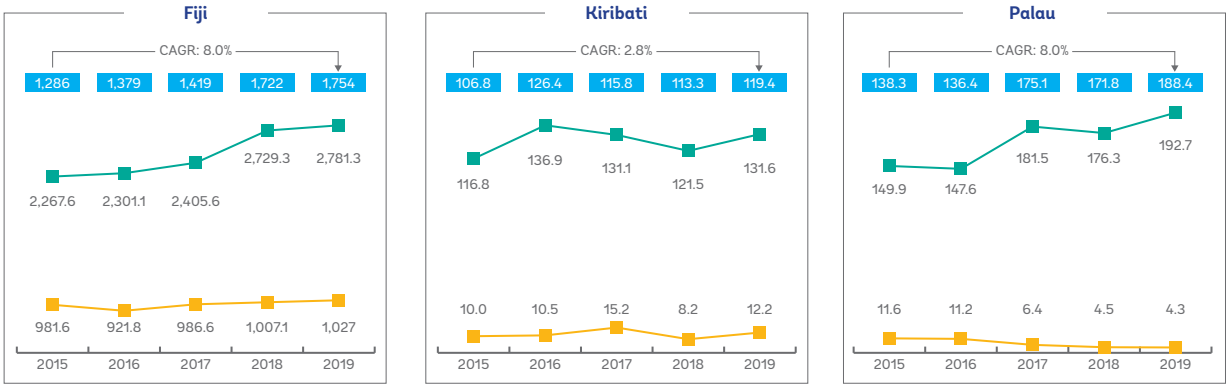
International exports are generally considerably lower in tonnage and value than imports. The exceptions are PNG and Solomon Islands due to their mineral resources and logging (Figure 4).

While fish is the main natural resource for most smaller PICs, most revenue comes from licenses to distant water fishing nations, mostly from North and East Asia. Only a small portion (less than 15 percent) is processed and exported from PICs—and most of that from the largest countries of PNG, Fiji, and the Solomon Islands.

Aside from copra, exports from smaller countries are mainly low volume products that attract a premium price in certain markets—such as single source chocolate from Samoa, squash and vanilla from Tonga, or kava for the growing Pacific diaspora in Australia and New Zealand.

Ample capacity and connectivity in international shipping exists for these low-volume exports. Constraints on PICs export potential come mainly from issues around production and internal supply chains. The current capacity and frequency of shipping is adequate to support increased export of goods. It is accepted that international shipping lines encourage development of PIC exports so as to provide additional revenue and utilization of the large volume of otherwise empty container exports.

Figure 4 Trade Balance Between Imports and Exports in the PIC12 Countries



Source: World Bank, SPC International Merchandise Trade Statistics (SPC, 2022)

Notes: CAGR stands for Compound Annual Growth Rate. The use of CAGR instead of average annual growth rate helps smooth the annual growth rate of net import value over a period of time, especially for PICs with widely varying net import values over the years.

Trade between Pacific Island countries

Trade between PICs remains low, largely because they produce similar agricultural goods and mostly to meet their own requirements—there is little surplus. Increasing maritime connections between PICs is therefore unlikely to substantially increase trade, and the high costs of transport would make these goods uncompetitive with those imported from Pacific Rim countries. Potential does exist for the larger PICs—PNG and Fiji—to export more value-added goods within the Pacific region through their existing hub port arrangements (ADB, 2020). It is acknowledged that consumer foods manufactured in PNG and Fiji have to compete with the landed pricing of similar goods imported from North and SE Asian countries.

Shipping Lines

Imports and exports are carried by a small number of established service providers

A reasonably small mature network of shipping lines and ship operators carry goods to the PIC12 countries, mainly from north and east Asia, Australia, and New Zealand. The shipping lines are typically part of a larger corporate entity and have other direct or indirect commercial interests in the countries they provide shipping services to. In the most recent decade, shipping lines servicing PICS have been rationalized through mergers, acquisitions, and space-sharing agreements.[1]

Low-volume PIC routes can sustain a limited number of carriers

Eight shipping (carrier) organizations provide 25 scheduled international routes for the PIC region. These schedules involve a deployed fleet of 55 multipurpose vessels (MPVs) with an average nominal capacity of 1,424 TEU. The total one-way annual TEU capacity for the PIC region is estimated at 500,000 to 600,000 nominal[2] TEU.

Swire Shipping, headquartered in Singapore, has the greatest market share and reach, supplying 44 percent of total capacity each year. It deploys 22 of the 55 MPVs. Sofrana ANL, headquartered in Melbourne, is the second largest carrier, with a 21 percent share of capacity. The great majority of Swire and Sofrana capacity is in services to PNG. Kyowa/NYK is important in the North Pacific and has a 10 percent share, and Maersk has a 7 percent share. While Neptune Pacific Direct Line (NPDL) has a relatively small share of TEU capacity (4.3 percent), its larger share of total port calls per year, indicate its importance as a provider to the smaller PICs. NPDL is critically important to the smaller atoll states of Kiribati and Tuvalu. Matson Line, operating limited services from New Zealand to a range of Polynesian ports, has also traditionally linked Hawaii and Guam with West Coat USA. Nauru Shipping Line's (NSL) share of less than 1 percent reflects Nauru's minor container trade task.

The long-standing experience of carriers is critical to the effectiveness and efficiency of operations. Established carriers understand the nature of port capabilities and can implement measures to mitigate port operations constraints and conditions. They often have established landside services including designated agents and off-dock storage for containers, and investments in agency companies and freight forwarding which can ensure service reliability (Table 2).

[1] In 2010 Pacific Forum Line (PFL) suspended services from Australia and New Zealand to Pacific Islands in favor of vessel space-sharing with Pacific Direct Line (PDL). In 2013, the Government of Samoa agreed to sell a controlling interest of PFL to Neptune Pacific Line (NPL). In 2012 Matson line acquired Reef Shipping, followed in 2013 by Swire Shipping Group purchasing Polynesia Line Ltd. In 2014, the independent Mbf Carpenters Shipping withdrew its ships in favor of a vessel space-sharing agreement with Swire Shipping on services between East Asia and PNG, Solomon Islands, and Vanuatu. In 2017 Sofrana Unilines was acquired by ANL, followed with NPL acquiring PDL to form the newly branded NPDL in 2020 (UNESCAP, 2022).

[2] Nominal TEU refers to the maximum empty container capacity of vessels.

Table 2 Shipping Lines Direct and Indirect Investments in Local Commercial Activities

Local PIC Investments	Summary of Services
Stevedoring	Investments in cargo handling at port side. Includes heavy plant equipment, training stevedores, certification, and employing administrative staff.
Port Agency Services	Investments in local offices supplying (a) statutory, operational, and administrative services to ship arrivals and cargo services at the port; and (b) employing off-port staff and management.
Trucking	Investments in light and heavy road trucks involved in cargo distribution, empty container handling, and storage off-dock.
Warehousing	Investments in warehousing and distribution of freight to importers and wholesalers. Includes warehouses, machinery, and staff.
Freight Forwarding	Investments in local PIC offices and staff providing cargo brokerage and handling services for supply chain services.
Crewing Agencies	Investments in crew agencies at PICs that offer subsidized training and certification. Recruitment of qualified PIC seafarers for seagoing careers.

Source: World Bank

Shipping Routes

Whether carrying imports or exports, the 25 scheduled international shipping routes in the Pacific form three distinct patterns:

- **Shuttle services** are shorter haul dedicated shipping routes that link Pacific Rim ports and larger PIC gateway ports. In the PIC region, examples of shuttle services are: NPDL's routes between New Zealand (Tauranga) and Fiji (Suva and Lautoka); Swire Shipping from Australia into Fiji; and Maersk which shuttles between Solomon Islands (Noro), PNG ports, and Malaysia (Tanjung Pelepas). Matson Line also has a shuttle service that operates from Auckland to a range of Polynesian ports including Fiji, Samoa, Cook Islands, Niue and Tonga.
- **Multi-port long haul services** connect multiple PICs to Pacific Rim ports on longer scheduled routes. These often have three to four vessels deployed on them to ensure a regular frequency of service to PIC ports. Services falling into this category include those offered by Swire shipping, Kyowa Shipping, or the Matson Line, which originate and return from Northeast Asia, Southeast Asia, and the West Coast of the United States of America. Mariana Express Lines provide a direct service from China and Hong Kong to PNG, Solomon Islands, Fiji and FSM and RMI.
- **Intra-regional PIC services** do not connect with Pacific Rim ports but travel between PIC ports only. Examples include: NSL operating between Fiji (Suva) and Nauru and NPDL's 2-vessel service between Fiji (Suva), Samoa (Apia), Tuvalu (Funafuti), and Kiribati (South Tarawa).

Shipping Network Arrangements

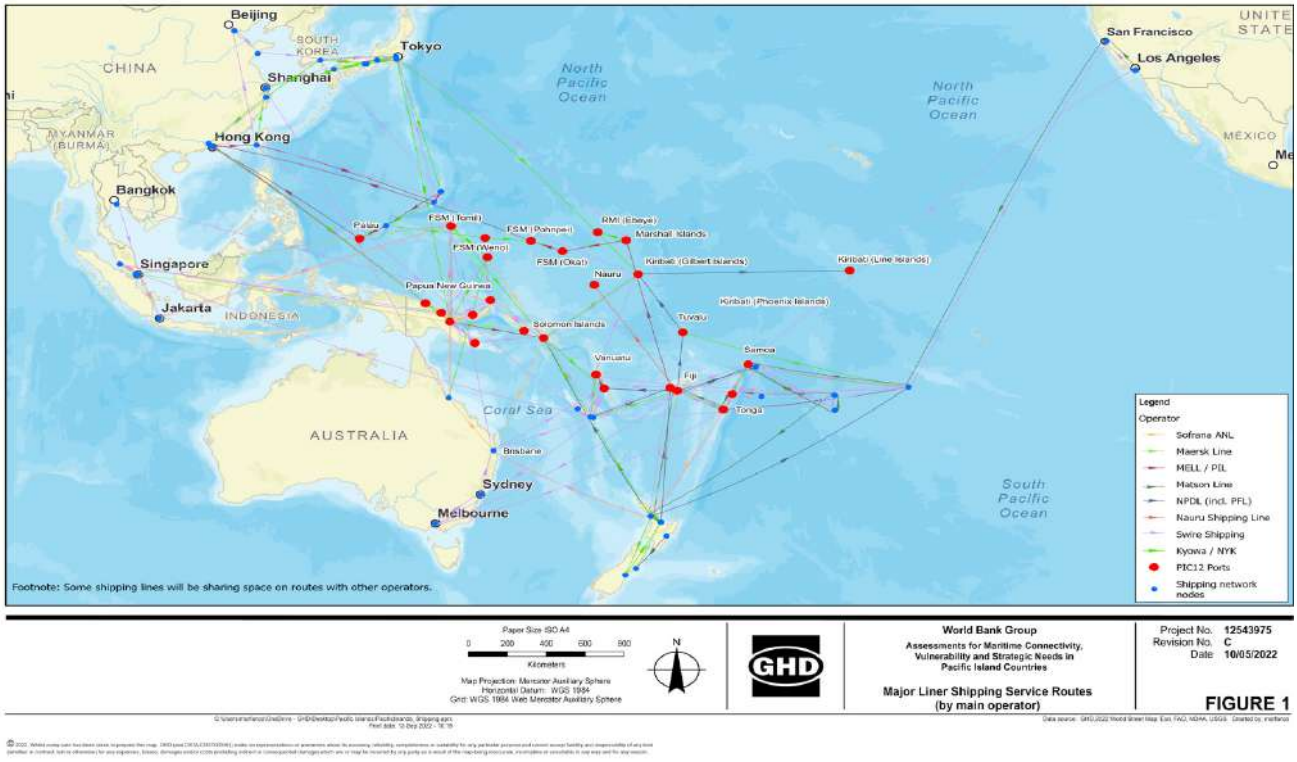
All but two PIC12 countries are serviced by multiple carriers. The exceptions are the remote micro-states of Nauru and Tuvalu, which are each serviced by only one carrier.

The network of carriers and routes (Figure 5) has evolved over several decades into a relatively mature commercial arrangement which provides reliable and affordable services to PICs, while adapting to changing conditions. Ships are deployed with capacity and operational characteristics to match trade volumes, service frequency, and physical port settings.

Alliances and consortia within the network of scheduled services provide for vessel "space-sharing"—this allows carriers to maintain commercially viable utilization of the network capacity and reduce their overall deployment of ships. This reduces the network's overall operational costs and balances market share opportunities for each carrier involved in vessel space-sharing.

While these arrangements do not match the scale of larger global shipping networks, in general, they are large enough to provide some level of economy of scale. That most of the carriers have multiple vessels also provides some redundancy and resilience to supply chains—a major shipping line has the capability to switch ships out of a scheduled route to fill service gaps in another, and temporarily charter ships into service to replace vessels that have been removed for repairs and maintenance.

Figure 5 Network of Scheduled Shipping Routes

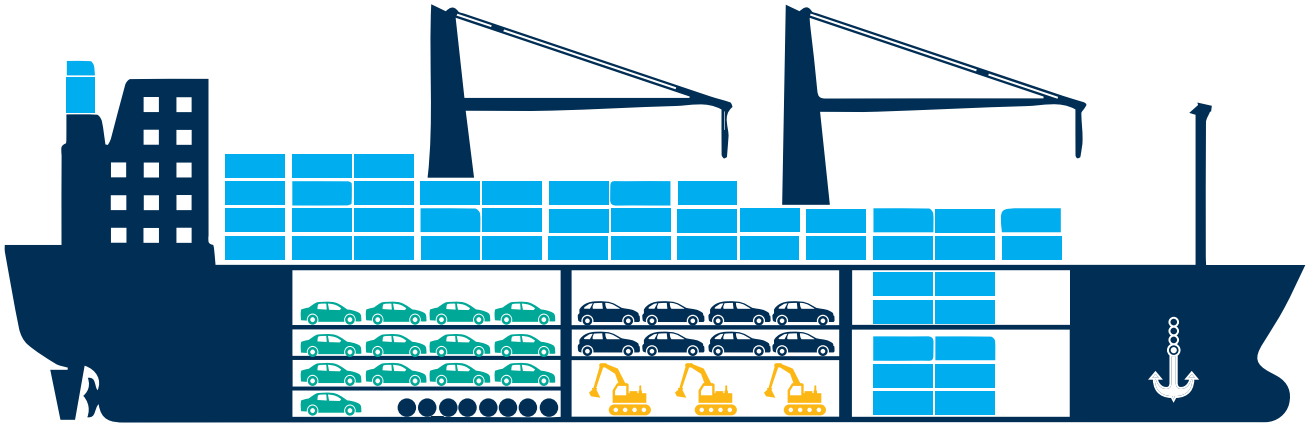


Source: World Bank, data collated from shipping company schedules.

Ship Size and Configuration

Ships deployed on international services to PICs are flexible multipurpose general cargo and container vessels (MPVs) with ship-mounted cranes capable of handling containers and break-bulk cargoes (Figure 6). These MPVs are operated under long-term charter or as owned assets purpose-built for Pacific trade routes.

Figure 6 Configuration of a Multi-purpose Vessel Like Those Deployed in the Pacific



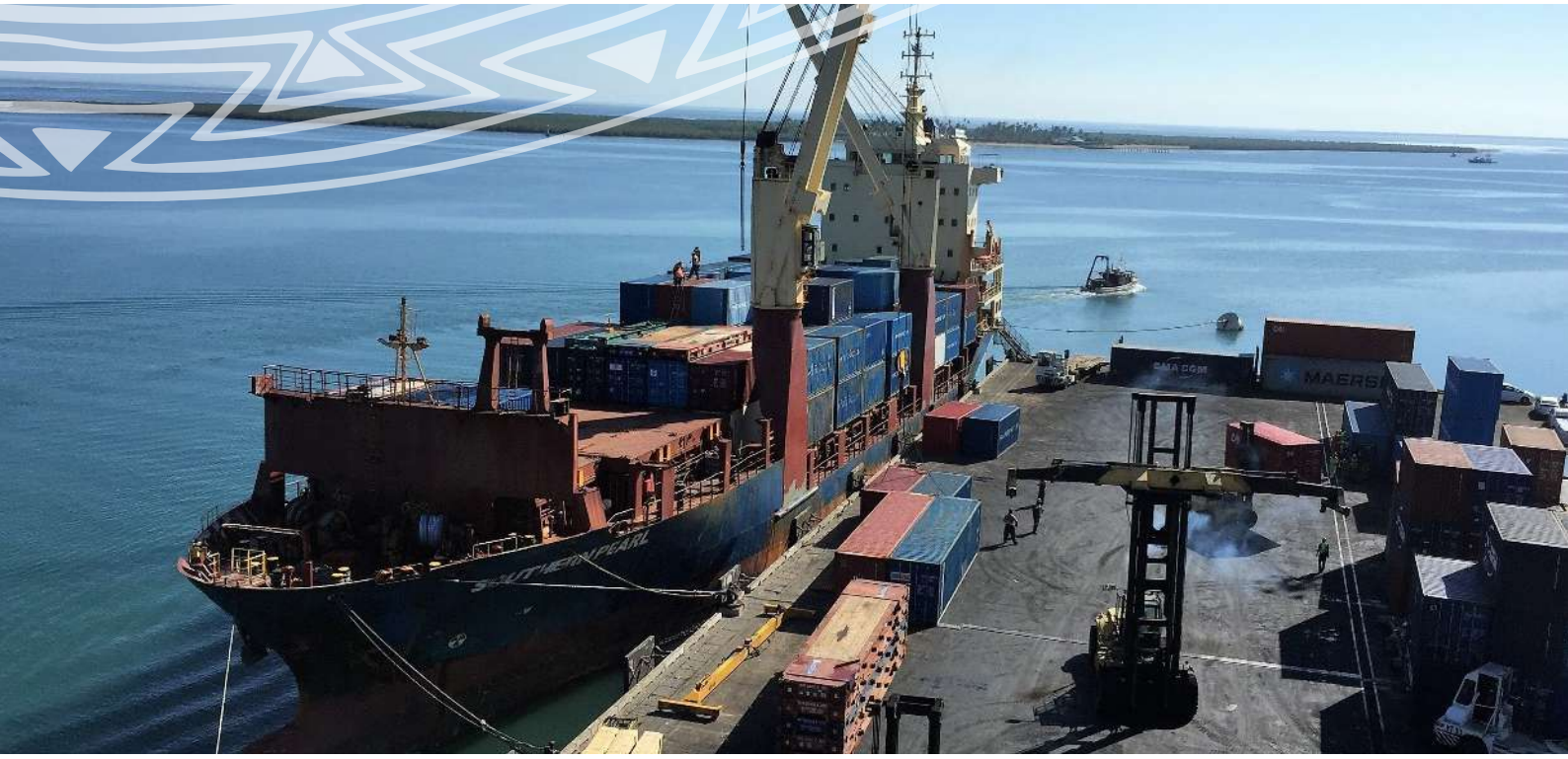
Source: Kyowa Line

Most MPV's have at least two cranes per ship, which reduces the need to install costly shore-side cranes. Ship-supplied cranes are maintained by the shipping company to comply with international survey safety standards, creating a natural resilience in the system.

MPV ships deployed on Pacific islands trade routes vary in capacity from 500 TEU to 2,800 TEU. Vessel size is matched to the volume of trade, the frequency of service, and the port settings. Smaller vessels are deployed on shuttle routes between regional hub ports and the smaller PIC12 states, such as from Fiji to Tuvalu and Kiribati. Larger capacity vessels operate on routes from Pacific Rim countries, such as from Southeast Asia to PNG, Fiji, and Solomon Islands. Intermediate vessels work routes between Australia and New Zealand and ports in Samoa, Tonga, Fiji, and Vanuatu.

PNG, Fiji, and Solomon Islands have the highest levels of trade volumes and growth (SPC, 2022). Planned port expansions and relocations make their ports prime candidates to attract vessels of greater capacity. PNG and Fiji have ambitions for ports capable of handling the larger gearless container vessels. That would give vessels plying between north and east Asia and Australia and New Zealand opportunity to divert to Suva and Lae ports (PNG Report, 2022) (Fiji Sun, 2021).

Typical Multipurpose vessel (MPV) deployed on PIC trade routes



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Containers arrive full, leave empty

Containers of imported goods arrive full but, due to the low volume of exports, most are back-loaded empty. Along with long distances and small volumes, this imbalance contributes to the higher cost of shipping to PICs.

A small number of TEU containers are utilized to export high-value niche products, such as coffee, cacao, kava, coconut oil, vanilla, squash (Tonga), beef (Vanuatu), or frozen and canned tuna. Fiji has the lowest number of empty container returns as it exports processed foodstuffs, beverages, textiles, cement, building materials, and bottled water. One possibility being explored in some PICs is to fill empty return containers with recyclable waste.

Bulk PIC exports of minerals, logs, sugar, whole frozen tuna and woodchip do not help reduce the number of empty exported containers because these are in separate supply chains, transported in dedicated, specialized vessels.

The high proportion of empty return containers is an unavoidable characteristic of Pacific trade, with its large volumes of imports and low volumes of exports. In contrast with busier regions of the world where stronger two-way trade prevails, the imbalance is a fact of life that must be accommodated rather than considered as a deficiency in the system.

Exports of empty containers are an unavoidable characteristic of Pacific trade.

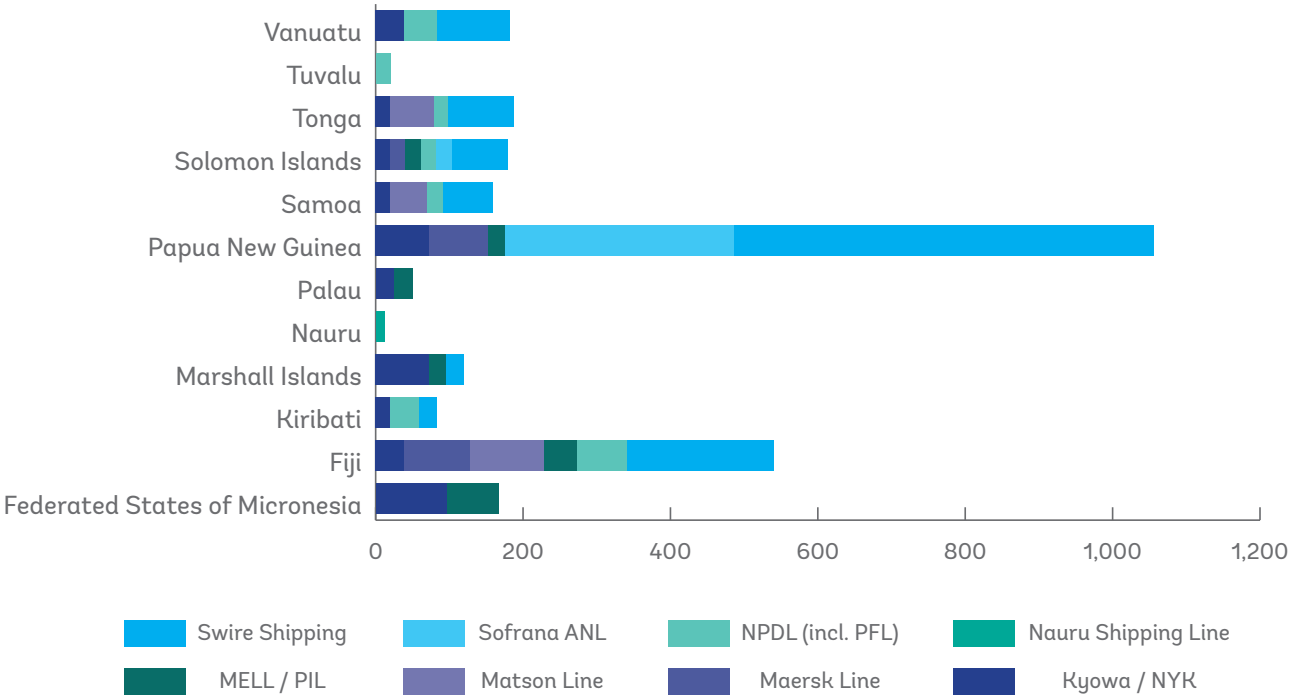
Service Levels and Pricing

Frequency and reliability of ship calls is a critical measure for international shipping to PICs because of their high dependence on imports, financial limitations on holding large inventories, and limited storage facilities. However, due to small volumes and long distances, the service levels of frequency and reliability are naturally lower than in larger Pacific Rim countries which benefit from economies of scale.

The evolution of the shipping network over several decades means:

- Most PICs are reasonably well served by the frequency and reliability of visits (Figure 7)
- On-island storage and stock levels match the levels of shipping
- The frequency, routing, ship size, and pricing have adjusted to form a commercially sustainable model.
- There is a moderate level of competition between shipping lines.

Figure 7 Annual Number of Port Calls in the PIC12 by Shipping Line



Source: World Bank Assessment

Notes: Port calls are estimated from shipping company published service routes and frequency, Maersk ceased services to Fiji in mid-2022.

Shipping prices are relatively high, and PICs are sensitive to increases

Small volumes, long distances, high empty container returns, and inefficient ports make shipping costs relatively high for PICs. Fewer economic resources make PICs very vulnerable to sustained price increases and sudden price shocks (such as global fuel price rises), and the logistics constraints experienced during the COVID-19 pandemic.

While the relatively small number of carriers means effective competition may not be achievable, two significant attempts have been made to establish oversight to monitor, examine, and influence pricing and service levels—the Micronesian Shipping Commission (MSC) established in 2006, and the Central Pacific Shipping Commission (CPSC) established 2014. The MSC covers the Micronesian sub-region and includes Palau, Federated States of Micronesia (FSM), and the Marshall Islands (RMI). The CPSC includes Kiribati, RMI, Nauru, Tuvalu, and Wallis and Futuna. Both commissions aim to ensure minimum service levels and affordability by licensing qualified carriers. They also restrict the number of carriers to ensure services remain commercially viable. Their effectiveness has not been reviewed.

Remote micro-states are under-served by international shipping

While most PICs have adequate service levels and pricing, the micro-states of Nauru and Tuvalu, and Kiritimati, a remote island in Kiribati, receive far fewer port calls and struggle with service delays and cancellations, sometimes causing shortages of critical supplies. These islands also experience higher shipping prices than other PICs, leading to a perceived lack of fair play by existing commercial carriers.

In response, in August 2020 the Government of Nauru established a dedicated service—the Nauru Shipping Line (NSL)—with a single chartered vessel operating between Fiji and Nauru. As a result, the existing commercial operator, NPDL, withdrew its direct international shipping services to Nauru. While the Government intended to bring costs down by running its own shipping line, low utilization mean costs are now higher than before, and additional risks are introduced by the lack of redundancy.

The Government of Tuvalu has occasionally entered charter arrangements, using a tug and barge to deliver project cargo and construction materials from Fiji. Because these bulk shipments were previously handled in containers, the transfer to bulk reduced the volume of containerized freight available to the dedicated shipping line, NPDL. The Tuvalu Government has also investigated options to charter or purchase a small MPV to operate between Fiji and its gateway port, Funafuti.

Action 3 in the *Blue Transformation* study seeks to help resolve issues faced by these remote micro-states by delivering supply chain security for essential imports and improving their connectivity to overseas export markets. Its focus on enhancing maritime services to better connect communities is founded on equity—leaving no one behind.

Box 1: Could a hub-and-spoke model improve shipping in the Pacific?

The potential for a 'hub-and-spoke' model for Pacific regional shipping has been on the table for many years. While part of the PIC network already functions as hub-and-spoke, the idea is to centralize most cargo distribution through one or two hub ports and replace existing multi-port schedules with feeder ships that make direct calls to PIC gateway ports as final destinations. The theory is that this approach will reduce costs and improve service levels by:

- Establishing hub ports that can service the large (gearless) container vessels that transit the North-South Pacific trade routes, capturing some of the economies of scale and lower freight rates these large, more frequent container vessels offer.
- Replacing "milk run" routes with fewer smaller intra-regional vessels that make direct calls to PICs, shortening transit times and reducing capital and fuel costs.

Preliminary modelling carried out as part of this study showed that, given the small volumes, the cost of diverting large container ships to the nearest hub port outweighed potential benefits. The model also raises a great deal of political and commercial complexity.

Key Areas for Attention

The overall aim for international shipping is to maintain consistent, reliable, cost-effective services of the appropriate type, capacity, frequency, and affordability to ensure resilient and secure supply to PICs.

With a small number of exceptions, PICs receive services of satisfactory frequency and reliability, provided by commercially sustainable international shipping services. Key areas for attention are:

Monitor, examine, and influence pricing and service levels

Independent oversight to monitor, examine, and influence pricing and service levels (capacity and frequency) is needed. This could, at a basic level, improve transparency of international shipping pricing for freight including ancillary surcharges to reduce asymmetric information between PICs and carriers. A more ambitious oversight model could incentivize carriers to ensure PICs receive fair prices and service levels. Mechanisms to achieve long-term efficiency gains and reduce fuel use and greenhouse gas (GHG) emissions could be included. A first step could be to review the effectiveness of the Micronesian Shipping Commission and the Central Pacific Shipping Commission.

Shipping services to remote micro-states and islands

New models are needed to provide adequate and affordable services for Nauru and Tuvalu, and remote islands such as Kiritimati. Some work is needed to explore how to ensure commercial carriers provide adequate service levels, while also ensuring profitability of the route and a fair shipping price for customers. This could include building community service obligations into a contractual arrangement with shipping companies. Possible instruments include a freight equalization scheme,[1] and approaches like the Franchise Shipping Schemes (FSS) deployed by several PICs in domestic shipping. To create the right incentives to establish enduring arrangements, the gap between what users pay and revenue that delivers a fair profit to the carrier would need to be guaranteed by donors over the long term (effectively in perpetuity). The benefits of incentivizing established commercial shipping lines to provide this service include the economies of scale and redundancy they bring, and their existing experience and knowledge of the Pacific. It also recognizes their existing investments in landside services, infrastructure, and employment in PICs.

Activities that provide services to the shipping sector

Opportunities exist to develop Pacific Island maritime sectors to capture some of the economic activity shipping generates. This could include: developing seafarer skills to enable Pacific peoples to obtain employment as ship's crew; ship provisioning; and ship repairs at strategic located shipyards.

[3] For example, the Tasmanian Freight Equalization Scheme, which provides payments to shippers to compensate for the additional costs of goods moved by sea between Tasmania and the mainland (Tasmanian Freight Equalisation Scheme, 2022).

Gateway Ports

Overview

In Pacific Island countries (PICs) gateway ports are multifunctional and provide a hub of local economic activity. This differs from the global trend towards specialized, high efficiency ports.

Gateway ports are generally of the right scale and type and vary in their need for infrastructure investment to expand, rehabilitate, or improve resilience to the impacts of natural hazards. Development of some ports is constrained by a lack of available land and in some cases urban encroachment.

Most PIC ports have low utilization and are not financially self-sustaining. Investment decisions need to be carefully assessed to ensure they address both current issues and long-term needs.

Asset management and maintenance are two critical issues—a "build–neglect–rebuild" paradigm prevails. A general lack of maintenance reduces the life of the asset and increases the overall cost. Better governance and oversight are needed, along with ongoing support from development partners across the life cycle of port infrastructure and equipment.

Because ports are long-lived assets, master planning is critical to ensure those serving as international gateways develop over time in ways that meet the needs of the community and the changing environment.

Actions 1, 2, and 5 of the *Blue Transformation* study will help address issues facing gateway ports. Action 1 promotes a whole-of-life approach to building and maintaining port infrastructure so that these assets last their designed life. Action 2 focuses on improving how countries plan resilient maritime transport systems, including infrastructure. And Action 5 promotes enhancing governance and oversight to ensure life cycle maintenance is planned, funded, and delivered.

This chapter sets out:

- The *role*, *size*, and *multifunctional* character of PIC gateway ports
- Developments in gateway port *infrastructure*, and ports in need of donor support
- Challenges ports face around *maintenance*, *governance*, *management*, and *sustainable financing*
- An assessment of gateway ports' *sustainability* initiatives (Green Ports)
- The role of *master planning* to guide development over the medium to long term
- *Key areas for attention*—opportunities to improve gateway ports.

The Role of Gateway Ports

Hubs of economic activity

Gateway ports are the major international seaports in each PIC where customs, immigration and biosecurity clearance take place, and imported goods are transferred to hinterland transport arrangements or to domestic shipping services for further distribution within the country. Most PICs have one gateway port, almost always located in the nation's capital. Exceptions are Papua New Guinea (PNG), Fiji, and the Solomon Islands where the economy and population are large enough to sustain more than one gateway port.

All PIC gateway ports are constrained by geography and the urban areas that have grown up around them. In larger PICs, the location of ports within townships creates problems with urban encroachment, including traffic congestion, incompatibilities between business and community activities, and limitations to port expansion.

In smaller PICs, colocation is less of an issue. Rather, the port provides a busy focal point for employment, domestic shipping, and seaborne passenger transport services. Because activities are consolidated at one site, the gateway port becomes integral to both international and domestic shipping. Often goods are cleared through customs and transferred to near-port wholesalers where they are traded and returned to the port zone for distribution to outer islands by domestic vessels.

Gateway ports are a lifeline for Pacific people

Gateway ports are integral to normal life in PIC12 countries, which rely on sea-borne imports for daily necessities. Following disasters, these ports are critical—a conduit for supplies of medicine, food, water, and shelter. An important consideration for the design and operation of port infrastructure is ensuring it remains operational during a disaster. The resilience (and vulnerability) of gateway ports to natural hazards, including climate change impacts, is discussed in more detail in the chapter on *Disaster and Climate Resilient Maritime Transport*.

The lack of alternatives for gateway ports creates supply chain vulnerability

Many outlying towns and villages on Pacific islands are small and cannot justify the permanent infrastructure of a designated international port. Most PICs depend on one gateway port, and this lack of alternatives creates a vulnerability if the primary port is out of operation due to an accident or natural disaster. This was the case in Nuku'alofa, Tonga, in December 2022, when volcanic activity closed the international gateway port (RNZ, 2022). Other gateway port closures occur from time-to-time due to seasonal oceanic swell and high winds, such as in Apia Port in Samoa and Betio port in Kiribati.

Gateway Port Size and Operations

Gateway ports are generally of the right scale

Low traffic volumes mean most gateway ports are not adversely congested. Exceptions are ports in the larger economies of Fiji, PNG, and to a lesser degree, the Solomon Islands, where higher numbers of ship calls cause some congestion and conflict between users. Smaller PIC ports usually have a single quay line with one or two berths to accommodate international ships, which is adequate to manage ship arrivals with minimum congestion. Smaller PIC's do feel the impact of delays to imported goods particularly during peak import seasons, when international ship schedules overlap creating berth delays. This is infrequent but does reflect the limitations that a single wharf imposes.

Existing port and wharf development has largely been scaled to achieve the 'right-fit' to meet longer-term demand for freight and vessel activity. However, some port developments have been proposed that are over-scaled to future demand, such as the design for a greenfield port at Vaiusu Bay in Samoa with capacity for 300,000 twenty-foot equivalent units (TEU) per year (PECC, 2016). This was far greater than the volumes at Samoa's Apia Port, just 41,200 TEUs per year (SPA, 2020). Overcapacity leads to inefficiency and adds to the vital and costly task of maintenance. It is essential for gateway port developments to be right-sized to meet expected demand over the 50-year build life of major port infrastructure. The other adverse effect of overscale development is the greater burden to the economy of sovereign guaranteed loans and blended finance that PIC's bear longer term.

PIC gateway ports are multifunctional

Port developments must deliver multifunctional operations to cater to a wide variety of activities and users. This contrasts with global settings where larger scale ports specialize in different types of cargo and ships.

An example of a multiuser port is in Apia, Samoa. Within its small port zone are petroleum storage tanks, domestic ferry passenger terminals, cargo sheds, a yacht marina and hospitality waterfront, a heavy plant machinery storage area, customs and quarantine buildings, a police patrol boat base, a cable storage shed, and the container storage yard.

The limited scale and diverse range of goods requires PIC ports to provide infrastructure and flexible services for a variety of ship and cargo types. For example, all PIC gateway ports use plant equipment that is adaptable such as reach stackers or forklifts or a combination of both to handle the mix of containers, break-bulk, unitized timber packs, oversized cargo loads, and palletized freight. This contrasts with larger container terminals (>500,000 TEU) that exclusively use plant that is linear in design and much less adaptable such as straddle carriers and rubber-tired gantry cranes to stack containers in uniform rows within large-scale hardstand areas.

Onboard ship cranes are appropriate and effective for most PIC gateway ports

Globally, larger ports use rail-mounted or mobile shore cranes to load and unload cargo, particularly containers. Because they are faster than ship cranes, they provide productivity and efficiency gains by reducing ships' dwell time at port.

It has been suggested that shore-side cranes would realize productivity gains for PIC gateway ports. However, low volumes of freight and the relatively low frequency of ship calls to most gateway ports mean shore-side cranes would not deliver significant efficiencies. The exceptions are some major hub ports, such as Lae and Motukea in PNG, and Suva and Lautoka in Fiji.[1]

Installing permanent shore-side cargo cranes at smaller PIC ports would impose additional costs and increase operational risks. They would have relatively low utilization and would require significant maintenance. Further, dependence on shore cranes would be a significant vulnerability should shipping lines be encouraged to switch to gearless ships. Port infrastructure would likely need to be upgraded to strengthen and expand the wharf deck to cater for the larger footprint and payload of heavy cargo cranes. In some cases, wharves built in the last 10 years would need to be upgraded to allow gearless ships to call. The same upgrades would have to occur across the full range of ports serviced by the same ships.

The current situation of using ship-mounted cranes offers significant advantages to Pacific ports. This system has natural resilience: the cranes are properly maintained by the ship operators to international survey standards and each ship has several cranes which provides immediate redundancy in the case of a breakdown. In terms of economic cost, the cranes have higher utilization rates, and the cost is spread across multiple ports and passed on through shipping prices, which is more efficient and reduces the financial burden on ports.

A further advantage is when a port is disrupted by a natural disaster or other event. Multipurpose vessels (MPVs) with ship-mounted cranes provide resilience as they can transfer cargo at anchorage from the ship to flat bottom landing craft or barges, which then carry the cargo to shore which can be offloaded using adaptability of fork hoists or reach stackers.

Green Ports

The development and operation of ports in PICs use large amounts of resources including land for the port and surrounding activities, construction materials, energy, and water. The operations of a port create greenhouse gases (GHG), water pollution, solid and liquid waste (for example, oil spills), and air, noise, underwater vibration, and light pollution both from the port itself, and from ships using the port. Port development and operations have a significant negative impact on local biodiversity in sensitive marine environments.

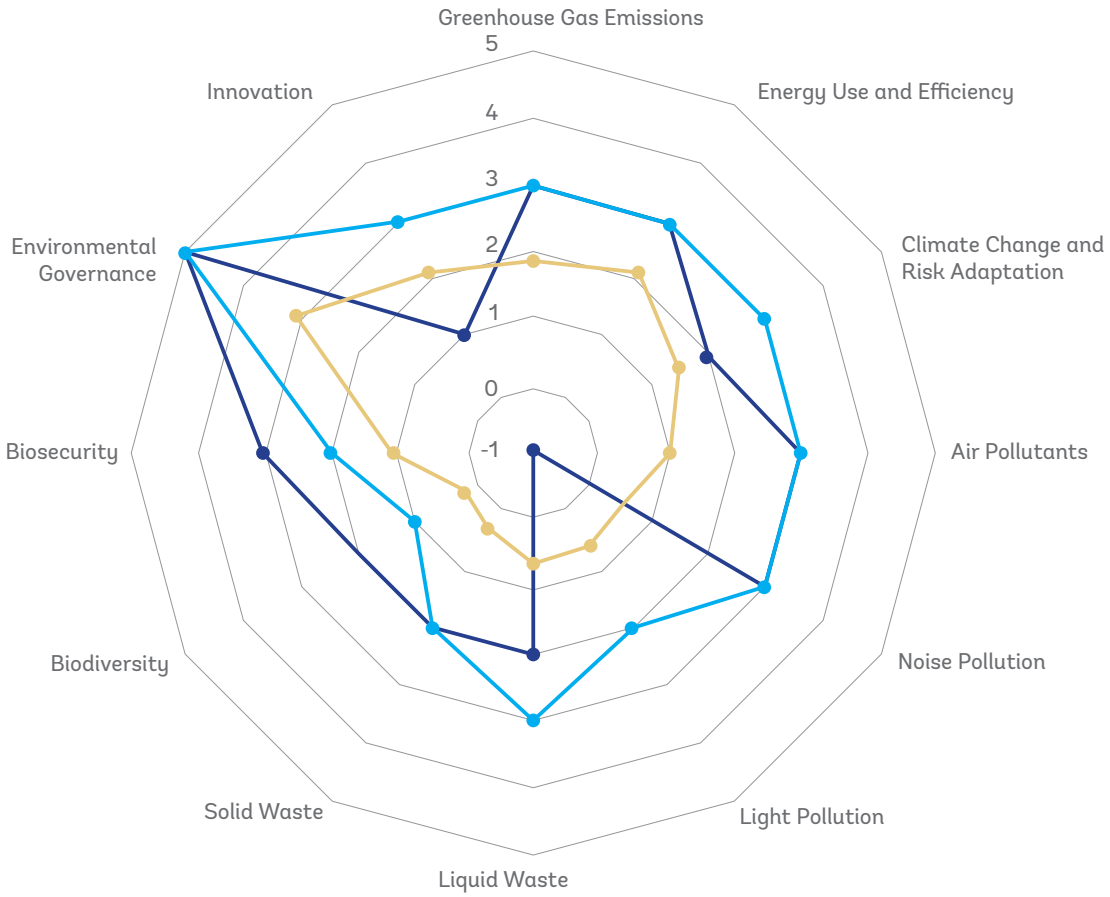
"Green Ports" is a term widely used for a range of infrastructure and operational measures ports can adopt to reduce their energy and resource consumption and environmental impacts. These measures include energy efficiency and conservation, and the use of renewable energy, waste management, water use management, pollution controls, biosecurity measures, and the conservation and management of local ecosystems. It also carries with in consciousness of impacts upon the local communities that surround the operating port and incur heavy vehicle traffic traversing local roads.

[1] Larger ports may benefit from the higher handling rates and ability to service gearless ships that shore-based cranes allow. Lae and Motukea ports in PNG, and Suva Port in Fiji, already have mobile harbor cranes installed, which are used in conjunction with ship cranes. The operator of Lae Port plans to install rail-mounted gantry cranes in the latter half of 2022.

A study carried out as part of *A Blue Transformation for Pacific Maritime Transport* established criteria to evaluate the environmental sustainability of PIC ports, benchmarking them against a selection of "peer ports" in other small island states from the Caribbean, Iberian Peninsula, and Indian Ocean. This benchmarking showed that several larger PIC ports have made good progress in implementing Green Ports measures–including Motukea and Lae (PNG), Suva and Lautoka (Fiji), and Honiara (Solomon Islands)–while most smaller ports have few measures in place. Figure 8 illustrates that the best performing PIC ports are generally assessed at a similar level to global peer ports, while PIC port average scores demonstrate that there is significant room for improvement regionally to align environmental sustainability performance with best practices in global peer ports.

There is considerable opportunity for Pacific ports to advance their green port credentials by drawing on technical advisory support, guidance, and oversight from existing regional organizations, including the Pacific Regional Environment Programme (SPREP) and Pacific Community (SPC). A new development in this sector is the announcement of an Oceania arm of the global GreenPort Congress which has been operating in Europe for two decades. The GreenPort Congress will host its inaugural conference in Newcastle, Australia, in February 2023 and aims to create a community of ports and maritime stakeholders that are focused on sustainability and knowledge sharing (Mercator Media, 2022). The progress already made by several larger PIC ports illustrates how these practices can work in a Pacific context.

Figure 8 Comparison of PIC Port Performance Against Global Peer Ports



Source: World Bank

Note: Higher scores indicate higher performance, the score of -1 means no information was available for light pollution for any of the peer ports.

Port Infrastructure Development

PIC ports have developed in response to changing conditions

Development of gateway ports has happened over time in response to growing trade volumes, changes to cargo handling methods, and changes in ship size and configuration. Some legacy issues related to the original site selection and design of Pacific Island ports can constrain options.

Modernization of infrastructure has taken place in stages. The first stage (1960–80s) involved replacing timber structures with concrete decks and piles. The second stage (1980–2000s) focused on strengthening wharf structures, deepening channels and depth alongside the berth, and allocating yard space to meet the demands of containerization. The third stage, over the last 10–20 years, has confronted the need for further expansion within the limitations of urban encroachment, leading to relocation being considered for a few ports. More recently, port development has emphasized the need to build in resilience to natural hazards and the impacts of climate change.

Recent significant investment in port infrastructure and equipment upgrades are listed in Table 3, along with areas where further support from development partners is needed.

From time-to-time renewal, reconfiguration, and design changes are needed

Changing demand, ships, and cargoes mean PIC ports need to reconfigure their infrastructure and superstructure from time to time. In some ports, these adjustments have occurred or are underway.

An example of the need for reconfiguration is Pohnpei Port in the Federated States of Micronesia (FSM). Because the port is shared between fishing vessels and international container ships, it has suffered from limited berth capacity and constrained yard space. Reconfiguration will aim to deliver improved efficiency and productivity for both industry sectors.

Future planning for energy storage and supply should be part of long-term master planning for ports. This will emerge as PICs transition to greater renewable energy supplies, lessening the need for large-scale petroleum storage tanks, which in many cases are sited on or adjacent to port land. Remediation and reallocation of such brownfield land may include storage for non-fossil fuels.

Relocating a port can address spatial, operational, or climate challenges for some PICs

Port relocation is required when the original site becomes constrained, operations are no longer economically viable, or there are concerns about its vulnerability to climate change. Some gateway ports in Pacific countries with larger economies have already completed relocation or are currently undertaking the process. While full port relocation is a long-term action, shorter-term steps may include phased relocation, reconfiguration of port superstructure to better suit immediate needs, and protecting approaches to the port from urban encroachment.

In 2018, Port Moresby in PNG was the first Pacific Island gateway port to be relocated. The entire port operations were transferred eight kilometers from the city boundary to the dedicated industrial zone of Motukea on the other side of Fairfax Harbor. The new location of Port Motukea provides deepwater access and modern wharves and has space to expand on both the marine and landside to meet future growth of vessel numbers and freight volumes.

Suva Port in Fiji is currently co-located alongside the central business district (CBD). It shows how urban encroachment and the lack of planned freight corridors can place operational limitations on port activities (Figure 9). Only a few meters separate the port boundary and the neighboring passenger bus terminus and fresh produce markets. Alternative sites are undergoing evaluation. A new port site will provide two main benefits: allowing the port unencumbered access to land of sufficient scale at a new site to operate its marine and land side operations; and providing prime waterfront land at the existing site for the city to extend existing tourist and business precincts.

Figure 9 Satellite Image of Suva Port Showing Multiple Functions and Urban Encroachment

Source: World Bank using image from Google Earth.

Honiara Container Terminal, Solomon Islands, is a legacy CBD port location that has had to adapt to the growing demands of containerization at a constrained site. It has the added disadvantage of being on a peninsula with limited scope for land reclamation. Traffic congestion in Honiara CBD is made worse by the port's location—a single access road adds heavy vehicle movements to an already congested road system. Port relocation has been discussed over the last decade, and some private sector operators are investing in alternative port sites. This may impact the commercial monopoly of the Government-owned port if it remains at its current location.

Future constraints should be considered carefully when redeveloping ports that are already experiencing urban encroachment.

Table 3 Major Infrastructure Development Needs and Activities for Pacific Gateway Ports

Country	Port	Condition	Major needs	Activities
PNG	Lae: Container terminal	Good New facility built 2017	Expand Masterplan update 2026	Development underway with support from the Australian Infrastructure Financing Facility for the Pacific, 2022
	Lae: Old wharves	Average Aging wharf hardstands in various stages of disrepair	Masterplan update 2026 Rehabilitate within 5–10 years	Masterplan completed by PNG Ports Corporation, 2020
	Motukea	Good Land reclaimed and new terminal built 2000–2015	No immediate major needs Masterplan update 2026	Masterplan completed by PNG Ports Corporation, 2020 Terminal leveling and new paving completed 2021–22
Fiji	Suva	Average–Poor Failing in sections Impacted by urban encroachment	Rehabilitate: short term 1–10 years Relocate: within 10 years	Masterplan for Fiji ports completed, Asian Development Bank (ADB), 2017 Relocation study underway, ADB, 2019–present day
	Lautoka	Average–Poor Subject to tidal inundation	Expand, rehabilitate, and reconfigure Elevate height of terminal yard	New container yard construction underway, support from China, 2022

Country	Port	Condition	Major needs	Activities
Solomon Islands	Honiara	Good–Average Capacity limitations Impacted by urban encroachment	Expand Rehabilitate aging No.1 wharf Relocate within 10 years	Construct new wharf and expand terminal yard, Japan International Cooperation Agency (JICA), 2016 Upgrades to buildings, security, terminal lighting, Solomon Islands Ports Authority, 2018–2024 Planned expansion and paving of yard, SIPA, funded 2021–ongoing **Funding and support required for the rehabilitation of No.1 international wharf in the short term and relocation of the port within 10 years, and ongoing asset management**
	Noro	Poor Failing in sections	Expand and rehabilitate Masterplan within 5 years	Memorandum of understanding (MOU) between Solomon Islands Infrastructure Program (SIIP) and SIPA for support to upgrade Noro port, 2022
Vanuatu	Port Vila: Lapetasi terminal	Very good New facility built 2017	Masterplan within 5 years No immediate major needs	Construction of Lapetasi new international wharf terminal completed, JICA, 2017
	Port Vila: Main cruise wharf	Average–Poor	Structural condition assessment Reconfigure, rehabilitate	Main wharf rehabilitated, JICA, 2010
	Luganville	Good–Average	Masterplan within 5 years Reconfigure	Rehabilitation and extension of Luganville main wharf completed, concessional loan from China, 2018 **Funding and support needed to develop a masterplan and reconfigure storage areas**
Kiribati	Betio Tarawa	Average–Poor Failing at fisheries wharf	Masterplan required immediately Structural condition assessment for fisheries wharf and international wharf Reconfigure, rehabilitate	Construction of Betio international port completed, JICA, 2014 Construction international port fuel storage tanks completed, 2021 **Funding and technical support needed for masterplan, condition assessment, rehabilitation, design and construction of upgrades, and ongoing asset management**
	Ronton Kiritimati[1]	Poor Legacy wharf inappropriate design for modern MPV ships	Masterplan required immediately Structural condition assessment international wharf	Construction of main wharf circa 1970 **Funding and technical support needed for masterplan, condition assessment, design and construction of upgrades, and ongoing asset management. European Union has interest to fund port development, 2020**

[2] Ronton Port on Kiritimati is a special case—a port servicing a relatively small, very remote population, distant from the main port of Betio on Tarawa.

Country	Port	Condition	Major needs	Activities
Samoa	Apia	Good–Average Urban encroachment Subject to ocean swell and storm surge	Expand Extend breakwater Relocate fuel tanks Masterplan within 5 years	Masterplan for Samoa ports completed, ADB, 2016 Construction of international wharf extension, hardstand, and yard expansion completed, JICA, 2018 Feasibility study—breakwater for safer navigation and berthing of international ships, ADB, 2019 Feasibility study into relocation, China, 2019. Relocation considered not viable by Government of Samoa ADB has committed funding to extend the breakwater **Support is needed to relocate fuel tanks and possibly to co-fund the extension of the breakwater for resilience and safe berthing**
Tonga	Nuku'alofa	Average–Poor	Expand, rehabilitate, new builds Masterplan	Study expansion and upgrades to international port terminal areas, ADB, 2018 Upgrade underway, detailed design for wharves terminal yard area, ADB, 2022 Construction planned for completion, ADB, 2024–25
Tuvalu	Funafuti	Average–Poor	Masterplan required immediately Expand, rehabilitate, new builds	Construction upgrades international wharf, terminal completed, JICA, 2009 **Support is needed for masterplan, design and construction of upgrades, and ongoing asset management**
Nauru	Aiwo	Poor	Expand, rehabilitate, new builds	Port planning, detailed design, and construction works underway for new wharves and port terminal, ADB/ Australia, 2018–present day
FSM	Dekehtik Pohnpei	Average–Poor	Masterplan Expand, reconfigure, rehabilitate, and new builds	Scoping study for port development, Pacific Regional Infrastructure Facility (PRIF), 2010 Development planning for port development, ADB, 2015 Needs assessment for enhanced safety, efficiency and resilience upgrades at four principal ports, World Bank Group (WBG), 2022 Strategic masterplans for four principal FSM ports underway, WBG, 2022 Needs assessment for search and rescue (SAR) equipment and training in procurement process, WBG, 2022
RMI	Delap dock Majuro	Average–Poor	Masterplan Expand, reconfigure, rehabilitate, and new builds	Needs assessment for enhanced safety, efficiency and resilience upgrades, WBG, 2022 Strategic masterplans expected to begin, WBG, 2022
Palau	Koror	Poor	Masterplan Expand, reconfigure, rehabilitate, and new builds for existing port	Planning Needs Long Term for Ports Palau, 2016, International Finance Corporation (IFC) **Support is needed for a masterplan and assessment of development options**

Source: World Bank team data collection, **Bold** text indicates where there is an unmet need for support from development partners as of September 2022.

Asset management

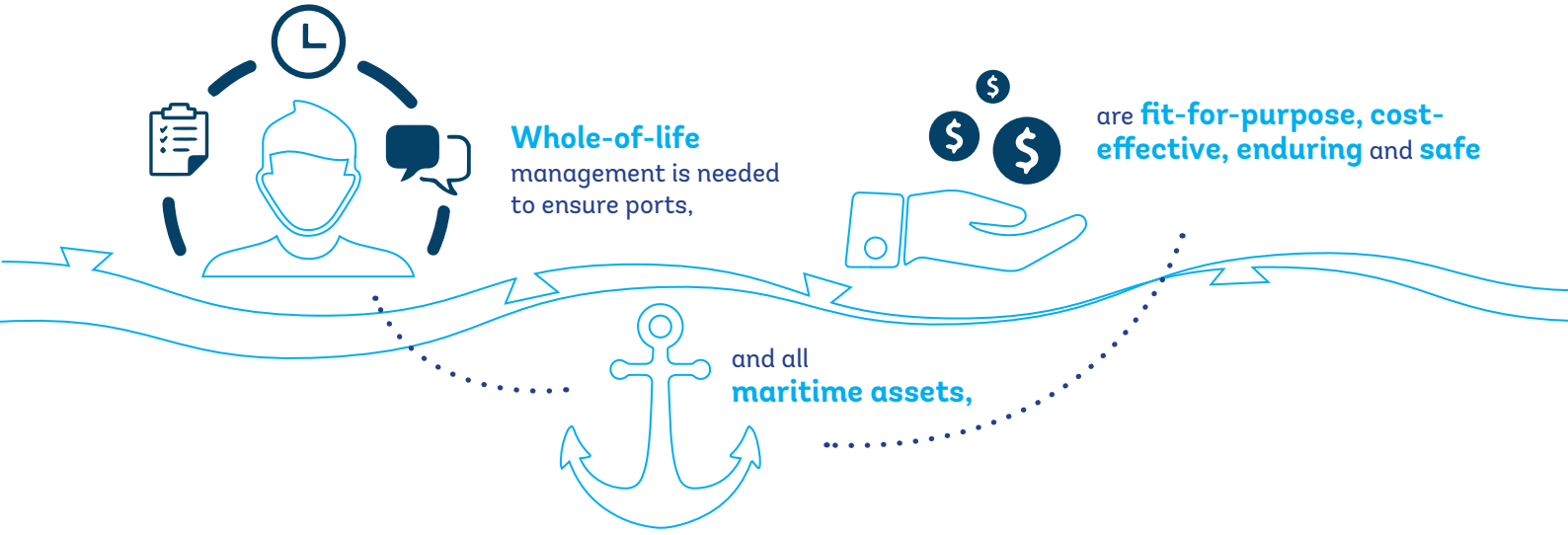
A whole-of-life approach to asset management is needed

One of the most important recurrent gaps in Pacific Island ports development is the lack of preventive maintenance applied to major infrastructure and superstructure at the gateway ports—the "build-neglect-rebuild" paradigm (Alejandrino-Yap, Dornan, & McGovern, 2013). Past World Bank Groupstudies have highlighted that maintenance arrangements for Pacific ports' infrastructure are: "…sporadic, with maintenance plans, funds and asset registries absent" (World Bank Group, 2015).

Lack of maintenance reduces the life of an asset and increases the overall cost. De Sitter's generally accepted *Law of Fives* estimates that in the case of concrete structures, such as wharves and hardstands: "…every dollar of routine maintenance that is deferred will end up costing $5 in repairs, or ultimately, $25 in rehabilitation or replacement as the asset declines over time" (1984).

Addressing maintenance gaps would improve the reliability of service, enhance efficiency, and is integral to passenger and cargo safety. For example, in Apia, Samoa, a lack of maintenance caused crowding and disrupted cargo operations when the main wharf degraded to the point it was unsafe for use by heavy machinery, reducing the available area of wharf and hardstand (PRIF, 2014). Lack of maintenance also reduces structural integrity and increases a port's vulnerability to natural hazards.

The whole-of-life approach to infrastructure is Action 1 in this *Blue Transformation* study. It considers infrastructures' full lifetime costs at the planning and design phase. This includes identifying how maintenance will be financed and delivered, and ensuring the design and construction are appropriate for the available resources and capabilities of the country.



Badly corroded concrete at Salelologa Wharf in Samoa

Source: Adrian Sammons / AMSTEC.

Budgeting for the true whole-of-life costs of asset management

Typically, development partners provide loans or blended finance for the construction phase of infrastructure projects, and the country is responsible for the ongoing cost of maintenance and repairs. A major reason for the degradation of infrastructure and superstructures is because no budget is allocated to preventative maintenance, resulting in the urgent need for partial or complete rebuild.

A recent Pacific Regional Infrastructure Facility (PRIF) study benchmarking infrastructure maintenance in the Pacific emphasizes the critical need for PICs to limit investment in infrastructure and focus on strategic priorities, so that the stock of infrastructure is within the capability of the country to maintain (Fawcett & McGovern, 2022).

The true cost of providing port services includes the whole-of-life costs of infrastructure and equipment, including maintenance and renewal. However, this is rarely properly quantified or budgeted (ADB, 2007), (World Bank Group, 2015), (JICA, 2013). The planning and construction costs of new assets can constitute as little as 20 percent of the total life cycle costs, while maintenance and refurbishments can be of the order of one-third of the total cost (Fawcett & McGovern, 2022). Country governments may accept a project to develop infrastructure without fully understanding the ongoing liabilities. One estimate of the cost to maintain existing infrastructure in the Pacific is around 3.1 percent of Gross Domestic Product (GDP) (Alejandrino-Yap, Dornan, & McGovern, 2013).

Providing an accurate cost assessment is often difficult, but even where there are adequate resources to do so, there is often a failure to allocate funds from national budgets (ADB, 2007). Transport projects are increasingly featuring activities that seek to address these challenges, such as maintenance funds and long-term performance-based construction and maintenance contracts.

Port Governance and Management

PIC ports authorities are still maturing in their governance and management arrangements. The development of self-managing ports in Pacific Island countries largely began in 1980–90 with legislation setting up state-owned enterprises. With responsibility transferring from government departments to the new port authorities, management and operational staff were recruited. Since then, management procedures and processes have benefited from technical advice. Support to refine these procedures, and include new systems and digitization, are the next stages for port authorities. It should be noted that some PIC's have not fully transitioned to autonomous Port Authorities and instead retained a departmental oversight. This is the case in Vanuatu and Tuvalu where the department resources and budget are not fully aligned to the needs of managing the operations of a modern maritime port, channels and their legal compliance requirements.

In recent years a regional technical assistance program offered by the Private Sector Development Initiative (PSDI, 2022) has provided support on governance and management techniques and processes. Continued technical support is appropriate for the future development and continued growth and sustainability of PICs ports authorities.

Room for improvement

The challenge of maintaining an effective governance regime at PIC ports has been identified in several research publications, including the World Bank report *Improving Ports and Maritime Shipping* (2015). Priority actions for sustaining appropriate governance include appropriateness and timeliness of policies, prompt enacting of regulations, and fiscal management.

Most PIC ports have an oversight and monitoring regime provided by a public enterprise ministry or equivalent. Before this some suffered from fiscal mismanagement which saw them approach insolvency. Analysis identified opportunities to improve including through greater board oversight of financial management, including debt ratios, and the need for financial controllers to have tighter fiscal management and systems (PRIF, 2014.)

Private sector participation in port services could support good governance and improve outcomes. Several public private partnership (PPP) arrangements have been completed at PIC ports, including in Fiji, Vanuatu, and PNG, and to a lesser extent in the Solomon Islands. Engaging in these formal contracts has provided state-owned authorities and corporations access to management and governance experience and knowledge. The case in Fiji has moved a step further—the PPP covers shareholder and shared board level arrangements that have allowed improvements in monitoring, evaluation, and governance practices. There are remaining opportunities at some PIC ports to deliver operational and fiscal benefits, including where a fragmented approach and duplication of effort occurs at the stevedore levels due to continuance of legacy pre-containerization arrangements.

Financial Sustainability of Ports

Most PIC ports will require ongoing financial support from development partners

Infrastructure development often includes an (implicit or explicit) assumption that an investment will facilitate economic growth and be able to generate economic returns to pay for maintenance and renewal costs (Alejandrino-Yap, Dornan, & McGovern, 2013). However, the lack of scale in many PIC economies leads to a low utilization of port assets and means these assumptions do not generally hold true (except in some of the larger countries.) PICs' high dependence on aid to finance port infrastructure is a symptom of this. A realistic view is that some immutable drivers—geographic characteristics, size, remoteness, etc—constrain the financial sustainability of many PIC ports, and consequently they will require ongoing financial support from development partners.

Port charges are attached to legacy tariffs and do not reflect true costs

Generally, legislation governing PICs ports and maritime services dictates that they should operate as a commercial enterprise. Some ports are profitable and pay a dividend to the government, while others just break even or experience financial distress (UNESCAP, 2022).

Port fees in the Pacific islands are generally low compared to peer ports in other regions. Due to the low level of

competition in shipping, there is unequal bargaining power between shipping companies and ports authorities on port charges. Port tariffs and the methods used to calculate them vary widely between PICs (McMahon, 2021). There has been a slow evolution of port tariffs which were originally aligned to port charge mechanisms used pre-containerization. Opportunities exist at this level to assist the ports authorities to review both marine and landside tariffs to ensure they align to full operational services provided and thereafter examine the basis of the listed charges. It is likely many PIC ports will have need for modernization of port tariffs included transition to use of cost – price formulas to ensure costs of infrastructure provision, repairs and maintenance, labour, administration, conservation, sustainability and consumables are adequately recovered.

Benchmarking of port charges across an array of PIC ports would be an additional characteristic to ensure the flow on effect of tariff modernisation with shared experiences and knowledge. It is worthwhile mentioning that international shipping lines appreciate the fragmented and legacy pricing arrangements that exist at some PIC ports that result in continuance of outdated port charges.

Infrastructure investments need to be fit-for-purpose and appropriately scaled

Infrastructure investments have a long-term financial impact on Pacific Island countries, either by incurring debt or by incurring maintenance and rehabilitation liabilities over the life of the asset (even when grant funded). The low utilization rates and limited opportunity to generate revenue from these assets means investment decisions should be carefully assessed. It is important to ensure assets are fit-for-purpose and realistically scaled to demand. Having appropriately scaled infrastructure with a focus on efficient operations will reduce the maintenance burden.

Key areas for attention

Improve master planning to make ports future-proof—resilient, right-sized, sustainable

Master planning is a dynamic, long-term approach that provides the conceptual design for future development of ports. The many considerations for master planning include future demand, possible revenue sources, location and land use conflict, maintenance capability and resources, and expected impacts of climate change.

Recurrent port master planning is linked to careful design and renewal planning of infrastructure and includes the long-term adaptation and future capacity and capabilities of the port.

Ideally, port master planning would occur at intervals no longer than seven years. This will enable the PIC ports to address strategic development priorities and funding estimates well before they become critical needs or impact service capabilities. Support for master planning activities could be provided by a centralized regional expert advisory panel, facilitated by resourcing existing regional bodies such as SPC and peer ports donating their expertise through organizations such Ports Australia Ltd.

Support could extend to helping PIC ports authorities identify and prioritize non-core cargo port-related services. Non-core cargo-related activities can help generate additional revenue and economic opportunities for the country but may also compete for the limited wharf space within the port operational areas, such as cruise ships and so need to be carefully thought through.

The approach of support could consider a cost benefit assessment associated but not limited to new business invitations to service international fishing fleets, fish processing plants.

Invest in maritime infrastructure for life—strategic whole-of-life asset management

Ongoing liabilities need to be estimated and communicated clearly in planning and design processes. While development partners are placing more emphasis on better maintenance budgeting, this is an area that requires more sustained attention, taking a more realistic view of the ability of most PICs to pay for this. Future support for PIC ports could consider periodic condition assessments and the implementation of preventative maintenance budgets as financing conditions. Whole-of-life performance-based contracts for the construction and maintenance of infrastructure and equipment are increasingly being applied.

Improving governance and increasing private sector participation

Improved governance and increased private sector participation in port operations is likely to improve effectiveness, renewals and maintenance of plant equipment, and the safety of operations. This is because of increased compliance with upskilling and certifying plant operators and adherence to manufacturers' service schedules. Productivity increases at cargo ship to shore level and ship dwell times alongside wharves are another likely outcome of broader private sector involvement, because of concession contractual obligations such as key performance indicators.

Developing management capacity

Enhancing the management of ports includes providing technical support in the process of achieving accreditation through the International Standards Organization (ISO). In particular, ISO standards for quality management, operational, safety, and environmental management and green ports practices (ISO 14001 and ISO 9001).

Regional level support could be developed by strengthening competencies and resources within existing Pacific organizations, such as SPC, to enable them to better guide PIC port authorities on their journey towards accreditation.

Improving cost recovery through port charges

PIC ports have an opportunity to enhance their revenues by adopting modern principles for port pricing formulas for core services such as berthage, wharfage, and pilotage. Increased and better aligned revenue from port charges could contribute to budget allocations for asset maintenance. For some larger PIC ports, it may be possible to return annual dividends to the (government) shareholder. It is suggested that consideration be given to a collective regional and harmonized approach to determining port fees which takes into account the true costs of providing port services including capex and opex (UNESCAP, 2022). Ready access to expert advisory services to support port management and decision-making in tariff management would be key to enabling this.

Encouraging private sector involvement in ports

There are multiple benefits for ports authorities from private sector involvement in port operations and management. Private sector involvement can range from small contract services, such as hardstand sweeping and cleaning after ship operations, through to large-scale contracts involving stevedoring and terminal management. These benefits may include improved management capacity, better financial management, reduced reputational and operational risk for port authorities, and the transfer of recurrent capital expenditure for heavy plant.

Increased private sector involvement could be supported by technical assistance to elaborate the process and the extent of viable options for private contractors and PPPs. These advisory services could provide PIC ports an understanding of the revenues and profit available under such schemes and a roadmap of the transactional processes involved.

Support for environmental management and green ports

Many green ports measures are simple and will have short-term paybacks, such as energy efficiency in air conditioning and lighting, energy conservation behaviors, and water savings. Other measures around pollution control and environmental management of ships may be more difficult. Measures should be implemented in a way that is fit for purpose and is within the appetite and capability of the port management. Technical assistance could be provided, building on the work of SPC and SPREP, to focus upon port-related leaks and adverse effects from chemicals, noise and vibration, light spill, cargo-related biosecurity and ship related invasive marine specie risks to the country, and dust from imported bulk goods and containers at the port site.

Domestic Maritime Transport

Overview

Domestic maritime transport is a vital service, but difficult and expensive to provide.

While international shipping services are generally satisfactory, this is not the case for domestic shipping. Providing safe, reliable, and affordable domestic shipping services is one of the most difficult challenges for Pacific Island countries (PICs) and requires significantly increased attention from development partners.

Adequate domestic connectivity is critical to the viability of outer island communities. Improving the safety of domestic shipping through regulation, improved ship condition, and access to appropriate maintenance facilities is a critical priority.

However, these solutions are not simple, and it will take sustained effort over a long period of time to build the required culture of safety.

There are opportunities to strengthen domestic shipping through integrated system planning, more locally adapted and sustainable vessel technologies, and improved outer island infrastructure. Enhancing maritime services to better connect communities lies at the heart of Action 3 in this *Blue Transformation* study. Equity is fundamental, ensuring services cater for the most disadvantaged and vulnerable

Social and economic benefits accrue from investment

in safe, affordable, reliable maritime transport that **"leaves no one behind".**

This chapter of the report discusses:

- The *role* and *character* of domestic shipping in PICs
- Key challenges around *service adequacy*, *financial viability*, and *safety*
- The domestic *vessel fleets* and *fuel use*
- *Key areas for attention*—opportunities to strengthen domestic shipping.

Note that this study considers domestic passenger and cargo vessels—it does not include fishing or recreational vessels, small outboard vessels, or private vessels, such as dive boats, catering to the tourist market.

The Role and Character of Domestic Shipping

Domestic maritime transport in the PIC12 countries comprises both public and private shipping fleets and associated maritime infrastructure. For example, Tuvalu inter-island shipping is mostly provided by the government. Tonga and Samoa are largely served by state-owned enterprises (SOEs). In Vanuatu, Papua New Guinea (PNG), and Solomon Islands, the private sector provides all domestic shipping. Fiji, Kiribati, the Federated States of Micronesia (FSM), and the Marshall Islands (RMI) are serviced by a mixture of public and private.

Interisland shipping is a lifeline for communities dispersed across remote islands, providing access to essential imported goods and the ability for local producers to sell to market. The ongoing viability of outer island communities depends on maritime transport for healthcare, education, social services, and, importantly, to maintain social and family connections. These services become particularly critical in times of disasters when communities rely on shipping for food, shelter, health care, and drinking water supplies.

Domestic maritime transport is the biggest challenge for PICs, difficult and expensive to provide.

Service Levels and Financial Viability

Many routes are not commercially viable, and those communities are underserved

Maintaining safe, reliable services of adequate frequency to remote communities is incredibly challenging and expensive. Even though domestic connectivity is critical to the viability of outer islands communities, these are often underserved with infrequent, unreliable services, and ongoing safety issues.

Many domestic shipping routes cover long distances, have low volumes of passengers, low-value traded goods, and limited ability to pay. Many routes are uneconomic and commercially unviable, resulting in the need for sustained subsidies to ensure adequate services. The lack of financial viability creates serious safety issues—cheaper overaged (>20 years old) commercial vessels are purchased, poorly maintained, and often sail overloaded and in poor weather. Many such vessels used in PIC's for interisland transport were originally designed for specific routes in different seagoing environments and for specific applications within those navigation areas. There is a pre-dominance of domestic ships purchased from Japan which were operated in the protected waters of the Seto inland sea region[1]. Examination of the suitability of these vessels in PIC interisland unprotected sea routes offers a further opportunity for technical development advisory assistance. There have also been cases in the Solomon Islands where end of life Sydney harbor ferries were purchased for use in open sea interisland use (RNZ, 2011).

Rapid urbanization is shifting people from outer islands and rural areas to the main cities, reducing long-term patronage and creating further challenges for the ongoing viability of interisland shipping.

Unsurprisingly the most profitable services exist on routes with the highest demand and/or shortest transits, which then become most attractive to private shipping operators. On other routes, as margins reduce, the attractiveness wanes leaving them poorly serviced, with reliability and frequency issues. Efforts to address this imbalance often fall to PIC governments where they have typically either run or subsidized the services themselves, often with donor support.

Franchise shipping schemes have shown promise on unprofitable routes

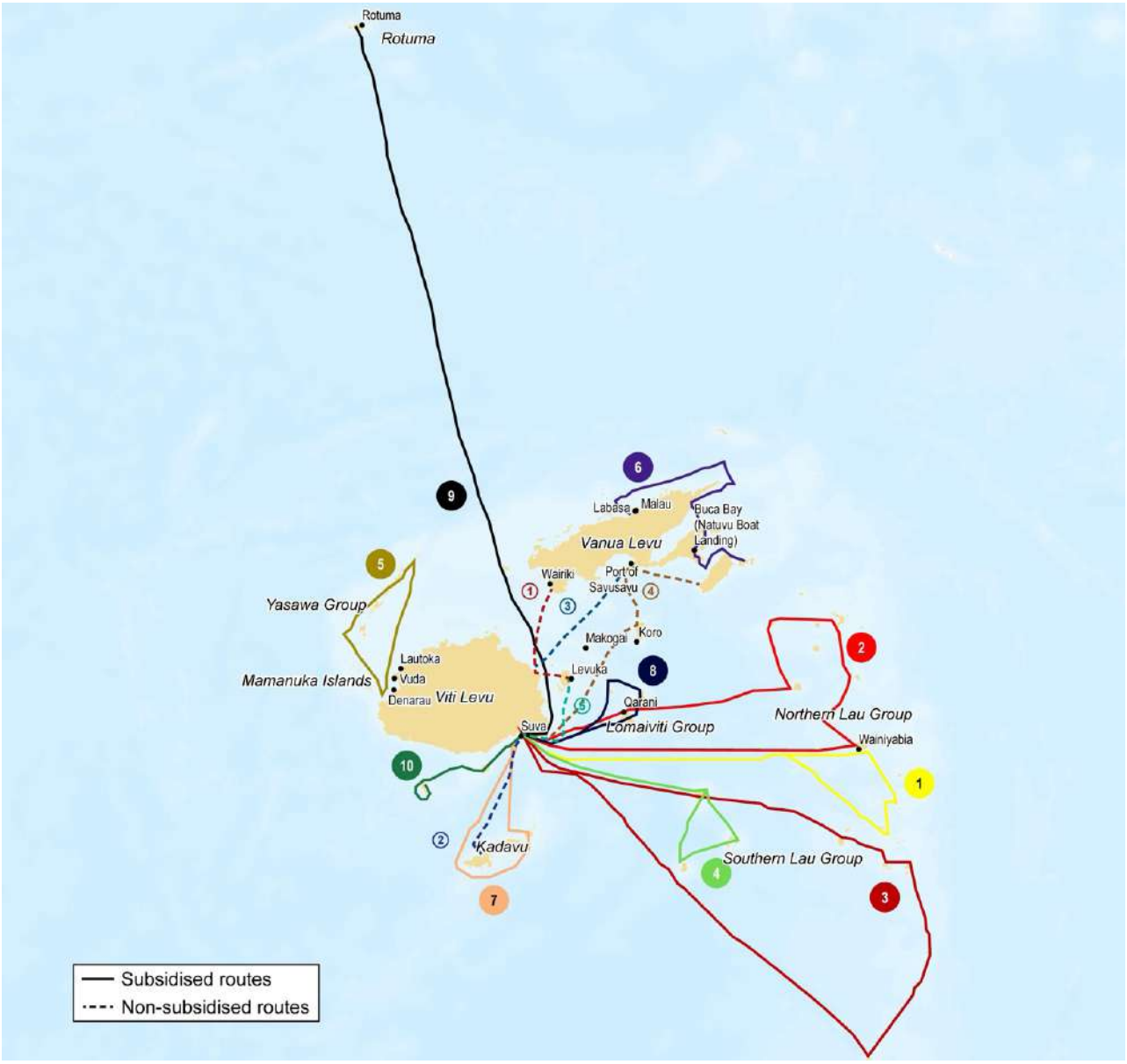
Various efforts have explored the use of shipping subsidies, known as franchise shipping schemes (FSS), to support the private sector to deliver shipping services on specified routes. These FSS routes to remote areas have been designated as community service obligations under a performance-based contract model. These contracts can specify vessel capacity and safety compliance, routes, locations, frequency of calls, monitoring mechanisms, and tariff structures for passengers and cargo (Tinio M. C., 2017).

The best example is Fiji's Government Shipping Franchise Scheme, which has been running since 1996. It takes the form of a competitive auction among shipping companies to receive subsidies for uneconomic routes (World Bank Group, 2015). The scheme currently supports 10 routes to remote islands—5 operate twice per month, 4 monthly, and 1 route, to northeast Vanua Levu, every 2 months (Figure 10). The services are provided by five private shipping companies, as well as the Fiji Government Shipping Services (Fiji MCTTT, 2022).

[1] Seto Inland Sea is the protected body of water separating Honshū, Shikoku, and Kyūshū, three of the four main islands of Japan (Kagawa University, 2022).

Figure 10

Fiji Domestic Shipping Subsidized and Non-Subsidized Routes



Source: World Bank assessment using information from Fiji Ministry of Commerce, Trade, Tourism and Sport (Fiji MCTTT, 2022).

FSS trials in PNG, Vanuatu, and the Solomon Islands have demonstrated the value of replacing infrequent and unpredictable ad hoc services with scheduled shipping at affordable rates. These Asian Development Bank (ADB) supported programs were evaluated to have had positive impacts on economic activity. Communities are more able to plan increased local production and have more reliable access to imported goods and services.

In carrying out these extended trials, lessons included the need to carefully structure tenders, contracts, and payments. They also highlight the difficulties operators have in accessing finance. The trials clearly identified the need for complementary investment in supporting infrastructure, maintenance services, and administration of safety regulations (Pacific Private Sector Development Initiative, 2017) (Tinio C. , 2017).

Franchise shipping schemes may need permanent subsidies

The FSS schemes were supported by time-limited grant funding from the ADB, with the management and cost handed back to the government at the end of the project. As a result, these schemes have either been discontinued or scaled back (UNESCAP, 2022). One assumption underpinning the trials of in PNG, Vanuatu, and the Solomon Islands is that providing additional, regular services would stimulate enough economic activity for the route to become commercially viable, so that subsidies can later be reduced or removed (Pacific Private Sector Development Initiative, 2017). As discussed throughout this report, the fundamental conditions of widely dispersed populations and a narrow economic base means that this is unlikely to be the longer-term outcome for many routes.

Permanent subsidies are needed to provide remote islands with safe reliable services

As part of a broader approach to social and economic integration of PICs, a strong case can be made for the need for permanent subsidies to support reliable and safe outer island shipping services over the long term.

Donor-funded vessels are important, but should not crowd out the private sector

To improve the safety and frequency of services, many government-run shipping services have acquired new vessels with donor support, including in Tonga, Samoa, RMI, Kiribati, and Tuvalu. While many routes serviced by these ships are unprofitable for the private sector, there are some which could be operated on a commercial basis, such as the short sea transit[1] of the Samoa ferry route between Upolu and Savai'i islands.

There is also evidence that some new donor-funded vessels, which do not carry depreciation costs and therefore can be operated at a lower cost than commercial vessels, have interfered with the provision of services on some FSS routes (Pacific Private Sector Development Initiative, 2017).

Samoa Shipping Corporation domestic vessels at Apia Port, Samoa

Source: Adrian Sammons / AMSTEC.

[2] Domestic interisland route between Salelologa to Mulifanua is 23 km (SSC, 2022)

Safety

Several major domestic maritime transport disasters have occurred across the Pacific in recent years due to the inherent lack of a safety culture:

- The loss of 74 lives when the ferry MV Princess Ashika sank in Tonga in 2009
- Estimates place 150 killed when the MV Rabaul Queen sank in PNG in 2012
- The deaths of 95 people when the MV Butiraoi sank in Kiribati in 2018
- The deaths of 27 people washed overboard from the MV Taimareho 1 in the Solomon Islands in 2020.

In addition to these major incidents, each year there are many groundings, collisions and other accidents causing damage to ships, environmental pollution, and injury and death. There are many more incidents in small boats with one estimate of 59 casualties between 2017 and 2019 (McMahon, 2021), however the lack of data and reporting means that overall the scale of deaths at sea in PICs is unclear (Figueroa, Mathenge, Linhart, & James, 2020).

Safety issues arise from multiple factors

Poor maritime safety arises from the interaction of many aspects across the domestic maritime transport system including:

- The unsuitability of vessels, and their age and condition
- Poor asset maintenance and the lack of maintenance facilities
- Unsafe operating practices, including passenger and cargo overloading, sailing into poor weather, poor ship handling, and lack of safety gear
- The lack of appropriate infrastructure for safely loading and unloading passengers and cargo, including the ship-to-shore transfer of passengers
- Limited search and rescue (SAR) response assets and capability
- Inadequate aids to navigation
- A lack of appropriate regulations and enforcement capacity
- The lack of a safety culture (World Bank Group, 2015).

These issues have likewise been identified in government led accident inquiries and highlight that with a multitude of systematic failures in safety across the Pacific maritime sector, disasters and accident will inevitably occur.

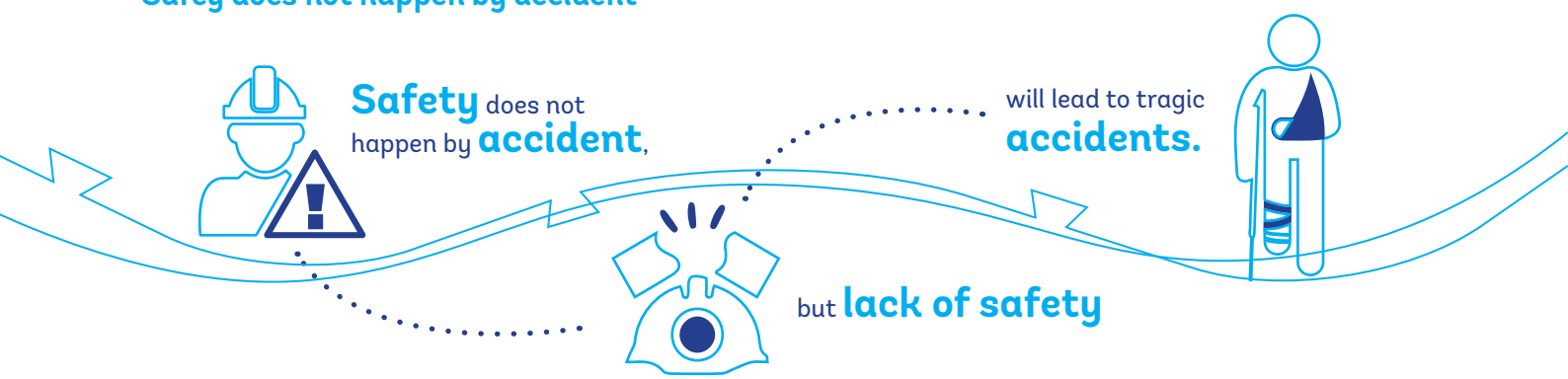
The lack of a culture of safety

Two fundamental issues underpin Pacific maritime disasters—the lack of a safety culture and of effective regulations and compliance around safe practices. Combined this leads to heightened risk of disasters or accidents occurring. Further, there is a lack of safety awareness within the community, and passengers can be reluctant to speak up about safety standards when there is no other option for interisland transport.

One example is the MV Butiraoi—a 17-meter wooden catamaran built in 2010—that sank in Kiribati in 2018, with the loss of 95 lives. An inquiry found a litany of failures. The ship had run aground twice, compromising the integrity of its structure, and was prohibited from carrying passengers. Despite severe weather warnings, the ship left Nonouti for Tarawa—a 2-day voyage—with 102 passengers and 30 tons of cargo. Within three hours, the ferry broke up and sank. The operator had not notified the authorities of its whereabouts and an emergency locator beacon was not activated or did not work. No one knew the boat had left Nonouti and no search and rescue was mounted for eight days. Although around 30 people survived in life rafts from the initial sinking, all but 7 perished from lack of food and water(Tahana, 2019).

Similarly, a long list of failings led to the loss of 74 lives with the MV Princess Ashika sank in Tonga in 2009. These began with the purchase of an overaged, unseaworthy vessel, which was overloaded when it left Nuku'alofa Port with very limited righting capability (stability) due to the incorrect balancing of ballast (Transport Accident Investigation Commission, 2010).

Safey does not happen by accident



Maritime safety in the Pacific needs leadership, commitment and investment, and is the focus of Action 4 in the *Blue Transformation* study.

The Ferry MV Butiraoi Sank in Kiribati with 102 People Onboard

Source: Government of Kiribati

Domestic vessels

Vessel design is often not fit-for-purpose

Vessel design is often not fit-for-purpose. This may mean the capacity is not right-sized for demand—the ship is either too expensive to operate or not large enough. It may also mean the vessel size and design does not match the geography and infrastructure—for example, the draft may be too deep for the available depth alongside domestic jetties. Many vessel procurement decisions are made without considering current or planned ship maintenance capacity in PICs or across the region. This leads to unexpected maintenance costs and/or gaps in maintenance activities.

It is essential that new vessel builds are future ready—they must incorporate fuel efficiency technology today and be able to be retrofitted with low-carbon technologies when these become available (Figure 11).

Figure 11 Impression of the Motor-sailing Freight Ship being designed by Swire Shipping and the University of the South Pacific (USP) with the Aim of Reducing Emissions by 25 Percent

Source: VPLP Project Cerulean.

Vessels are often old and poorly maintained

Vessels are often purchased end-of-life and, as a result, have higher operating costs and higher maintenance needs which are often not met. Many vessels operate outside normally accepted safety limits.

In a sample of four of the PIC12 countries, the average age of domestic vessels is more than 23 years as declared in their national registries (Table 4). This elevates concerns about vessel safety, reliability, efficiency, and greenhouse gas (GHG) emissions.

Table 4 Age of Domestic Ships in Sample PIC countries

Country	Total domestic vessels	Average age	Maximum age
Vanuatu	243 vessels	38 years	57 years
Solomon Islands	304 vessels	29 years	75 years
RMI	34 vessels	30 years	55 years
Kiribati	44 vessels	23 years	41 years

Source: World Bank, based on data provided by national maritime transport agencies, and (Oxley, 2018)

Governments suffer from the perennial problem of failing to plan for maintenance, including setting aside funds for maintenance and repair costs. This has resulted in even brand-new donor–funded vessels degrading to the point of being unserviceable within only a few years.

One major constraint is the lack of adequate maintenance facilities—drydocks and slipways—in most countries. Within the PIC12 group of countries, the exceptions are Fiji and PNG, which host a thriving maritime repair and maintenance sector that attracts a cluster of marine technical services in those countries. To be maintained, ships must therefore sail to Fiji or PNG, or New Caledonia or Australia. These journeys are often unaffordable, or simply not possible for the overaged ships (World Bank Group, 2015).

Alongside the lack of maintenance planning, most countries lack sufficient capacity to consistently carry out surveys and enforce full compliance with vessel safety regulations.

Domestic Vessel Beached to Perform Repairs and Maintenance in Santo, Vanuatu

Source:Adrian Sammons / AMSTEC.

Slipway in Shipyard in Suva, Fiji

Source: Adrian Sammons / AMSTEC.

Fuel use and greenhouse gas emissions

Fuel is the largest operating expense for shipping operators, and fuel price increases can heavily impact on the affordability of domestic shipping services. Decarbonizing domestic shipping can improve energy security and therefore the security of transport services over the medium to long term. It can also support PICs to achieve their nationally determined contributions (NDCs).

Decarbonizing and reducing fuel use can be achieved by improving logistics and routing; modifications to existing fleet and fleet operation; and replacing ships in the fleet over time with vessels of appropriate design and size.

Domestic Maritime Infrastructure

Domestic port facilities vary significantly in scale across the region. At the main gateway ports and urban centers, they typically comprise very busy nodes of some size, while in outer island settings they are usually basic and may often be no more than a beach landing. Domestic port facilities may be:

- Small wharves and jetties
- Temporary pontoons and landing barges
- Rampways that are only compatible with landing craft vessels
- Beach sites—with no formal infrastructure.

Many outer islands lack appropriate infrastructure

Many islands lack appropriate jetties or docks for loading and unloading ships. In some locations (for example, Tuvalu, Vanuatu, Solomon Islands and Kiribati) many of the landings can only be accessed by small craft because of shallow water over reefs or other navigational restrictions (narrow channels, etc). It is common for domestic port infrastructure settings to be incompatible with the vessel types in use. This includes a lack of concrete barge ramps, load-restricted wharves, short jetties, and insufficient water depths. There are inconsistent settings across water depths, wharf lengths, barge ramp sizes, and types of infrastructure available across the outer island networks.

Passengers and cargo are often transferred from the ship to shore in a small workboat or raft, which is unsafe unless seas are calm, and is not accessible for older people or those with limited mobility.

Cargo is at increased risk of damage, loss and spoilage from exposure to weather, sea spray, and immersion if it must be manually handled over or through water. Outer island docks also lack sheds and shelters to protect passengers and cargo from the weather. Where livestock are transported, there is a lack of infrastructure to support animal welfare as part of the transport and supply chain system.

Fuel drums being towed in the water behind a small boat in Malaita, Solomon Islands

Source: Irene Scott/AusAID

Approaches to islands are often hazardous

Safety issues with vessels are often compounded by difficult and hazardous navigational approaches to islands, caused by narrow channels, strong currents, breaking waves, inadequate turning basins, reefs, shoals, and wrecks. There is a lack of aids to navigation marking channels, hazards, and sailing routes, and often if there, they are in poor condition. Charts are often inaccurate and out of date.

Infrastructure is often in poor condition and poorly maintained

The poor condition and inadequate maintenance of maritime infrastructure is a well-recognised phenomenon in PICs (World Bank Group, 2015). As discussed in the chapter: Disaster and Climate Resilient Maritime Transport for PICs, the lack of preventative maintenance at domestic ports and jetties is commonplace and contributes to the degraded services and hazardous conditions. Damage from severe weather and cyclone events, coupled with shortfalls in maintenance (both funding and delivery), are the primary issues affecting the conditions of domestic maritime facilities. This includes inadequate or missing fenders, bollards, uneven and compromised hardstand surfaces, wharf lights damaged or missing, and weather damaged cargo storage facilities.

Box 2: Return to the future—a sustainable way forward

While still used in some places in the Pacific, smaller traditional coastal watercraft have largely been replaced by motorized small boats, causing a dependence on expensive imported fuel and parts, and the loss of knowledge of boatbuilding and seafaring technologies (Baker & Campbell, 2021).

The last few decades have seen a cultural renaissance of traditional boatbuilding, navigation, and voyaging. The vessels are sustainable, low-carbon technology, and very well adapted for island life.

Several projects are exploring Pacific traditional-style sailing vessels built with modern composite materials and auxiliary power. For example, Okeanos Foundation for the Sea runs a small fleet of sail- and solar-powered vessels. The two vessel types—Vaka Motu and Vaka Moana— are both considered suitable for trips up to 200 nautical miles (350 kilometers). Vaka Motu are reportedly operating in Vanuatu, RMI, FSM, and Palau. Vaka Moana are deployed in Tahiti, Samoa, New Zealand, Cook Islands, and Fiji.

Okeanos Foundation for the Sea's Vaka Moana—built based on drawings by Captain James Cook around 1770.

Source: Naval DC

Another project, in the RMI, is working to develop small coastal boats powered by solar and wind, hybridizing traditional design with inexpensive modern boatbuilding techniques. The project is also building a custom-design low-carbon interisland passenger and cargo ship.

Other examples of auxiliary sailing vessels returning to trade in the Pacific islands include the *SV Kwai*, a 36-meter, 180 ton sailing vessel with passenger and cargo capacity. It has operated commercial trading routes between the Cook Islands and Hawaii since 2006, making calls to the Line Islands in Kiribati. The *SV Kwai* was purchased by the RMI Government in 2021 as part of its domestic shipping service, delivering provisions to outer islands and collecting copra to transport to Majuro.>>

Key areas for attention

Most PICs need to improve domestic connectivity to support social and economic integration and resilience. In most cases, that requires urgent attention to improving safety, taking a multi-faceted approach to vessel maintenance, financial sustainability of shipping operators, improved outer island infrastructure, the procurement of appropriate and safe vessels, and training for the workforce.

The key areas for attention for Pacific domestic shipping speak to all five Actions in this *Blue Transformation* study—improving infrastructure by adopting a whole-of-life approach to asset management; improving planning to make maritime transport integrated, resilient and future-proof; better connecting communities by providing equitable and affordable services, especially for outer island communities, and the most vulnerable and poor; improving safety through leadership, commitment, and investment; and enhancing governance to increase compliance with all safety measures and practices.

To achieve these outcomes, key areas for attention in domestic maritime transport are:

Integrated planning for interisland maritime transport systems

Planning for domestic shipping should take an integrated and long-term view of the domestic maritime transport system—the shipping fleet, infrastructure, financing, policy, and workforce. This thinking should be underpinned by a national policy direction for rural and remote outer island communities. It should consider the role of regular shipping connections and improved freight handling in supporting the viability of outer island life, including the potential to support local food production and consumption.

Integrated systems planning considers how to optimize how the interconnected components of the domestic shipping system work together, over time. Analysis and planning at a systems level can consider a range of options combining aspects of:

- **Routing:** to consider the best arrangement of services
- **Fleet planning:** number, size, technology, and design of vessels and time frames for maintenance and renewal
- **Vessel design:** matching vessels to navigational environment, landside geography and infrastructure (for example, multihulled vessels can land on beaches and are not restricted by tides or reefs); incorporating low-carbon technologies over time
- **Infrastructure design:** appropriate, maintained, and resilient to natural hazards and climate change
- **Removing tidal, weather, and night-time restrictions** through infrastructure, channels, and aids to navigation.

If done well, integrated systems planning can potentially deliver a range of benefits including more frequent and reliable services; shorter transit times; more appropriate ship and infrastructure design; improved safety and ease of handling cargos; and reduced fuel use and GHG emissions. Systems planning should ensure decisions include whole-of-life thinking about cost and maintenance (Baker & Campbell, 2021). There are likely to be trade-offs between capital cost, operating and maintenance costs, service levels, and safety.

An example of integrated system planning in the Pacific includes current work to develop a roadmap for decarbonizing maritime transport in RMI, supported by GIZ, along with a wider plan to decarbonize domestic maritime transport across the region undertaken by the World Bank.

Improve outer island infrastructure to make shipping safer and faster—leaving no one behind

Improving outer island infrastructure can have a range of benefits for both shipping and safety. Removing tidal, weather, and nighttime restrictions through infrastructure, channels, and installing aids to navigation can improve the safety of calling into islands and significantly reduce transit times and fuel use.

Improved structures and shelter can make boarding and disembarking safer, easier, and more comfortable for passengers, and can improve cargo handling. Care should be taken to make sure the level of infrastructure development is appropriate and within the capability of the national government agencies and local community to maintain and refurbish. It is also important to make sure infrastructure is well-matched to the types of service vessels, and to the geography and needs of the community.

Provide sustainable financing mechanisms for outer island services

Renewed attention is needed on mechanisms to ensure reliable and affordable services to outer islands with small populations, including involving the private sector through franchise shipping schemes or other novel mechanisms. Investigation is needed into how barriers to accessing capital might influence shipping operators into purchasing cheap, end-of-life vessels, and whether financial instruments (such as concessional loans or rebates) could play a role. Reservation funds for vessel replacement and maintenance could be explored. Long-term performance-based maintenance contracts for donor-funded vessels could accompany the procurement of vessels.

Improve vessel design and selection

Individual vessels are significant, long-lived investments—this means each vessel needs to be carefully specified to ensure it is suitable for the application. There is an opportunity for more support to ensure new vessels are better designed to suit the application including capacity and type, draft and hull type, propulsion technology, match to island geography and port settings, maintenance facilities, and capability. It is important that new vessels built now are designed to be able to be retrofitted as low-carbon technologies are developed (Baker & Campbell, 2021).

Provide accessible maintenance facilities throughout the region—Safety doesn't happen by accident

There is a critical need to provide maintenance facilities around the region that are accessible for domestic shipping fleets. This would involve identifying strategic locations for permanent drydocks and slipways that can be accessed relatively easily by most countries. These facilities could be managed by the private sector under long-term performance-based contracts, staffed by standing maintenance teams. Although it will likely cost more than current arrangements and require ongoing subsidy, it is the kind of step change needed to improve domestic vessel safety. Economies of scale could be realized including keeping inventories of spare parts.

Long-term, adequate, sustained investment is needed to build a strong maritime safety culture

PIC approaches to improving safety have often been limited to developing legislation. While regulation of domestic shipping safety is a critical gap, the solution requires more than simply adopting model legislation. Regulations must be fit-for purpose, focused on outcomes, and supported by implementation resources. Improving maritime safety and consolidating a strong maritime safety culture across a range of PICs, some of which have traditionally accepted high levels of loss of life at sea, is a long-term undertaking.

While there have been efforts by various partners to support maritime safety in PICs, including the Pacific Islands Domestic Ship Safety Programme funded since 2010 by the New Zealand Government, and the Pacific Safety of Navigation Project, funded by the International Foundation for Aids to Navigation, the level of investment and sustained effort has been inadequate for the need and requires contributions from the pool of development partners.

Improve training and workforce development

Major domestic shipping accidents including loss of life, highlight the need to ensure that training providers have the resources to effectively train maritime workers across all aspects of ship safety including survey, safety inspection and enforcement, safety instructions, engine operation and maintenance, safety equipment repair, and manifest and record keeping. (World Bank Group, 2015) A step up in the scale of investment in workforce development is needed, with a focus on culture and attitudes, management systems, and seafarer skills.

Key Related Sectors

Overview

Four sectors are discussed in this chapter that have a close relationship to maritime transport:

- Cruise ship tourism
- Tuna fisheries
- Fossil fuel import supply chains
- Bulk commodity shipping

While separate from the core activities of international liner shipping and domestic shipping, they interact with maritime transport, particularly around port infrastructure and services, and the domestic regulatory functions around maritime transport.

While each Pacific Island country (PIC) will have different opportunities in each of these sectors, this part sets out their key characteristics, focusing on implications related to maritime transport.

Cruise Ship Tourism

International cruise ships are economically significant to only two of the PIC12 countries

Of the PIC12, only Vanuatu and Fiji hosted significant annual numbers of cruise ships before the COVID-19 pandemic, with 201 (in 2014) and 145 (in 2018/19) respectively. Papua New Guinea (PNG) and the Solomon Islands hosted smaller numbers, with 60 and 13 respectively in 2016 (IFC, 2019). More distant ports, such as Tonga or Samoa, receive fewer calls a year (5–15 average). Kiribati and the Marshall Islands (RMI) experienced fewer than one visit per year from larger cruise ships with more than 1000 passengers and several smaller expeditionary voyages from boutique cruise ships of fewer than 200 passengers (Earnshaw, 2015).

A couple of assumptions prevail about the relationship between port infrastructure and cruise ships. One is that building dedicated cruise ship terminals will attract more cruise ship port calls. This assumption needs to be challenged, particularly for PICs. The number of cruise ship calls in a port is largely determined by its proximity to the seasonal cruise hub markets of Australia and New Zealand and traveler preference for shorter cruises—globally the average cruise length is about seven days. Cruises of 4–7 days can visit Vanuatu, and slightly longer cruises of 8–10 days can extend as far as Fiji (ADB, 2020). Far fewer cruise ships venture further than Fiji unless they arrive at more distant ports on longer haul itineraries, such as round-the-world and expeditionary cruises, which are significantly fewer than the seasonal short haul hub port cruise itineraries.

The second assumption is about the income from cruise ship passengers. This is modest compared to tourists that arrive by air because cruise passengers spend limited time ashore and are not using local accommodation and other services. As can be seen in Table 5, although Vanuatu receives more than twice as many cruise ship passengers as visitors arriving by air, total cruise passenger spend is around 10 percent of that by visitors who arrive by air. It is estimated that each visitor arriving by air brings between 15 and 35 times more economic benefit to the country than each cruise ship passenger.

Fees paid by cruise companies include charges levied by government departments, port authorities, customs and immigration fees, and port anchorage fees (IFC, 2019). These fees are often negotiated by cruise ship companies. Cruise port calls place significant demand on PIC ports management for additional safety and security services, and further work may be needed to assess whether these charges are adequate to cover costs.

Table 5 Comparison of the Economic Impact of Cruise Ship Passengers vs Visitors Arriving by Air in Fiji and Vanuatu.

	Cruise ship passengers				Visitors arriving by air			
	Cruise passengers per year	Direct economic impact per year (USD million)*	Indirect economic impact per year (USD million)*	% GDP	Visitors arriving by air	Direct economic impact per year (USD million)*	Indirect economic impact per year (USD million)*	% GDP
Fiji (2018–19)	240,000	21	23	~0.8	1.4 million	1,400	2,200	~30
Vanuatu (2014)	300,000	28	14	~4	120,000	280	330	~31

Source: IFC and UNCTAD data (IFC, 2019), (IFC, 2014), (Terauds, 2022)

Increased value capture from cruise ships depends only partly on infrastructure

IFC studies for Vanuatu (IFC, 2014) and Fiji (IFC, 2019) examined several options to increase the beneficial economic impact of cruise ships. They found that the more time passengers spend ashore, the more they are likely to spend. Time ashore can be increased by improving passenger flow and their ability to board and disembark the ship easily, and by providing more tourist activities. The studies found that measures to improve visitor experience and increase spend included improving the information provided and opportunities to access handicrafts, clothing, tours and excursions, and restaurants. However, what is needed is increased public-private partnerships between the cruise companies and country to overcome passenger flow issues and tourist information gaps. Another opportunity with great potential for economic benefit is to develop provisioning cruise ships with fresh local produce, although this faces production constraints, particularly in Vanuatu. These opportunities do not need major infrastructure solutions and can make use of existing assets and facilities.

Infrastructure is not always the answer. Analysis of proposed investment to develop improved port infrastructure facilities for cruise ship passengers in Lautoka (Fiji) showed that the cost significantly outweighed expected benefits in terms of increased dwell time and visitor expenditure (IFC, 2019).

However, investment in basic cruise ship infrastructure can bring economic benefit to more remote destinations, especially where there are no other forms of tourism, such as Mystery Island in Vanuatu, or Dravuni Island in Fiji. These investments could be undertaken by both the client country and private cruise companies and might include landing jetties, covered areas, and public toilets, and hydrographic mapping for improved navigation (IFC, 2014) (IFC, 2019).

Cruise Ship Passengers Ferried Ashore on Remote Mystery Island in Vanuatu

Source: Vanuatu Travel.

Some busier ports may benefit from separate facilities for cruise ships

The cruise ship sector operates independently of the commercial international shipping networks handling containers, break-bulk, and bulk materials. But in most cases, cruise ships use the same berth in port as shipping and they are afforded priority berthing. If a cruise ship needs to berth, any other ships need to stand off, causing delays. A cruise ship call involves a stay of around 12 hours but requires full lockdown of the port to ensure compliance with international customs and immigration formalities. This can be highly disruptive and expensive to oversee. When ships cannot unload at the agreed time, demurrage is payable to the ship, increasing the costs of landed goods. Even for ports that receive only a few cruise ships each year, congestion can still impact commercial operations at the ports.

One solution often proposed is the construction of dedicated wharves or separate berths for cruise ships. Port Vila, in Vanuatu, is the only port in the region that benefits from having its cruise berth separated from container operations. This is because of the recent investment in the Lapetasi container terminal, completed in February 2018. Cruise ships now share the old international wharf ('main wharf') with tanker calls.

Suva Port received 58 cruise ship calls in 2018—40 percent of Fiji's total port calls. A temporary terminal to separate cruise ships from the main Suva port was considered. An economic assessment showed this would have only a marginal net present value, even including the effects of reduced disruption to freight operations at the port and reduced demurrage fees. However, the analysis concluded that the idea was worthy of additional consideration. As a longer-term solution, separating passenger and cargo traffic is proposed in the recent master plan for a new port in Suva.

Cruise ship environmental impacts need to be managed

The environmental impacts of cruise ships include very high greenhouse gas (GHG) emissions, air, noise, and light pollution. Several cruise ship companies have had criminal proceedings for illegal discharges of oil, solid waste, and greywater. All these can have a serious negative impact on fragile marine environments, particularly in remote and pristine locations (Lloret, Carreño, Carić, San, & E. Fleming, 2021).

In 2021, French Polynesia banned ships over 3,500 passengers from making port calls and has set a limit of 1,200 passengers for Bora Bora, the most popular destination. The Government's concerns were that large ships place too much pressure on existing infrastructure, and their presence negatively impacts the experience for other visitors (Laird, 2021) who bring far greater economic benefit. In most cruise ship hub ports residing in developed countries, the ports authorities generally place a per head cruise ship passenger levy. This levy is aligned to recouping costs of additional security and safety measures and includes a conservation levy for environmental safeguards required. PIC ports have been reluctant to impose similar passenger levies on visiting cruise ships due to the implied reduction in ship calls if additional charges are introduced.

PICs have limited capacity to effectively develop environmental regulations and ensure compliance, and this should be supported in any efforts to develop cruise ship tourism.

Implications of cruise ships for port development need careful consideration

The potential to develop cruise ship tourism outside of PICs where it is already established should be assessed for net benefits, including economic, environmental, and social aspects, particularly when considering infrastructure investments. Fiji's established cruise ship tourism has been incorporated into the master plan for the new Suva Port, which will include dedicated cruise ship infrastructure. In other ports, the case for dedicated cruise ship infrastructure is less clear.

The uncertainty of dedicated cruise ship terminals is evident in Tonga. In 2012 the Ports Authority of Tonga constructed a separate wharf (Vuna Wharf) in Nuku'alofa dedicated for cruise ship calls (Matangitonga News, 2012). The aim to attract greater number of cruise ship visits however was not realized and a similar number of calls has been retained.

Tuna fisheries

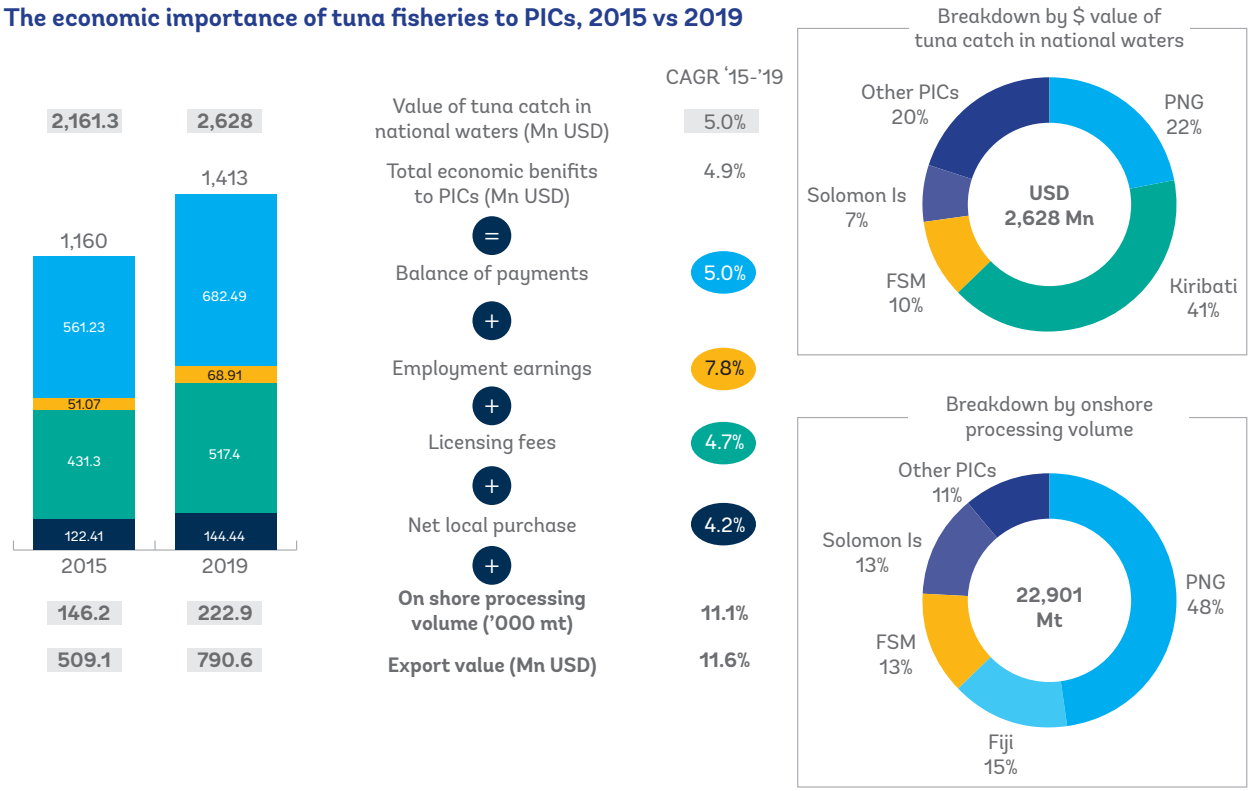
Tuna fisheries are economically important for PICs

The benefits of tuna fisheries are very significant for PICs, with several being 'tuna dependent' (Bell, et al., 2021). Tuna fisheries in the Pacific are diverse and include industrial purse seiners, longline and pole-and-line fisheries targeting skipjack, yellowfin, bigeye, and albacore tuna, as well as coastal artisanal fisheries (WCPFC, 2020). Value is captured by Pacific Island countries in several ways, including through license fees, participation in the industry directly through Pacific-owned vessels, value-add through onshore processing, employment in both processing and harvest sectors, and services to fishing vessels including repairs and provisioning.

In the last decade, improved regional governance of the tuna fishery has increased the revenue from access fees to Pacific Islands by around 500 percent, reaching a high of US$550 million in 2019, mostly from purse seiners (Ruaia, Gu'urau, & Reid, 2020). Most notably, the Parties to the Nauru Agreement (PNA) Vessel Day Scheme (VDS) has enabled PICs to assert their economic rights over tuna and dramatically increase revenue (Aqorau & Sokimi(Jnr), 2019).

The value of tuna products processed onshore and exported has also seen a steady increase, with exports from Forum Fisheries Agency (FFA) member countries[1] doubling in value in the decade to 2019 (Figure 13) (Ruaia, Gu'urau, & Reid, 2020). Regional efforts to increase benefits to PICs from tuna fisheries focus on increasing the share of catch taken by Pacific-owned fleets, onshore processing, employment, and reduction of illegal, unreported, and unregulated fishing.

Figure 12 Indicators on Tuna Fisheries and Economic Benefits to PICs



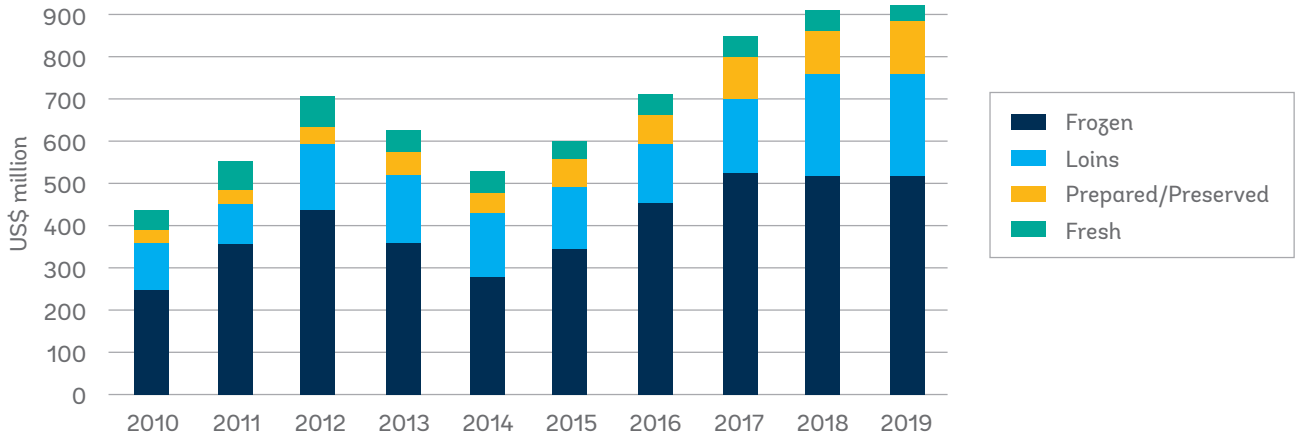
Source: (FFA, 2020)

Tuna catch is mostly transshipped, with a smaller amount processed onshore and exported

Most catch is transshipped from the fishing vessel to refrigerated fish carrier vessels with capacities of 3,000 to 5,000 tonne of tuna, then transported to large processing facilities in Southeast Asia or PNG. A large proportion of transshipment from purse seiners is done in port, while others transship at sea, both legally and illegally (Pew, 2019). A portion of the catch is landed for export after various types of processing, including sorting and transfer to refrigerated containers, loining, and canning. The proportion of catch taken in FFA members' waters processed onshore reached a high of 14 percent in 2019 (Ruaia, Gu'urau, & Reid, 2020), as shown in figure 12. Some high value fish are selected for air export. A very small amount—between 0.1 and 0.3 percent—is landed for domestic consumption (Tolvanen, Thomas, & Lewis, 2021).

[1] FFA members include Australia, Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, New Zealand, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, and Vanuatu.

Figure 13 Value of Tuna Imports from FFA Countries to Major Markets



Source: (Ruaia, Gu'urau, & Reid, 2020)

Transshipment to fish carrier, Pohnpei FSM

© Adrian Sammons / AMSTEC.

Tuna ports depend on the location of fish stocks and other factors

Some ports in the Pacific see a higher rate of tuna-related activity. The major purse seiner transshipment ports are Majuro (RMI), Tarawa (Kiribati), Pohnpei (Federated States of Micronesia (FSM)), Funafuti (Tuvalu), and Lae and Madang (PNG). These ports are favored for transshipment due to their proximity to fishing grounds, anchorage conditions, and the availability of services such as fishing net repairs, health care, recreation for crew, helicopter servicing, provisioning, and ease of flying international crew in and out (Blaha, 2019). The volume of transshipment at these ports varies from year to year as fish stocks migrate, influenced by the El Niño Southern Oscillation (ENSO) conditions (Tolvanen, Thomas, & Lewis, 2021). Both the size and location of these fish stocks will be increasingly affected by climate change (Bell, et al., 2021).

Onshore processing

Some ports do more onshore processing than others. For example, Noro Port in the Solomon Islands processes around 28,000 tonnes—loining, canning, and exporting frozen whole fish in containers (Ruaia, Gu'urau, & Reid, 2020). PNG and Fiji have significant onshore processing of tuna, and it is increasing in RMI, FSM, Kiribati and Samoa.

Some smaller PICs see potential economic opportunity in increased onshore processing—including simple transfer to refrigerated containers, loining plants, and canning. However, the feasibility and scale of this may be limited and depends on a range of factors including:

- Availability and cost of labor and supervisory capacity
- Affordability and reliability of power and fresh water
- Frequency and reliability of shipping connectivity
- Cost of imported inputs such as blank cans and edible oils
- Cost of bringing in empty refrigerated containers, and the power needed to run them.

It is also challenging for PICs to compete with the economies of scale determined by large processing facilities—for example, a cannery in Thailand might employ 12,000 people and process 3,000 tonnes a day of tuna (Hamilton, Lewis, McCoy, Havice, & Campling, 2011). Of all PICs, Melanesian countries, and in particular PNG and Fiji, have the scale and shipping connectivity to support onshore tuna processing.

Discharge of tuna to factory at Noro Port, Solomon Islands

Other opportunities for PICs to capture more of the benefits from tuna fishing include providing services in port, such as fishing net repair and refueling. These services can take up substantial space within a port precinct but can attract fishing vessels to the port. Some shipping vessels refuel in port, but most refuel on the high seas to avoid the taxable cost of landed fuel. Where a cluster of tuna fishing activity takes place, fishing boats using the port can be required to take on bunkers and fresh water.

Fossil Fuel Import Supply Chains

PICs depend on imported fuel and are vulnerable to price shocks and supply chain disruptions

All PICs are critically dependent on imports of fossil fuel not only for domestic transport, but also for electricity, which is mostly diesel generation. Fuel demand in PICs is very low by global standards, and this lack of scale, along with additional transshipment steps necessary for many countries, contributes to the high cost of fuel supply, making PICs sensitive to global price increases.

The essential reliance on imported fuel, coupled with small-scale storage and long distances from refineries, means PICs are very vulnerable to disruptions in the supply chain. Improved energy security is a key driver in the shift to renewables. Also, the shift to renewables will bring more predictable (although not necessarily cheaper) energy prices.

Demand for imported fuel is expected to increase, then decrease with decarbonization efforts

Apart from PNG, Fiji, and Samoa—which have large amounts of hydroelectricity—renewable energy generation currently contributes less than 20 percent share of electricity across PICs. Land and maritime transport are almost 100 percent fossil fuel driven, and account for more than half of fuel use.[1]

Despite PICs' ambitions, the rate of renewable energy generation significantly lags national targets (Figure 14).[2] Even if significant progress is made against these targets in the next few years, a study of fuel use and supply security in the Pacific from 2019 has forecast that for most PICs, at least until 2030, fuel demand will increase. This is because the growth in transport fuels will more than offset the reduction in fuel use for electricity generation (Hale & Twomey, 2019). Beyond 2030, with higher levels of renewable energy in place, the aim will be to dramatically reduce fuel use by accelerating the electrification of both land and coastal sea transport. Countries that could see a decline in fuel demand much earlier include FSM, RMI, Nauru, Tonga, and Tuvalu—largely due to flat or declining populations (Hale & Twomey, 2019).

Forecasting demand for liquid fuels over the next two decades is highly uncertain. Changes in demand will depend on many factors, including changes in population and gross domestic product (GDP), gains in energy efficiency, the rate of investment in renewable electricity, and the electrification of transport over time. Sustained high oil prices will reduce demand, as will breakthroughs in the cost and availability of low emission transport technologies. The rate of renewable electricity deployment will depend on government appetite, absorptive capacity, and the availability of both equipment and experts in a tight global market.

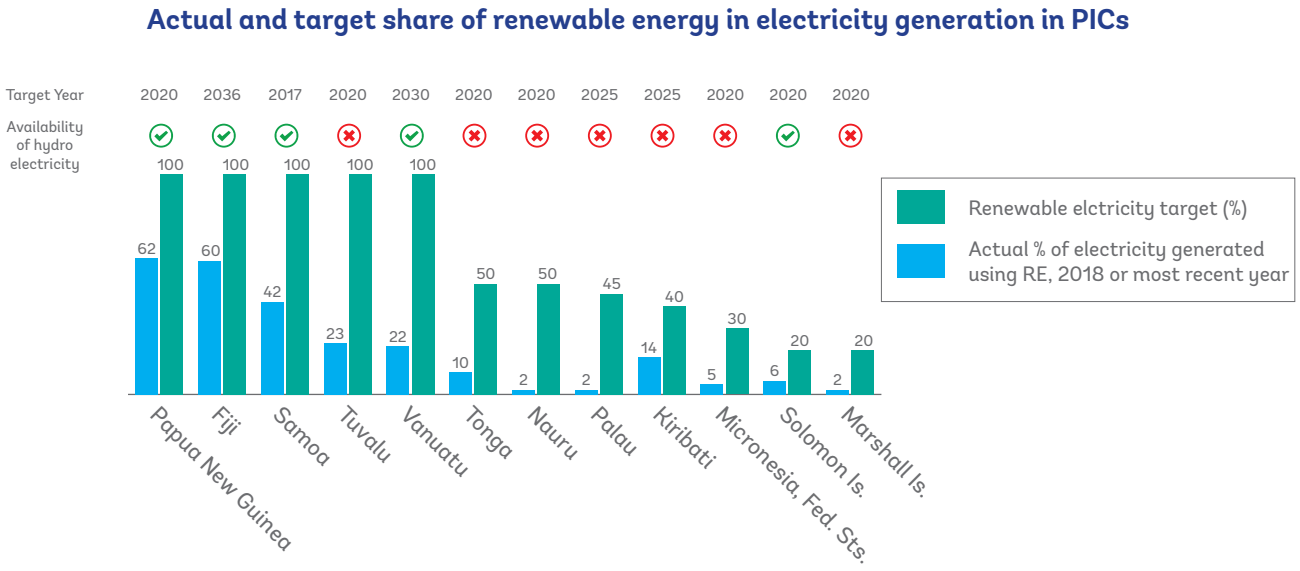
Even with successful decarbonization, critical dependency on some level will remain

PICs are likely to remain critically dependent on imported fossil fuels over at least the next two decades, even at reduced volumes. As the larger grids shift to renewables, the amount of diesel use will decrease. However, smaller volumes of diesel (or imported biodiesel) will be needed right up to the point where grids reach 100 percent renewables. Even after this point, diesel supply chains can provide energy resilience and emergency response.

[2] Based on Fiji's Low Emissions Development Strategy, transport accounts for around three-quarters of fossil fuel use (GGGI, 2018), whereas in the Marshall Islands transport accounts for around one-fifth of fuel use (Curd, 2018).

[3] Targets were originally set when it was widely thought that renewable energy would be a simple and cheap alternative to diesel-generated power. The experience of deployment in the last decade in PICs has tempered this ambition somewhat, particularly for those PICs without hydro resources. It is now understood that solar and wind generation in PICs, with its maintenance and replacement costs and need for battery storage, can be at least as expensive as diesel generation, as well as presenting a range of policy, engineering, and land access challenges.

Figure 14 Actual Renewable Energy Share vs Targets in PIC[12]



Source: Targets (SPREP, 2020), RE generation (McMahon, Pacific Infrastructure Performance Indicators 2021, 2021) except FSM and RMI from (SPREP, 2020)

While small in scale, international shipping of fuel into PICs is generally fit-for-purpose, with a variety of suppliers, ship sizes, and routes.

Liquid bulk imports comprise refined petroleum products (diesel, gasoline, jet fuel) supplied from refineries in Singapore, and liquified petroleum gas from refineries in Australia, as well as small quantities of edible oils and chemicals. These products are distributed by tanker ships with capacity typically ranging from 30,000-50,000 tons deadweight (DWT) (known as "Mid-Range") either directly to individual PICs, or via transshipment through a bulk fuel terminal in Suva, Fiji. The fuel products going through Suva are handled using smaller tankers (6,000-10,000 DWT), ISOtainers (24,000 Litres), or barges for onward distribution.

The security and resilience of the fuel supply chain in PICs is critical and requires attention to holding sufficient stocks in country, and within the supply chain. Contingencies might range from having a ship divert to deliver extra fuel, to switching from bulk to ISOtainers in the case of damage to mooring or storage facilities (Hale & Twomey, 2019). Port facilities for fuel handling and storage are a key element of energy security in the region—in some cases these facilities are poorly maintained and in poor condition.

The global tanker industry comprises public and private companies, national and international oil companies, petroleum trading companies, and companies engaged in the tanker market as a segment of their involvement in the wider shipping market (dry bulk, container, etc). With most fuel moved by sea globally, the market has a good ability to adapt to market constraints and is a relatively secure part of the supply chain (Hale & Twomey, 2019).

Fiji is a particularly critical part of the regional fuel supply chain for two reasons:

- It forms an important hub for regional aviation fuel security in cooperation with Australia and New Zealand
- It is a transshipment hub for fuel supplies to smaller PICs that do not have the volume demand or storage capacity for the larger medium range (MR) tankers to make direct port calls.

As renewables replace demand for fossil fuel and imports reduce there will be adjustments to the frequency and capacity of shipping for bulk fuels to PICs, which at some stage may become commercially unviable.

Domestic fuel handling

Fuel distribution to outer islands requires often small volumes to be carried on both small and large vessels. This is done in various ways, including in the bunker tanks of barges, in a tanker truck on a barge, in drums or small 1,000 liter intermediate bulk containers. This way of transporting fuel is inefficient, and there are safety issues in both the handling of drums and risk of spills and fire. Fuel can also be transported in ISOtainers (24,000 Litres) if there is a container service between islands (Hale & Twomey, 2019).

Fuel in 200 liter drums being loaded onto domestic ship at Honiara

Ship bunkers

While international liners do not bunker in PICs, and this is likely to remain the case, there is potential for increased bunkering of shipping fleets at selected ports—as has been observed in Fiji and the Solomon Islands. This may increase the need for better fuel storage and handling assets in these specific ports, but this is something that is generally handled by dedicated bunker fuel supply chains.

Bulk shipping

Bulk shipping operates outside the merchandise trade sector and is generally fit-for-purpose

Bulk shipping takes place at PICs to perform specific trade functions that multipurpose vessels (MPV) cannot perform. Single commodity cargo types in larger tonnage volumes are suited to bulk shipping. Due to the lower value of bulk materials, economies of scale are required for import bulk shipments to be viable. This means that bulk shipping is more commonplace in the larger PIC economies of PNG and Fiji and to a lesser degree in Solomon Islands.

Many dry bulk ports are located at the point of production, as is the case for bulk mineral exports and bulk woodchip or logs. In port settings that regularly handle bulk cargoes there are often dedicated facilities which do not interfere with the MPV container operations. However, in smaller PIC ports with limited berth capacity there is contest for berth space between MPV ships and bulk ships, usually liquid bulk tankers.

Bulk berth at Walu Bay, Suva Port, Fiji

Source: Adrian Sammons / AMSTEC.

Three types of bulk shipping

Dry bulk import shipping occurs in larger Pacific Island economies that have higher demand for imported grains, clinker, and fertilizers as inputs to manufacturing. Dry bulk export shipping includes forestry products (round logs), wood chip, raw sugar, and minerals and are shipped on charter vessels that operate independently of the merchandise shipping companies and those supply chain networks.

Liquid bulk shipping caters to petroleum product import demand and exports (from PNG as a producer and Fiji as a fuel transshipment hub). This important sector operates outside the merchandise MPV shipping network and relies on bulk onshore storage capacity.

The fisheries sector handling *bulk whole frozen tuna* are mostly distant water foreign fleets that operate independently of the merchandise container shipping companies. This large tonnage sector predominantly transfers frozen tuna to refrigerated bulk vessels which sail direct to foreign processing factories. The transfer is designated under the fisheries licensing to occur within lagoon or sheltered anchorages in the territorial sea limits[1] of PICs.

Key Areas for Attention

As already stated, these four sectors discussed are separate from the core maritime transport activities of liner shipping and domestic shipping. However, they clearly interact in various ways. Over all four sections, the most relevant maritime transport-related opportunity is:

Account for these four sectors when developing port master plans

Ensure that port master planning (discussed in the chapters on *Gateway Ports* and *Disaster and Climate Resilient Maritime Transport*) adequately considers the need to accommodate and service cruise ships, the tuna fishing industry, fuel supply and handling, and bulk shipping over the design life of the port. This may include the future need for terminal space, facilities, proximity to processing or storage facilities, and intermodal transport connections with consideration for lower impact on public access roads to and from the port node.

Cruise ships

Specific to cruise ships, the two most relevant opportunities are:

- Assess whether the fees paid by cruise companies are adequate to cover the costs of hosting visits by their ships. For example, cruise ships place significant demand on ports for safety and security services as well as attention to monitoring environmental impacts. Support PICs to set fair, regionally-consistent port fees and other charges using cost-recovery and benefit-sharing principles. Support for application and justification of cruise passenger levies.
- Support PICs' to improve management of the environmental impacts of cruise ships, especially when in port. Such as by developing environmental regulations for cruise ship visits and ensuring compliance.

Tuna fishing

It is beyond the scope of this report to provide recommendations for port development to support the capture of more benefits from the tuna industry. The key implication for ports is that if there is economic potential to provide onshore processing or services, then the port precinct will need to provide space and facilities to enable that. Port master planning should make sure to consider any potential for different types of onshore tuna processing and other services including net repairs, making sure to consider all the factors and whether the activity is feasible. The emerging case in Kiribati being that the Ministry of Fisheries has design ambitions to reconfigure the Betio port as predominantly a fisheries sector facility, yet the ports Authority requires greater area dedicated to general cargo and container yard space. Master planning of ports will provide a balanced consideration and apply first principles of economic planning to support prioritizing of developments.

Fossil fuels

- Probably the key issue around fuel is the safe handling of fuel on domestic routes. Solutions to this would require a closer look at ways to handle fuel containers, including fit-for-purpose facilities for landing (including lifting gear), as well as suitable stowage on vessels.
- The change in overall demand over time is likely to be met naturally with adjustments in service from suppliers. It is possible this will need attention in the future if the volumes become so small that fuel shipping becomes commercially unviable, and countries are left without reliable supply. In the medium to long term, it is possible that support will be needed to ensure critical supply.
- Energy security and resilience of PICs needs particular attention to high-level response plans in the case of disruption to the main supply route, including working with Australia and New Zealand on contingency plans (due to their existing role in humanitarian response for the region). (Hale & Twomey, 2019)

[4] Territorial sea limits are generally 12 nautical miles off the coast.

Resilience of Maritime Transport Systems to Natural Hazards and Climate Change

Overview

Resilience to the impacts of natural hazards and climate change can mean many things. In this chapter it specifically refers to the resilience of the maritime transport systems in Pacific Island countries (PICs) to the risks posed by natural hazards and climate change.

Assets are typically located on open coasts, at or near sea level. Climate change is raising sea levels and increasing the frequency and severity of storms. Infrastructure is often not constructed with climate-resilient standards and often poorly maintained, in part because of the cost. In addition, decision-makers may not have access to information about how to adequately plan for and manage the risks and impacts of natural hazards and climate change on maritime transport systems.

These factors combine into wide-ranging impacts—following disasters, maritime operations and systems have limited ability to bounce back, largely due to a lack of contingency and business continuity planning, and a general shortfall of government capacity in building maritime sector resilience.

Natural hazard and climate change risks must be a key consideration for all maritime transport system planning and asset management. Action 2 in the *Blue Transformation* study is critical to achieving this. Its purpose is to improve how transport systems are planned and designed to deliver resilient and future-proofed services and infrastructure. These will help reduce the Pacific's vulnerability to economic and environmental shocks, and help build economic growth and stability.

This chapter aims to provide:

- An overview of the key natural hazards in PICs and their impacts on maritime transport systems (including ports most at risk)
- An overview of the relationship between these risks and the broader impacts on regional supply chains
- Capacity and capability gaps
- Opportunities to help strengthen the resilience of PICs' maritime transport systems to key natural hazards and climate change.

Resilient maritime transport systems are important for the overall resilience of PICs

Ports are critical nodes for Pacific economies and societies

The maritime transport systems of PICs are highly exposed to a range of natural hazards and climate change. Their impacts can include: direct damage of port assets (for example, wharves, jetties), equipment (such as, cranes and moorings) and other coastal infrastructure (such as connecting roads); income losses resulting from disrupted port operations; and critical food shortages and export losses should a severe weather event cause ships to skip some islands.

The location, climate, and geographic orientation of maritime assets determines their level of exposure to hazards. Ports, wharves, and supporting infrastructure that are highly exposed to natural hazards are more susceptible to damage, service disruption (temporary and extended), and maritime accidents potentially leading to loss of life and cargo.

Building resilience of the maritime transport system is critical for maintaining connectivity and services for energy and food security, and for effective disaster response and recovery. Transshipment, hub ports, and gateway ports are most critical to a resilient system, particularly those handling strategic commodities (for example, fuel) for dependent countries with limited storage.

The more vulnerable Pacific countries and individual islands share common challenges. They rely on imports of food commodities and fuel. They are a long way from major hubs where replacement services for international shipping are sourced. They have limited domestic shipping services and lack network redundancy. Their economies are highly vulnerable to supply and price shocks.

Ports are a lifeline

Ports are a critical lifeline in the aftermath of a disaster, supporting necessary relief efforts. Damage to critical infrastructure—such as ports, wharves, ships, and lighthouses—can hinder relief and recovery efforts by making it difficult to rescue people and deliver goods, services, supplies, and materials for reconstruction. It is important that port designs consider how the basic port facilities can withstand the impacts of natural disasters so the port can remain operational in the aftermath of such events. Such approaches are increasingly being adopted by port renewal and expansion plans in the Pacific, including in Nauru, Solomon Islands (Honiara), Samoa (Apia), and Tonga (Nuku'alofa) (Arslanalp et al., 2021).

Service disruption may be temporary or extended. The strong correlation between the strength of a disaster event and how long disruption goes on for indicates that the increased severity of some natural disasters under climate change scenarios will cause greater disruption or downtime at ports. Verschuur et al. (2020b) found that an increase of 16 kilometers/second in wind speed in a natural disaster event was correlated with a two-day increase in disruption. Similarly, a 1-meter increase in storm surge correlated with a two-day increase in port disruptions. These impacts are likely to be greater in PICs that have little or no redundancy in their network, where redirection options to mitigate disruption are limited.

Threats to economic activity

Most imports (by value) arrive through seaports in PICs—about 80 percent to nearly 100 percent (Arslanalp et al., 2021). The Republic of the Marshall Islands (RMI) has the highest proportion of imports delivered by maritime transport in the world at 99.2 percent (Verschuur et al., 2021). For exports, the Solomon Islands has the world's second highest share of exports dispatched by sea at 99.5 percent (Verschuur et al., 2021).

Given the high dependency of Pacific supply chains on functioning maritime transport systems, investment in the resiliency of maritime transport systems to natural disasters is vital. In small island states up to 43.5 percent of economic activity can depend on trade through a single port (Arslanalp et al., 2021). Of the PIC12 countries, Kiribati, RMI, Nauru, Palau, Tonga, and Tuvalu have one primary port. The international port operations within these counties are more vulnerable to disruptions because there are limited alternative wharf options if the primary port is damaged.

Supply chain impacts

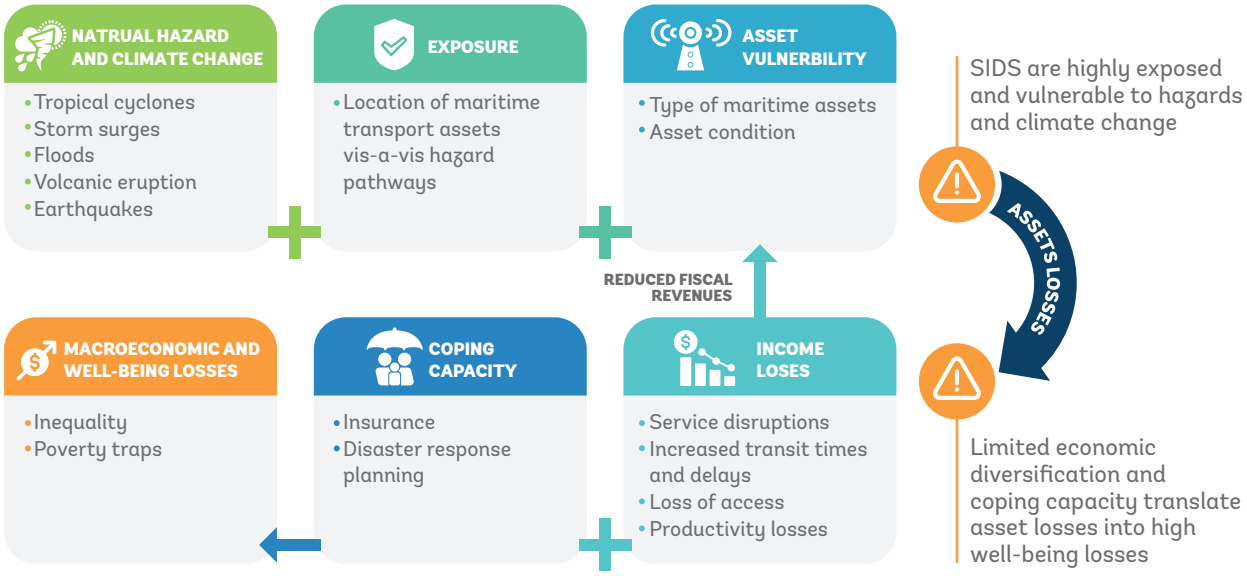
Natural disasters can often impact more than one country and one port at a time, creating regional disruptions. For example, Tropical Cyclone Harold that tracked over Solomon Islands, Vanuatu, Fiji, and Tonga in 2020, had a notable impact on regional supply chains.

There is potential for supply chain disruptions to become more severe in the future given the increasing complexities of supply chains, their reliance on maritime transport systems, and the potential worsening of natural disaster events due to climate change. It has been estimated that 1–6% of PICs' trade can be disrupted by climate extremes and natural disasters (Arslanalp et al., 2021).

Framework for understanding the impact of natural hazards on maritime transport systems

This chapter follows a 6-part framework that brings together natural hazards, exposure of maritime assets, asset vulnerability, asset and income losses, and coping capacity, as shown in figure 1. Each aspect of this framework is described—including the macroeconomic and well-being losses that ensue—to provide a high-level assessment of the resilience of the region's maritime transport system to natural hazards and climate change. Figure 7 shows policies and investments that could help strengthen these systems.

Figure 15 Framework Showing Maritime Transport Asset Losses, Income Losses, and Well-being Losses



Source: Adapted from World Bank, 2017, p. 10

Note: SIDS are "Small Island Developing States".

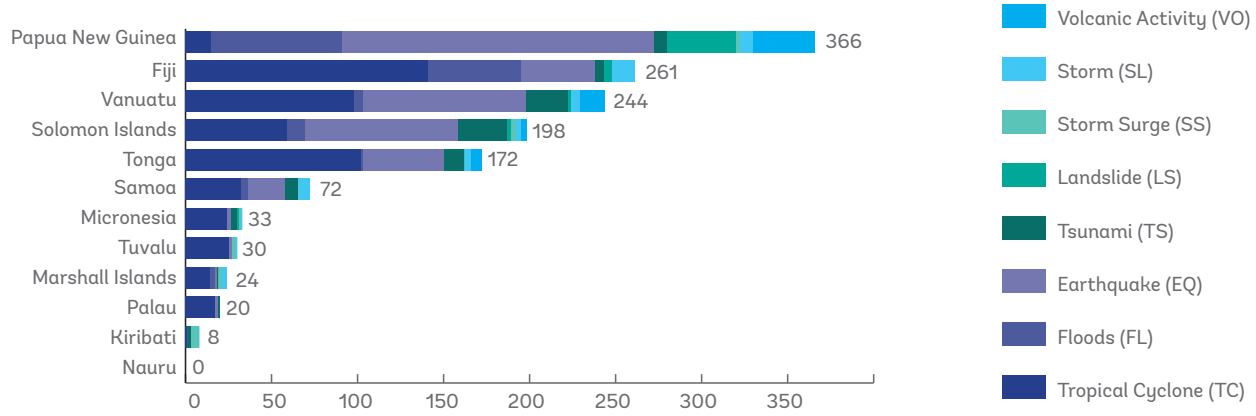
1. Natural hazards and climate change in the Pacific

PICs are among the world's most exposed and vulnerable countries to natural disasters. Vanuatu, the Solomon Islands, and Tonga are ranked as the three countries most at risk of natural disasters based on the World Risk Index, with 6 of the PICs among the top 20 countries (Bundnis Entwicklung Hilft, 2021). Figure 2 shows the total number of events, broken down by the PIC12 countries, between 1900 and 2020.

PICs are exposed to a range of natural hazards, including tropical cyclones, regional storms, coastal flooding, earthquakes, tsunamis, and volcanic eruptions (PCRAFI, 2013).

Climate change is expected to exacerbate these risks, particularly the impacts of sea level rise, more variable weather patterns, and the changed intensity and frequency of extreme events, such as storm surges and tropical cyclones. The result will be an increase in the number of multi-hazard events the PICs will face. For example, coastal flooding caused by sea level rise will be exacerbated when severe events that raise water levels coincide—such as storm surges, king tides, cyclones, and high swells.

Figure 16 Total Natural Hazard Events Recorded from 1900–2020, by Country



Source: Project team assessment based on data from Secretariat of the Pacific Community, Pacific Data Net, 2022.

2. Exposure of assets to natural hazards and climate change

Table 1 shows the exposure of PIC12 ports to key hazards, and the types of asset losses and disruptions that result from these. Table 2 visually shows the combined severity of key natural hazards at each of the primary ports for each country. This data is extracted from the multi-hazard spatial maps shown in Figures 3 and 4. Spatial maps and detailed definitions for each hazard are presented in more detail in the accompanying Hazard Exposure Technical Note. Ports most exposed to multiple hazards are at the top of the table, and the least exposed are at the bottom. It shows that the five ports most exposed to multiple hazards are Nuku'alofa in Tonga, Luganville in Vanuatu, Apia in Samoa, and Suva and Lautoka in Fiji. Apia and Suva are also regional hub ports.

Table 6 Hazard Exposure for PIC12 Ports

Hazard	PIC12s with ports most exposed to this hazard	Resulting asset damages and losses
1. Tropical cyclones	Most frequent type of disaster recorded for most PIC12s, except for Kiribati and Nauru.	» Damaged infrastructure, equipment, and cargo » Disruption of operations.
2. Regional storms	All PIC12s are affected by storm-related swell waves. Many sites are relatively sheltered, so site-specific analysis is required to assess the detailed impacts. However, combined with sea level rise, wave events and their effects, which were rare in the past, will become common within the next 50 years (up to 2072).	» Damaged infrastructure, equipment, and cargo » Disruption of operations » Waves can interrupt operations, but, more critically, may cause flooding due to wave runup and overtopping, and erosion, with long-term impacts.
3. Coastal flooding	All PIC12s, but particularly the low-lying atoll nations, such as Marshall Islands, Kiribati, and Tuvalu.	» Damaged infrastructure, equipment, and cargo » Disruption of operations » Affects connections and access to ports » Flooding of seaports and connecting roads and rail lines » Increase in maintenance and rehabilitation costs.

Hazard	PIC12s with ports most exposed to this hazard	Resulting asset damages and losses
4. Tsunamis	Potential to affect most ports, although effects will vary enormously depending on local bathymetry and topography. Greatest risk is in Papua New Guinea (PNG), Vanuatu, Solomon Islands, and Tonga.	» Damaged infrastructure, equipment, and cargo » Disruption of operations » Affects connections and access to ports » Flooding of seaports and connecting roads and rail lines » Increase in maintenance and rehabilitation costs.
5. Earthquakes	Earthquakes are severe in some countries (Vanuatu, Tonga, and Fiji) and may critically affect port infrastructure (for example, in PNG, Samoa, and Solomon Islands).	» Damaged infrastructure, equipment, and cargo » Disruption of operations » The effects of earthquakes can be addressed, after assessment, through structural upgrading where applicable, combined with disaster response planning. In a few cases, especially if the port is built on reclaimed land, ground conditions may need retrofit improvements if liquefaction effects are assessed to be critical.
6. Volcanic hazards	The Solomon Islands, PNG, Vanuatu, Samoa, Fiji, and Tonga are exposed to volcanic hazards. However, only three sites are at high risk, of which one, Honiara, is a hub port. The effect of a volcanic eruption can be catastrophic with long-term impacts, as shown by Rabaul Port in PNG after the 1994 eruption of Mount Tavurvur.	» Damaged infrastructure, equipment, and cargo » Disruption of operations » Severe corrosion due to volcanic ash.
7. Sea level rise	All PIC12s. The amount of sea level rise varies with geographical location and local tectonic plate movements. Sea level rise is occurring three times faster than the global average in some areas of the Pacific Ocean, such as around the Solomon Islands, PNG, and the Marshall Islands (RMI) (Howes et al., 2018). Atoll countries (RMI, Kiribati, and Tuvalu) are potentially the most severely affected because they are low-lying (95–100 percent of the population live less than 5 meters above sea level1) with limited land available, no opportunity to retreat or relocate, and expensive land raising and reclamation are possibly the only viable adaption option available.	» Damaged infrastructure, equipment, and cargo » Transient or permanent flooding of seaports and connecting roads and rail lines » Increase in maintenance and rehabilitation costs » Increases in sea levels over time may make some ports unviable, or at least severely affected, without adaptation.

Notes:

(1) Tropical cyclone—a low-pressure system that forms over warm tropical waters, in the region of the South Pacific Ocean. Cyclones typically form when the sea-surface temperature is above 26.5°C. Associated with strong wind, rain, and wave action. NB. These are called typhoons in the North Pacific.

(2) Regional storm—regional low pressure storm system (larger and slower compared to tropical cyclones) that typically generates waves that can travel large distances as long-period swell.

(3) Coastal flooding—occurs when sea water rises to a level that is high enough to flood infrastructure and buildings and is above the normal (astronomical) tide levels. It can be due to the presence of a storm, winds, powerful ocean movements, or cyclonic activity.

(4) Tsunami—an ocean wave generated by earthquakes, undersea landslides, volcanic eruptions, explosions, or meteorites. These waves can travel great distances sometimes across entire oceans and can affect extensive coastal areas.

(5) Earthquake—a sudden slip on a fault, and the resulting ground shaking and radiated seismic energy caused by the slip, or by volcanic or magmatic activity, or other sudden stress changes in the earth.

(6) Volcanic hazard—A volcano is a vent in the Earth's crust from which eruptions occur. A volcanic eruption is when lava and gas are released from a volcano.

(7) Sea level rise—an increase in the level of the world's oceans because of global warming.

[1] UN-OHRLLS, SIDS in Numbers 2013 and 2015.

Figure 17 Multi-hazard maps for: (a) Tropical Cyclone Tracks and Intensities, 1972 to 2022; (b) Regional Wave Heights in meters (99 percentile); and (c) coastal flooding height in meters (50 year return period)

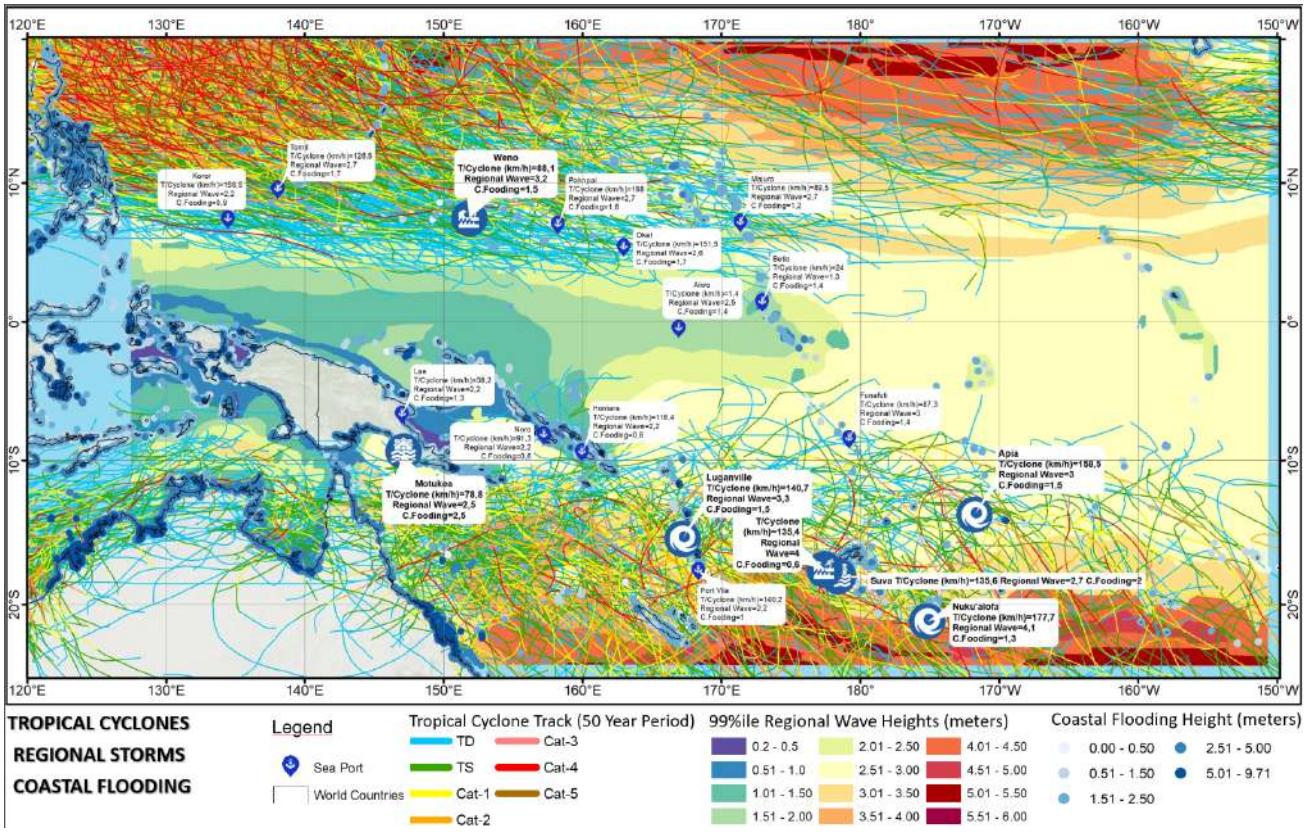


Figure 18 Multi-hazard maps for: (a) Tsunami Hazard Rupup; (b) Earthquake Peak Ground Acceleration (250 year return period); and (c) Volcanic Hazard Level (VHL).

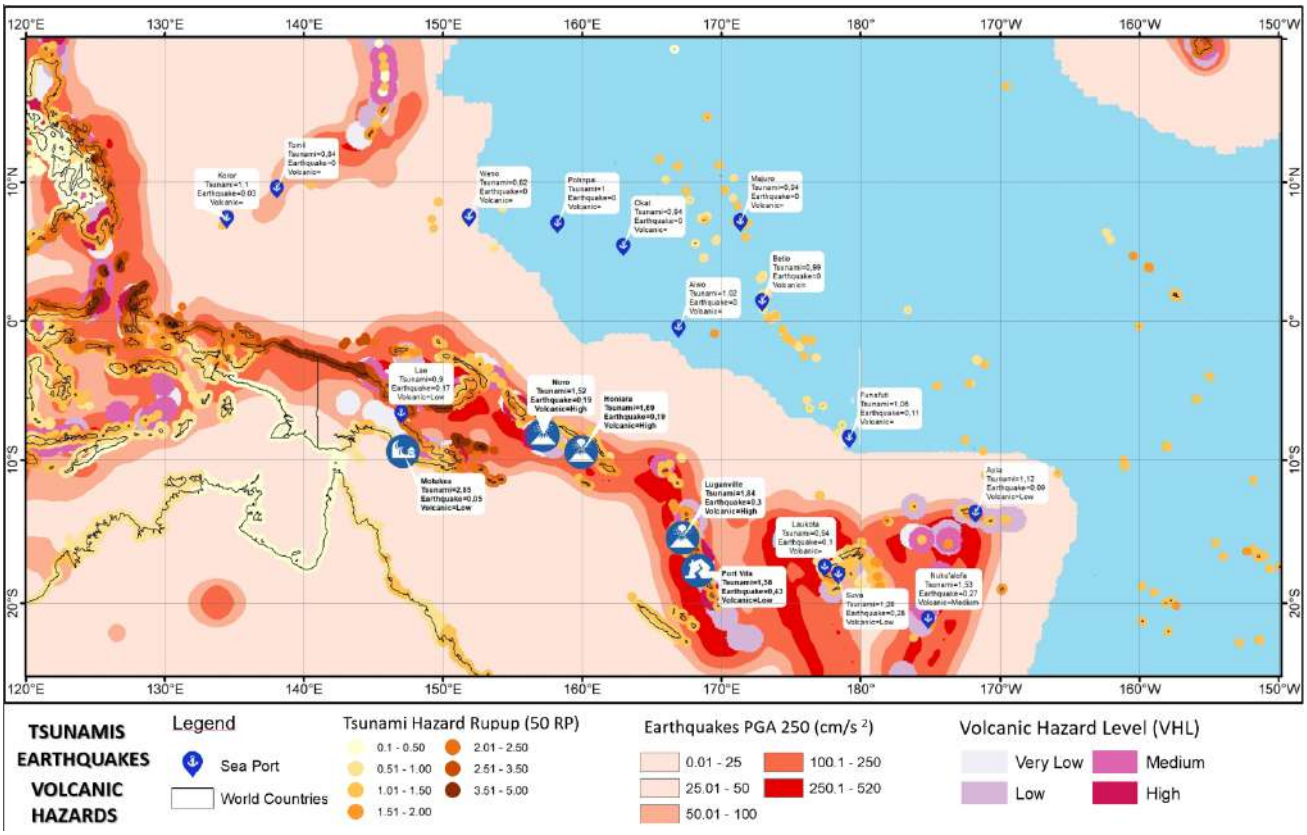


Table 7 Multi-hazard Heat Map Port Exposure

Higher Hazards

Lower Hazards

Country	Port	Port Category	Wave Fetch Conditions (1)	T/Cyclone Gust Speed (km/h) (2)	T/Cyclone Wave Height (m) (3)	Regional Storm Wave Height (m) (4)	Coastal Flooding (m) (5)	Tsunami Max. Inund. Height (m) (6)	Earthquake PGA (g) (7)	Volcanic Hazard Level (8)	SLR (SSP5-8.5, 2050 (m) (9)
Tonga	Nukuálofa	Primary	Open	178	9.1	4.1	1.3	1.5	0.27	Medium	0.27
Vanuatu	Luganville	Primary	Open	141	6.7	3.3	1.5	1.8	0.30	High	0.24
Samoa	Apia	Primary & Hub	Open	159	7.9	3.0	1.5	1.1	0.09	Low	0.31
Fiji	Suva	Primary & Hub	Open	136	6.4	2.7	2.0	1.3	0.28	Low	0.26
Fiji	Lautoka	Primary	Open	135	6.3	4.0	0.6	0.9	0.10		0.25
Solomon Islands	Honiara	Primary & Hub	Limited by Central Province Islands	116	3.2	2.2	0.8	1.7	0.19	High	0.22
FSM	Weno	Primary	Open	88	3.5	3.2	1.5	0.8			0.24
Solomon Islands	Noro	Primary	Semi-enclosed	91	2.8	2.2	0.6	1.5	0.19	High	0.22
Vanuatu	Port Vila	Primary	Sheltered	140	0.7	2.2	1.0	1.6	0.43	Low	0.25
PNG	Motukea	Primary & Hub	Semi-enclosed	79	1.0	2.5	2.5	2.9	0.05	Low	0.22
Marshall Islands	Majuro	Primary	Limited by lagoon	90	1.7	2.7	1.2	0.9			0.27
Tuvalu	Funatuti	Primary	Limited by lagoon	87	1.2	3.0	1.4	1.1	0.11		0.25
Nauru	Aiwo	Primary	Open	1	0.0	2.5	1.4	1.0			0.25
Palau	Koror	Primary	Semi-enclosed	157	1.1	2.2	0.9	1.1	0.03		0.25
FSM	Pohnpai	Primary	Enclosed	188	1.0	2.7	1.8	1.0			0.27
FSM	Okat	Primary	Enclosed	152	0.7	2.6	1.7	0.9			0.25
PNG	Lae	Primary & Hub	Open	38	1.1	2.2	1.3	0.9	0.17	Low	0.22
FSM	Tomil	Primary	Semi-enclosed	127	0.7	2.7	1.7	0.8			0.25
Kiribati	Betio	Primary	Open	24	0.6	1.3	1.4	1.0			0.25

Colour Legend:

High Medium Low Very Low Not applicable

Source: Project team assessment

Notes: The data in each column are as follows:

(1) Wave fetch conditions: Anything other than "Open" indicates that the distance over which waves may be generated is limited by land or reef boundaries (measured from Google Maps for calculation purposes). "Open" means open ocean conditions in deepwater conditions without considering depth effects or alignment of the winds with the port. (As the analysis involves many approximations, any wave heights calculated should be treated as relative only.)

(2) T/Cyclone Gust Speed (Vmax): The maximum 3-second gust windspeed for 50-year return period from https://www.geonode-gfdrrlab.org/layers/hazard:viento_mundo_tr50_int1;

(3) T/Cyclone Wave Height: The maximum significant wave height corresponding to Vmax (adjusted to 10-minute sustained average

following Harper et al, 2010) calculated using the effective fetch method of Young (1988) for a standardized cyclone with a 30 km radius to maximum wind speed and a 6 m/s (21.6 km/h) forward speed.
(4) Regional Storm Wave Height: The 99 percentile significant wave height interpolated from Trenham et al. (2013);
(5) Coastal Flooding: The flooding height from the Global Flooding dataset for storm surge and extreme sea levels, including tides (as calculated following Muis et al. 2016) for a 50-year return period from the GFDRR Global Muis RF 50 dataset: https://www.geonode-gfdrrlab.org/layers/hazard:ss_muis_rp0050m;
(6) Tsunami Maximum Inundation Height (MIH): For a 50-year return period from the GFDRR Global Tsunami Hazard GTM RP50 dataset https://www.geonode-gfdrrlab.org/layers/hazard:ts_mih_rp50;
(7) Earthquake PGA: The peak ground acceleration (pga) as a multiple of gravitational acceleration (g) for a 250-year return period (the lowest return period for which data is given) available from https://www.geonode-gfdrrlab.org/layers/hazard:gar17pga250;
(8) Volcanic Hazard Level (VHL): Assigned to an area within a 100 km radius of the volcano from https://www.geonode-gfdrrlab.org/layers/hazard:volc_globalproximalhazard_wgs84; and
(9) SLR: The predicted sea level by rise by 2050 for SSP 5-8.5 from https://sealevel.nasa.gov/ipcc-ar6-sea-level-projection-tool.

Ways to reduce exposure

Assess each country's overall risk profile

The risk profiles developed by the Pacific Catastrophic Risk Assessment and Financing Initiative (PCRAFI) can help assess risks from natural hazards at a country level.

Disaster Risk Reduction for the maritime sector needs to have a strong institutional basis to ensure it is prioritized, planned for, and implemented. It includes the following:

1. Identify, assess, and monitor disaster risks and early warning.
2. Use knowledge, innovation, and education to build a culture of safety and resilience at all levels.
3. Reduce the underlying risk factors.
4. Strengthen disaster preparedness.

Adapt infrastructure to meet climate change impacts

The Intergovernmental Panel on Climate Change (IPCC) has a framework of four approaches to adapting infrastructure to climate change. They are relevant to the PIC12 countries:

- **Avoid:** prevent development in exposed areas. This option does not apply to atolls where most settlements are already exposed.
- **Protect:** separate vulnerable maritime transport areas, especially wharves, infrastructure, warehouses, and adjoining roads from the hazard—for example, flooding and coastal erosion.
- **Accommodate:** continue to occupy vulnerable areas but accept the greater degree of hazard by changing land use, changing construction methods, improving preparedness, raising existing land, and/or creating new land.
- **Retreat:** abandon maritime transport structures in currently developed areas, move them to new, safer areas and require that new developments be set back from the shore, as appropriate.

Infrastructure-related adaptation responses may include but are not necessarily limited to: relocating highly exposed port infrastructure to a location out of harm's way; reengineering the design of the deck (for example, to be more robust to extreme seas); raising the height of the infrastructure; improving drainage to reduce flood impacts; reconfiguring the port layout to better facilitate operations in high wind; or adding redundancy of wharves and handling equipment.

To develop effective adaptation strategies, it is essential to distinguish between the impacts of: (a) changes in the frequency and/or severity of extreme weather events; and (b) changes in "normal" climate conditions, such as higher mean temperatures, higher mean sea level, the level and pattern of precipitation, and El Niño-Southern Oscillation (ENSO) cycles.

Enhancing maritime infrastructure whole-of-life cycle management

PICs can reduce maritime infrastructure vulnerability through effective whole-of-life cycle management, which includes:

- Systems planning
- Engineering and design
- Operations and maintenance
- Contingency programming
- Institutional capacity and coordination[1]

3. Asset vulnerability

The vulnerability of Pacific maritime assets has a direct bearing on the regional network's susceptibility to the impacts of natural hazards, and the extent to which its peoples and economies are negatively affected. How vulnerable assets are depends on their type and quality—including design characteristics, the quality of build, and the maintenance regime.

Measuring maritime assets' vulnerability requires detailed on the ground assessments. Some key measures to reduce vulnerability include:

- Increase infrastructure maintenance
- Increase standards for buildings and infrastructure
- Retrofit buildings and infrastructure
- Establish robust early warning systems.

Vulnerable infrastructure should be rebuilt or retrofitted to higher standards aimed at mitigating the impacts of hazards, including sea level rise. For some countries this may entail upgrading new investment projects to make them more climate resilient, which is relatively inexpensive. For others, it may mean retrofitting existing climate-exposed critical assets or developing coastal protection infrastructure, both of which are significantly more expensive. Many of the ports in the Pacific were built in the 1970s when trade began to expand and are reaching the end of their economic lives under the design codes of that time (ADB, 2019). Much of the critical infrastructure in the region is due for an upgrade to adapt to risk from cyclones, floods, storm surges, and sea level rise (Arslanalp et al., 2021).

The cost of physical adaptation measures can be large depending on the scale of adaptation required and the type and number of assets included. The International Monetary Fund (IMF) estimates that between 2021 and 2031, investment to climate-proof infrastructure will average 3.3 percent of gross domestic product (GDP) annually for the Asia-Pacific region.[2] The amount will be much higher for some PICs compared to others and detailed site-specific analysis is required to determine the costs of these measures.

4. Asset damage and income losses

Among the many impacts of natural hazards are physical damage to assets and income losses due to service disruptions and increased transit times. Costs are many and varied. For example, physical damage to the maritime transport system (such as, ships and supporting infrastructure) brings the high costs of salvage efforts and repairs, and the loss of berthing fees from cancelled ships. Inspecting the structural integrity of maritime infrastructure before it can resume operations also comes at a cost.

Costs can be very high. For example, over two days in March 2015, Tropical Cyclone Pam struck Vanuatu as an extremely destructive Category 5 cyclone,[3] with estimated wind speeds of 250 kilometers per hour and wind gusts of up to 320 kilometers per hour. The total damages and losses were estimated to be approximately US$449.4 million. Of that, US$10.4 million was in the maritime sector (Esler, 2015).

[2] World Bank, Climate and Disaster Resilient Transport in Small Island Developing States: A Call for Action, 2017.

[3] IMF, 2021, https://www.imf.org/en/Publications/Departmental-Papers-Policy-Papers/Issues/2021/03/24/Fiscal-Policies-to-Address-Climate-Change-in-Asia-and-the-Pacific-Opportunities-and-49896

[4] Category 5 tropical cyclones are by definition the strongest tropical cyclones that can form on Earth. The categories are based on the Australian tropical cyclone intensity scale within the South Pacific basin.

Box 3: Maritime sector losses from Tropical Cyclone Pam in Vanuatu

Tropical Cyclone Pam struck Vanuatu in March 2015. It severely damaged Port Vila, the main port. Water-based infrastructure was hardest hit, with sunk carrier vessels, damaged navigational aids, and damage to other marine vessels, in particular the smaller fleet (Esler, 2015). Direct damage to the maritime sector in Vanuatu was estimated to cost US$365,664 (Esler, 2015). TC Pam also resulted in operational losses. Ships were unable to sail (for example, cruise liners were temporarily diverted) and passenger vessels that sank or ran aground had to be salvaged (Esler, 2015). It is estimated operational losses from TC Pam to the maritime sector cost about US$10.08 million (Esler, 2015). After the cyclone, 19 cruise ships cancelled their stopover in Vanuatu. The decline in tourism numbers contributed to an estimated overall tourism loss of US$7.8 million (Esler, 2015).

Remote infrastructure can be more at risk

Many domestic jetties and wharves in the outer islands are in poor condition and lack basic facilities such as storage and shelter. These assets are at high risk to damage from natural hazards. For example, in 2020, TC Harold washed away several causeways and severely damaged jetties on the remote islands of Koro and Moala in Fiji (Deo, 2020). Local businesses that used maritime transport to transfer goods from outer islands to the main island for export were severely impacted.

Table 8 outlines the damages and losses to the maritime transport system resulting from natural disasters between 2009 and 2018.

Table 8 Maritime Asset Damages and Losses from Disasters in the Pacific, 2009–2018

Country	Year	Natural Disaster Event	Maritime asset Damages[ß] (USD million)	Maritime asset Losses± (USD million)	Total Combined Damages/Losses (USD million)	Maritime Damage as Proportion of GDP (%)
Samoa	2009	Earthquake	6.73	2.40	9.13	1.57
Fiji	2012	Tropical Cyclone Evan	0.18	0.06	0.24	0.01
Samoa	2012	Tropical Cyclone Evan	26.0	9.20	35.20	4.63
Vanuatu	2015	Tropical Cyclone Pam	0.37	10.08	10.45	1.36
Fiji	2016	Tropical Cyclone Winston	8.34	0.02	8.36	0.17
Tonga	2018	Tropical Cyclone Gita	0.57	0.21	0.78	0.16

Source: GFDRR, Post Disaster Needs Assessments, http://www.gfdrr.org/en/post-disaster-needs-assessments

Notes: [ß] Maritime damages are defined as the monetary value of fully or partially destroyed maritime assets, stock, and property. It is initially assumed that assets will be repaired or replaced to the same condition—in quantity and quality—prior to the disaster. That is, valued at agreed replacement (as opposed to reconstruction) costs (modified from UN ECLAC/R. Jovel, 2007).

[±] Maritime losses are defined as changes in the flow of goods and services that will not be forthcoming until the destroyed assets are rebuilt or recovered. These losses will be quantified at the present value of such flows. Losses include the production of goods and services that will not be obtained; higher costs of operation and production; reduced income; and increased expenditure. A distinction is made between private and public losses (modified from UN ECLAC/R. Jovel, 2007).

5. Coping capacity

The ability of PICs to build their coping capacity involves multifaceted policies including:

- Developing integrated government-wide objective setting and results monitoring for climate resilience to provide the required focus and incentives during implementation
- Implementing alternative coordination mechanisms to facilitate cooperation across institutional mandates
- Balancing capacity building with capacity supplementation to ensure long term sustainability of management systems
- Scaling up social protection after shocks
- Increasing financial inclusion
- Increasing access to insurance
- Making available contingent finance and reserve funds.

6. Macroeconomic and well-being losses

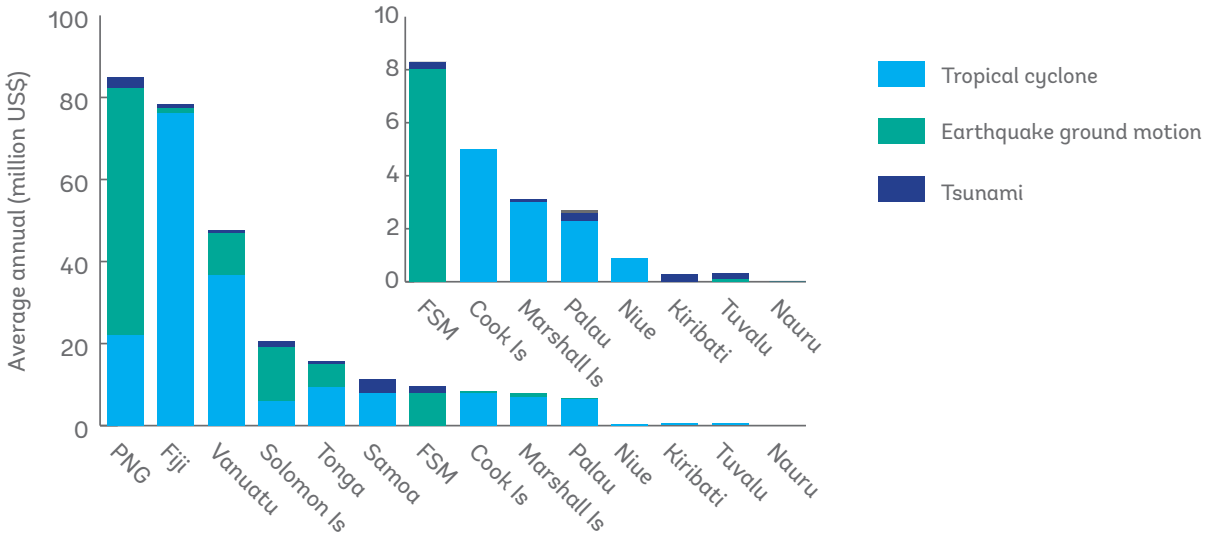
Natural disasters affect economies at large and have far-reaching macroeconomic impacts. These can affect the maritime sector due to flow-on effects from reduced investment in the sector, reduced trade, and reduced overall economic activity.

PICs suffer very high economic losses when extreme events strike, with average annual losses ranging between 1 and 10 percent of GDP.[1]

One estimate is that in the 65 years from 1950 to 2015, about 1,950 natural disasters occurred across the Pacific region, causing an estimated annual direct loss of US$284 million (PCRAFI, 2015).

Damages and losses for a single disaster can equate to more than 30 percent of GDP— for example, Cyclone Evan (Samoa, 2012), Cyclone Pam (Vanuatu and Tuvalu, 2015), and Cyclone Gita (Tonga, 2018) (Arslanalp et al., 2021). Figure 6 shows the average annual losses for the PIC12 countries, and Niue, Cook Islands, and Timor-Leste.

Figure 19 Average Annual Losses from Key Hazard Events in PICs



Source: PCRAFI, 2015 (based on PCRAFI 2011 data).

The result of these large macroeconomic losses means a country must redistribute its wealth to those most in need, resulting in whole-of-country well-being losses.

[5] Climate and Disaster Resilient Transport in Small Island Developing States: A Call for Action, 2017, https://openknowledge.worldbank.org/handle/10986/28798

Challenges

Six key factors challenge the Pacific region's ability to build resilience into its maritime transport system. They are described here, at a high level:

Lack of detailed climate and disaster risk information: Site-specific climate and disaster risk data for each port may not be available. Obtaining this information often requires technical skills not available in country.

Lack of climate resilient planning tools: Many institutions do not have planning tools (for example, maritime system vulnerability assessments or climate-informed port master plans) for staff to identify and prioritize vulnerable maritime network assets and take the systematic measures needed to enhance climate resilience.[1]

Institutional and capacity issues: These typically relate to: (i) narrow and shallow institutional structures that may not have specialized units focused on climate and disaster resilience; (ii) capacity constraints which make it difficult to effectively manage and supervise various aspects of the system, and very few staff who have backgrounds in climate resilience; and (iii) weak enabling environments and limited planning tools.[2]

Lack of government funding and reliance on donor funding: PICs often face a limited revenue base, which limits available funding for infrastructure, making them reliant on donor funding to meet their infrastructure and capacity building needs.

Inadequate asset management and maintenance regimes: There is often limited capacity of staff to undertake the necessary strategic asset management including: assessing the need for assets; assessing the level of service required to keep systems well-functioning; and every aspect of financial planning and monitoring.[3]

Opportunities to improve resilience

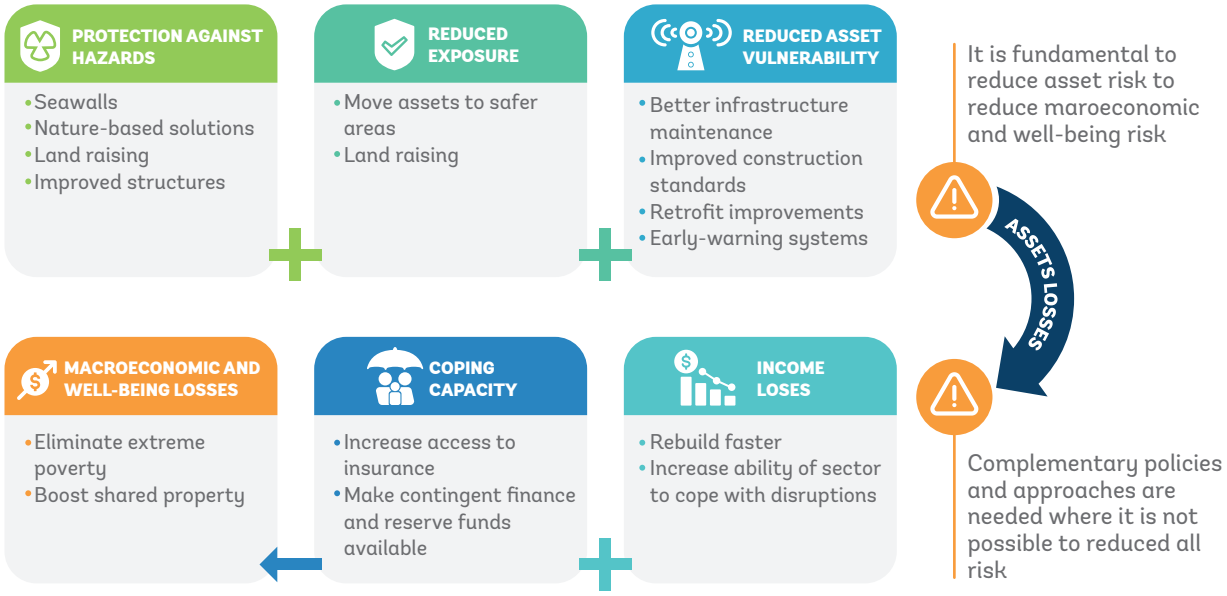
At regional and national levels, maritime sector policies and asset management need to adapt to reflect the impacts of disasters arising from natural disasters and climate change. Figure 7 shows the policy and asset management building blocks that will help lead to fewer asset, income, and well-being losses.

[6] The few institutions that do are typically funded by donors, with work carried out by donors or international consultants. This can mean local capability and capacity is not fostered. Tools also need to be updated regularly, as vulnerabilities and priorities change, but governments generally do not plan for the recurrent funding that is required, which again means donors are needed to fill the gap.

[7] Many PICs lack climate resilient transport policies or standards, and institutional oversight for enhancing climate resilient maritime infrastructure is generally not well defined.

[8] In 2020, the Pacific Region Infrastructure Facility created a "Methodology for Condition Assessment of Public Sector Infrastructure Assets in Pacific Island Countries" to assist with asset condition assessments (https://www.theprif.org/document/regional/infrastructure-maintenance/methodology-condition-assessment-public-sector).

Figure 20 Policies and Measures to Reduce Asset, Income, and Well-Being Losses from Natural Disasters



Source: Adapted from World Bank, 2017, p.11).

Key areas for attention

Eight key areas for attention provide opportunities to help build resilience in the maritime sector in relation to natural hazards and climate change. These address Actions 1, 2, and 3 in the *Blue Transformation* study—improving infrastructure through whole-of-life asset management; using integrated planning to improve resilience; and better connecting communities by preparing for supply chain disturbances.

Integrate natural hazard and climate change risk into port master planning

This requires a clear understanding of the specific risks facing a country's maritime sector so that appropriate adaptation measures can be prioritized. These include improving coastal protection near maritime assets and adapting maritime infrastructure to better withstand sea level rise, waves, tropical cyclone wind speeds, and changes in rainfall and temperature.[1] This will ensure that investment in port infrastructure is informed by a vulnerability approach that better understands the risks not only to the port assets but also to the people that use these assets. Good planning and management of natural hazard and climate change risks will improve the safety of port assets and the people who use them.

[9] PICs urgently need site specific marine and climate studies to better understand the exposure of coastal infrastructure to marine environments and changing climate conditions.

Build redundancy into the networks

Reducing risk should consider the vulnerability of domestic maritime connectivity and build redundancy into networks where possible to reduce the reliance on primary ports, particularly where these are extremely vulnerable to natural hazards and climate change. This is important from a safety perspective, as domestic maritime connectivity is particularly important to people during not only ordinary times, but also particularly during times of natural disasters where large numbers of people may need to be moved to safer ground on other islands and goods/services transported to those in need who may be affected by a natural hazard or climate change risk.

Design resilient infrastructure

Maritime infrastructure needs to be designed to be resilient to climate change and natural hazards. Such design aspects may include but are not limited to reengineering the design of the deck (for example, to be more robust to extreme seas); raising the height of the infrastructure; improving drainage to reduce flood impacts; and reconfiguring the port layout to better facilitate operations in high wind. Whilst making port infrastructure more resilient may prove more expensive in the short-term, it can prove less expensive over the long-term as assets are more likely to withstand natural hazard and climate change risks and therefore avoid frequent rebuilding of less-resilient port assets.

Strengthen collaboration between regional, national, and sub-national port authorities

Due to limited resources in each PIC, shared regional resources, training, and monitoring could be considered and supported by, or hosted in, an appropriate regional organization. This collaboration could also help facilitate standard strategic and operational documentation for port authorities in PICs.[1] A more collaborative approach and the sharing of resources will likely assist in improving the affordability of some areas. For example, in construction, asset management, training, website hosting, data collection and as joint-contracts could be used for such areas. PICs may also look at joint procurements for port assets, safety equipment etc to help reduce some of the importation/transportation costs associated with the delivery of these assets to each country. More joined-up approaches across Pacific port authorities will also likely help build skills and knowledge amongst staff in the specific issues faced by ports in PICs.

Strategic asset management

There is a need to adopt strategic asset management approaches for maritime transport assets. This should include assessing the need for assets, the level of service required to keep systems well-functioning, and every aspect of financial planning and monitoring.[2] The best practices of lifecycle asset management should be applied. The overall goal of strategic asset management is to help assets remain well-functioning for as long as possible and to be able to ensure appropriate financial planning to support this. Strategic asset management will assist with reducing the vulnerability of the assets and improve the safety of the assets and the people that use them.

[10] Such opportunities may include things such as: (i) regional programs to support development of business continuity and resilience planning; (ii) opportunities for peer collaboration and learning between port authorities; (iii) programs to support port authorities and managing bodies in developing Emergency Response Plans specific to the hazards likely at each site.

[11] Maritime transport systems in PICs need long-term planning to upgrade and properly maintain domestic maritime infrastructure, including undertaking feasibility studies, bathymetry surveys for all jetty locations, and developing an asset management database for all maritime infrastructure in the country.

Strategic business planning

There is a significant gap in strategic business planning (that is, multi-revenue streams and diversified business planning) for the maritime sector across PICs. Filling this gap would reduce the countries' vulnerability to systemic shocks that may be caused by natural disasters. While beyond the purview of this report, strategic business planning would also reduce PICs vulnerability when faced with civil unrest, economic downturns, health catastrophes, and other unforeseen events. Strategic business planning will assist with reducing the vulnerability of the assets and improve the safety of the assets and the people that use them.

Streamline DRM/DRR approaches in planned maritime infrastructure projects

Disaster risk management (DRM) and disaster risk reduction (DRR) approaches need to be streamlined across key stakeholders—private and public—in the maritime sector, at a national and regional scale. Currently, it is evident that priorities differ between local ministries and the private sector. Consequently, higher emphasis is placed on increasing the resilience of primary and hub ports, while domestic jetties in outer islands are neglected.

It is recommended that a region-wide online portal be developed that captures best practices to help port authorities across the region develop strategies, respond better, and "build back better" following disasters. The importance of learning from disasters and collaborating with stakeholders across the region in a coordinated manner is of critical importance for the port industry, so that new infrastructure can be planned to be as resilient as possible.

Supply chain resilience, risk assessment, and preparedness

It is critical that maritime authorities are prepared for disturbances to supply chains—regional and domestic—in a similar way that they are prepared for natural hazards. This includes building knowledge of supply chain disturbances, anticipating and preparing responses, and maintaining strong coordination across the Pacific and with key international partners.

Given the commonalities of supply chain problems faced by PICs and their limited domestic resources to respond to these, there needs to be consideration given to a more regional approach to managing these supply chain problems. Such an approach should consider:

1. Pooled regional resources—people, technical advice, and equipment
2. Coordinated assistance of bilateral and multilateral donor partners

3. A regional approach by development partners and regional organizations to monitor maritime transport system vulnerabilities in an ongoing way.As mentioned above, a more collaborative approach and the sharing of resources will likely assist in improving the affordability of some areas (eg. construction, asset management, training, website hosting, data collection etc) as joint-contracts could be used for such areas. PICs may also look at joint procurements for port assets, safety equipment etc to help reduce some of the importation/ transportation costs associated with the delivery of these assets to each country. More joined-up approaches across Pacific port authorities will also likely help build skills and knowledge amongst staff in the specific issues faced by ports in PICs.

Sector Governance and Institutions

Overview: The Role of Governance in the Pacific's Maritime Sector

The 2017 World Development Report (World Bank 2017) states "The global development community needs to move beyond asking 'What is the right policy?' and instead ask 'What makes policies work to produce life-improving outcomes?'".

For Pacific Island countries (PICs), whose economies are challenged by their responsibilities to secure, protect, and ensure safety across huge maritime areas of responsibility, a large part of the answer is effective, fit-for-purpose governance. Getting this right is a precursor to effective policy development and delivery.

Until relatively recently support to PICs has focused on their international obligations relevant to international shipping. As a result, governance for domestic maritime transport has fallen behind.

Therefore, today, the highest priority is to strengthen effective governance at both regional and national levels.

Action 5 in the *Blue Transformation* study supports this by seeking to enhance governance to improve efficiency and deliver better outcomes.

The elements of effective fit-for-purpose maritime governance

At a high level, governance is about having clear goals and an environment that enables them to be achieved. In practice, that means having appropriate institutions and arrangements in place—within and between countries—where roles, responsibilities, and accountabilities are defined and allocated. And where it is clear who is responsible for what, at what level.

How It Works Today: The Current Structure of Pacific Maritime Sector Governance

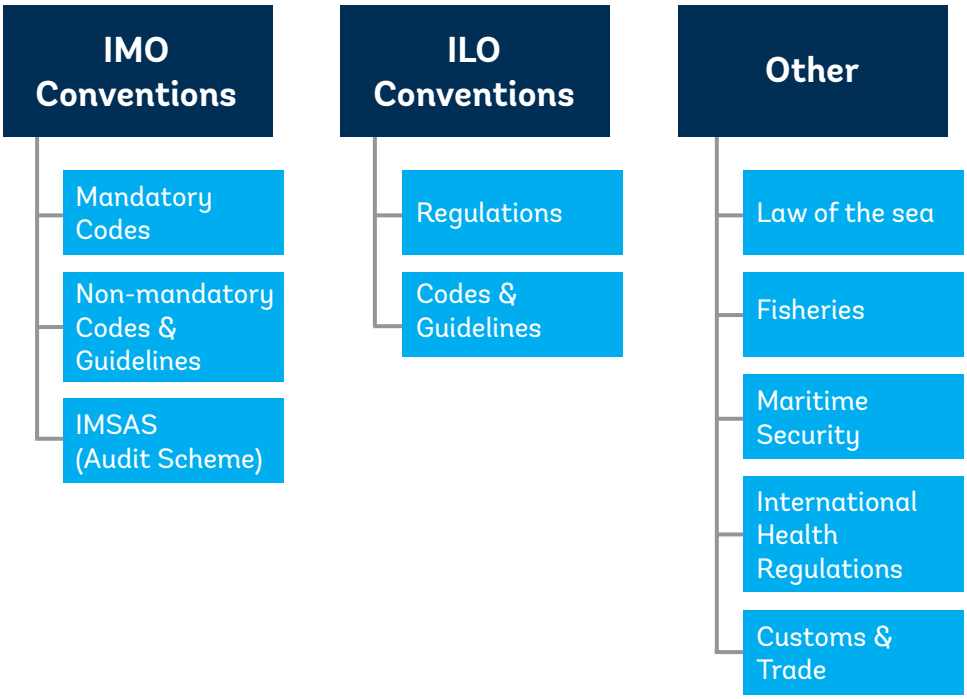
To provide context for the study's assessment of how Pacific maritime governance can improve, this section describes how it currently works—at international, regional, and national level.

Maritime governance at international level

Pacific Island countries have small economies, but geography gives them large maritime responsibilities. International shipping relies on individual countries to provide infrastructure and services to secure their routes across vast areas of ocean and into harbors and ports. Countries are also expected to police their waters to protect the ocean and coastal environmental. These national responsibilities for international shipping are vested through international treaties and conventions, which countries are expected to adapt and translate into their own legal and regulatory systems.

Doing so is a significant challenge. Pacific Island countries face a vast, complex, and constantly moving global regulatory framework for the maritime sector—international conventions, regulations, codes, guidelines, and audits (Figure 15). Once adopted by the PIC governments must be enacted into national laws and regulations, that thereafter require compliance and oversight.

Figure 21 Key International Maritime Conventions and Instruments



Source: World Bank

Maritime governance at regional level

The PIC region benefits from several long-established regional organizations and a long history of successful cooperation and regional solidarity. Moreover, these organizations exist within relatively coherent governance hierarchies, which include regular Heads of Government processes and sectoral Ministerial processes (Figure 16).

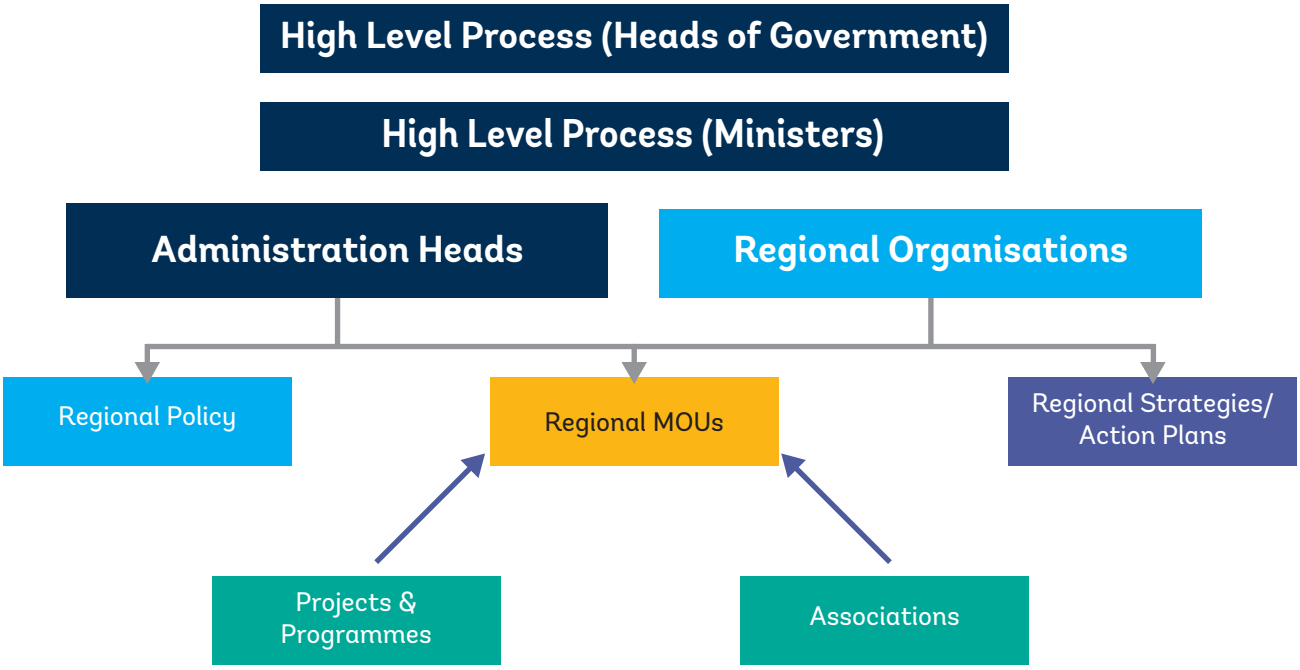
The most important of these for the maritime sector are meetings of the PIC Transport Ministers every 2–3 years (coordinated through the Pacific Community (SPC)), and Environment Ministers attending Noumea Convention Meetings, usually every 2 years (coordinated through the Pacific Regional Environment Programme (SPREP)).

Liaison between regional organizations and national governments takes place regularly at the project level, and more formally through annual meetings of the heads of national administrations. Meetings are convened by the SPC under the Pacific MoU.

Through these high-level processes, supported by the regional organizations, the PICS have developed a regional policy—the Framework for Action on Transport Services (FATS 2011–2020)[1]—and a series of regional memoranda of understanding (MOU), strategies, and action plans. A multitude of projects, technical assistance programs, and maritime associations provide support.

[1] Framework for action on transport services 2011–2020 : improving the efficiency, effectiveness and sustainability of Pacific transport services.

Figure 22 Schematic of Institutional Structures and Governance Hierarchies at SPC and SPREP



Source: World Bank

Maritime governance at national level

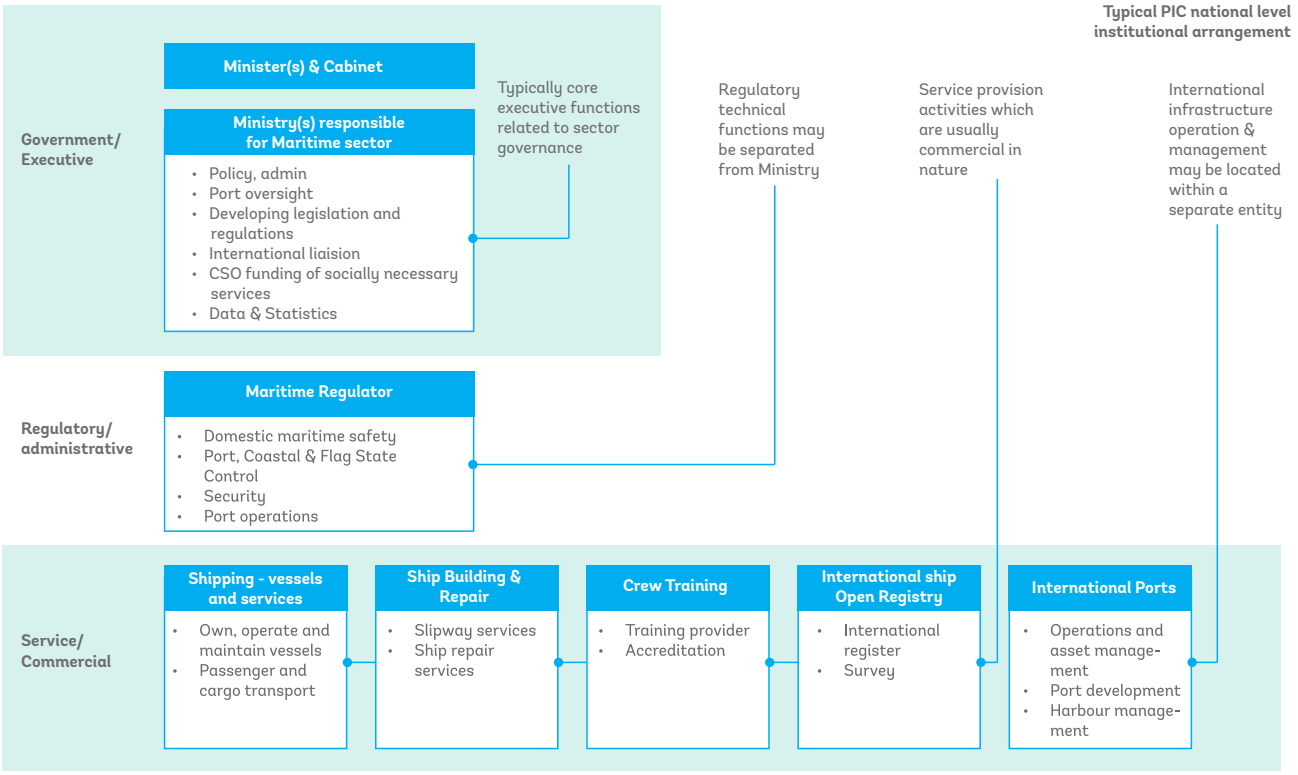
Pacific countries adopt different models for allocating functional and service responsibilities at national level. While there is therefore no single model to describe, in general terms, the natural layers of separation applied are (Figure 17):

- **Overall sector governance:** governments control core functions to ensure that maritime sector outcomes are focused on national development goals.
- **Regulatory and administrative functions:** these are generally focused on safety, security, and environmental protection.
- **Marine services and commercial activities:** these provide the on-the-ground infrastructure and services necessary for the maritime sector to efficiently transport passengers and cargo.

Inevitably there are tensions when functions are separated within and between institutions. It allows the tailoring of governance arrangements, specialist technical resourcing, and clear roles and accountabilities to be allocated, but potentially leads to siloed ways of working. Tensions can also arise if cross–agency collaboration leads to role confusion.

Striking the balance between role clarity and collaboration in the legal framework, the institutional arrangements, and on-the-ground delivery is critical to ensuring broad alignment on the overall goals for the sector, and countries' ability to deliver safe, secure, clean, and efficient maritime services.

Figure 23 Typical National-level Institutional Governance Arrangement in PICs



Source: World Bank

How Effective is Maritime Governance: An Assessment of Current Practice

Effective institutional governance is a precursor to effective policy development and delivery.

The primary focus of this study is to find ways to help Pacific Island countries improve how their governance institutions are set up and operate. To that end, it assessed them against the characteristics listed below to establish how well they enable good decision-making, implementation, transparency, learning, and improvement:

- How they are constituted and funded.
- Their organisational goals.
- Their roles and accountabilities.
- How they collaborate internally and externally.
- How they measure and report on their performance.
- The study did not assess the specific content of policies, strategies, plans, and programs. If the above characteristics are in good shape, then the right policies, plans, programs, and actions will follow.

The study's findings are delivered along four themes—general, international, regional, and national (domestic).

General findings

Limited legal, technical, and financial resources in the maritime sector stretch PICs ability to deliver outcomes

Factors combine to magnify the challenges PICs face in achieving effective governance—large maritime areas, small economies, limited legal and technical capacity, and limited funds. As a result, several face shortcomings in their legislative, regulatory, operational, technical, human, and financial capacities and capabilities.

More effort is needed to coordinate and target donor support

External multilateral and bilateral support for the Pacific maritime sector are extensive. Progress has been made through various initiatives, particularly around shipping safety.

However, frequently this support is uncoordinated and untargeted to regional or national policies or priorities, and results in support for ad hoc short-term programs and projects—often to meet the donor's agenda, programming, and financing rules.

Some donors recognize the problem. For example, a recent New Zealand review concluded that future support should be based on a long-term strategy for the maritime sector, align with work by regional agencies and other development partners, maintain a multi-pronged approach customized to the needs of participating countries, and involve partner countries in decision-making.

International findings

Global perspectives have diverted attention from governance at regional and national levels

The study found that most support to help PICs meet their global responsibilities has focused on their obligations to international shipping. While good progress has been made in this area, it has to some extent diverted attention and resources away from the regulation, infrastructure, and services needed to improve governance in regional and domestic maritime transport.

Ratification of international conventions needs to be followed with effective implementation

Most of the PICs included in this study have ratified most of the mandatory International Maritime Organization (IMO) instruments (Table 6).

While global maritime treaties are intended to deliver results by being implemented at country level, this has not consistently happened. Some PICs have given international conventions legal effect through national legislation—the process of 'domestication'—but not all. Similarly, a few have implemented some of the necessary technical, regulatory, and control steps, supported by sustainable resourcing—but not all.

Table 9 Adoption of International Maritime Instruments by the PIC12

As at 11/05/2022	Fiji	Kiribati	Marshall Islands	Micronesia (Fed. States of)	Nauru	Palau	Papua New Guinea	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
MO (Mandatory / III Code)												
IMO Convention 48	X	X	X		X	X	X	X	X	X	X	X
SOLAS Convention 74	X	X	X		X	X	X	X	X	X	X	X
SOLAS Protocol 88	X	X	X		X	X		X		X	X	X
LOAD LINES Convention 66	X	X	X		X	X	X	X	X	X	X	X
LOAD LINES Protocol 88	X	X	X		X	X		X		X	X	X
TONNAGE Convention 69	X	X	X		X	X	X	X	X	X	X	X
COLREG Convention 72	X	X	X		X	X	X	X	X	X	X	X
STCW Convention 78	X	X	X	X	X	X	X	X	X	X	X	X
MARPOL 73/78 (Annex I/II)	X	X	X			X	X	X	X	X	X	X
MARPOL 73/78 (Annex III)		X	X			X	X	X	X	X	X	X
MARPOL 73/78 (Annex IV)	X	X	X			X	X	X	X	X	X	X
MARPOL 73/78 (Annex V)	X	X	X			X	X	X	X	X	X	X
MARPOL Protocol 97 (Annex VI)		X	X			X		X		X	X	X

As at 11/05/2022	Fiji	Kiribati	Marshall Islands	Micronesia (Fed. States of)	Nauru	Palau	Papua New Guinea	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
IMO (PSC)												
CLC Protocol 92	X	X	X		X	X	X	X	X	X	X	X
BUNKERS CONVENTION 01	X	X	X		X	X		X	X	X	X	X
ANTI FOULING 2001	X	X	X			X				X	X	X
BALLAST WATER 2004	X	X	X		X	X				X	X	
NAIROBI WRC 2007			X		X	X				X	X	
SAR Convention 79		X				X	X	X		X		X
IMO (Other)												
SOLAS Protocol 78	X	X	X			X		X		X	X	X
FACILITATION Convention 65	X		X			X		X		X		X
London Convention 72		X			X		X		X	X		X
London Convention Protocol 96			X							X		X
FUND Protocol 92	X	X	X			X	X	X		X	X	X
LLMC Convention 76		X	X		X			X		X	X	X
LLMC Protocol 96			X			X		X		X	X	
SUA Convention 88	X	X	X	X	X	X		X		X	X	X
SUA Protocol 88	X	X	X		X	X				X		X

As at 11/05/2022	Fiji	Kiribati	Marshall Islands	Micronesia (Fed. States of)	Nauru	Palau	Papua New Guinea	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
SUA Convention 2005	X		X		X	X						X
SUA Protocol 2005	X		X		X	X						X
SALVAGE Convention 89	X	X	X			X				X		X
OPRC Convention 90			X			X		X		X		X
HNS Convention 96								X		X		
HNS PROT 2010												
SFV Protocol 93		X										
Cape Town Agreement 2012												
OPRC/HNS 2000						X						X
STCW-F Convention 95		X			X	X						
INTERVENTION Convention 69	X		X				X			X		X
INTERVENTION Protocol 73			X							X		X
CSC Convention 72			X							X		X
CSC amendments 93			X							X		X
IMSO Convention 76	X		X			X			X	X		X
INMARSAT OA 76			X							X		

As at 11/05/2022	Fiji	Kiribati	Marshall Islands	Micronesia (Fed. States of)	Nauru	Palau	Papua New Guinea	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
IMSO amendments 2006												
IMSO amendments 2008	X					X						
FUND Protocol 2003					X							
SOLAS Agreement 96												
STP Agreement 71												
Space STP Protocol 73												
NUCLEAR Convention 71												
PAL Convention 74			d							X		X
PAL Protocol 76			d							X		X
PAL Protocol 90										X		
PAL Protocol 02			X			X						
HONG KONG CONVENTION												
CLC Convention 69	d		d				d			d	d	d
CLC Protocol 76			X								X	X
FUND Protocol 76			X									X

As at 11/05/2022	Fiji	Kiribati	Marshall Islands	Micronesia (Fed. States of)	Nauru	Palau	Papua New Guinea	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
Labour												
ILO Convention 48	X	X	X		X	X	X	X	X	X	X	X
MLC 2006	X		X			X		X			X	
Seafarers' Identity (Revised)		X	X									X
WFC 2007												
Law of the Sea												
UNCLOS	X	X	X	X	X	X	X	X	X	X	X	X
UNFSA	X	X	X	X	X	X	X	X	X	X	X	X
PSMA	X					X				X		X
UNCTOC	X	X	X	X	X	X						
Trafficking in Persons Protocol	X	X		X	X	X						
Smuggling of Migrants Protocol	X	X			X	X						

- Ratification of the mandatory IMO Conventions is high for most countries (FSM being the main exception, not being an IMO member). All study PICs are also party to UNCLOS
- The Picture with other conventions (IMO and non-IMO) is more mixed. Potential areas for further consideration within the PICs could be IMO conventions specific to fishing vessels (Cape Town/SFV, STCW-F) and the ILO
  Maritime Labour and Work in Fishing Conventions.
- It should also be noted that conventions above are just a snapshot of the international instruments applicable to the maritime sector - many more obligations and standards apply through a range of other instruments.

"Mandatory"IMO instruments (III Code/ IMSAS)

"Priority"IMO Instruments (subject to PSC Code / UNCLOS)

No/limited relevance (not applicable to PICs or out of date / redundant instruments)

Regional findings

Regional solutions have a critical role to play and can mitigate challenges at the national level

The study identified that appropriately mandated regional governance structures are needed where there is common ground and common interest—which is frequently the case. Centralized regional effort can reduce duplication, capture economies of scale, and support better national outcomes.

A regional governance layer is imperative to reduce the legal and technical burden on national governments and allow them to focus resources on regulation and service provision.

Regional architecture is well-established, but institutional responsibilities need to be formally defined

It is evident that PICs and the institutions recognize sectoral needs and are developing regional responses—a long history of successful cooperation exists. For example, the Pacific MoU[1], signed by nine PICs, is a significant development not only because it addresses a key regulatory gap in the region, but also because it establishes an annual process for meetings of the Heads of Maritime Administrations.

But, while there is a well-established regional architecture for some things, there is no single regional agency responsible for or leading on regional maritime sector issues in the Pacific. This does occur in other parts of the world: examples include the *Maritime Organization for West and Central Africa* (MOWCA); and the *Red Operativa de Cooperación Regional de las Autoridades Marítimas de las Américas* (ROCRAM).

At present, SPC is the main regional organization dealing with maritime matters:

- It has observer status at the IMO
- It is the implementing body for IMO technical cooperation division activities
- It coordinates or oversees various maritime programs or interventions
- It facilitated the adoption of the Pacific MoU—and is designated as the interim secretariat.

However, various other organizations are also involved in an array of regional initiatives, which are in turn responsible for various programs, strategies, projects, etc, which draw on PICs' limited resources (Table 7).

[2] The Third Pacific Regional Energy and Transport Ministers' Meeting, held in April 2017 (Nuku'alofa, Tonga), adopted the Memorandum of Understanding on Flag State Implementations for Domestic Ships (Pacific MoU), the first in the world to address the safety of domestic shipping. Despite inclusion in previous discussions, port state control was excluded from the MoU to avoid duplication with the Tokyo MoU. https://www.spc.int/updates/news/2017/04/first-regional-agreement-for-safety-of-domestic-shipping.

Table 10 Maritime-related Regional Programs, Strategies, and Projects in the Pacific

Organization / Activity	Mandate	Type of organization / activity	Fiji	Kiribati	Marshall Islands	Micronesia, FS	Nauru	Palau	Papua New Guinea	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
Heads of Government (PIF, PIDF, PIDP, Ad Hoc)	Various	High-Level Process (HoG)	■	■	■	■	■	■	■	■	■	■	■	■
Energy and Transport Ministers Meetings	SPC	Process (Ministers)	■	■	■	■	■	■	■	■	■	■	■	■
Ministerial Meetings / Noumea Convention Meetings MOPs	SPREP	Process (Ministers)	■	■	■	■	■	■	■	■	■	■	■	■
Pacific MOU Meetings	SPC	Process (Administration Heads)		■	■				■	■	■	■	■	■
Tokyo MOU Meetings	Tokyo	Process (Administration Heads)	■		■				■					■
Meeting of Officials	SPREP	Process (Administration Heads)	■	■	■	■	■	■	■	■	■	■	■	■
Pacific Community	SPC	Regional IGO	■	■	■	■	■	■	■	■	■	■	■	■
Pacific Regional Environment Programme	SPREP	Regional IGO	■	■	■	■	■	■	■	■	■	■	■	■
Central Pacific Shipping Commission	SPC	Subregional IGO		■	■		■						■	
Micronesia Shipping Commission	(SPC)	Subregional IGO			■	■		■						
Pacific MOU - Regional Standards	SPC	Regional MOU (Standards)		■	■				■	■	■	■	■	■
Seafarers Training and Certification MOU (2005/2019)	SPC	Regional MOU (Harmonization)	■	■	■	■	■	■	■	■	■	■	■	■
Maritime Search and Rescue Techinacal Arrangement	PACSAR	Regional MOU (Cooperation)				■		■			■			■
Pacific Islands Regional Marine Spill Contingency Plan (PACPLAN)	SPREP	Regional MOU (Cooperation)	■	■	■	■	■	■	■	■	■	■	■	■
Pacific Search and Rescue Steering Committee (PACSAR)	PACSAR	Regional MOU (Cooperation)	■	■	■	■	■	■	■	■	■	■	■	■
Framework for Action on Transport Services	SPC	Regional Policy												
Regional Strategy on Safety of Navigation in the Pacific	SPC	Regional Strategy/Action Plan	■	■	■	■	■	■	■	■	■	■	■	■
Pacific Regional Reception Facilities Plan	SPREP	Regional Strategy/Action Plan	■	■	■	■	■	■	■	■	■	■	■	■
Regional Strategy for Pacific Women In Maritime 2020-2024	SPC	Regional Strategy/Action Plan	■	■	■	■	■	■	■	■	■	■	■	■
Pacific Regional Marine Litter Action Plan 2018-2025	SPREP	Regional Strategy/Action Plan	■	■	■	■	■	■	■	■	■	■	■	■
Pacific Ports 2030-2050	SPC	Regional Strategy/Action Plan	■	■	■	■	■	■	■	■	■	■	■	■
Pacific Safety of Navigation (SoN) Project	SPC	Regional Project	■	■	■	■	■	■	■	■	■	■	■	■
Pacific Islands Domestic Ship Safety (PIDSS) Programme	SPC	Regional Project	■	■	■	■			■	■	■	■	■	■
Pacific Maritime Safety Programme (PMSP) (MNZ)	SPC	Regional Project		■						■		■	■	
Pacific Blue Shipping Partnership	MCST	Regional Project	■		■						■		■	■
Maritime Technology Cooperation Centre In the Pacific	SPC	Regional Project	■	■	■	■	■	■	■	■	■	■	■	■
Pacific Regional Navigation Initiative (PRNI)	SPC	Regional Project		■						■	■		■	■
SPC Technical Support - Governance (Policies, Laws, III Code Strategies)	SPC	Programme	■	■	■	■	■	■	■	■	■	■	■	■
IMO Integrated Technical Cooperation Program (ITCP)	SPC	Programme	■	■		■	■	■	■	■	■	■	■	■
Pacific Ocean Pollution Prevention Programme (PACPOL)	SPREP	Programme	■	■	■		■	■	■	■	■	■	■	■
Pacific International Maritime Law Association / PIMLaws		Association (Non-government)												
Pacific Islands Maritime Association (PacMA)		Association (Non-government)												
Pacific Maritime Transport Alliance (PMTA)		Association (Non-government)												
Pacific Island Ship Owners Association (PISA)		Association (Non-government)												
Pacific Women in Maritime Association (PacWIMA)		Association (Non-government)												

Source: World Bank

Regional standards for domestic shipping are emerging, but need further development to deliver results

While there are many (already stated) reasons to embrace the Pacific MoU, there is room (and need) to improve its mechanisms, in particular its current "standards". These are not adequate to control and manage domestic shipping safety issues and need to be reformulated to focus on all the results that need to be attained, including but not limited to legislation. For example, the SPC (ibid.) has identified ongoing factors that continue to hinder maritime safety—inadequate law and/or lack of enforcement; overloaded ships; negligence and/or ignorance; not-fit-for-purpose vessels; lack of safety equipment and essential services; lack of capacity and resources to conduct safety inspections and audits; poor management of shipping companies; and lack of safety awareness raising in the community.

National findings

The lack of regulations and standards for domestic shipping is a critical gap

The lack of international regulation or standards for domestic shipping—which represent the bulk of PIC shipping and where most maritime accidents occur—remains a critical gap. While many countries have developed national regulations based on IMO standards, this has not occurred extensively in the PICs and a regional approach is only beginning to emerge. The Pacific MoU is a crucial driver and resource.

There is a large gap between the Pacific MoU model legislation and current implementation

Anecdotally it appears there are significant gaps between the stated regulatory and policy goals for domestic shipping in the Pacific MoU, and how PICs put them into actual practice. That is, actual national laws did not reflect the model legislation referred to in the Pacific MoU. Papua New Guinea (PNG) is an exception with strong performance in terms of enacting a high number of domestic ship safety regulations.

Regional strategies do not adequately reflect the varied roles and needs PICs have as flag, port, and coastal states

While the study highlighted the compelling need to avoid duplication, capture economies of scale, and support better national outcomes, it also highlighted the importance for each PIC to determine its own strategies and priorities for international and domestic regulation according to its flag, port, and coastal state responsibilities. There is much common ground between Pacific Island countries, but a one-size-fits-all approach to adopting and implementing IMO conventions is not appropriate.

Having contributed to relevant regional approaches, PICs need to determine the implementation strategies relevant to their needs and adapt regional solutions appropriately.

Demarcation of roles and responsibilities is not clear

The study found that national legislation does not always demarcate, or even establish, the mandates, functions, or powers of public bodies. In some Pacific Island countries, there is also a lack of clarity concerning the distribution of responsibilities and powers between national-level and provincial governments. In general, policy and regulatory responsibility for maritime safety, international shipping, domestic shipping, and ports of national importance should be clearly allocated to national rather than provincial governments, and this is not always the case.

Liaison between government agencies within a PIC lacks the necessary collaboration and role clarity

Linked to the above finding, the study found that liaison between different parts within a country's national government is often suboptimal. A primary cause is the use of cross-sector committees, where attendance can be at an insufficiently senior level and issues of role clarity do not get properly addressed. Other common problems are an over-reliance on legislation to clarify roles and accountabilities, and institutions acting in silos rather than collaborating on implementing regulatory controls. One outcome is that, when an emergency does happen, such as an oil spill, the overlaps between maritime regulators and government environmental agencies mean there are no clear accountabilities and sometimes very little may happen on the ground.

Dedicated national policies, plans and regulations for the maritime sector are inadequate

Officially, most Pacific Island countries prioritize the maritime sector in national development plans.[1] A feature common across the plans of most PICs is a significant focus on improving port infrastructure and domestic shipping services. However, despite the nominal priority given to the maritime sector, and despite the availability of technical assistance provided by SPC, the development of dedicated national maritime policies or strategies has been slow.

Similarly, in all studied countries, there is a gap between existing legislation and the regional standards adopted by the Pacific MoU.

Regulators require autonomy, independent funding, and access to government decision-makers

In Pacific Island countries, the top level of executive functions is almost universally the responsibility of government ministries, with the technical expertise needed to provide advice more likely to be concentrated elsewhere, within regulatory functions.

In an ideal world, technical experts in maritime regulatory and operational functions are well-resourced to provide independent advice on all policy development at the executive level. In reality Pacific Island governments differ in the degree to which they choose to separate their executive, regulatory, and service functions. The result is regulators operating under varying levels of integration, independence, and funding. The most serious risks are a lack of role clarity and conflicts of interest. Where PICs absorb most regulatory functions within ministries, close to government, substantial institutional reform is required.

The study found a growing trend toward that reform. Some countries have been 'early adopters', including PNG in 2003 and Fiji in 2009. For example, PNG's National Maritime Safety Authority (NMSA), established by statute, is an autonomous statutory authority responsible for all maritime safety needs. Among its roles, NMSA is responsible for regulating maritime safety standards and controlling marine pollution in PNG waters, and fulfils PNG's obligations under international maritime conventions.

More recently, Vanuatu (2019) and Solomon Islands (2018) have followed. The Vanuatu Maritime Regulator is an independent Government-owned entity whose responsibilities include enshrining the principles of independence and best practice.

With donor support, other PICs are moving toward the reform pathway.

There is a very high reliance on external support

Currently, there is a very high reliance on external support to help PICs deliver on their huge maritime responsibilities to secure, protect, and ensure safety in their EEZs. They are a long way from being self-sufficient.

[3] Fiji, Kiribati, Marshall Islands, Palau, Nauru, PNG, Solomon Islands, Tuvalu) directly reference the maritime sector in the key goals or focus areas of their national development plan, while in FSM it is included in its Infrastructure Development Plan*

Key areas for attention

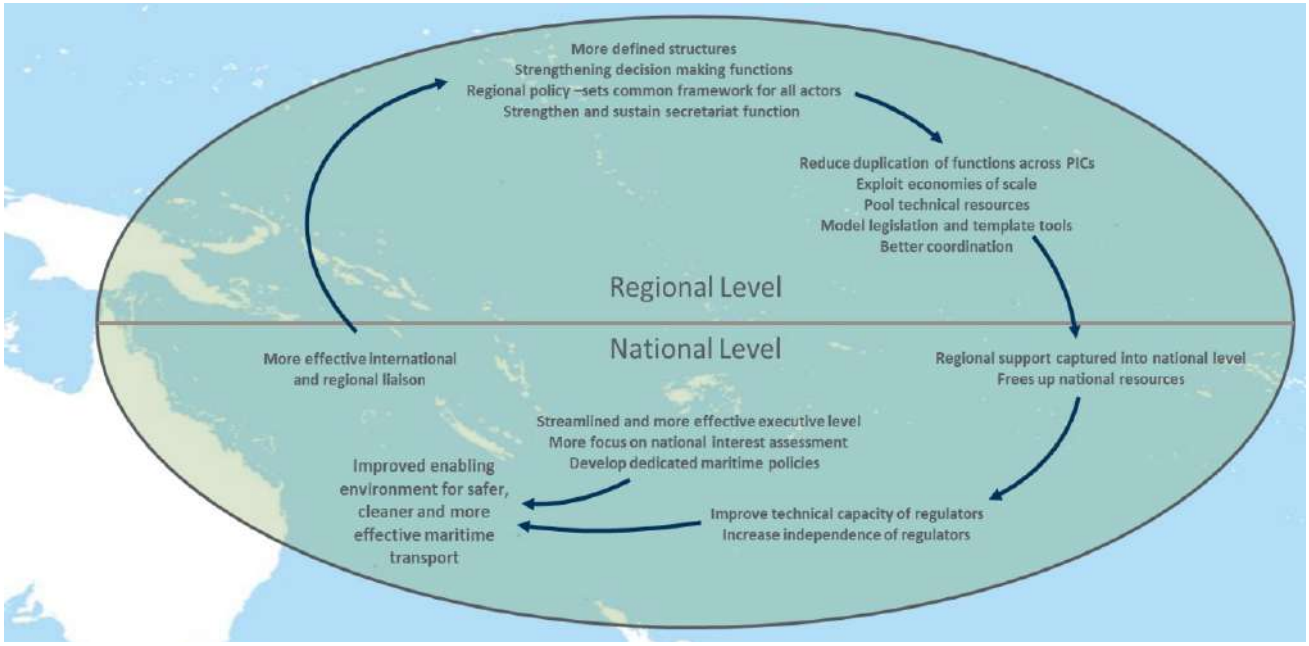
General

The highest priority is to strengthen effective governance at regional and national levels

This means improving regional and domestic policy, legal, and planning frameworks. It also means considering how governance arrangements can be improved to ensure the needed changes are delivered, monitored, reviewed, and implemented (Figure 24).

There will always be resourcing challenges. Within countries, executive and administrative procedures and practices need to operate efficiently and in a more integrated way, to avoid duplication of effort across different agencies, and identify synergies. Between countries, the need is to orient governance around the agreed regional goals of maritime safety, security, environmental protection, and efficient transport. PICs also need to continue to work together—identifying synergies and avoiding duplication of effort across different agencies. The Pacific MoU, among other regional initiatives, is a step on that pathway.

Figure 24 A Framework for Effective Regional and National Governance for Pacific Island Countries



Source: World Bank assessment

Maximise the outcomes from donor support

An opportunity exists to develop a high-quality outcomes-oriented regional donor policy focused on longer-term, sustainably resourced programs and projects. It would serve as the common reference framework for all actors—regional, national, and all development partners—and help ensure that interventions are coordinated and targeted to regional and national goals. The policy could prioritize initiatives that support the development of effective governance. **Better outcomes will flow from improved governance at regional and national levels.**

Strengthen the role of maritime regulators

Maritime regulators are the technical experts in regulatory and operational functions. They should be viewed as centers of national expertise in maritime technical matters and supported with appropriate independence, funding, and training.

Regional

Regional solutions should be prioritized

The Pacific region has a unique economic geography and should seek Pacific solutions and approaches to maritime regulation, including global maritime regulation. Key opportunities are to:

- Address gaps in international regulations—notably safety and environmental control for domestic shipping.
- Support harmonization of regulatory requirements across PICs to facilitate regional traffic.
- Pool resources to achieve economies of scale.

The Pacific MoU is a significant step toward achieving this and needs to be more widely adopted. Potential exists to build on its structure and influence, particularly through meetings of the Heads of Administrations. For example, its scope could be widened to other areas of concern for domestic shipping governance, which would broaden and improve outcomes for PICs. Regional models in other parts of the world may offer insights—for example, MOWCA and ROCRAM.

The MoU offers the opportunity to centralize effort at the regional level, such as within the SPC. This would likely reduce overlaps and gaps in project implementations and deliver benefits from retained knowledge and expertise. A clear mandate and more formal mapping of responsibilities would also enable more coordinated decision-making and the effective delivery of region-wide actions. Note also, that because not all PICs are signatories to the Pacific MoU, it may be better to establish the Administration Heads process under SPC rather than the MoU.

It is imperative that the MoU's mechanisms are improved to ensure they are fit-for-purpose and effective.

Work is underway on a new regional policy to replace the Framework for Action on Transport Services 2011–2020 (FATS) (though the COVID-19 pandemic has slowed progress). While the FATS currently has a broad scope on wider transport policy, there is benefit in new policy focused just on the maritime sector.

An outcome–orientated regional maritime policy would help to solidify the progress already being made by taking a more strategic approach, focusing on outcomes and goals, and identifying how existing regional governance machinery can be applied, extended, or developed to support those goals.

Scope for other improvements to regional policy leadership include additional resources for permanent secretariat support within existing architecture—such as within SPC—to provide strategic and informed advice to ministers and governments across PICs and help ensure decisions and objectives are followed up and supported.

Stronger regional arrangements should free up PIC resources to focus on their national priorities

Regional mechanisms are well-established and moving towards developing stronger and more comprehensive regional maritime governance, such as the Pacific MoU. There is a need to build on existing regional maritime governance structures and support current momentum.

Building support for high-level decision-making processes and defining a more structured coordination for maritime governance may add impetus to regional governance and may improve coordination (and reduce conflicts and duplication).

An outcome–orientated regional maritime policy would help to solidify the progress that is being made and provide a clear strategic direction for the region.

National

Regulation for domestic shipping is a critical gap to be closed

Strategies need to focus on the application of the regulations. Developing the regulatory framework for domestic shipping should not focus only on new legislation. A pressing need is to address problems in implementation, compliance, and enforcement of existing regulations, particularly given the difficulty of getting local fleets to meet new standards (a problem compounded by aging domestic fleets).

PICs need to identify their own priorities and outcomes before adopting international conventions

The national interest of each Pacific Island country varies, and therefore not all international instruments are relevant or important to their circumstances. Given their very stretched national resources, each PIC must determine its own strategies and priorities for international and domestic regulation and take care in selecting which IMO conventions and other instruments to accede to, beyond the mandatory core conventions.

In-country expertise

In PICS, effective sector committees supported with appropriate advisors can progress many of the institutional constraints and barriers by streamlining decision-making and 'getting the right people in the room'. Advisors could be provided, at least in part, through regional support but should ideally also be in place at the national level.

Transforming Pacific Maritime Transport - Ways forward

Overview of Ways Forward

A great deal of data and analysis is presented in this report, drawn together in the interests of supporting Pacific Island countries to achieve the sea transport services and infrastructure that best meet their needs. Each chapter concludes with a section collating key areas for attention—opportunities to strengthen and improve the performance of international shipping, gateway ports, domestic sea transport, and governance, and help the Pacific build resilience to disasters and climate change.

This final chapter synthesizes those many issues and challenges, distilling them into the most significant and far-reaching opportunities to transform maritime transport in the Pacific. These are grouped under three broad themes—infrastructure, services, and governance and capacity building.

Resilient, green, and safe maritime infrastructure	Reliable, affordable, safe, and inclusive maritime transport services	Governance and capacity building
• Port master planning • Design and construction of resilient, safe infrastructure • Asset management/ maintenance • Sustainable financing arrangements • Greening ports	• Domestic system planning • Domestic shipping safety regulations • Access to vessel maintenance facilities • Buidling skills and a culture of safety • Models & financing for non-profitable routes	• Regional governance • Regional advisory services • National governance and policy • Training and skills development • Oversight of international shipping • Donor coordination

Resilient, green, and safe maritime infrastructure

Opportunities to develop resilient, green, and safe infrastructure have been grouped under five themes covering best practices for planning, designing, building, maintaining, and financing ports, so that they are fit-for-purpose, affordable, and safe.

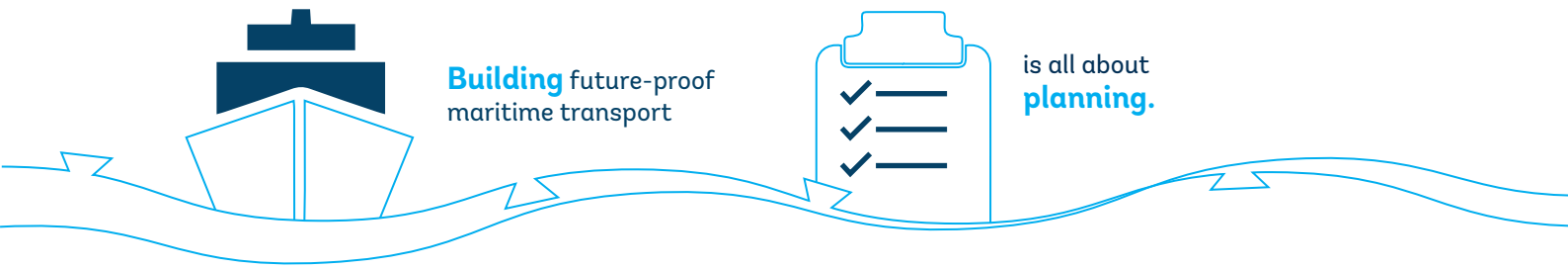
Port master planning

Several PICs need support to develop port master plans. Master planning is an approach to dynamic, long-term planning for ports that provides the conceptual design for short- and long-term future development. This is a fundamental requirement ensuring ports remain adequate in their provision of capacity and capability in the long term. Port infrastructure investment must consider demand forecasts, adaptation and resilience, location, adequacy in design, and implementation

Issues that can be considered in master planning include:

- **Long range demand forecasts,** which include changes to vessel types and sizes, and freight volumes and pack types.
- **Urban encroachment** that may impact road network connectivity, and other urban-related conflicts.
- Consideration of wider supply chain movements that interact with the port, such as changes to the **locations of main industrial areas and port users demands,** including cruise ships, the tuna fishing industry, fuel supply and handling, and bulk shipping over the design life of the port.
- **Links to national planning** of associated transport and infrastructure developments.
- **Refreshing the options for plant equipment and cargo-related terminal management systems** to improve productivity.
- Long-term planning for **alternative fuels storage and handling.**
- **Community engagement.**
- **Climate change resilienc**e relative to sea level rise and storm surges.

Design and construction of resilient, safe infrastructure



While significant attention has been given to gateway port upgrades in recent years, several still have significant needs for rehabilitation, reconfiguration, seismic strengthening, or other upgrades to make them more resilient to natural hazards and more functional.

Further, for most PICs, the need for investment in outer island infrastructure is greater—docks, jetties, channels, and aids to navigation. By removing tidal, weather, and nighttime restrictions, and creating facilities for loading and unloading in different weather conditions, the safety, comfort, efficiency, and resilience of the system can be greatly improved.

The design and construction of this infrastructure should be informed by natural hazard and climate risks, and use appropriate construction methods and materials, with consideration of ongoing maintenance requirements. Whole-of-life costs should be estimated and accounted for at the outset.

Asset management and maintenance

The prevailing approach in the Pacific is the "build-neglect-rebuild" paradigm, rather than whole-of-life asset management. This applies to major ports infrastructure, other smaller maritime infrastructure, equipment, and vessels. The issue is both a lack of maintenance planning, and a lack of associated budgeting to support maintenance. Developing approaches to strategic asset management and maintenance planning requires effort across multiple levels, from governments and development partners setting aside budgeted funds for recurrent maintenance and renewal, through to operational managers planning scheduled maintenance and outages, and to technicians who can do the work. Supporting the development of strategic asset management capability is one of the core services that could be provided by a regional technical advisory service, described under the next theme, *Services*.

It is recommended that focused attention be given to maintenance planning systems, maintenance capacity, and to the reservation of funds at the design phase of any project to develop infrastructure or purchase a vessel. Performance-based contracts for construction and maintenance are increasingly being used, and this should become a requirement so as to ensure implementation of period inspections and timely maintenance are carried out. This will result in longer asset life, reduce failures and instill a change in the management priorities and value applied to the book value of assets.

Sustainable financing arrangements

Financial sustainability of PIC ports is a priority action. To achieve this, support is needed for a collective regional approach to monitoring and modernizing port charges, plus ready access to expert advisory services to support port management and decision-making in tariff setting and pricing management. Private sector involvement should be encouraged, using performance-based contracts where possible. The planning phase of projects should identify the gap between costs and revenue, and ensure arrangements are put in place for either government or donor subsidy.

Greening ports

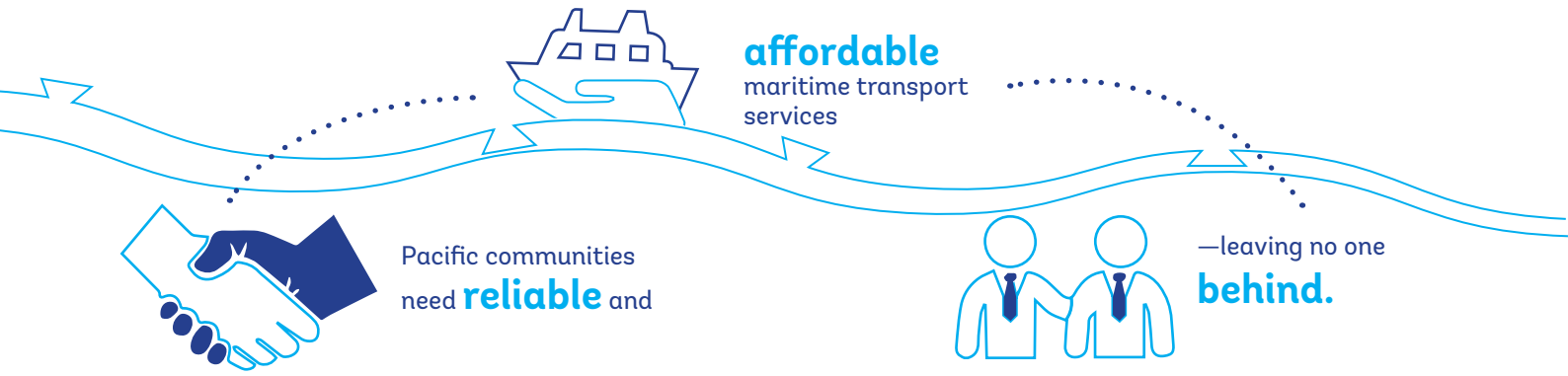
Opportunity exists to provide technical advisory support to enable PIC ports to advance their green port credentials. Improved environmental management and reduced energy costs can be achieved with guidance and oversight from existing regional organizations, including the Pacific Regional Environment Programme (SPREP) and the Secretariat of the Pacific Community (SPC). Some exemplary practices already underway in the Pacific also provide opportunities to identify regional solutions. Significant work and resources are required to execute these actions.

Reliable, affordable, safe, and inclusive maritime services

Opportunities to develop reliable, affordable, safe, and inclusive maritime transport services are grouped under five themes—improving system planning, regulations, and access to maintenance facilities, building skills and a culture that values safety, and ensuring nonprofitable routes also receive the services required.

Integrated domestic maritime system planning

Support is needed for maritime transport plans that are national, strategic (long term), and integrate the countrywide needs of the whole transport system. Such systems planning looks across a range of interconnected aspects of domestic shipping to optimize how the components of the system work together, over time. Planning should be underpinned by a national policy direction for rural, remote, and outer island communities, and consider the role regular transport services play in supporting the viability of outer island life and rural economic development programs, particularly for agriculture and fishing.



Systems level planning for domestic shipping should encompass the shipping fleet, infrastructure, financing, policy, and workforce. Options can combine:

- **Routing:** the best arrangement of services to inner and outer islands, and the frequency of visits
- **Fleet planning:** number, size, technology, and design of vessels and timeframes for renewal
- **Vessel design:** vessels matched to geography and infrastructure, incorporating low-carbon technologies over time
- **Infrastructure**: appropriate design, and resilient to natural hazards and climate change
- **Tidal, weather, and nighttime restrictions:** using navigation technologies and infrastructure design, channels, and aids to navigation to remove these restrictions.

Done well, integrated systems planning can potentially deliver a range of benefits including more frequent and reliable services; shorter transit times; more appropriate ship and infrastructure design; improved safety and ease of handling cargos; and reduced fuel use and greenhouse gas (GHG) emissions. Systems planning should include whole-of-life thinking about cost and maintenance so that decisions can be made about trade-offs between capital costs, operating and maintenance costs, and service levels. Vessel safety, however, remains the priority and cannot be compromised.

Domestic shipping safety regulations

Regulation for domestic shipping safety is a critical gap that needs to be closed. Strategies need to focus on implementing existing regulations. That is, developing the regulatory framework for domestic shipping should not focus only on new legislation—a pressing need is to address problems in implementation, compliance, and enforcement of existing regulations, particularly given the difficulty of getting local fleets to meet new standards (a problem compounded by aging domestic fleets). Support for domestic regulations can be achieved by strengthening regional arrangements to focus more on results, providing advisory support to implement appropriate instruments, and investing in the capability of national regulators.

Access to vessel maintenance facilities

There is a critical need to provide accessible maintenance facilities around the region for domestic shipping fleets. This would involve identifying strategic locations for permanent dry docks and slipways that can be accessed relatively easily for most countries. These facilities could be managed by the private sector under long-term performance-based contracts, staffed by standing maintenance teams. Although it will likely cost more than current arrangements and require ongoing subsidy, it is the kind of step change needed to improve domestic vessel safety. Economies of scale could be realized, including keeping inventories of spare parts.

Building skills and a culture of safety

Major domestic shipping accidents highlight the need to ensure that training providers have the resources to effectively train maritime workers across all aspects of ship safety, including survey, safety inspection and enforcement, safety instructions, engine operation and maintenance, safety equipment repair, and manifest and record keeping (World Bank Group, 2015). The scale of investment in workforce development needs to increase, with a focus on culture and attitudes, management systems, and seafarer skills. It is likely this will require long-term generational change, sustained support, and investment in maritime training institutes and established programs, like New Zealand's Pacific Maritime Safety Program.

Models and financing for nonprofitable routes

Renewed attention is needed on mechanisms for ensuring reliable and affordable services to outer islands with small populations, including involving the private sector through franchise shipping schemes or other mechanisms. Investigation is needed into how barriers to accessing capital might play a role, resulting in shipping operators purchasing cheap, end-of-life vessels, and whether financial instruments, such as concessional loans or rebates, could help improve and modernize domestic fleets. Reservation funds for vessel replacement and maintenance could be explored. Long-term performance-based maintenance contracts for donor-funded vessels could accompany the procurement of vessels so as to ensure they reach their design life expectations.

There is also a need to consider new models for providing adequate and affordable regional shipping services for the remote, small countries of Nauru and Tuvalu, and for other remote islands such as Kiritimati. These might include donor support for financial instruments, such as freight equalization payments, associated with a regional approach to community service obligations for shipping companies.

3. Governance and Capacity Building

Six themes capture the substantive opportunities to improve governance and build capacity in Pacific Island countries. The ambition is to: improve regional-level governance, and the advisory services and policy to support this; improve training and skills development; provide greater oversight of international shipping services; and better coordinate and target the involvement of donors.

Regional governance

Better outcomes will flow from improved governance at regional and domestic levels. Stronger regional arrangements will allow Pacific Island countries to focus their limited resources on their national priorities. Regional mechanisms are already well-established and moving towards developing stronger and more comprehensive maritime governance, such as the Pacific MoU. There is a need to build on these and support current momentum. Building support for high-level decision-making processes, and defining more structured coordination, may add impetus to developing regional governance, which in turn may reduce conflicts and duplication. A new regional maritime policy is being developed to replace the existing Framework for Action on Transport 2011–2020. There should be active engagement in, and support for, this process from both PICs and development partners to ensure it focuses on outcomes that matter for Pacific countries.

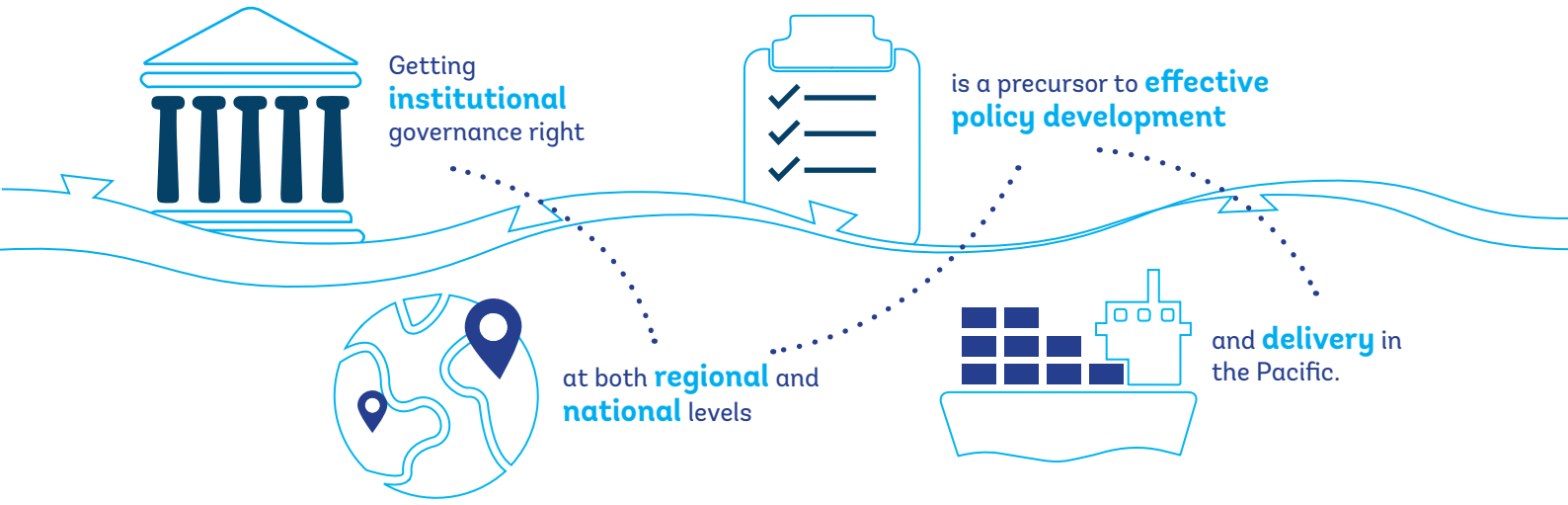
Regional advisory services

There is a need for a step up in regional capability. In particular, technical advisory services to support the planning, design, and operations of national maritime transport systems, and technical and operational assistance for policy, regulation and compliance, port governance arrangements, planning, financial management, port and shipping operations, engineering, design and procurement of vessels and equipment, and asset management.

Some regional experts are currently housed at SPC and SPREP, while consultants are made available to governments through individual projects. Gaining access to this advice is often done in the context of a specific program, and the barriers can be substantial. There is a need to increase the scale of this assistance available and lower the barriers for PICs to access specialist advice.

It may take time to develop and retain a cohort of skilled people who are both technically capable and understand the PIC maritime transport sector's particular characteristics and constraints. Developing this regional capability requires long-term sustained, programmatic resources (rather than project-based), and investing in regional organizations including SPC and SPREP. One useful approach will be to deepen partnerships with agencies from Pacific Rim countries, such as Maritime New Zealand, the United States Coast Guard, and Australia's Pacific Maritime Training Services Program.

It is important also to strengthen national capacity with embedded expertise.



National governance and policy

In PICS, effective sector committees supported with appropriate advisors can break down many of the institutional constraints and barriers by streamlining decision-making and ensuring people with the appropriate accountabilities and responsibilities are present. Advisors could be provided, at least in part, through regional support but should ideally also be in place at the national level.

Training and skills development

There is a need for a transformational step change in support for institutional capacity, capability, and workforce development across all dimensions of the ports and shipping sector (policy, governance, planning, management and operations, and seafarers and technicians) including a strong focus on domestic shipping. This requires long-term, sustained funding to build regional education programs.

Oversight of international shipping

There is a need to explore ways to monitor, examine, and influence pricing and service levels for international shipping. This could, at a basic level, improve transparency of shipping charges to reduce asymmetric information between PICs and carriers. A more ambitious oversight model could incentivize carriers to ensure PICs are receiving fair prices and service levels. Mechanisms for long-term efficiency gains and reducing fuel and GHG emission could be included. Reviewing the effectiveness of the existing Micronesian Shipping Commission and the Central Pacific Shipping Commission would be a good place to begin.

Donor coordination

More effort is needed to coordinate and target donor support. Donors recognize the problem. For example, a recent review of New Zealand's support to the Pacific maritime sector concluded that future support should be based on a long-term strategy for the maritime sector, align with work by regional agencies and other development partners, maintain a multi-pronged approach customised to the needs of participating countries, and involve partner countries in decision-making.

While processes have been put in place through various projects and programmes to ensure collaboration and coordination and avoid duplication, these are ad hoc arrangements. More enduring solutions are needed to organise assistance more effectively. A high-quality outcomes-oriented regional policy should be embedded in the regional architecture as the common reference framework for all actors (regional, national, and all development partners). Regional organizations, PICs and donors should ensure that interventions progress towards the intended outcomes.

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