Pacific Infrastructure

PERFORMANCE INDICATORS

2011

PRIF

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ADB Australian Government AusAID European Union NEW ZEALAND Aid Programme WORLD BANK GROUP

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Abbreviations

ADB	Asian Development Bank
AUS	Australia
Avg	Average
CAPA	Centre of Asia Pacific Aviation
EC	European Commission
EU	European Union
FSM	Federated States of Micronesia
FSS	Franchise Shipping Schemes
GDP	gross domestic product
ICT	Information Communication and Technology
IWG	Infrastructure Working Group
JMP	Joint Monitoring Program
kW	kilowatt
kWh	Kilowatt Hour
lcd	liters per capita per day
M&E	Monitoring and Evaluation
MDG	Millennium Development Goal
Mdn	Median
MSC	Micronesian Shipping Commission
NRW	Non Revenue Water
NZ	New Zealand
PIAC	Pacific Infrastructure Advisory Center
PIC	Pacific Island Country
PIPI	Pacific Infrastructure Performance Indicator
PNG	Papua New Guinea
PPA	Pacific Power Association
PRIF	Pacific Region Infrastructure Facility
PWWA	Pacific Water and Wastes Association
RMI	Republic of the Marshall Islands
SPC	Secretariat of the Pacific Community
SPREP	South Pacific Regional Environment Programme
SWM	Solid Waste Management
TEU	twenty-foot equivalent unit
TOE	tons of oil equivalent
UNICEF	United Nations Children's Fund
USA	United States of America
WB	World Bank
WHO	World Health Organization

Notes

"US$" refers to US dollars
"AU$" refers to Australian dollars

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I Setting the Context

1 Introduction

The key long-term goal of the Pacific Region Infrastructure Facility (PRIF) is to achieve increased quality and quantity of infrastructure for all people in Pacific Island Countries (PICs)[i]. As part of realizing this goal, the PRIF Infrastructure Working Group (IWG) at a meeting in April 2010 underscored the importance of Monitoring and Evaluation (M&E) as a means of appraising how well the PICs are performing in the infrastructure sector and what impact PRIF partner activities are having on overall infrastructure performance (see Box 1). The Pacific Infrastructure Advisory Center (PIAC), the technical assistance arm of PRIF, was thus tasked with measuring performance indicators in the infrastructure sub-sector across the PICs.

The Pacific Infrastructure Performance Indicators (PIPIs) report correlates with the M&E reporting framework of the PRIF which aim to provide information to PRIF partners on infrastructure in the Pacific and assess the effectiveness of PRIF activities and outcomes.

This report presents a set of PIPIs using a standardized approach for purpose of measuring infrastructure development and service delivery.

Box 1: PRIF Monitoring and Evaluation Framework

Infrastructure performance in PICs	PRIF Activities and Outcomes	PRIF Management	*What to monitor?*
• How well are PIC's performing in infrastructure? • What needs to change? •What are the priorities and processes for change?	*• Implementation – is PRIF operating as planned? • Program results and outcomes – is PRIF having the desired effects? • Program Efficiency – is cost reasonable for outcomes achieved?*	*• How well are PRIF processes achieving its objectives? • Do PICS have better support and access to assistance? •Is coordination of partners effective?*	*Key Questions*
• Performance indicators & benchmarks • Good practice defined • PIC sector situation • Sector gaps &priorities	•PIC sector performance •Effectiveness of PRIF pipeline • Assessment of PRIF outputs and outcomes •Activity outcomes from partners	•PRIF performance •PRIF processes •PRIF management – partners, contractor and Board	*What is Needed for Monitoring?*
• Performance Indicators (PIPIs) •Benchmark Studies • PIC Sector Road Maps •Research studies	• PRIF Council meeting feedback • Sector performance reviews •Partner reports to IWG and Board	• Stakeholder feedback •PRIF Council meeting •Annual Report •Board and IWG minutes	*Key Reports / Processes*

Source: Adopted from PRIF Design Document. 2010.

2 Objectives

The PIPIs present a set of baseline performance indicators from which the impact of activities and strategies of the PRIF program can be effectively monitored and evaluated. The PIPIs reflect the state of each infrastructure sector, form a common basis for measuring infrastructure performance in the Pacific over time and highlight the contribution and impact on the Millennium Development Goal (MDG) indicators.

The PIPIs reflect the state of each infrastructure sector [and] form a common basis for measuring infrastructure performance in the Pacific.

The purpose of the performance indicators benchmarking exercise is to:

- Provide a tool for measuring and monitoring infrastructure performance
- Create a baseline data set which can be replicated in future years in order to show correlation between PRIF activities and infrastructure performance
- Help identify gaps and deficiencies in infrastructure services
- Provide a basis for evaluating trends in infrastructure performance across PICs

3 Methodology

The PIPIs have been assembled using the combined resources of PIAC and the PRIF Secretariat with the assistance of sector specialists.

The methodological approach used in this exercise consisted of a three-phase process:

1. *Development of Indicators*
The PIAC and PRIF Secretariat teams developed the initial indicators for measuring infrastructure performance based on the objectives set-out in the PRIF Design Document and through consultation with sector specialists in the Energy, Information and Communication Technologies (ICT)/Telecommunications, Water & Sanitation, Solid Waste and Transport Sectors. The PIPIs were presented and subsequently approved by IWG.

2. *Implementation – Data Gathering*
Most of the quantitative indicators could not be directly extracted from available materials and field visits to PICs. However, information that was collected proved to be useful. Given the cited limitations, the overall data collection process has been a low cost exercise executed by PIAC and Secretariat staff. Indicators used to construct the baseline were gathered using the following research process:

- Review of data sources and identification of gaps
- Collection of best available baseline data from a variety of sources
- Request to countries and stakeholders to assist in filling data gaps
- Compilation of primary data sets and baseline indicator tables for each of the subsectors in the 12 PRIF countries.

The PIPIs dataset was assembled using data gathered from a wide range of sources. Where available and accessible, primary data was gathered from:

- National and regional infrastructure service providers, e.g. airlines and port authorities,
- International and regional organizations, e.g. Centre for Asia Pacific Aviation (CAPA), World Health Organisation (WHO), UNICEF, Secretariat of the Pacific Community (SPC), Applied Geoscience and Technology Division (SOPAC), South Pacific Regional Environment Programme (SPREP), and
- Power and water subsector benchmarking technical assistance (TA) conducted by PIAC in consultation with Pacific regional organizations.

Secondary data was also gathered from:

- PRIF donor partners' project reports and analysis,
- Databases such as the World Bank, WHO and ADB Economic Indicators,
- Existing published country reports, and
- Various reports which look at the status of infrastructure in specific subsectors.

It is notable that in the transport sector (roads, aviation and maritime) comparable regional data is very rarely collected. This created large gaps in the information presented in the PIPIs. The lack of data for indicators means that often the status of a certain indicator is left unclear. In some cases where data gaps are present or where the available data is outdated, evidence sourced from the observations of independent sector specialists is used to help develop a picture of the current situation.

3. *Analysis and Production of Baseline Reports*
Following the data collection process, the PIAC and Secretariat teams prepared baseline reports for each infrastructure subsector, including an analysis of data and comparison across PICs. The data and baseline analysis was peer reviewed by sector and regional specialists. Specialists' comments were incorporated into the final report.

With the exception of the Transport sector, the use of the median as a measure of overall regional performance minimizes the bias from extremely low or high outliers. A median by definition indicates or shows performance level for 50% of the PICs. Averages on the other hand can be skewed as bias is introduced through the imputation of extremely low or high performance. Another approach to measure overall performance is the use of a weighted mean, but a limited dataset precludes the calculation of this statistic.

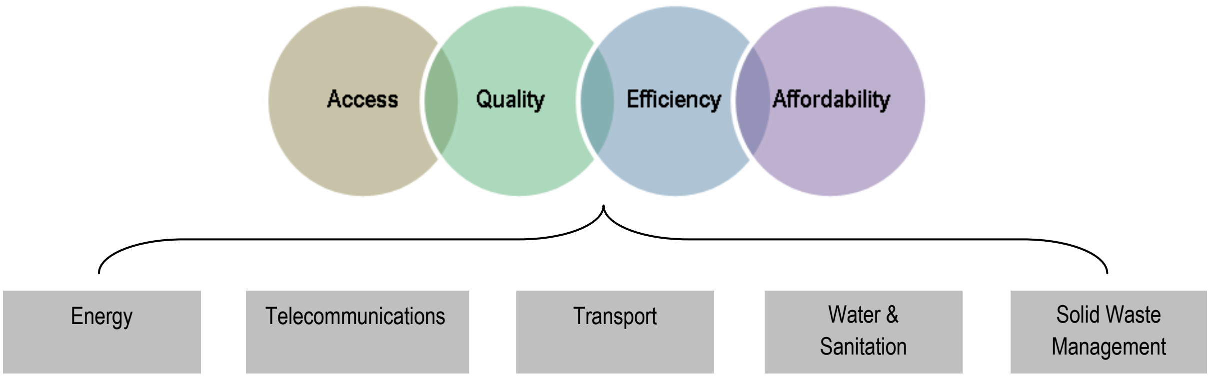
A qualification to the analysis and production process is the ongoing power and water performance benchmarking exercises conducted jointly by PIAC with the Pacific Power Association (PPA) and the Pacific Water and Wastes Association (PWWA). Findings from these exercises will help mediate data and knowledge gaps in the PIPIs.

4 Scope and Limitations

The scope of the PIPIs is shaped by a focus on five key infrastructure subsectors which includes energy, ICT/telecommunications, solid waste management, transport and water and sanitation.

The PIPIs link with the MDG indicators in the water and sanitation and ICT/telecommunications sectors and provide relevant data on each infrastructure subsector by assessing performance through the four staple markers of quality, efficiency, access and affordability (Figure 1.4.1).

Figure 1.4.1 PIPIs scope framework



The scoping framework articulated above, though ideal, does not apply consistently to all the subsectors for two key reasons. First, application was limited by data availability and data was collated on a best effort basis where appropriate. Secondly, supplementary indicators specific to particular subsectors were employed to provide a faithful quantitative account of performance.

The following table provides a practical overview of the indicators selected to review performance in each subsector:

Table 1.4a PIPIs indicators overview

Subsector	Indicators
Energy	▪ *Access:* Access to Electricity | Electricity Production (Capacity and Actual) ▪ *Affordability:* Electricity Tariffs (Commercial and Residential) ▪ *Energy Use:* Total Fuel Imports | TOE per capita | Renewable Energy Share | Clean Energy Contribution ▪ *Efficiency:* Distribution Losses
ICT/ Telecommunications	▪ *Access:* Fixed Line, Mobile Subscriptions and Internet Users per 100 People | Total Teledensity | Fixed Broadband Subscribers per 100 People ▪ *Affordability:* Telecommunications Service Price as % of Average Monthly Income (Fixed Line, Mobile and Internet) | Number of Service Providers (Fixed Line, Mobile and Internet) ▪ *Quality:* International Internet Bandwidth per Person | Secure Internet Servers per 1 Million People
Solid Waste Management	▪ *Access:* Access to Regular Waste Collection (Urban) | Frequency of Household Waste Collection ▪ *Sustainability:* Recycling Services and Waste Sorting ▪ *Quality:* Environmental Standards of Landfills ▪ *Efficiency:* Cost Recovery
Transport	**ROADS** ▪ *Access:* Total Road Network | Paved Roads | Unpaved Roads | Paved Roads as % of Total Road Network | Road Density | Population Density | Private Motor Vehicle Registrations ▪ *Quality:* Paved Roads ▪ *Affordability*: Vehicle Registration Tariffs
	AVIATION ▪ *Access*: Number of Operational Airports (Paved/Unpaved) | Scheduled Take-Off and Landing by Airport | Average Passenger Numbers | National (and other) Airline Carriers | Inbound Flights per Week | Inbound Seats per Week | Domestic Air Services in PICs ▪ *Affordability*: Air Travel Costs | International Air Freight Rates | ▪ *Efficiency*: Average Waiting Time for Services | Institutional Arrangements for Pacific Airports
	MARITIME ▪ *Access:* Frequency of International Shipping Services per Month | Shipping Traffic in Ports (Vessels per Year) | Number of Main Ports ▪ *Affordability*: Stevedoring Charges *Efficiency/Productivity*: Cargo Handling Equipment and Facilities in Major Ports | Vessel Turn-Around Times | Port Administration
Water and Sanitation	▪ *Access:* Access to Improved Water Source (Urban and Rural)| Access to Improved Sanitation (Urban and Rural)| Incidence of Water Borne Diseases ▪ *Quality:* Availability of Water Supply in Piped Water Supply Systems ▪ *Efficiency*: Estimated Non Revenue Water| Metered Connections| Employees per 1000 Connections| Cost Recovery ▪ *Affordability:* Average Tariff (Water and Sewerage Services)

The limitations of the PIPIs are as follows:

Table 1.4b PIPIs limitations

Limitation	Explanation
Dataset features only PRIF partner countries	▪ PRIF partner countries include: Cook Islands, Federated States of Micronesia, Kiribati, Republic of Marshall Islands, Nauru, Niue, Palau, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu. ▪ Papua New Guinea (PNG), the Fiji Islands and Timor Leste are excluded from the dataset
Applicability of common indicators	▪ Access, affordability and quality are consistent measures used throughout all the PIPIs. Efficiency and other measures are variable, limited by data availability and collated on a best effort basis.
Snapshot approach	▪ The PIPIs do not present a time series data, rather the approach is a snapshot based on latest available data
Timeliness, accuracy and consistency of data	▪ Data from consistent years are collected and applied as much as possible however, where no data exists for a particular time period, the latest available data is applied. Where data obsolescence is an issue, an interpretation of performance is made based on qualitative evidence sourced from specialists but this may not present an accurate picture of the circumstances. ▪ The accuracy of data is also limited by the use of multiple sources, thus reducing the consistency of the information presented. ▪ Selected reports consulted in this exercise are often many years old, but may be the best available source of comparative data for certain indicators. This is particularly the case for the Aviation and Maritime sub-sectors, where performance is based on the last available data gathered from a secondary source, which is now outdated. ▪ Consulting individual service providers and organizations often resulted in the collection of data on a per-country basis. The collation of this data in order to create an easy reference set may not provide a consistent comparative interpretation.
Data gaps	▪ Data gaps exist among countries and some countries do not have data for specific infrastructure sectors or indicators. Data gaps compromise the clarity and certainty of indicators but qualitative evidence sourced from independent sector specialists is used as a substitute in order to demonstrate the current situation. ▪ In the Energy and Transport sectors in particular, data is limited and comparable regional data is rarely collected. ▪ In contrast, data for Water and Sanitation and Telecommunications regularly updated by various interest groups in the Pacific given the links shared with the MDGs and the number of donor-agency projects conducted in these fields.
Data sources	▪ Although some data originates from primary sources, the dataset is mainly based on secondary research. This includes collating statistical data from global, regional or industry publications, commissioned or special topic research reports on particular sectors and literature review of research reports on the five infrastructure sub-sectors. ▪ As primary infrastructure data is not readily accessible in the Pacific, the accuracy of information and analysis presented in the PIPIs is limited at times.
Lack of common statistical framework	▪ The lack of common statistical frameworks calls for cautious interpretation
Data disaggregation	▪ The PIPIs do not disaggregate data by gender (male/female) or geographic/demographic differentiation (urban/rural). Urban/rural comparisons only extend to the Water and Sanitation sector.

5 Report Structure

The PIPIs report is organized into three sections.

Following this contextual introduction (Section I), Section II presents the baseline performance indicators for each infrastructure subsector including Energy, ICT, Solid Waste Management, Transport and Water and Sanitation.

Section III concludes with the identification of a range of strategic recommendations derived from the PIPIs data collection and analysis project. The recommendations hone in on practical approaches to navigating data gaps in the future and also distinguishing pathways for advancing PRIF monitoring and evaluation.

Datasets for each subsector are included in Appendix D for easy reference. Where graphs are presented, the color gray marks the highest indicator/s while blue marks the lowest indicator/s.

II Performance Indicators: Economic Infrastructure Subsectors

1 Energy

Energy is a fundamental input to most economic and social activities and underpins most of the MDGs in areas such as education, health and communications. It is also required as an input to basic living standards such as lighting, cooling, and heating. The PRIF partners are working with other development partners and organizations in the region to provide support for increased and equitable access to reliable and affordable energy. Therefore, the focus of Energy PIPIs is on access, affordability, energy use, efficiency and quality indicators as appropriate means of quantifying progress in this subsector. Considering the MDG's focus on environmental sustainability, data on renewable and clean energy in the PICs will also be examined.

Energy PIPIs

Access to electricity:
- Highest access: Nauru, Niue and Tuvalu.
- Poorest access: Solomon Islands

Affordability (Residential and Commercial):
- Most affordable: Nauru
- Least affordable: Tuvalu

Energy Use:
- High fuel imports: Cook Islands
- Low fuel imports: Vanuatu
- Samoa has the highest share of clean energy and renewable energy while RMI, Tonga and the Solomon Islands fall below the median for each

Efficiency:
- High distribution loss: RMI
- Low distribution loss: Niue

Access

Access to reliable and safe electricity is increasingly important given the educational needs of children as well as for communications and media through the use of information technology. Measures include access to electricity (as a % of total households), electricity production capacity (installed kW per capita) and actual electricity production (kWh per capita).

There is no single accepted international definition for access to electricity. For purposes of this report, the definition used refers to the percentage of households who have electricity in their home, whether it be commercially sold, either on-grid or off-grid or otherwise sourced.

In access to electricity, both productive capacity and actual production is considered. Productive capacity[2] indicates whether there is adequate capacity to absorb growing demand given that large scale power systems take considerable lead time in the planning, design and implementation of infrastructure civil works. Statistics describing actual electricity production on the other hand offer insight into demand, in particular with respect to grid-connected supply. These access indicators are presented in Table 2.1a below:

Table 2.1a Access to electricity indicators[3]

Indicators	Cook Islands	FSM	Kiribati	Nauru	Niue	Palau	RMI	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
Access to electricity (% of total households)[a]	99	54	29	100	100	97	80	99	7.6	78.1	100	19
Electricity production capacity (kW per capita)[b]	0.75	0.32	0.06	0.47	1.14	0.97	0.50	0.13	0.02	0.14	0.19	0.10
Electricity production (actual) (kWh per capita)	2865	927	244	1433	2410	5035	1260	476	118	467	376	270

[a] 2005. [b] 2008 except Niue 2004; Palau, Solomon Islands and Vanuatu 2007; Samoa 2003 and FSM 2002.

Sources: **1.** Asian Development Bank (ADB).2009. *Key Indicators for Asia and Pacific. Enterprises in Asia: Fostering Dynamism in SMEs*. **2.** South Pacific Regional Environment Program (SPREP). 2005. *Pacific Regional Energy Assessment*. Vols. 1-16: Apia, Samoa. **3.** Various internal ADB Reports. 2009. (Provided by P. Johnston).

Electrification rates in PICs are characterized by extremes – good access levels exceeding 95% and very poor levels as low as 7.6%. Reliability of power supply, however, is a common issue among PICs whether with good or poor access to electricity.

Electrification rates in the PICs are characterised by extremes with good access levels exceeding 95% and very poor levels as low as 7.6%.

While the PIC average of 71% electrification rate appears comparable with developing countries' average of 73%, weighting by population will make the PIC average lower due to poor access rates in larger PICs such as Solomon Islands. The PIC average is also lower than the world and OECD averages at 78.9% and 99.8%, respectively.[4] Notably, it is lower than the Peoples' Republic of China's average of 88.5% and most of East Asia.[5]

Median electrification is high at 89% in PICs, with Niue, Nauru and Tuvalu topping the access to electricity indicator at 100%. PICs with poor access have variable access levels with Vanuatu, Solomon Islands and Kiribati at below 30% and RMI at 80%. In particular, only 19% and 7.6% of total households in Vanuatu and Solomon Islands respectively have access to electricity (see Figure 2.1.1). Unfortunately, there is no data available to further differentiate this statistic amongst rural versus urban populations. Qualitative evidence sourced from expert observations indicates that the peri-urban and urban areas,[6] particularly of Honiara in the Solomon Islands, are pulling the overall percentage of households with access up. It is highly likely that the percentage of rural households with access is lower than the national average.

Figure 2.1.1 Access to electricity

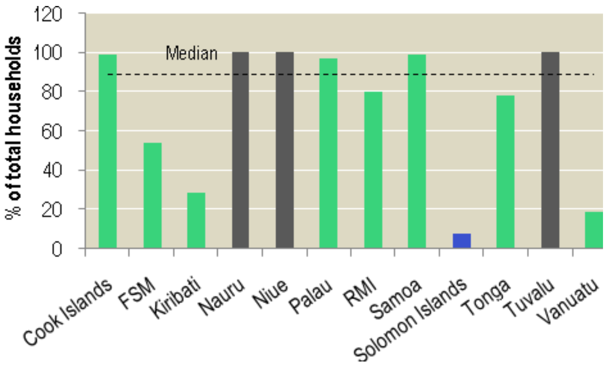
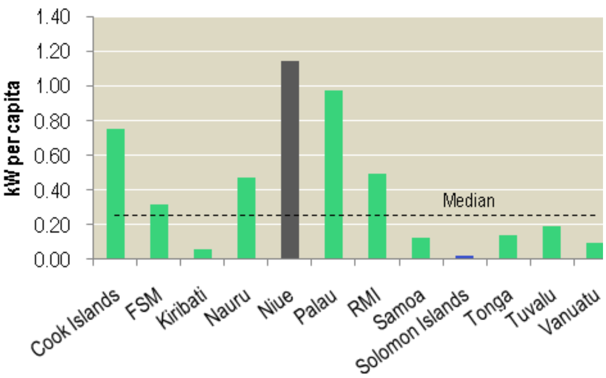
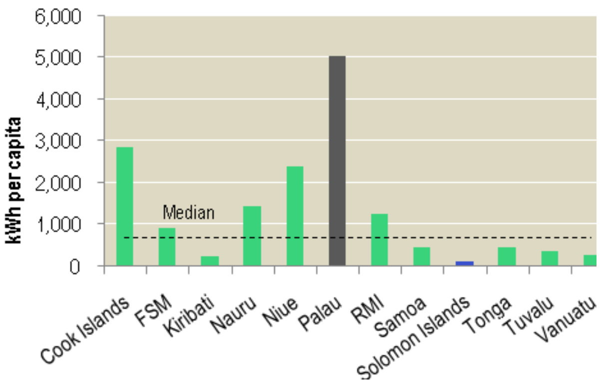


Figure 2.1.2 Electricity production capacity



The median electricity production capacity across PICs is 0.25 kW per capita (Figure 2.1.2). Solomon Islands and Kiribati score the lowest at 0.02 kW and 0.06 kW, respectively. Other PICs falling below the median include Samoa, Tonga, Tuvalu and Vanuatu. This partly reflects the Pacific region's underinvestment in modern energy services as well as limits to the size of infrastructure assets due to small markets and geographical separation making it difficult to realize economies of scale.

Figure 2.1.3 Actual electricity production



Palau shows the highest levels of actual electricity production (Figure 2.1.3) at 5,035 kWh per capita. In general, electricity consumption correlates with income levels. However, in the case of Palau, RMI and FSM, the level of consumption of electricity per capita is due in part to a long period (the UN trust territory era) of highly subsidized electricity, which continued well into the era of political independence.[7] Nauru's electricity production has fallen substantially during the past decade, peaking at 3,112 kWh per capita in 2004 and dropping to 1,433 kWh per capita in 2008 following the collapse of its economy. PICs falling below the median of 702 kWh per capita include Kiribati, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu. Notably, the PIC average is higher than the median at 1,323 kWh per capita, and is comparable to the developing countries' average at 1,169 kWh per capita although lower than the global average of 2,596 kWh per capita.[8]

The Solomon Islands score quite low with electricity production of only 118 kWh per capita, or just a sixth of the PIC median. This is largely an effect of the very low access rate of 7.6% coupled with its relatively large population.

Affordability

Measures of affordability include average end-user electricity tariffs in US cents per kWh for both residential and commercial users and average petrol prices (US$ per liter), presented in Table 2.1b.

Table 2.1b Energy affordability indicators[9]

Indicators	Cook Islands	FSM	Kiribati	Nauru	Niue	Palau	RMI	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
Average end-user electricity tariffs (US cents/kWh) Residential[a]	48.5	42.6	31.9	10.1	49.7	25.6	29.8	40.5	50.5	50.0	83.0	72.1
Average end-user electricity tariffs (US cents/kWh) Commercial[b]	54.9	46	49.9	21.1	48.5	38.1	35.8	42.2	55.5	50	94.3	50

[a] 2010-2011. [b] 2010.

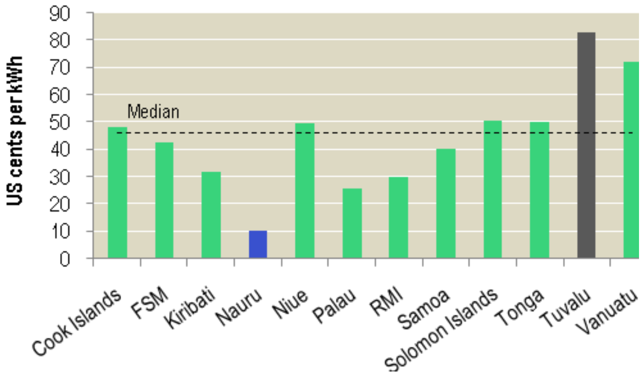
Sources: **1.** Calculated from preliminary data from PIAC and Pacific Water and Wastes Association (PWWA). 2011. *Performance Benchmarking of Power and Water Utilities in the Pacific*. (Including fuel price surcharges and taxes) (Provided by P. Johnston).

The PIC median residential cost is US45.6 cents per kWh (Figure 2.1.4) while the average is slightly lower at US44.5 cents per kWh. This average is still higher than household tariffs for Caribbean utilities[10] with an average of US36.6 cents per kWh.

PIC costs are higher in general than the Caribbean as PICs are more isolated and have more dispersed islands.

The Asian Development Bank observes that

Figure 2.1.4 Average end-user electricity tariffs (residential)

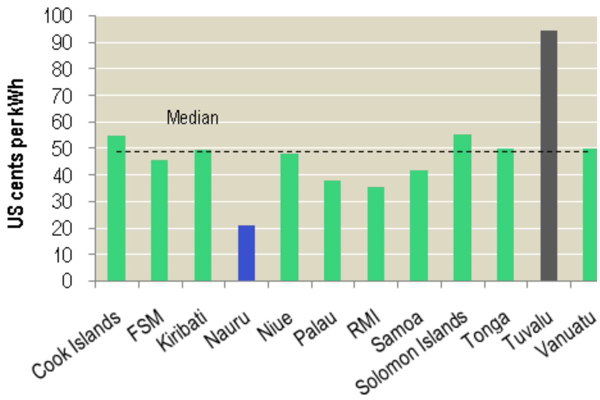


the Pacific's remoteness from major markets and its small, dispersed communities are causes of these high costs. These factors contribute to high transport costs and mean that production takes place at the upper end of cost curves.[11]

Tuvalu[12] has the highest tariff at US83 cents per kWh, followed by Vanuatu at US72.1 cents per kWh while Nauru has the least cost at US10.1 cents per kWh. Other PICs below the median include Kiribati, FSM, Palau, RMI and Samoa. Tariff rates are influenced by cost recovery levels (i.e., Solomon Islands, Palau, Samoa, and FSM do not fully cover costs), subsidization (i.e., Nauru and Niue) and/or price cross-subsidy policies (i.e., implemented in Kiribati and Solomon Islands).

The median commercial tariff is higher than the residential tariff at US48.5 cents per kWh (Figure 2.1.5). Tuvalu (US94.3 cents per kWh) and Solomon Islands (US55.5 cents per kWh) are the PICs with highest tariffs to the commercial sector. Other PICs that are above the median include the Cook Islands, Kiribati, Tonga and Vanuatu. On the other hand, Nauru at US21 cents per kWh has the lowest cost for commercial users. Notably, the range of commercial tariffs for PICs are consistent with residential charges such that those countries that fall below the median include FSM, Niue, Palau, RMI and Samoa.

Figure 2.1.5 Average end-user electricity tariffs (commercial)



Energy Use

Selected indicators of energy use is fuel imports as percentage of GDP and Tons of Oil Equivalent (TOE) per capita, renewable energy share and clean electricity contribution, presented in Table 2.1c.

Table 2.1c Energy use indicators

Indicators	Cook Islands	FSM	Kiribati	Nauru	Niue	Palau	RMI	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
Total fuel imports (% of GDP)	28.8	14.4	13.6	4.5	-	26.5	18.2	8.1	6.1	16.1	12.6	4
Tons of Oil Equivalent (TOE) per capita	1.46	0.36	0.20	1.27	-	2.84	1.00	0.39	0.13	0.44	-	0.13
Renewable energy share (%)	>1	0.45	>1	0.2	2.6	3	1	42	.04	>1	2.1	19
Clean energy contribution (%)	-	-	-	-	2	-	0.18	36	0.64	10.64	1.4	-

Sources: **1.** ADB. 2010. *Pacific Economic Monitor*. July, p.20.[13] (ADB estimates based on fuel prices from statistical agencies and various reports of government agencies, reserve banks, and newspapers.) **2.** Pacific Islands Forum Secretariat (PIFS). 2007. *Pacific Fuel Price Monitor*. May. **3.** World Bank. 2008. *Global Purchasing Power Parities and Real Expenditures.* Washington D.C: 2005 International Comparison Program. **4.** Internal ADB reports. 2009. Provided by P. Johnston. **5.** South Pacific Regional Environment Program (SPREP). 2004. *Pacific Regional Energy Assessment*. Volumes 1-16. **6.** United Nations Statistics Division. Trade Statistics Section. **7.** Secretariat of the Pacific Community (SPC). n.d. *Pacific Regional Information System (PRISM).* **8.** G. Zieroth. 2011. *Indicators for the Framework for Action on Energy Security in the Pacific*. SPC. **9.** Pacific Infrastructure Advisory Center (PIAC) and Pacific Power Association (PPA). 2011. *Power Benchmarking Exercise*. **10.** International Renewable Energy Agency (IRENA), 2011. *IRENA Workshop: Accelerated Renewable Energy Development on Islands with Emphasis on the Pacific Islands.*

Figure 2.1.6 shows that for the least developed countries such as Kiribati, Nauru, Solomon Islands, Samoa, Tuvalu and Vanuatu, the percentage of imported fuel to the overall size of economy is modest, that is below the median of 14%, with Vanuatu having the lowest figure at 4%. Higher performing economies have a sizeable component of GDP for their fuel imports, such as Cook Islands at 28.8%. Cook Islands has a large tourism sector which is clearly energy intensive. Other PICs above the median include Palau, RMI, Tonga and FSM.

The indicator also highlights the dependency of economies on imported fossil fuels and the vulnerability of PICs to oil price changes, with only modest changes in oil prices having significant negative impacts.

The tons of oil equivalent (TOE) indicator in Figure 2.1.7 displays total oil imports (including gasoline, aviation gasoline, kerosene, jet fuel and automotive diesel fuel) that remained in the PIC (i.e. net of re-exports) relative to the population size.

Median usage of oil among PICs is 0.41 TOE per capita. Palau has the highest rate of usage at 2.84 TOE per capita, nearly seven times the median, followed by Cook Islands at 1.46 TOE per capita. Vanuatu, Solomon Islands and Kiribati have the lowest usage at 0.20 TOE per capita or less. Notably, RMI would have a higher TOE per capita at 1.002 based on total imports but actual TOE per capita is only 0.61 owing to its function as a fuel bunkering and re-export hub.

Figure 2.1.6 Fuel imports

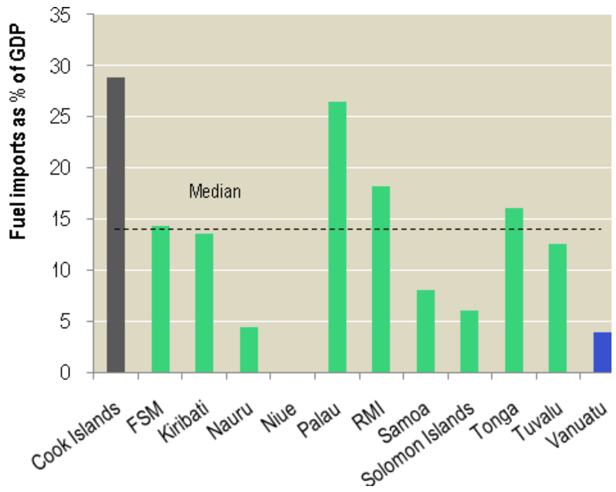
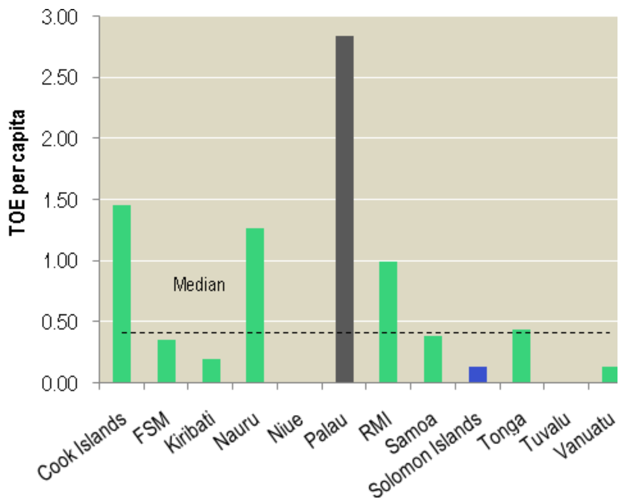


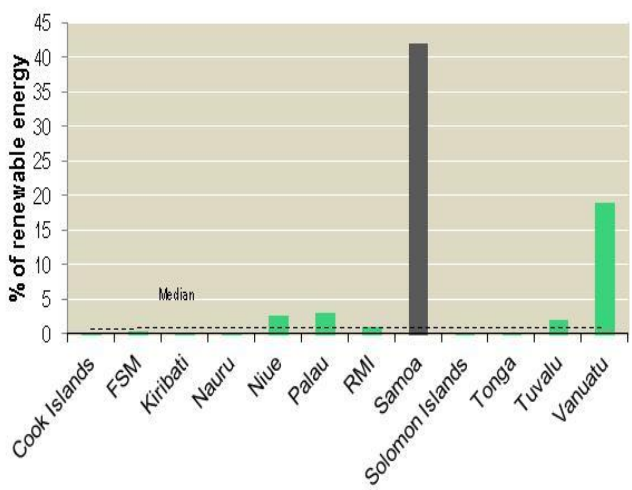
Figure 2.1.7 Tons of Oil Equivalent (TOE)



The PIC average of 0.78 TOE per capita compares with usage in Sub-Saharan Africa, the Asia-Pacific and developing country averages at 0.60, 0.72 and 1.07 TOE per capita, respectively. However, PICs usage most likely lags behind the developed countries and world average of 4.68 TOE per capita and 1.64 TOE per capita, respectively.[14]

The renewable energy share indicator measures renewable energy as a percentage of electricity generated or managed by the power utilities, largely grid-connected but a small amount of rural stand-alone systems. The PIC median

Figure 2.1.8 Renewable energy

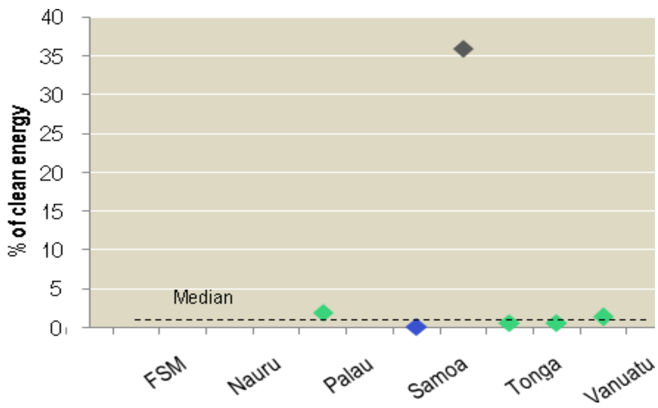


(excluding Fiji and PNG which have extensive renewable energy generation but are not included in this review) is approximately 0.7% with Samoa having the highest grid-connected renewable energy share of electricity generation at 42%, followed by Vanuatu at 19% (Figure 2.1.8). Other PICs have very minimal share (from less than 1% to 3%) but have continued to progress their renewable energy targets with small renewables-based electricity generation into their respective grids primarily with solar, wind and hydro. There is also the notable increase in electrifying the rural areas and remote islands with small stand-alone household PV systems and mini-grid systems.

The percentage of renewable energy to the grid can change dramatically from year to year depending on the availability of the hydro resource. The solar resource, which is a small amount of RE generation but rapidly growing, is much more consistent from year to year.

Clean energy share (Figure 2.1.9) is a complementary indicator that measures share of renewable as a percentage of total electricity supply. RMI is lowest at 0.18% while Samoa is highest at 36%, which can be explained by reference to its hydro-power station. Those countries falling below the median of 1.02% include Solomon Islands and Tonga.

Figure 2.1.9 Clean energy share



Efficiency

A selected measure of efficiency is distribution losses which compares the amount of kWh sold with the amount of kWh sent out from the power station. Note that again, data is only available from six PICs, pending the results of the 2011 benchmarking exercise. Although this does not represent the full picture, it provides an indication of the level of distribution losses. The data results are presented in Table 2.1d.

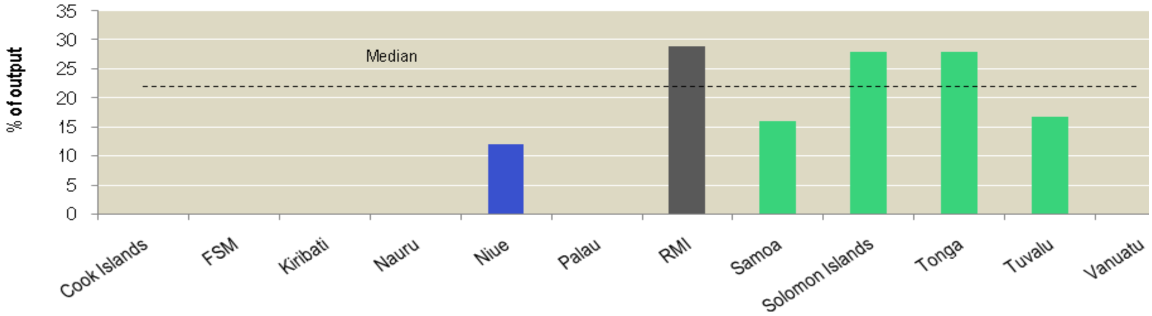
Table 2.1d Energy efficiency indicator

Indicators	Cook Islands	FSM	Kiribati	Nauru	Niue	Palau	RMI	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
Distribution losses (% of output)	-	-	-	-	12	-	29	16.02	28	28	16.66	-

Source: G. Zieroth. 2011. *Indicators for the Framework for Action on Energy Security in the Pacific.* SPC.

Figure 2.1.10 shows that RMI has the highest distribution losses at 29% followed by Solomon Islands and Tonga, both at 28%. Those falling below the median of 22% include Tuvalu (16.66%), Samoa (16.02%) and Niue (12%).

Figure 2.1.10 Distribution losses



2 Information Communication Technology (ICT)

ICT infrastructure is increasingly viewed as a pillar of economic development given that ICT underpins modern business needs to tap new markets, provides a platform on which new and existing business can be developed (as reflected for example in e-commerce and e-government) and also reduces the time and costs associated with distance.

There is also now growing evidence of the role that ICT can play in enhancing human and social development. The use of ICT is seen as a way to reach Millennium Development Goal (MDGs). Specifically, MDG Target 8.E states that "In cooperation with the private sector, make available the benefits of new technologies, especially information and communications".

ICT PIPIs

Access:
- Highest teledensity: Palau
- Lowest teledensity: Kiribati

Affordability (fixed line):
- Most affordable: Palau
- Least affordable: Kiribati

Quality:
- Highest internet bandwidth: Tonga
- Lowest internet bandwidth: Kiribati

There is…growing evidence of the role that ICT can play in enhancing human and social development.

ICT is an enabler to a variety of economic activities and therefore developing indicators can encompass a wide-ranging spectrum - the use of ICT by business, international trade in ICT goods, ICT in education, ICT producing sector and ICT by households and individuals. A key priority of PRIF which is also consistent with the Pacific Digital Strategy is to improve the accessibility and affordability of communications technology in the Pacific. Therefore, the focus of the ICT PIPIs is on ICT infrastructure core indicators, which includes access, affordability and quality.

Access

Measures of ICT access include ICT-related MDG indicators, namely fixed, mobile and internet coverage measured by fixed telephone,[15] cellular subscribers[16] and internet users[17] per 100 persons.

Other non-MDG access indicators included are broadband uptake[18] as measured by broadband subscribers per 100 people, and total teledensity[19] which is a combination of fixed and mobile connection indicators. These are presented in Table 2.2a below:

Table 2.2a ICT access indicators

Indicators[a]	Cook Islands	FSM	Kiribati	Nauru	Niue	Palau	RMI	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
Fixed lines per 100 persons	34.7	8	4	18	66	70	7	18	2	25	15	3
Mobile subscriptions per 100 persons	35.1	34.3	1.04	14.9	38.5 (2004)	66.6	1.68	84.4	5.87	48.73	20.2	15.39
Internet users per 100 people	30.3	15	2	30	66	27	4	5	2	8	43	7
Total teledensity per 100 people[b]	54.2	22	5	29	95	96	9	85	7	73	-	20
Fixed broadband subscribers per 100 people	7.4	0.10	-	-	-	0.48	-	0.10	0.29	0.70	4.60	0.07

[a] 2008. Cook Islands, FSM, RMI, Samoa and Vanuatu 2009. [b]Total teledensity data is retained at 2008 figures for all countries as a consistent year is required to generate teledensity figure.

Sources: **1.** International Telecommunications Union (ITU).2009. *Information Society of Statistical Profiles – Asia and the Pacific.* Geneva: Market Information and Statistics Division. **2.** World Bank. *National Statistics Offices*. **3.** United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP).2009. *Statistical Yearbook for Asia and the Pacific.* Bangkok: United Nations. **4.** ADB.2009. *Key Indicators for Asia and Pacific. Enterprises in Asia: Fostering Dynamism in SMEs*. **5.** Network Strategies. January 2011. *ICT-Based Inclusive Growth and Poverty Reduction in the Pacific*: *An Investigation of Potential ICT Interventions* (unpublished). Report for the ADB.

Samoa is the leader in mobile access with 84 subscribers per 100 people, while its performance in fixed lines access is just below the median[20] at 16 fixed lines per 100 people. Tonga, Tuvalu, Vanuatu, FSM and Solomon Island similarly have higher levels of mobile access over fixed line access (see Figure 2.2.1 and 2.2.2). Palau has the highest fixed line subscription at 70 subscribers per 100 people.

Figure 2.2.1 Fixed lines

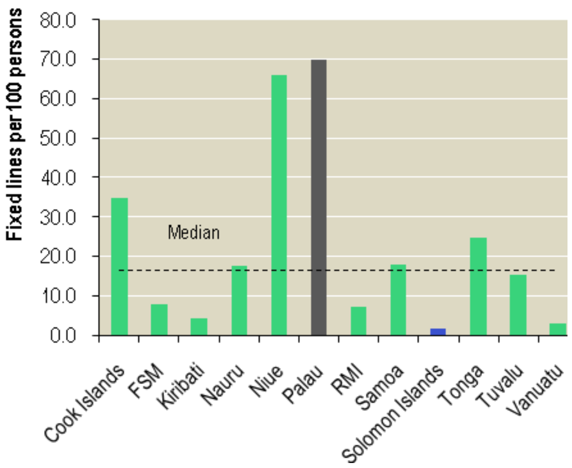
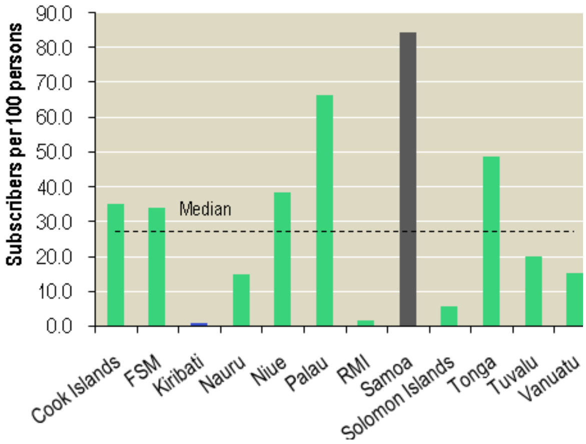
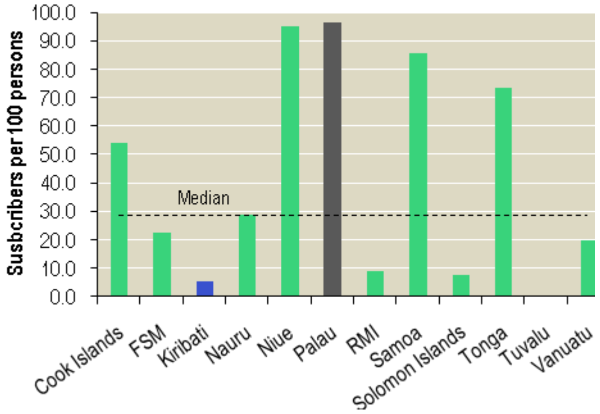


Figure 2.2.2 Mobile subscriptions



Combining fixed and mobile access connection indicators, an indicator of ICT sector performance is total teledensity which is defined as both fixed and mobile connections per 100 persons, presented in Figure 2.2.3. Palau, with a teledensity of 96 subscribers per 100 persons, is the top performer. Total teledensity however is low in most PICs particularly in Kiribati, Solomon Islands, RMI, Vanuatu and FSM which are all below the total median PIC teledensity based on the national aggregate of 28.8 subscribers per 100 persons.[21]

Figure 2.2.3 Total teledensity (fixed and mobile subscribers)



However, given the advent of relatively inexpensive mobile technology, this is starting to change rapidly. As with other developing nations which do not have extensive established fixed line systems, mobile technology is allowing the PICs to catch up without investing in new or existing capital intensive fixed line infrastructure. Countries above the median include Palau, Niue, Samoa, Tonga, Cook Islands and Nauru. Palau's high teledensity is attributable to high levels of fixed lines (2nd highest) and mobile access (highest). Niue's high teledensity is attributable to good fixed line access while mobile access ranks fourth.

Internet usage is fairly low in most PICs, with a median of 11.3 users per 100 people (Figure 2.2.4) except for the three countries that stand out with higher than expected internet use: Niue, Tuvalu and Nauru. In the case of Niue, highest usage at 66 users per 100 people, this would be based on the high fixed line penetration combined with the free WiFi internet for citizens offered through the Internet User's Society of Niue.

Internet usage is fairly low in most PICs... [and] broadband access is only available in eight of the fourteen PICs.

Broadband access is only available in eight of the fourteen PICs. Penetration levels are very low at less than one subscription per 100 people (Figure 2.2.5) with the exception of Tuvalu and the Cook Islands having more than one subscription per 100 people. Notwithstanding the low uptake, it is encouraging to observe the availability of broadband technology in these countries.

Figure 2.2.4 Internet users

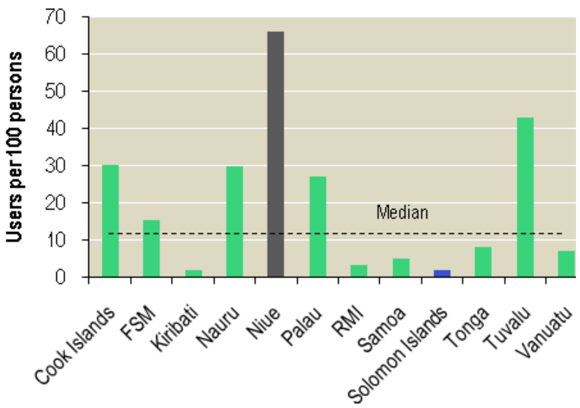
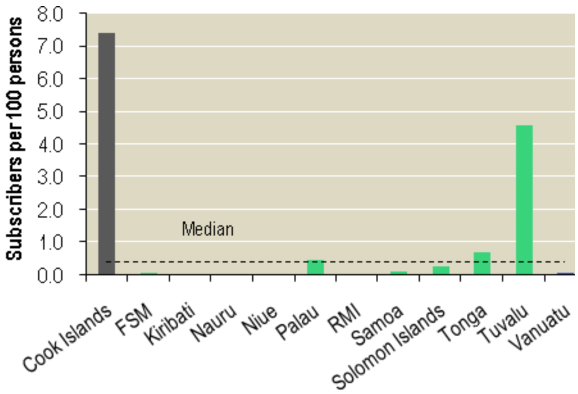


Figure 2.2.5 Fixed broadband subscriptions



Affordability

Measures of the affordability of fixed telephone, mobile and internet access, is assessed using the percentage of monthly income required to pay for a specified level of service for each type of ICT service.[22] Note, however, that not all PICs have been included in the affordability assessment as prices were not available in all cases.

Table 2.2b ICT affordability indicators[23]

Indicators[a]	Cook Islands	FSM	Kiribati	Nauru	Niue	Palau	RMI	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
Telecommunications service price as % of avg. monthly income (high usage)- Fixed Telephone	-	64.60 (2010)	93.30	-	-	1.50	19.90	21.3 (2010)	-	17.5	-	12.8 (2010)
Telecommunications service price as % of avg. monthly income (high usage)- Mobile[b]	15.2	15.3	67.2	38	-	7.6	-	14.1	53.5	11.9	-	19.11
Telecommunications service price as % of avg. monthly income – Internet[c]	3.9 (2010)	10.8 (2010)	10.9	-	-	4		3.1 (2010)	-	9.0	-	11 (2010)
Competition – Number of service providers for phones, mobile and Internet[d]	1	1	1	1	1	2	1	2	2	2	1	2

[a, b & c] 2008 [d] Data recorded in 2008 but the figures remain the same in 2011.

Sources: **1.** ITU. 2009. *Information Society of Statistical Profiles – Asia and the Pacific.* Geneva: Market Information and Statistics Division. **2.** World Bank. *National Statistics Offices.* **3.** PIFS. 2010. *Review of Pacific Digital Strategies by Network Strategies*. **4.** ADB. 2010. *Pacific Economic Monitor*. **5.** Network Strategies. January 2011. *ICT-Based Inclusive Growth and Poverty Reduction in the Pacific*: *An Investigation of Potential ICT Interventions* (unpublished). Report for the ADB.

In terms of affordability,[24] PICs which have better affordability for high usage of fixed lines at approximately 20% of monthly income are Palau, Vanuatu, Tonga and RMI (Figure 2.2.6). Notably, Kiribati has the worst affordability requiring 90% of average monthly income. It is only in Palau where the cost for a high volume user less than 10% of income.

Figure 2.2.6 Fixed line affordability

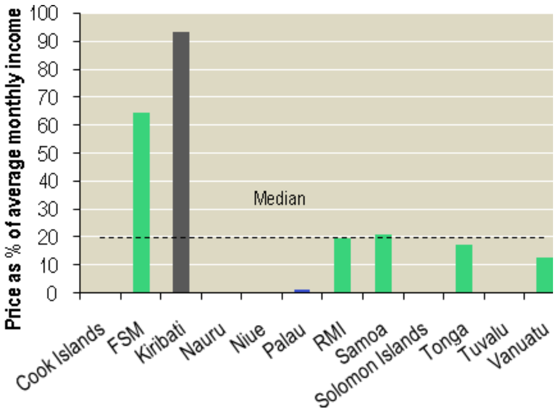
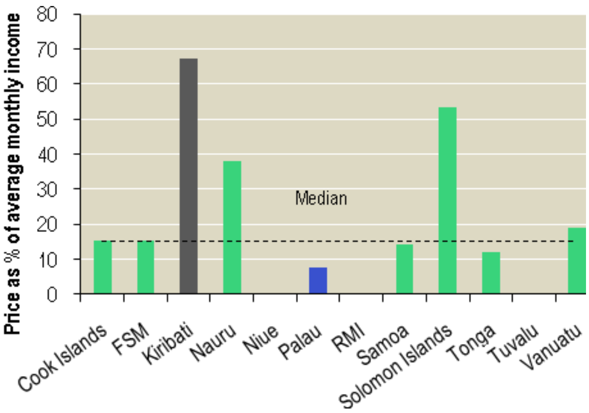


Figure 2.2.7 Mobile affordability



Palau also leads mobile affordability (Figure 2.2.7) followed by Tonga, Samoa, Cook Island and FSM. Notably, Palau tops teledensity figures as a result of its performance in mobile affordability. Samoa is the top performer in terms of internet affordability followed by Cook Island, Palau and Tonga (Figure 2.2.8).

Samoa, Tonga, Vanuatu and Palau have two competitors each (see Figure 2.2.9). All the other PICs have monopoly operators. In general, the countries with competing operators such as Tonga and Palau have the most affordable mobile services.

Figure 2.2.8 Internet affordability

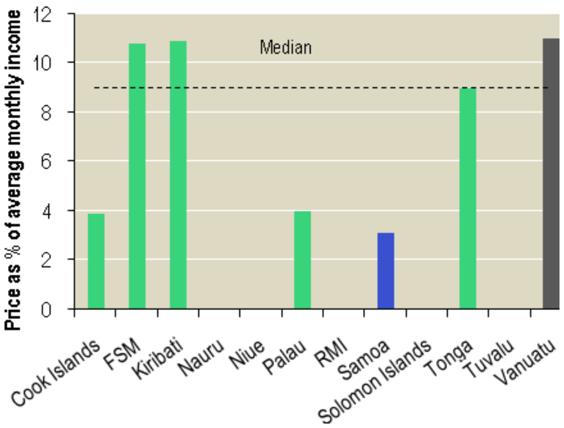
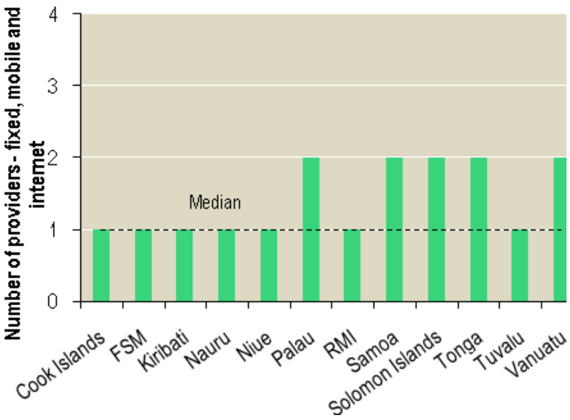


Figure 2.2.9 Competition



The situation in the Solomon Islands is rapidly changing with the recent introduction of competition in mobile markets. The ADB Pacific Monitor[25] observed that a government monopoly provider operating on an independent, commercial basis has not necessarily been a barrier to lower prices. The notable exception is FSM with one of the most affordable in mobile services despite having a monopoly operator. Vanuatu is also an exception with competition not leading to better affordability particularly for internet services.

Quality

The measure of quality is the international internet bandwidth[26] (bits per internet user). A higher bandwidth capacity per internet user indicates better quality. However, capacity is also influenced by the number of internet users sharing the bandwidth. Therefore, the total capacity needs to expand if there are more users in order to have adequate bandwidth per user.

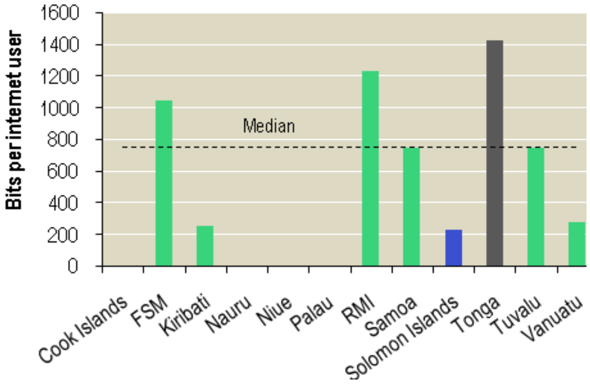
Table 2.2c ICT quality indicators

Indicators	Cook Islands	FSM	Kiribati	Nauru	Niue	Palau	RMI	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
International internet bandwidth per person or inhabitant (bits per internet user)[a]	-	1053	256	-	-	-	1235	750	232.7	1429	750	286
Secure Internet servers (per 1 million people)[b]	-	9.03	-	-	-	49.03	33.52 (2008)	22.37	2.00	28.86	-	-

[a] Kiribati, RMI, Solomon Islands and Vanuatu (2002). FSM and Samoa (2007) [b] 2009.
Source: **1.** ITU World Telecommunication. 2010. *ICT Indicators Database*. 15th ed.

Tonga is the top performer in international bandwidth per internet user (Figure 2.2.10), but this is attributable to a low number of internet users rather than high capacity. Tuvalu presents a good balance with international bandwidth at the median level coupled with the second highest number of internet users (see Figure 2.2.4).

Figure 2.2.10 International bandwidth



3 Solid Waste Management

Increasing volumes of solid waste and poor solid waste management are a growing problem for many PICs, which adversely impacts tourism, trade, public health and the environment. Apart from increasing waste volumes, the problem is further aggravated by the limited land areas available in PICs especially in small atoll islands and the population density in some of the countries. The lack of infrastructure, lack of cost recovery and lack of capacity to manage solid waste in an adequate way compounds the dilemma. In many PICs, solid waste management responsibilities are spread across multiple agencies, including various ministries, municipal councils and private sector operators. These issues will be explored in turn through the key indicators of access and efficiency.

Solid Waste PIPIs

Access to waste collection:
- Regular waste collection in urban areas: Cook Islands, Nauru, Niue, Palau and Samoa
- Irregular waste collection in urban areas in Kiribati and some states in FSM

Sustainability:
- Recycling of waste to some degree implemented in most PICs except Nauru and Niue

Quality:
- Landfills meet environmental standards: Cook Islands
- Landfills do not meet environmental standards: Nauru and Niue

Efficiency:
- Cost recovery is very poor in all PICs

Access, Quality and Sustainability

A critical issue related to solid waste is the lack of general appreciation of the impact of poor solid waste management. This is reflected in the lack of appropriate policies, strategies, legislation, enforcement and financial resources for the sector in many of the PICs. The result of this is that there are few initiatives to reduce the waste at source in order to minimize the amount of waste that needs to be recycled. Fortunately there are an increasing number of PICs that are trying to increase the volume of recycled waste in various ways. However, the efficiency and effectiveness of efforts to collect and/or dispose of landfill waste is not very high in most PICs. A summary of key indicators on solid waste management in PICs is provided in Table 2.3a below.

Access to Solid Waste Collection Services

A solid waste collection service exists in most capitals and larger towns in the Pacific Region (Figure 2.3.1). On average, waste is collected at a frequency of one to three times per week (Figure 2.3.2).

Figure 2.3.1 Access to regular solid waste collection (urban)

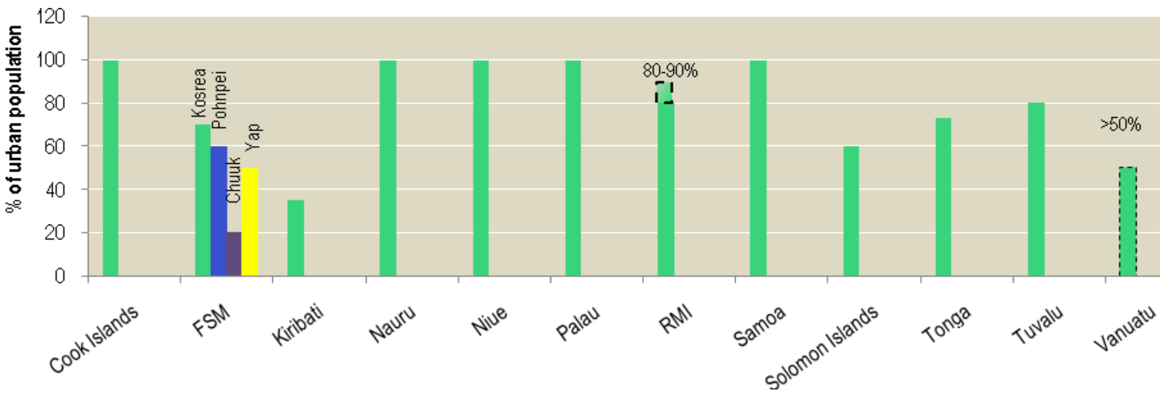


Table 2.3a: Key performance indicators for solid waste management

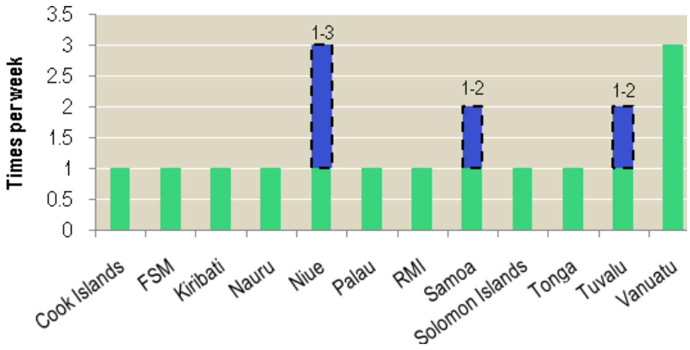
Indicators	Cook Islands	FSM	Kiribati	Nauru	Niue	Palau	RMI	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
Access to regular solid waste collection service in urban areas (% of urban population)	100	Kosrea 70, Pohnpei 60, Chuuk 20, Yap 50	35	100	100	100	80-90	100	60 (Honiara)	73	80	>50 (Port Vila)
Frequency of household collection service per week in urban areas (number)	1	1	1	1	1-3	1	1	1-2	1	1	1-2	3
Does a system exist for sorting and/or recycling (part of) solid waste? Y/N	Recycling of ferrous metals, aluminum cans, batteries, copper, brass, cardboard	Kosrae, Pohnpei, Yap: some collection of aluminum cans, PET , glass, batteries	Successful recycling of aluminum cans and car batteries	No	No	Yes, waste is partly recycled	Some recycling of aluminum cans and scrap metals	Recycling of bottles and cans and scrap metal	Some private sector involvement in recycling of metals	Some recycling of metals, PET bottles and aluminum cans	Recycling of aluminum cans on Funafuti	Some recycling of bottles and scrap metals
Does the landfill meet environmental standards? Y/N	Yes	Semi aerobic landfill in Kosrae, dumps in other states	Landfill at Betio yes, Dump in Nanikai, Landfill in Bekinebeu not used	No	No	Sanitary landfills in 2 states, dumpsites in 3 states	Well operated dumpsite in Majuro, dumpsite in other islands	Yes, landfills for Upolo and Vaia'ata	Dumpsite in Ranadi and other islands	Landfill on Tongatapu and dumpsites in other islands	Dumpsites managed by island councils	Landfill in Port Vila Dumpsites in other islands
Cost Recovery	Environmental levy for visitors and landfill tipping fees	Disposal fee on some imported items	Collection fee for HH but revenues only partly used for SWM	No	No fees	No fees	In Majuro, revenues from fees, subsidies and sales recyclables	No fees for collection, tipping fees at landfills	Council Taxes include waste management	Fees exist but only 6% is paid	Collection fees on Funafuti	Revenues from property tax, tipping fees and pre-paid bags

Sources: Data provided by authorities during PIAC field visits and sourced from SPREP, utilities and project reports.

In many urban areas, persons who own a vehicle transport their waste to the dumpsite, where accessible and considerable amounts of waste are burned.

In rural areas, formal solid waste collection services rarely exist and waste is either burned or dumped by households in informal dumpsites.

Figure 2.3.2 Frequency of solid waste collection (urban)



Recycling of Waste

The typical composition of domestic solid waste in the Pacific Region consists of biodegradable waste (58%), paper (12%), plastic (10%), glass (6%) and metals (8%).[27] The process of recycling waste aims to extract as much as possible useful waste from the waste stream, in order to re-use it and to minimize the volume of disposed waste as much as possible.

In most PICs, the potential use of solid waste as a resource is not yet fully exploited.

In most PICs, the potential use of solid waste as a resource is not yet fully exploited. An estimated 58% of waste in PICs is organic waste which could provide very useful material for enriching often poor soils in PICs. Unfortunately, only a few countries have regular separation of biodegradable waste from the regular waste stream. As a consequence, a considerable amount of landfill space is wasted and drives landfill costs unnecessarily high. In most countries, large scale composting facilities do not exist. Home composting is stimulated in most countries but still not sufficiently developed.

In general, recycling in the Pacific Region is difficult because of the small volumes of waste and the lack of recycling facilities on most of the islands in combination with the high costs of transporting recyclable materials. In a number of PICs, collection and recycling of PET bottles, aluminum cans and scrap metal does take place, but at a rather modest scale. Aluminum cans are collected, often by private businesses, because aluminum cans are relatively easy to recycle and it can be profitable. Glass bottles are sometimes collected and recycled in schemes organized by the local manufacturer. There is also potential for the recycling of End of Life Vehicles which are found in many PICs and contain relatively large volumes of scrap metals and other materials; however in most PICs this potential is not really utilized.

Solid Waste Disposal

In the Pacific Region, sanitary landfills are only found in about half of the larger towns. Sanitary landfills are controlled and well managed landfills that are designed and constructed to isolate the waste from the environment, to recover and treat leachate and gases and ideally, have a final restoration plan. In the remaining towns, the outer islands and rural areas, waste is usually disposed of in informal and often uncontrolled dumpsites.

In most cases, landfills and dumpsites in the Pacific are not very well managed and heavy equipment is lacking. Because of this, compaction rates are very low which contributes to the shortening of the lifetime of landfills, high costs and the spillage of waste into the environment.

Problems related to solid waste disposal are the lack of suitable land, the porous nature of the soils and the high dependence in many PICs of ground- and surface water for drinking and irrigation purposes.

Efficiency

Cost recovery

Cost recovery for solid waste management in almost all PICs is very poor. In most countries there is no collection fee and if a fee has been established like in Tonga, cost recovery is very low. There are some countries that have included solid waste management fees in municipal taxes.

Cost recovery for solid waste management in almost all PICs is very poor.

In some countries, fees are automatically deducted from the salaries of civil servants, but the revenues of such fees are only partly used for solid waste collection and a larger part is reserved for other purposes. In most countries, tipping fees are applied for waste disposal at landfills. The potential for creating revenues and employment though recycling of waste is only partly utilized.

4 Transport

Across the Pacific, poor transport links can create serious constraints for economic growth, service delivery and socioeconomic activities. Lack of adequate transport creates problems for rural accessibility and hinders safe, reliable and efficient inland and inter-island connections. To access tabular data for transport indicators, please consult Appendix D.

A Roads

Geography and population distribution patterns in PICs affect transport needs and the economy of transport services. Transport conditions as a whole for the PICs is varied, for example the Solomon Islands has a population of 560,000 people spread over six main islands and a total of 80-90 inhabited islands. Most countries have one or more major population centers that also provide central port and airport facilities. Road transport is often vital to the economy of transport in these centers and also to the ability of the rest of the population to access these networks.

All inhabited areas need reasonable road networks to provide access to population centers, ports, airports and areas of agricultural production; but road transport is particularly important on larger islands with larger populations. As such, measures of access and quality are essential to an assessment of road infrastructure in PICs although other measure relating to safety and the maturity of public transport systems could also provide useful indications of overall performance.

Roads PIPIs

Access:
- RMI has the highest road density
- Solomon Islands and Vanuatu have two of the lowest recorded road densities

Quality:
- Nauru, Niue and Tuvalu report having all roads paved
- Cook Islands, Samoa and Solomon Islands have less than 15% of roads paved

Affordability:
- Reports from RMI suggest annual vehicle registration costs US$35 but data for other PICs is unavailable

Access

Access to roads is a key indicator for road infrastructure, particularly in rural areas. The coverage and density of road networks in particular are crucial to understanding road accessibility and the broader economics of road transport in each country.

Road traffic volumes, while an important indicator, are generally not major concerns in PICs although some urban areas suffer from road congestion at peak times. Road safety is a significant issue due to high levels of pedestrian traffic, lack of investment in road accident prevention measures and a lack of public education and enforcement of road regulations. Road accidents in PICs tend to be low compared with many developing countries but significantly higher than for developed countries,

Road safety is a significant issue due to high levels of pedestrian traffic [and] a lack of investment in road accident prevention measures…

however there is no comparable data readily available to identify the number of accidents in relation to traffic volume and the severity of accidents.

Road Network Access

Road network access indicators, including total recorded road lengths, are shown in Table 2.4a below:

Table 2.4a Road network access indicators

Indicators	Cook Islands	FSM	Kiribati[a]	Nauru	Niue	Palau	RMI	Samoa	Solomon Islands	Tonga	Tuvalu[b]	Vanuatu
Total road network (km)	320	240	798	24	120	-	2028	2337	1360	680	20	1070
Paved roads (km)	33	42	133	24	120	-	-	332	33	184	20	256
Unpaved roads (km)	287	198	665	-	-	-	-	2005	1327	496	-	814
Paved roads (km) as % of total road network (km)	10.3	17.5	16.7	100	100	-	-	14.2	2.4	27.1	100	23.9

[a] Kiribati Rapid Stocktake Report [b] PIAC
Source: CIA World Factbook. 2011

Nauru, Niue and Tuvalu are the only PICs to report all roads as paved (Figure 2.4.1), while the picture in countries including Cook Islands, Solomon Islands and Samoa is substantially different with reports indicating less than 15% of roads are paved (Figure 2.4.2). Note, however, that unpaved roads do not necessarily hinder access in all PICs.

Figure 2.4.1 Total road network

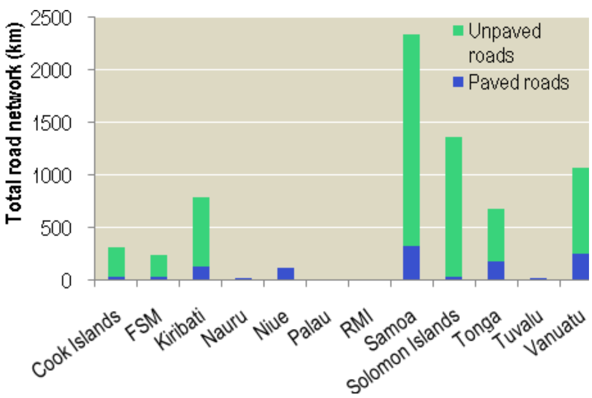
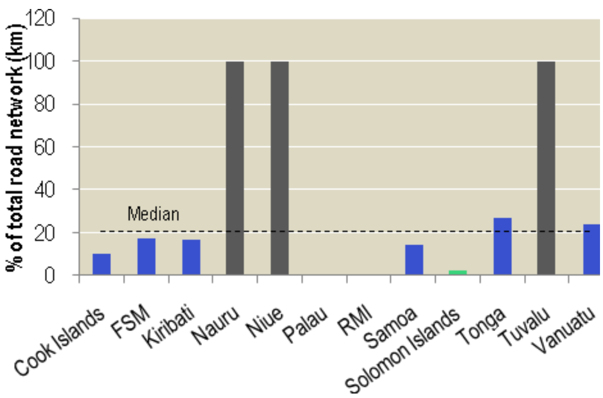


Figure 2.4.2 Paved roads as percentage of total road network



The length of roads in relation to the area of land is a measure of the density of the road network and an indicator of the level of access to the network. The ratio of roads divided by land area is shown in Table 2.4b. The density of population is an indicator of the ability to serve population by a network of roads. Generally, the higher the population density, the easier it is to provide roads and land transport services that serve the access needs of the population and economy.

Table 2.4b Road density and population density

Indicators	Cook Islands	FSM	Kiribati	Nauru	Niue	Palau	RMI	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
Road density - road kilometres per sq. km[a]	1.36	0.34	0.83	1.14	0.46	0.33	11.2	0.83	0.05	0.95	0.31	0.09
Population density - persons per sq. km[b]	49	153	123	441	5	45	364	68	20	171	403	18

[a] Length of roads in kilometers / area of land in square kilometres. [b] Population/area of land in square kilometers.
Source: Derived from data in CIA World Factbook. 2011.

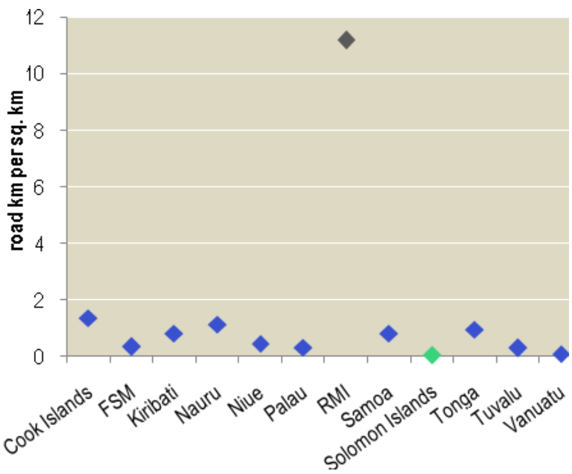
The PICs can be organized into four main categories on the basis of this road and population density data:

1. Populations widely spread over many islands – low population and low road density, e.g. Solomon Islands, Vanuatu and Tuvalu.
2. Small states with population focused on a few main islands and a network of roads serving relatively densely populated areas – high population densities and high road densities, e.g. Tonga, Samoa, Kiribati and Palau.
3. States with populated small islands with little need for extensive road networks, e.g. Niue, Tuvalu and Micronesia.
4. Countries enjoying financial or technical-assistance relationships with developed countries resulting in relatively extensive road networks, e.g. FSM and Cook Islands.

In terms of road network density (Figure 2.4.3) the Solomon Islands ranks lowest with only 0.05 km of roads per km^2. Considering that the country is the largest country in terms of land area, this statistic is not surprising. However, the measure of road density is quite far below the average of the PICs, many of whom have similar geography and topography.

The Solomon Islands falls short even in comparison to PNG which has approximately 50% of the road density of the Solomon Islands, yet approximately 16 times the land area. With this assessment, it is important to acknowledge that in PICs such as the Solomon Islands, measures of transport performance need to look beyond road-network density to include water and air transport networks.

Figure 2.4.3 Road network density



Road Vehicles

The number of motor vehicle registrations (a useful measure of road use and access) in each country is shown in Table 2.4c and reveals quite clearly the substantial gaps in updated, consistent road registration data.

Table 2.4c Private motor vehicle registrations

Indicators	Cook Islands	FSM	Kiribati	Nauru	Niue	Palau	RMI	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
Cars	-	-	-	-	-	-	-	-	-	-	-	-
Pick ups and commercial vans	-	-	-	-	-	-	-	-	-	-	-	-
Trucks	-	-	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	-	-
Total	-	4 (2000)	13.9 (2000)	-	-	-	-	10.9 (2005)	-	-	-	-

Quality

A key issue for most PICs is the lack of road maintenance and the financial sustainability of road networks, particularly as there are pressures to expand road networks. Related to these issues is the quality of the institutional and regulatory environment of road transport, particularly in respect of the funding and pricing of road transport, the regulatory environment and the administration of road transport including road safety. However, performance indicator data on these aspects is not readily available. This is an area where specific research might be appropriate.

Road construction and maintenance presents an opportunity to develop local contracting capacity and create employment and training opportunity through labor-based construction and maintenance programs. Again, performance indicators on these aspects are not readily available, but are likely to be best collected as part of individual road projects in each country.

While available data is lacking on road maintenance and conditions, the percentage of paved roads (Table 2.4a) can be used as a proxy for road network quality. Furthermore, given Pacific environmental conditions and topography, unsealed roads can quickly deteriorate into muddy tracks years before their expected design life is due to expire, especially if they are not maintained properly.

Road construction and maintenance presents an opportunity to develop local contracting capacity and create employment through labor-based construction and maintenance

Without making any further assessments on relative road maintenance programs and using the sealed road proxy for road quality, once again it is observed that the Solomon Islands is far below the collective average of other countries in the region for this road infrastructure performance indicator.

A supplementary indicator of road services quality is the number of deaths from road accidents per 10,000 registered vehicles in each country. However consistent, recent and comparable data is not currently available for this indicator.

Affordability

Little comparative data currently exists for the costs of road maintenance and the tariffs associated with vehicle registration for the PICs, although reports from the Marshall Islands suggest that tariffs associated with annual vehicle registration is approximately US$35.[28]

B Aviation

Aviation is an integral component of infrastructure[29] *in the Pacific as air services are essential for the tourism sector and for the import and export of goods. Overall, PICs face many challenges in ensuring they have competitive air services and a focus in recent years has been to increase competition through greater commercialisation of government-owned airlines and airports. Although the entry of low-cost carriers and capacity–sharing arrangements between airlines on some PIC routes in the last decade have improved flight frequency and lowered the cost of air services in countries such as Samoa, Tonga and Vanuatu, PICs still face many challenges in ensuring they have a competitive and reliable aviation sector.*

The key indicators for aviation performance relate to access, affordability and efficiency. Data for aviation performance in the Pacific is currently lacking, and the data used for this benchmarking paper is primarily based on the most recent studies completed for aviation in the Pacific.[30]

Aviation PIPIs

Access:

- All PICs served by one or more airports suitable for international services but many airports do not have appropriate safety facilities to meet international standards
- Some Pacific airlines are government owned and operate as National Flag Carriers
- A large number of flights to the Pacific originate in Australia, New Zealand and Fiji

Affordability:

- Comparable costs data for aviation in PICs is difficult to ascertain
- Costing data from July 2011 indicates that flights to the RMI and Micronesia were the most expensive
- Domestic services are often very expensive as a result of limited competition and inappropriate aircraft

Efficiency:

- Cost recovery to maintain airport services and facilities is lacking
- Separation of regulatory and operational activities not instituted for all countries
- Comparable data is lacking for indicators of safety and security

Access

Access addresses airports, airline services serving the country domestically and internationally, flight frequency, and passenger and freight capacity. The access indicators are presented in Table 2.4d below.

Table 2.4d Aviation access indicators

Indicators[a]	Cook Islands	FSM	Kiribati	Nauru	Niue	Palau	RMI	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
Number of operational airports (paved/unpaved)	9 (8/1)	8 (6/2)	5 (4/1)	1 (1/0)	1 (1/0)	3	4(1/3)	3(3/0) (2011)[b]	12 (1/11)	4 (3/1)	1 (1/0)	4(3/1)
Scheduled take-off and landing by airport (Inbound international flights/week)	87	22	6	2	1	1	28	61	105	16	2	225
Average passenger numbers (international scheduled seats/week)	4356	3421	712	576	152	157	2797	4293	3948	2100	94	8677
Average (or range) air cost per ton-km (freight) ($/kg)	-	-	-	-	-	-	-	-	-	-	-	-

[a] Data encompasses primary operational airports and does not include privately used or seldom operated airports. Although the official data obtained from Innovata consultants suggests Palau receives only 1 flight per week, the Palau Visitors Authority, and *Delta Airlines* are recently reporting bi-weekly flights through Taipei, China and Palau as well as weekly *Continental Airlines* flights from Manilla and bi-weekly *Fly Guam* services between Palau and Guam. [b] Chris Bennett. 2011

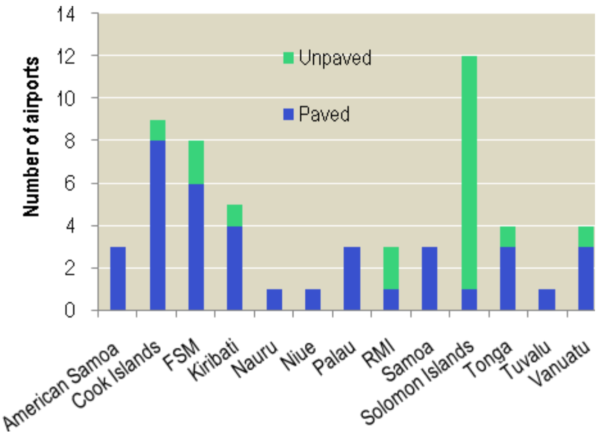
Sources: Asian Development Bank (ADB). 2007. *Oceanic Voyages: Aviation in the Pacific*. Philippines: Pacific Studies Series.

Airports

The number of airports indicator[31] demonstrates that all PICs are served by one or more airports suitable for scheduled international services and generally one or more other airfields. The 2006 data shows that countries such as Kiribati, the Marshall Islands, Tonga and Vanuatu have only a few operational (4-5) airports, while others including the Solomon Islands (12), Micronesia (8) and Cook Islands (9) have a significantly larger number.

This data is based on the number of primary operational airports, however field visits suggest that there are a large number of coral airstrips that are unsealed but can be and are used by turboprop aircraft. Including these airfields increases the number of airports significantly in some countries. For example, counting these airfields, there are 18 airports in Kiribati overall.[32] The paved-unpaved airports indicator (Figure 2.4.4) similarly illustrates that not all airports are paved and this has consequences for the type of aircraft that can use the airstrip. For domestic airports, often coral airstrips and turboprop aircraft will accommodate services; however, for international services a sustainable sealed airstrip is required with ongoing resurfacing.[33]

Figure 2.4.4 Paved and unpaved airports



Although this data is not currently available for all PICs, an indicator measuring capacity utilization of airports would also provide an evaluation of runway capacity, airport throughput and the size and type of aircrafts landing. It is known that many of the larger Pacific airports including Faleolo International in Samoa are capable of accommodating larger Boeing747 craft, however, most of the PICs including Tonga, Vanuatu, Kiribati and Solomon Islands have main airports that are suitable only for B767s and B737s.[34]

Air Services

Measurements of access to air services include the presence of a national carrier (Table 2.4e) and the frequency of domestic/international services (see Figure 2.4.5, 2.4.6 and Appendix B). Air services in the Pacific can be split into three categories:

Many PICs operate national carriers including Nauru (Our Airline), Vanuatu (Air Vanuatu) and FSM (Continental Micronesia).

- **Domestic Routes:** domestic services are those that operate within a PIC, generally between the main airport and key outer-island centers.
- **Intra-Regional Routes (between PICs):** intra-regional services are those that operate between PRIF PICs, for example between Tonga and Samoa.
- **International Routes (from outside PICs):** for the purposes of this report, international air services are those that operate between one of the PRIF PICs and another international location other than a PRIF PIC. The main international origins are Australia, New Zealand, USA, Fiji and PNG. Some PICs receive international services into more than one airport.[35]

(i) Carriers

Table 2.4e shows that Pacific airlines are primarily owned by national Governments and operated as National Flag Carriers. Exceptions to this include private investment in the Cook Islands and Micronesia and a joint government-private venture in Samoa and Tonga.

Many PICs operate national carriers including Nauru (Our Airline), Vanuatu (Air Vanuatu) and FSM (Continental Micronesia). The national carriers have a variety of ownership and operating arrangements including private investment in Air Rarotonga (Cook Islands) and Continental Micronesia (Micronesia); and a joint government-private venture in Polynesian/Polynesian Blue (Samoa). As not all PICs have national carriers, regional airline services do play an important role in the Pacific. For example, Fly Guam has begun operating services to Palau.

The national carriers of Nauru, Samoa (Polynesian/Polynesian Blue), Vanuatu and FSM also provide intra-regional or international services outside of their home country. In Tonga and Kiribati, the national carrier has instituted arrangements where other airlines provide international services on their behalf. National carriers generally provide domestic air services, except for Kiribati and in single-island PICs like Nauru.

Table 2.4e National and other carriers

Country	National Carrier	Ownership of National Carrier	Domestic Services	International/ Intraregional Services	Other International Carriers
Cook Islands	Air Rarotonga	Private	X		Pacific Blue, Air New Zealand, Continental Airlines, US Airways, United, Air Tahiti
FSM	Continental Micronesia.	Continental Airlines	X	X	-
Kiribati	Air Kiribati. *Operated by Our Airlines.*	Government		X	Air Pacific (flights to Tarawa and Christmas Is.)
Nauru	Our Airline	Government		X	-
Niue	-	-			Air New Zealand
Palau	-	-			Fly Guam
RMI	Air Marshall Islands	Government	X		United Airlines
Samoa	Polynesian Blue	Government, Virgin Blue and private		X	Air Pacific, Air New Zealand and Polynesian Blue
	Polynesian Airlines	Government	X		-
Solomon Islands	Solomon Airlines	Government	X	X	Pacific Blue
Tonga	Airlines Tonga. *Operated by Air Fiji and Virgin Blue.*	Air Fiji and private.		X	Pacific Blue & Air New Zealand
	Chathams Pacific	Private	X		-
Tuvalu	-	-			Air Pacific
Vanuatu	Air Vanuatu	Government	X	X	Pacific Blue, Air New Zealand, Air Pacific, Aircalin

Sources: Carrier websites, Skyscanner.com and Expedia.com.

(ii) Frequency and Capacity of Air Services

Figures 2.4.5 and 2.4.6 document measures of the frequency and capacity of regional and international air services - inbound flights and inbound seat capacity[36] (see Appendix B for a tabular representation of this data). It is important to note that the below is a set of comparable data for a specific period of time; as operated aviation services in the Pacific frequently change and the methodology for collection and processing of air services differs, the annual averages for this indicator may vary.

For March 2011, there were 61 flights per week to PICs from Australia and New Zealand, which have direct services to Cook Islands, Nauru, Niue, Samoa, Solomon Islands, Tonga and Vanuatu (Figure 2.4.5).

Figure 2.4.5 Inbound flights (2011)

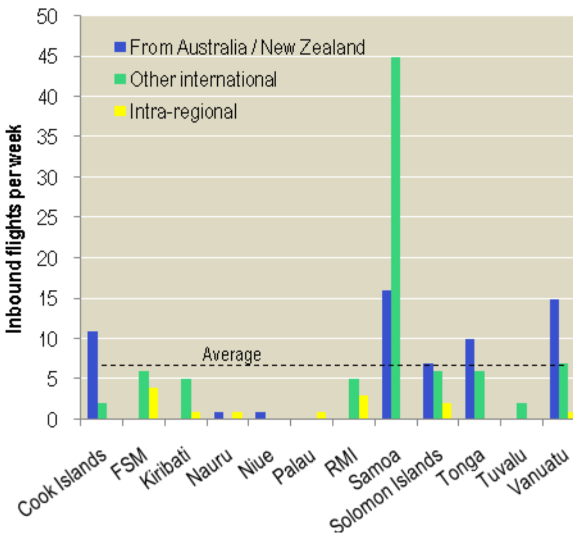
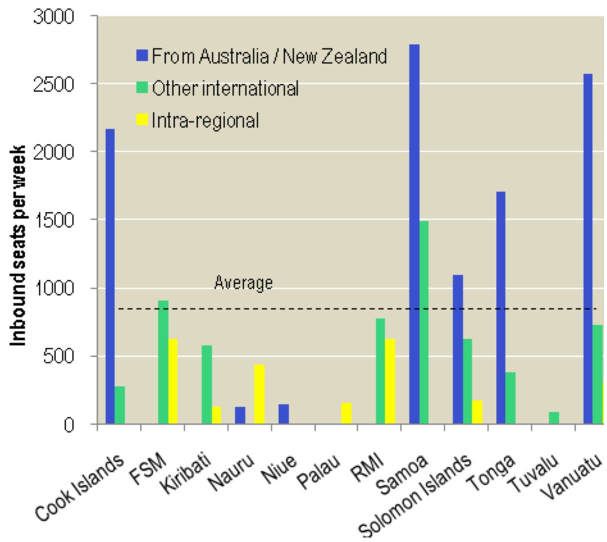


Figure 2.4.6 Inbound seats (2011)



A large proportion of flights from Australia and New Zealand are directed to Samoa, Vanuatu, Cook Islands and Tonga. In addition, there are 84 flights each week to PICs from other international sources. More than half of these flights are to Samoa from nearby American Samoa and Samoa also receives flights from Fiji and Hawaii.

The Cook Islands has flight connections to Guam and the USA; Micronesia and RMI are connected to Guam; and Micronesia also receives flights from Hawaii. Palau receives one flight per week from Micronesia and new services operating from Guam began in June 2011. Kiribati has air services to and from Hawaii while the Solomon Islands and Vanuatu have connections to PNG and New Caledonia, respectively.

Fiji is an important Pacific aviation hub for many PICs as a source of flights into Kiribati, Samoa, Solomon Islands, Tonga and Vanuatu as well as being the sole supplier of flights for Tuvalu. For larger island countries, in particular those serviced by low cost carriers, services to Australia and New Zealand are relatively frequent ranging from seven inbound flights per week in the Solomon Islands to 16 per week in Samoa.

For larger island countries…services to Australia and New Zealand are relatively frequent ranging from seven inbound flights per week in the Solomon Islands to 16 per week in Samoa.

Seating capacity is a product of flight frequency and the size of aircraft used. Some countries such the Cook Islands, Samoa, Tonga and Vanuatu have relatively high seating capacity ranging from 1,714 to 2,794 per week on routes from Australia and New Zealand (see Figure 2.4.6). Smaller countries such as Nauru and Niue have significantly less with only 132-152 seats per week from Australia and New Zealand. However, some countries have more seat capacity on flights between PICs. Nauru, Marshall Islands and Micronesia have relatively high seat capacity (444 – 628) on intra-regional routes.

Table 2.4f[37] presents a similar indicator for domestic scheduled flights and domestic flight seat capacity. Countries such as Vanuatu recorded 202 flights with a seat capacity of 5,058 over one week in 2011.

Table 2.4f Domestic air services in PICs per week

Country	Flights	Seats
Solomon Islands	90	2046
Cook Islands	74	1904
RMI	20	1384
FSM	12	1884
Vanuatu	202	5058

Sources: Flight diagnostics from Innovata LLC Consultants. March 2011. *Market Analysis Flights within the PRIF Region*.

In countries such as Micronesia and the Marshall Islands where flight frequency is less (12-20), seat capacity remains relatively high (1,384 -1,884) as a result of the large aircrafts used on these services.

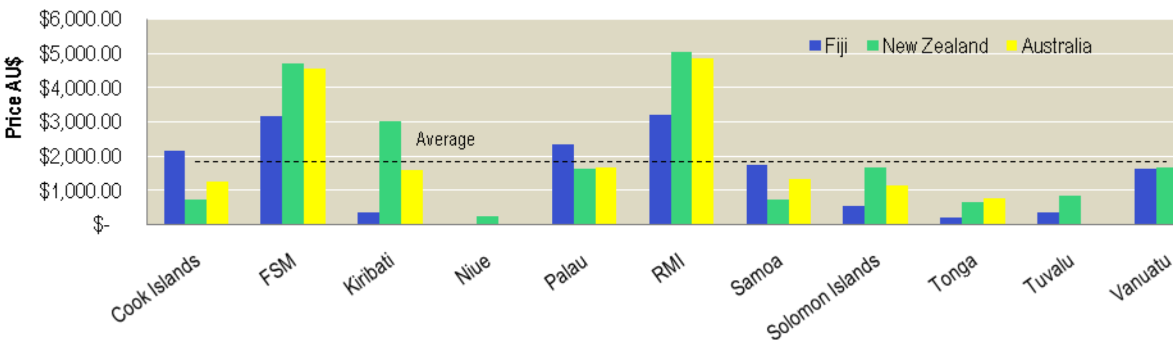
(iii) Freight

Another valuable indicator for measuring access is the freight capacity of air services, however, there is little country-by-country data currently available. For PICs, freight is primarily transported in the "belly-holds" of passenger planes and is therefore limited by the capacity of such flights. It is unclear whether this availability of space for freight is a constraint.

Affordability

Affordability compares the cost of international and domestic airfare, as well as passenger and landing charges and freight costs. It can be measured through a combination of passenger and landing charges, freight rates and average airfare for flying in and out of a PIC. There is currently no comparative recent data available for the associated passenger and landing charges for PICs. Figure 2.4.7 is a snapshot in time of the cost of flying from PICs to Australia, Fiji and New Zealand. A sample of airfares from online web sites was conducted on one day in March 2011 for travel in early July 2011 in order to ascertain average rates on offer, and the pricing comparison across PICs.[38]

Figure 2.4.7 Air travel costs



The results indicate that for that moment in time, the Marshall Islands and Micronesia were the most expensive of the PICs to fly from while Tonga, Samoa, and Tuvalu were significantly cheaper. The data should be treated with considerable caution as it is based on a one day sample taking an average of the highest and lowest fare to that destination from a travel website. It does not account for any promotions or deals for that particular time frame which would change the average cost of airfares, nor does it account for any changes to price due to changing availability at the time of booking. The fares include taxes and fees. This is also not a normalized reflection of cost versus distance ($/km) and should therefore be treated with caution.

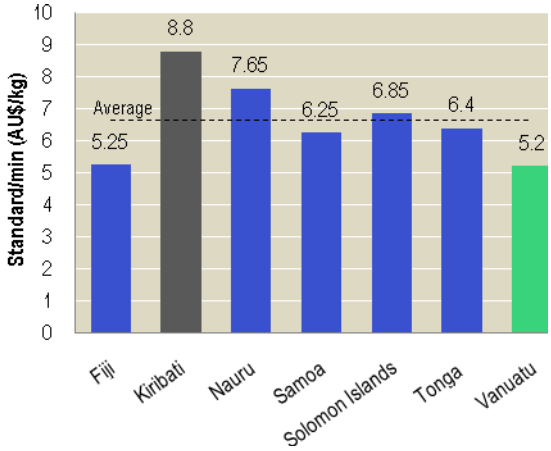
There is little data across the Pacific which compares the average cost of flying to and from PICs and a data gathering exercise such as this would need to be replicated over a longer period of time in order to produce a more accurate comparison. Insufficient data is available for a domestic airfare indicator.

(i) Air Freight Costs

Data for air freight rates (Figure 2.4.8) as a measure of affordability is currently limited to a certain number of PICs. However, as most freight is carried in the belly-holds of passenger aircraft, air freights in the Pacific compare unfavourably with those on mainstream routes between Australia, New Zealand and Asia. Pacific freight rates average at AU$6.63 per kilogram, and are significantly higher than rates on more heavily trafficked routes such as Melbourne, Sydney and Hong Kong where freight rates are less than AU$1 per kilogram.

Among the PICs, Kiribati has the highest rates followed closely by Nauru. Vanuatu and Samoa are comparably cheaper than other PRIF PICs analysed.

Figure 2.4.8 International air freight rates



Efficiency

Efficiency gauges the organizational structure of aviation, including the degree of commercialisation and competition in airline and airport services as well as the sustainability and cost recovery of operations. The primary indicators for efficiency include a calculation of cost recovery, average waiting times for services and also an assessment of the frequency of maintenance and upgrading of airport and air service facilities.[39]

The data needed for the calculation of cost recovery (revenue from airport operations, subsidies and contributions from Government as well as operating costs) and the average waiting time for services, is currently unavailable. Past reports have suggested that many Pacific airports do not have sufficient opportunities to recover costs[40] but the average waiting time for services (such as baggage delivery, immigration and customs processes) are reportedly relatively quick largely due to low traffic levels through Pacific airports.[41] However this is coupled with a lack of basic facilities such as retail outlets, taxi services, air-conditioning or fans in waiting rooms.[42]

Overall maintenance of international and domestic airstrips and upkeep of airport services is also lacking and there is a failure to keep up with the often increasing international standards of improved navigation and safety facilities.[43] This is not necessarily the case for the entire Pacific region, with many of the northern Pacific countries such as FSM profiting from upgraded terminals and runways as a result of investment from the USA.[44] Governance and management arrangements need to support the capacity of airports to provide services and generate revenue to help cover the costs associated with the maintenance of airport runways, navigation and safety equipment.

Table 2.4g below illustrates that most airports and terminal facilites in the Pacific are government owned and there is limited private sector involvement in aviation. Airports are generally operated by statutory corporations or Civil Aviation bureaucracies, however clarity is often lacking in regards to the distribution of responsibility between the government, the statutory authority and the airport management.

Table 2.4g Institutional arrangements for Pacific airports

Country/Airport	Faleolo International, Samoa	Bonriki International, Kiribati	Port Vila, Vanuatu	Koror, Palau	Fua'amout, Tonga	Pohpei, FSM	Amata Kabua, Marshall Islands
Private Ownership of Airport Infrastructure	No	No	No	No	No	No	No
Private Ownership of Terminal Facilities	No	No	No	No	No	No	No
Private Sector Participation in Ground Handling	Yes	No	Yes	Yes	Yes	Yes	No

Sources: **1.** World Bank (WB). 2006. *Pacific Infrastructure Challenge: A Review of Obstacles and Opportunities for Improving Performance in the Pacific Islands.* Report No. 36031: Working Paper. **2.** Asian Development Bank (ADB). 2007. *Oceanic Voyages: Aviation in the Pacific*. Philippines: Pacific Studies Series.

C Maritime

Transport is vital for all PICs given their remoteness from key markets and reliance upon imported goods and dispersed landmasses. However they are all relatively small economies with thin trade volumes, where imports exceed exports, long distances exist between ports and widely varying port access and facilities limit the economies of scale for maritime services. The performance indicators used to assess Maritime transport focus on access, affordability, and productivity (as a measure of efficiency).

Updated data for maritime transport in the Pacific is particularly deficient, and this has meant that there are numerous gaps in the maritime indicators. A portion of the data presented here is based on the last available reports for maritime performance in the Pacific,[45] but considering that this data is now largely redundant, it must be noted that elements of information contained in this report may not always provide an accurate account of the current condition of the maritime sector in the PICs. The level of maritime performance is thus based on the last available and consistent data.

Maritime PIPIs

Access:

- Samoa has the highest number of overall shipping services per month (11) while Nauru and Niue have the lowest number of overall shipping services per month (1 each)
- Solomon Islands has the highest number of ports (11) while Nauru, Niue, Palau, Samoa and Tuvalu have one each

Affordability:

- Ports in Vanuatu have the highest recorded stevedoring charges followed closely by Kiribati
- FSM and Tonga have comparatively lower recorded stevedoring charges

Efficiency:

- The 2004 Pacific standard was 10-12 TEU lifts per hour
- Tuvalu has the highest recorded vessel turnaround times while the Solomon Islands has a lower vessel turnaround time
- Comparable data for measures of safety and security is not currently available

Access

Maritime access is assessed with a focus on shipping and port services through specific indicators which measure the frequency of international container shipping services, cargo and passenger numbers, the number of international and domestic vessels per annum and the accessibility and capacity of ports.

Shipping Services

A fundamental indicator for maritime access is the frequency and freight cost per unit (TEU or revenue tonne) of international container shipping services in PICs. A considerable proportion of international inbound cargo is generally shipped to selected main ports and then re-distributed to outlying regional populations as domestic freight using small coastal vessels. Examples of this are in the Solomon Islands; where 90% of all international freight arrives at Honiara port of which approximately half is then cleared and received by importers and then on sold through wholesalers to trade stores on outlying Islands. The supply chain is fragmented and inefficient with imported products often moving into and out of warehousing numerous times before being consolidated and loaded onto coastal vessels often at local jetties adjacent to the international facility they were originally landed.

…while international services to the larger PICs are generally adequate…commercial shipping services to small PICs is comparatively infrequent.

The frequency of international shipping services indicator[46] (Table 2.4h) highlights that while international services to the larger PICs are generally adequate, commercial shipping services to smaller PICs is comparatively infrequent. The emerging trend has been to differentiate between the larger volume Pacific ports by including them into direct long haul shipping services from Asia and Australia/NZ whereas smaller markets of lesser volume are included into feeder networks using a larger pacific port as the transhipment hub. An example of this is whereby several shipping lines are servicing the Territory of the Wallis and Futuna Islands ports and Nauru by second carrier vessel transhipping through Suva, Fiji. This trend is expected to continue due to the improvement of infrastructure, superstructure and cost per unit at the larger pacific ports making them attractive transhipment hubs to regional shipping lines and those operating global services crossing between major trading countries of the pacific economies.

Another factor to consider in the realm of shipping frequency and freight cost to pacific ports is the legacy of regulated authorities controlling competition. Shipping into the Republic of the Marshall Islands (RMI), the Federated States of Micronesia (FSM) and Palau is regulated by the Micronesian Shipping Commission (MSC). The MSC reviews, approves and issues entry assurance licenses for international shipping lines providing shipping services to the member states. Shipping lines without the entry assurance license issued by the MSC are restricted from carrying cargo into any of the member states.

Table 2.4h International container shipping services in PICs per month

Country	FSM	Kiribati	Nauru	Niue	Palau	RMI	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
Multi - purpose	0	0	1	0	0	0	6	6	6	1	4
Cargo	6	3	0	1	3	4	5	2	3	2	3
All[a]	6	3	1	1	3	4	11	8	9	3	7

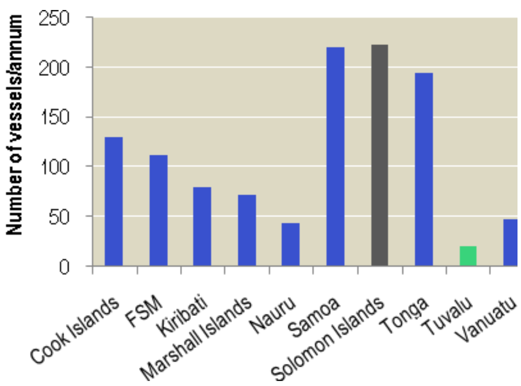
[a]Figures are approximations given that shipping services are not often run to set schedules.
Sources: Asian Development Bank (ADB). 2007. *Pacific Regional Transport Analysis*. Project No. 36661.

Container shipping services vary across the Pacific Islands but the main origins/destinations are relatively standard. South Pacific Countries' traditional main trading partners were Australia & NZ, and North Pacific was predominantly with the United States & North and East Asia. China & SE Asia are of increasing significance and the dominance of direct shipping services reflect this trade change, typified by larger vessels and consortium liner services.

Container port traffic per annum based on the Twenty-foot Equivalent Unit (TEU)[47] is an economic indicator which offers an assessment of maritime transport access per port, however this data is not currently available for all PICs. For the RMI in the period January 2010-March 2010, there was a reported throughput of approximately 381 containers.[48]

The number of vessels per annum indicator (Figure 2.4.9)[49] illustrates that shipping traffic to the PICs varies with larger ports in Samoa, Solomon Islands and Tonga serving an average of approximately 200 vessels annually while smaller ports such as Tuvalu and Nauru average less than 50 vessels per annum[50].

Figure 2.4.9 Shipping traffic in ports



Inbound and outbound domestic cargo and passenger numbers would also serve as an important marker of access and service, but contemporary data spanning across all the PICs is not readily available. The 2009 inter-island maritime statistics for Majuro in the Marshall Islands indicated that loaded/outbound general cargo topped 1511 tonnes and inbound cargo totalled 4807.25 tonnes, while outbound passengers were recorded at 3032 tonnes and inbound at 1768 tonnes.[51]

Domestic shipping service measures also suffer from a lack of data across the PICs. Nevertheless, significant economic, regulatory and operational challenges can be readily identified. Domestic shipping is an essential form of transport for many outlying islands and coastal villages, many of which have an absence of road or air transport connections. Reports suggest that domestic shipping operations in many PICs have a limited capacity, are unreliable and poorly regulated. Many routes are not commercially viable so as to support regular services and are served infrequently by poorly maintained vessels that in some instances fail to meet international safety standards.[52]

There have been gains in recent years with the franchising of domestic shipping routes in several Pacific countries including Vanuatu, PNG and Solomon Islands. These Franchise Shipping Schemes (FSS) have involved the contracting of private operators and the provision of subsidies by governments to deliver services of a predetermined quality to specified populations. Such FSS schemes have been implemented in Pacific Island countries with varying degrees of success but are leading examples of reform in the Pacific Islands domestic shipping environment.

Port Services

The number and capacity of ports is a useful indicator of maritime access presented in Table 2.4i (see Appendix C for port details). Generally, PICs each have one or two main trade ports for international shipping and several smaller secondary ports for domestic services. The main ports are usually distinguished by the fact they are also directly linked with the capital city of the state or are related to main trading activities for the host country such as fisheries, forestry or mining. It should also be mentioned that a key maritime service revenue function is also provided by safe anchorages particularly for fisheries that require protected anchorages for refrigerated fish carriers that spend long periods of time at such locations waiting offloading of tuna from ocean going purse seine fishing vessels.

Containerisation has altered the significance of a number of regional ports with a concentration of vessel and freight activity centralised to one or two locations, dependent upon the proximity of industrial activity and population base and urbanisation.

Table 2.4i highlights the number of key operational ports in PICs and their associated port infrastructure facilities, which range from basic wharves and hardstands to more sophisticated facilities with major superstructure and cargo-handling capabilities.

Some ports in the Pacific do not have wharves but instead use barges to transfer containers from vessels at mid-stream. Other PIC ports are limited by geography or location, such as Betio Port in Kiribati which has a shallow lagoon that precludes ships from docking quayside. Instead, ships must anchor at sea and barges are used to collect containers.

Another example with differing characteristics is Nauru where containers and break bulk cargoes are discharged in the boat harbour using a mobile crane to lift/lower containers onto a floating barge. The loading and unloading of containers in Nauru is problematic, due to the direct exposure to an open sea and a relatively small swell can stop the container operations.

Table 2.4iPorts in the Pacific Islands[53]

Country	Number of Main Ports
Cook Islands	2
FSM	4
Kiribati	3
Nauru	1
Niue	1
Palau	1
RMI	3
Samoa	1
Solomon Islands	11
Tonga	3
Tuvalu	1
Vanuatu	3

Sources: **1.** CIA World Factbook. 2011. **2.** Asian Development Bank (ADB). 2007. *Pacific Regional Transport Analysis*. Project No. 36661 **3.** David Jarvis (ed). 2010. *Ports and Terminals Guide 2011-2012.* IHS Fairplay.

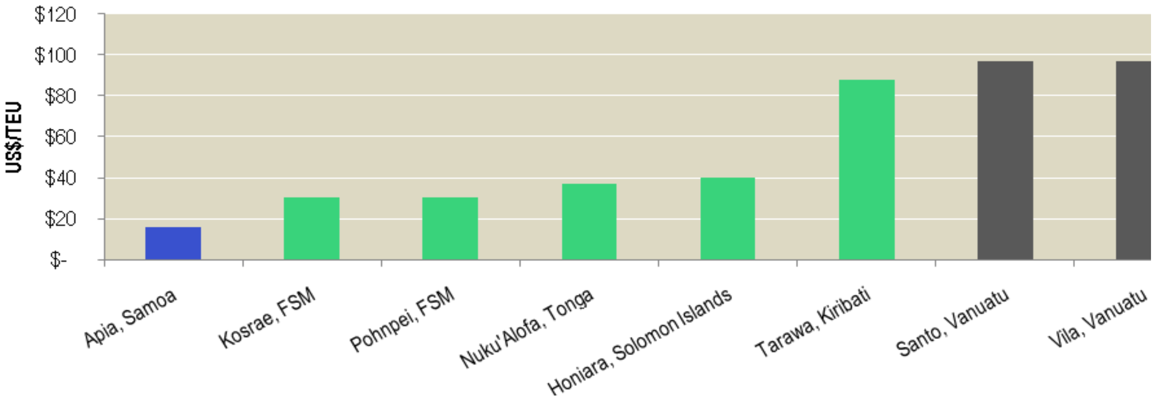
Affordability

Affordability is primarily evaluated through the port authority's tariff charges for wharfage and port dues and the stevedoring charges for cargo handling which combine to provide consolidated freight-rate indicators. It is important to note that as costs and services data change quickly, no updated dataset currently exists to provide an accurate comparison of port tariffs. Port tariffs reflect the charges incurred for vessels entering the port, charges per unit of cargo loaded/unloaded and transiting the berth and charges per vessel occupancy time spent at the port alongside the berth or at anchorage.

Stevedoring charges associated with the loading and unloading of ships are usually incorporated into overall freight rates charged by shipping lines but wharfage and handling charges at destination and are often levied on cargo movements separately. Port charges for stevedoring, port dues and wharfage, are not standardised across Pacific countries, often being dictated by local practices, assets involved and concession agreements in place.

Figure 2.4.10 is based on the latest available comparison of stevedoring charges from 2004 as outlined by the ADB.[54] It is important to note that while this data provides a comparative snapshot of stevedoring charges, these costs shift rapidly due to port tariff adjustments and more recent data would be required to provide an accurate representation of current costs. However, up to date data is not currently available.

Figure 2.4.10 Comparison of stevedoring charges



A performance indicator measuring freight rates and the influencing factors would ideally provide an assessment of the average cost of transporting a standardised unit of cargo to the PICs. There are a number of factors which drive freight rates, including the variable costs of operation, type of freight, the volume transported and the level of competition. Current comparative data is not currently available for this indicator, but is recognised as being of high importance when evaluating the landed cost of essential imports and the flow on effect to the economy.

Efficiency

Productivity is employed here as a means of evaluating the efficiency of maritime performance. As a result, the maritime efficiency indicators focus on the productivity of cargo-handling facilities at major ports, vessel turnaround times, and the administration of ports and shipping services. The quality of maritime performance is also affected by difficulties in conducting shipping maintenance, with many ships across the Pacific only able to perform major repairs in lieu of the ongoing servicing it demands. Port reform has been apparent in many Pacific Ports with Fiji and PNG leading examples of structural change, corporatization and capacity building.

Competition between Pacific ports is more evident with realization that port transhipment revenues are a significant growth potential.

Performance data for ports is limited, but available information regarding cargo handling facilities suggests that many PIC ports are poorly maintained and below international standards,[55] lacking basic superstructure such as shore-based cargo/container cranes, weather proof cargo sheds and suitable passenger terminals (Table 2.4j).

Table 2.4j Cargo handling equipment and facilities in PIC major ports

Country	Cook Islands	Kiribati	Nauru	Niue	Palau	RMI	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
Forklifts	X		[a]			X[a]	X	X[d]	X	X	X[e]
Cranes	X					X	X	X			X[f]
Storage			X			X[c]	X	X			X

[a] Loading arms [b, c, d, e & f] Only a few select ports/wharves
Sources: David Jarvis (ed). 2010. *Ports and Terminals Guide 2011-2012.* IHS Fairplay.

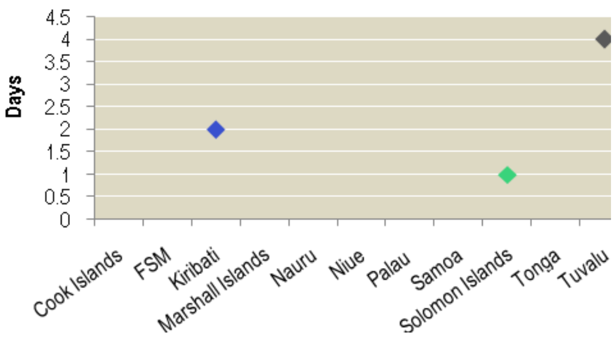
Nevertheless, this indicator presents a varied picture of productivity. Smaller PIC ports such as FSM and Kiribati lack the throughput volumes required to support permanent mounted shore-based cranes, while larger ports such as Apia and Port Vila often have a lesser capacity for cargo handling and storage. This results in inefficient cargo handling and dictates vessel calling at such ports need to be self-geared.[56] Although this figure is now outdated, in 2004 the 'Pacific standard' for container handling was 10 -12 TEU lifts per hour (this is about one-third of what is internationally recognised of a modern, well-equipped terminal).[57]

Another measure for the productivity indicator is the container handling rate (TEU lifts per hour), but recent data is unavailable for dwell times of vessels, operating and cargo working hours in order to make this calculation.

The vessel turnaround time indicator assesses the overall efficiency of a port: how long it takes a ship to berth, unload and load cargo and depart a wharf. Average vessel turnaround times for PIC ports are shown in Figure 2.4.11[58] however per country data is limited.

Furthermore, actual vessel working rates and port arrival congestion levels would provide a better indicator of efficiency; but this data is unfortunately non-existent.

Figure 2.4.11 Vessel turnaround times



Port Administration

Port administration illustrates the structure of port ownership and operations and provides a practical measure of overall efficiency. Port administration is typically divided into three main categories: 'Public Service' ports, 'Landlord' ports, and 'Private Sector' ports.[59] This structure facilitates an understanding of the incentive to operate ports on a commercial basis and achieve efficient, effective and customer driven service.

Public service ports are fully owned and operated by a government agency or authority such as Honiara and Noro in the Solomon Islands, Betio port in Kiribati and Funafuti in Tuvalu. In Kiribati, the government retains control of all port assets operated and maintained by the Port Authority.

The landlord model captures the state of affairs where private operators are granted concessions or contracts to manage the terminals and operating facilities of the port under the administration of the government port authority, which retains port ownership and provides the essential infrastructure. Examples of the landlord model include Apia port in Samoa, Pohnpei port in FSM and Nuku'alofa port in Tonga.

The shift towards a Landlord port allows better focus on port productivity, use of land and other assets and positions the Port Authority into a managing entity that selects partners and operators through contracted and concessional service agreements and chooses whether it wishes to enter into joint servicing arrangements or not via separate business structures. Pacific economies would benefit under the Landlord model as it frees up the port authority to better focus on managing and executing the planning of the port and the land use within the port area and the regulatory function of the port. This management includes the economic exploitation, the long-term development of the land and the upkeep of basic port infrastructure such as fairways, berths, access roads and jetties and ramps.

The private operators engaged in port service concessions may retain responsibility for buying all superstructure equipment or for leasing and operating equipment provided by the port authority. The Samoa Port Authority has placed most port services such as stevedoring and cargo delivery under a concession to the private sector, with the operator responsible for equipment provisions. Apia port in Samoa has comparatively high throughput rates and relatively low port charges, and is one of the "best performing ports in the Pacific."[60]

...port ownership largely rests with the national, provincial or local government [but]...qualitative evidence suggests private services have often resulted in more efficient service provision and improved customer service.

Although port ownership largely rests with the national, provincial or local government, under the private sector model, the port is owned and/or operated by a private firm. In some cases, the owners have contracted port operations and port services to private sector operators. Qualitative evidence suggests private services have often resulted in more efficient service provision and improved customer service.[61]

Although data is not currently available for all countries, overall, the landlord model and public sector ports are the most common across PICs. In some PICs, the resistance towards a transition to a 'Landlord' model of port administration creates additional costs and inefficiencies in the supply chain.[62] The lack of data also raises concerns about institutional processes and governance practices.

5 Water and Sanitation

As the population and demand for water increases, there is a corresponding increasing demand to provide improved sanitation to handle the increased volumes of wastewater and human refuse. In the recent past, the focus in this sector to a large extent has been on water supply rather than sanitation.

Furthermore, for both water supply and sanitation services, peri-urban or urban centers have been targeted for interventions given the PICs' typical small populations and the user volumes necessary to make systems financially viable, in addition to the perceived increased potential incidence of disease from untreated accumulation of waste in denser settlements.

However, given that the PICs typically have a majority of their respective populations in growing rural communities attention needs to be drawn to providing water supply and sanitation services to rural communities. This section will examine Water and Sanitation in the PICs through measures of access, quality, efficiency and affordability.

Water and Sanitation PIPIs

Access:
- Full coverage of water supply in urban areas in Niue, Samoa and Tonga
- Low water supply coverage in urban areas in Kiribati and Palau

Quality:
- Piped water available 24 hours a day in Cook Islands, Niue, Palau, Samoa, Tonga and Vanuatu
- Intermittent supply in FSM, Kiribati, Nauru, RMI, Solomon Islands and Tuvalu

Efficiency:
- Non Revenue Water between 40-60% in all PICs except Vanuatu

Affordability:
- In general most utilities are not able to recover routine operation and maintenance costs

Access to Improved Water and Sanitation (MDGs 7.8 & 7.9)

Given specific differences in location and topography, there are significant differences in the available water resources among the PICs. Access to improved drinking water sources (MDG 7.8) and access to improved sanitation facilities (MDG 7.9) is presented in Table 2.5a below.

The source of information is the Joint Monitoring Program (JMP) by World Health Organization (WHO)/United Nations Children's Fund (UNICEF)[63] for which data is provided by the countries themselves.

Access to an improved water source according to the standards of the JMP in many PICs does not mean that households are actually provided with sufficient and safe water supply.

Access to an improved water source according to the standards of the JMP in many PICs does not mean that households are actually provided with sufficient and safe water supply.

Table 2.5a Access to improved water and sanitation

Indicators	Cook Islands	FSM	Kiribati	Nauru	Niue	Palau	RMI	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
Access to improved urban water source (% total population)	98	95	77	90	100	78	92	100	94	100	98	96
Access to improved rural water source (% total population)	87	92	50	90	100	95	99	100	65	100	97	79
Access to improved urban sanitation (% total population)	100	59	47	50	100	96	83	92	98	98	88	66
Access to improved rural sanitation (% total population)	100	16	22	50	100	52	53	88	18	96	81	48
Incidence of water borne diseases (estimated deaths of diarhea per 100,000 inhabitants)[a]	5.2	15.6	28.6	14.6	-	5.6	27.4	11.2	18.1	9.8	21.9	8.5

[a] 2009

Sources: WHO/UNICEF. *Joint Monitoring Program (JMP) for Water Supply and Sanitation*.

Access to an improved water source (see Figure 2.5.1 and 2.5.2) refers to the percentage of the population with reasonable access to an adequate amount of water from an improved source, such as a household connection, public standpipe, borehole, protected well or spring, and rainwater collection. Reasonable access is defined as the availability of at least 20 liters a person a day from a source within one kilometer of the user's dwelling. This is a rather open definition and depends on the interpretation of "improved" and the assessment of "protected wells and springs".

For example in Kiribati, 72% of the "urban" population of South Tarawa is connected to the piped water system which only provides one to four hours of water on alternate days at very low pressure and the quality of the water supplied regularly does not meet basic WHO drinking water quality standards. In many PICs, water is used from shallow wells that are located at a close distance from septic tanks which often are too small and seldom cleaned. Relative to other PICs, there are significant differences between urban and rural water source accessibility in Kiribati, Palau, RMI, Solomon Islands and Vanuatu. Kiribati remains the poorest performer below the median in both urban (77%) and rural access (50%) while Niue, Samoa and Tonga enjoy 100% access to improved water source in both environments.

Figure 2.5.1 Access to improved water source (urban)

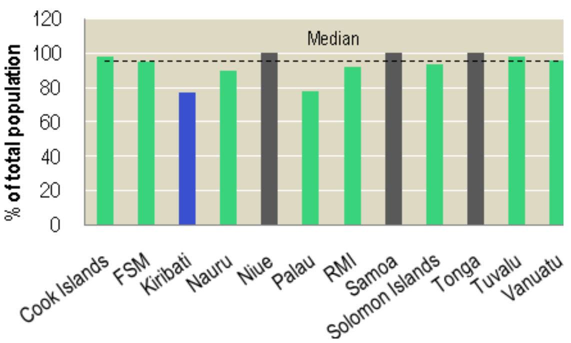
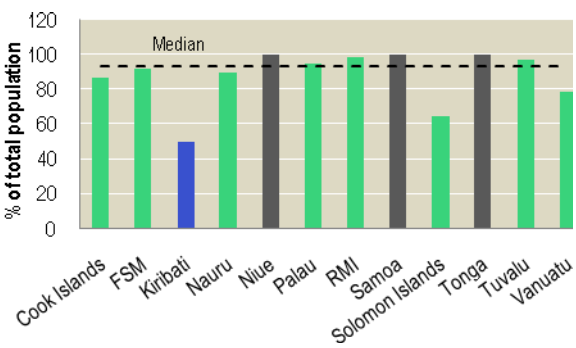


Figure 2.5.2 Access to improved water source (rural)



Access to improved sanitation facilities (see Figure 2.5.3 and 2.5.4) refers to the percentage of the population with at least adequate access to excreta disposal facilities that can effectively prevent human, animal, and insect contact with excreta. Improved facilities range from simple but protected pit latrines to flush toilets with a sewerage connection.

To be effective, facilities must be correctly constructed and properly maintained. For the majority of facilities in the Pacific Region this is not the case. Sewerage systems only cover small parts of some of the capital cities and often do not function very well. Septic tanks are often too small and rarely cleaned. Pit latrines are often not used due to cultural reasons.

Figure 2.5.3 Access to improved urban sanitation

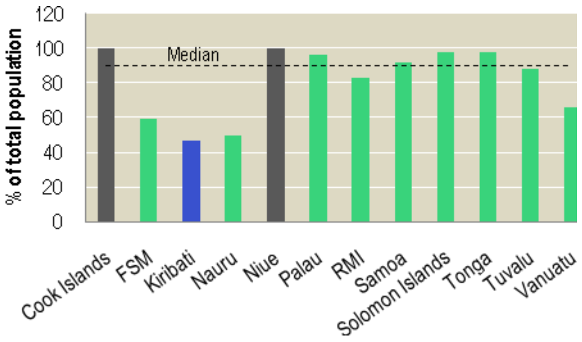
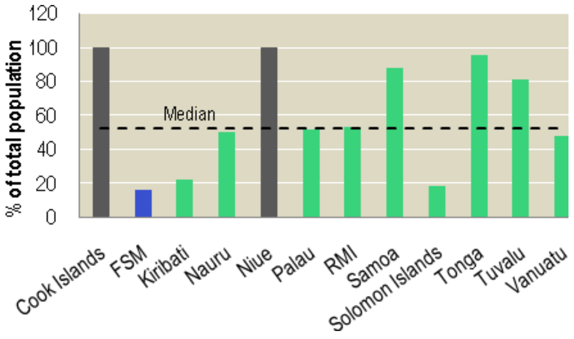


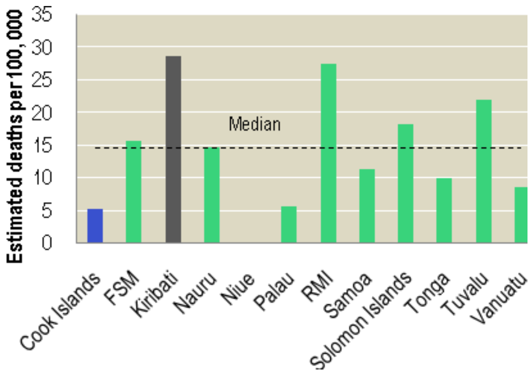
Figure 2.5.4 Access to improved rural sanitation



Improved Public Health

Improved water and sanitation facilities and hygiene should be reflected in improved public health as indicated by the incidence of waterborne diseases. Figure 2.5.5 presents data provided by the WHO on the estimated number of deaths per 100, 000 inhabitants of diarrhea in the Pacific Region. Although the report was published in 2009 the data is from 2004. In developed countries, the value of this indicator is in almost all cases below '1' but the Pacific average is more than '15' which indicates that there is still considerable scope for improvement.

Figure 2.5.5 Incidence of water borne diseases (diarrhea)



Quality of Piped Water Supply and Sanitation

The information in this section relates to the performance of piped water supply systems operated by water utilities in PICs. These systems are mostly found in the capital cities and major towns. Performance relates to the quality of water, the quality and continuity of water supply, efficiency of operations, affordability for customers and financial sustainability of the utility. Key performance indicators are provided in Table 2.5b below.

Table 2.5b Piped water supply systems in the Pacific

Indicators	Cook Islands	FSM	Kiribati	Nauru	Niue	Palau	RMI	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
Availability of water supply in piped water supply systems (average hours per day)	24	16	Tarawa: every 2 days 1-4 hours	Supply by tanker truck	24	24	6 hours during 1-2 days per week	24	Inter-mittent supply in elevated areas	24	Supply by rainwater collection	24
Estimated non revenue water:[a] Difference between water produced and water sold (%)	40-60	50	30-50	No piped water supply	-	40-50	-	50-60	40-50	40	No piped water supply	24
Metered connections (%)	0	70	0	0	0	>90	-	50	-	100	-	100
Employees per 1000 connections	-	18	15	13	-	16	17	9	7	11	-	-

[a] 2010 estimates

Sources*:* Data provided by utilities during PIAC field visits and sourced from utility and project reports.

Quality of Service

Quality of service can be measured by the quality of the water, the pressure at which water is supplied and the continuity and reliability of water supply. Reliable data on water quality and pressure in a water supply system is difficult to obtain and therefore the indicator provided here is the average number of hours that water is supplied in the system.

In half of the countries, piped water is supplied on a 24 hours per day basis whereas in the other half water is supplied on an intermittent basis.

In half of the countries, piped water is supplied on a 24-hour per day basis whereas in the other half water is supplied on an intermittent basis. A major issue with intermittent water supply is that there is no pressure in the system during periods that no water is supplied, creating the risk of contamination by for example polluted groundwater.

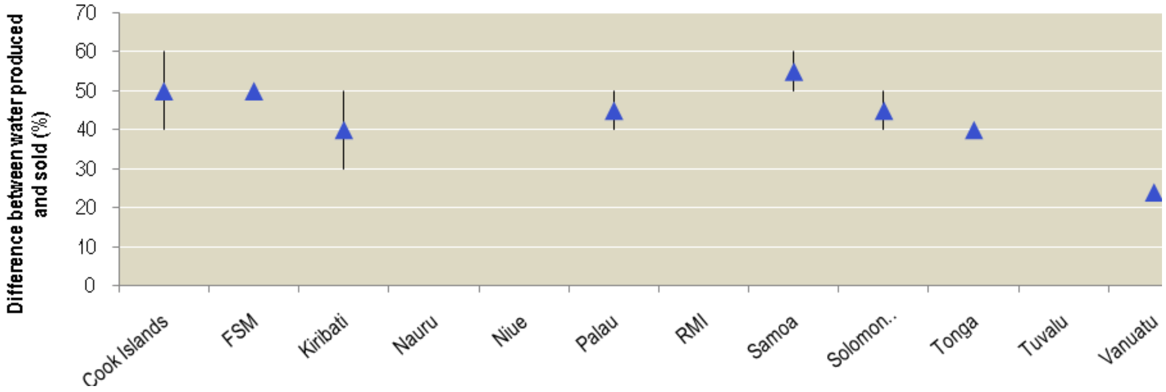
Efficiency

The reliability and continuity of piped water supply systems varies between 24/7 supply in the major piped water supply systems in six out of 12 countries, to intermittent supply in South Tarawa, Kiribati (one to four hours every two days) and in areas with higher elevation in Honiara in the Solomon Islands. Nauru and Tuvalu have no piped water supply systems.

A lot of water is lost and Non Revenue Water (NRW), which is the difference between water produced and water sold, is between 40% and 60% in all PICs except Vanuatu (Figure 2.5.6). NRW may include real (physical) losses and meter inaccuracies but also unauthorized water consumption (illegal connections) and unbilled but authorized consumption. Experience from developing countries demonstrates that in many cases a large part of NRW consists of real water losses.

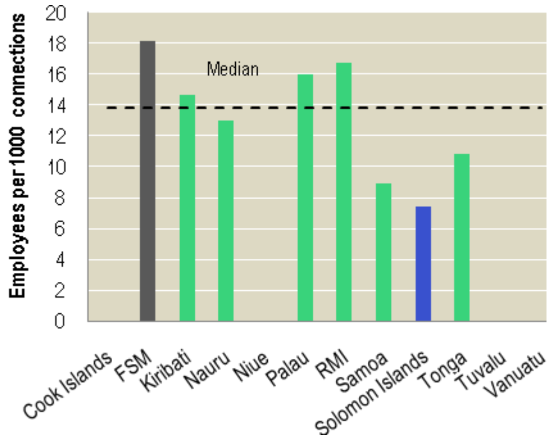
In view of the often limited water resources in PICs, the reduction of NRW and especially leakages in the system would be a first priority in any water supply rehabilitation or development program. Moreover, it is also difficult to maintain water quality standards in systems with high physical leakage.

Figure 2.5.6 Non Revenue Water



Another indicator for efficiency is the number of employees per 1000 connections, which varies between seven in the Solomon Islands and 18 in FSM (see Figure 2.5.7). In some cases (Kiribati and Vanuatu), power and water is provided by one utility and in these cases, an estimate has been made of the number of staff actually working for water supply. In larger water supply systems, this indicator normally ranges between zero to two staff per 1000 connections[64] and the high values for this indicator reflect the small size of water utilities in the Pacific and the level of efficiency.

Figure 2.5.7 Utility employees



Affordability and Financial Sustainability

With regard to affordability, the average price of water in most PICs is very low (see Table 2.5c). As a result, most water utilities in the Pacific region are not able to generate sufficient revenues to even cover routine operation and maintenance costs, which in most cases results in low service levels and higher costs for customers.

Most water utilities in the Pacific region are not able to generate sufficient revenues to even cover routine operation and maintenance costs, which in most cases results in low service levels and higher costs for customers.

Compared to other public utility services such as electricity, ports, aviation or ICT, water fees are generally very low and there is a hesitation among water utilities and policy makers to charge the real price for water. This may be for cultural and political reasons, for example to make water accessible to poor households.

Table 2.5c Water supply tariffs and cost recovery

Indicators	Cook Islands	FSM	Kiribati	Nauru	Niue	Palau	RMI	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
Cost recovery (revenues from tariffs/operating cost) (%)	0	-	50	21	-	44	77	94	92	125	-	-
Average tariff (US$ per m³) for water and sewerage services	No water tariff	0.26	US$10/HH month	2.50	No water tariff	0.22	0.375	0.25	0.96	1.03	-	0.66

Sources*:* Data provided by utilities during PIAC field visits and sourced from utility and project reports.

The result of the low tariffs is that many water utilities have insufficient revenues to sustain adequate service levels and carrying out regular maintenance. In most water utilities, the revenues (see Figure 2.5.8) from water fees and subsidies is insufficient to cover the costs of routine operation and maintenance. All cash income is usually spent on the costs of salaries and energy leaving no budget to purchase the spare parts, consumables and equipment needed for maintenance.

The effects of trying to keep tariffs low often have the opposite result of what policy makers want. For example, in Tarawa in Kiribati the fixed water fee per household per month is US$10. However, because of the poor service levels, the average household only receives an estimated $7m^3$ per month, resulting in an average fee of US$1.43 per m^3 which is in fact one of the highest rates per m^3 in the Pacific Region (see Figure 2.5.9).

Figure 2.5.8 Cost recovery

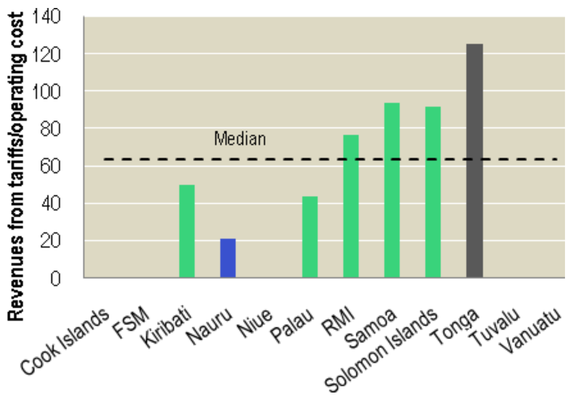
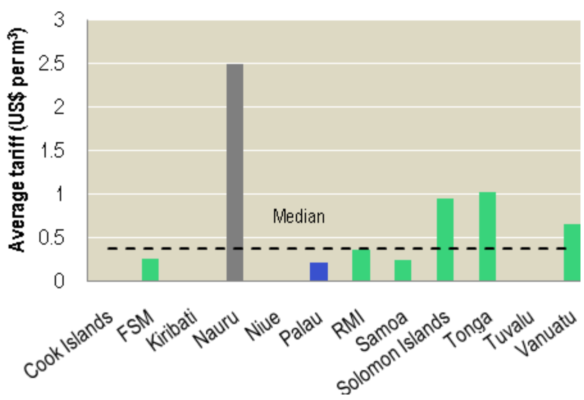


Figure 2.5.9 Average tariff for water and sewerage service



Another effect of low tariffs is that water consumption is in general quite high. For instance, in Palau water production equals about 870 liters per capita per day (lcd). In Samoa, the average water consumption used to be about 350 lcd but recent increases in water tariffs have considerably reduced average consumption. The highest water tariff of the region is charged in Nauru, which has no piped water distribution system and where households pay AU$10 for a truck of $4m^3$ to fill up their water tanks at home. However, also in Nauru the price does not cover operation and maintenance costs owing to the use of expensive desalination plants.

Charging for water to provide an incentive for reducing consumption, however, is not an easy task, because many of the connections of water utilities in the Pacific are not metered. From the PICs in this survey, only Tonga and Vanuatu have fully metered water supply systems and in Palau, FSM and Samoa, systems are only partially metered. In the other PICs, no metered connections exist, which again stimulates high water consumption because there is no deterrent to stop the wastage of water.

III Recommendations

The PIPIs underscore the reality that no central repository of relevant data on infrastructure subsectors in the Pacific currently exists.[65] Nevertheless, despite data gaps, this attempt to construct a first set of PIPIs exhibiting the latest available baseline data for the 12 PRIF countries has yielded meaningful results. The experience obtained in the current exercise also provides an approach to the ongoing collection and reporting of PIPIs in future years and for improving the Monitoring and Evaluation of PRIF.

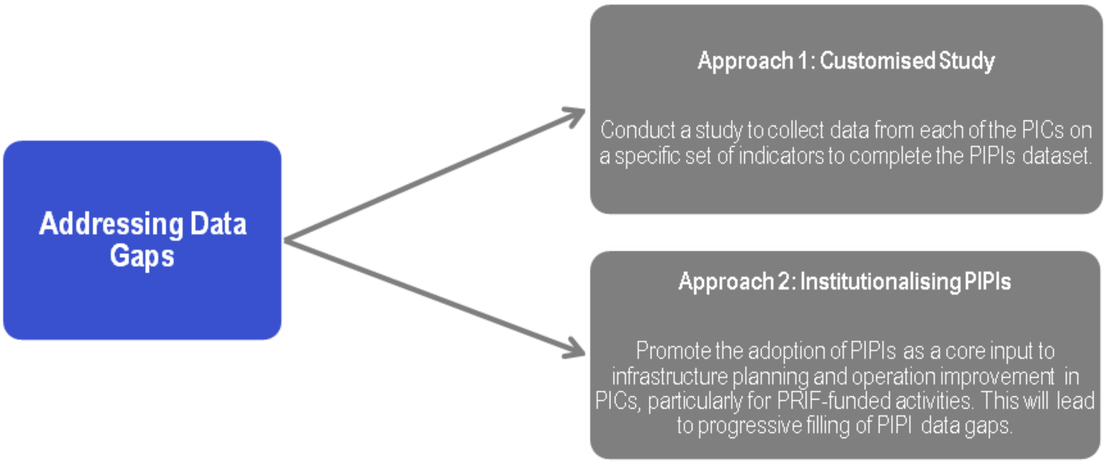
1 Approach to the ongoing collection and evaluation of PIPIs in future years

1a Filling Data Gaps

There is a need to fill a number of vital data gaps (see Table 3.1a) in the PIPIs in order to provide information on key strategic issues in each subsector and to provide a baseline for measuring PRIF outcomes in the future. Improving this dataset will enhance the ability of PRIF partners to draw inferences regarding performance of PICs and donor funding. It will also ensure there is a solid baseline for the evaluation of PRIF and partner investment in PIC infrastructure in forthcoming years.

There are two alternative approaches for filling these gaps: a *customised study* approach or *institutionalisation* approach extrapolated in Figure 3.1.1 below. These approaches are not necessarily mutually exclusive and can be strategically combined over a period of time where appropriate.

Figure 3.1.1 Addressing data gaps



1. Customised Study: the first approach will improve the quality of data and provides positive benefits relative to the cost of undertaking a targeted study.

2. Institutionalising PIPIs: the second approach is comparatively gradual but may be most appropriate where it is not cost-effective to initiate a customised study to address data gaps. PRIF partners will be encouraged to include the reporting of high level PIPIs when undertaking sector-specific work within a country. This work could be supported, designated and reported by the PRIF Management Unit.

The main data gaps and the alternative approaches to navigating each are shown in the following table.

Table 3.1a Two approaches to subsector data gaps

Subsector	Data Gaps	Approach 1: Customised Study	Approach 2: Institutionalising PIPIs
Roads	***Access:*** Road networks access; motor vehicle registrations ***Quality***: Road maintenance, regulatory environment and administration of road transport, deaths from road accidents per 10 000 registered vehicles ***Affordability***: Vehicle registration and road maintenance costs	A study of road maintenance approaches particularly in operations and funding is needed would meet the information requirements.	Update data on road networks through specific activities in each PIC.
Aviation	***Access***: Capacity utilization of airports, freight capacity of air services ***Affordability:*** Air freight costs, passenger and landing charges, average costs of inbound/outbound PIC flights ***Efficiency***: Airport operations, maintenance and management, cost recovery, service delivery times		Could be achieved by extending the World Bank regional aviation project. ADB Pacific Aviation Safety Office Project

Maritime	***Access:*** Container port traffic per annum, inbound/outbound cargo numbers, passenger numbers, domestic shipping services ***Affordability***: Port tariffs and wharfage, freight rates ***Efficiency:*** Port operations and management, container handling rate, work rates and congestion levels, port ownership	Several countries have requested port studies. A separate study of domestic shipping would be useful. Closer work with the Pacific Maritime Transport Alliance (PMTA) and national port authorities to facilitate regular data collection and maritime benchmarking. Commission a Quality Assurance Survey using a standard web based survey tool model to capture consistent data from each on performance in the terminal and ship handling and various other indicators.	
Energy	***Access:*** Urban/rural electrification ***Efficiency:*** Cost recovery, reliable energy conversion data (i.e. lost supply data), ***Energy use:*** Clean energy ***Quality:*** Electricity outage time (SAIFI; SAIDI)	Provide assistance to PPA in the implementation of power utilities benchmarking exercise in the next two years, until fully sustainable.	SPC as the new lead coordinating agency for energy is developing and maintaining a regional energy database as a central repository of energy data. Therefore, it is important to align the PIPIs work with SPC.
ICT	***Quality:*** Reported telephone faults		Fill data gaps progressively through ongoing studies and programs. Could be achieved by extending the World Bank/PRIF-funded projects including: ▪ the existing *Tonga/Fiji Connectivity Project* and *Pacific Regional Connectivity Project Preparatory Support* ▪ the existing *Telecoms Policy and Regulations Assistance* activities in Kiribati, Solomon Islands ▪ Potential upcoming projects include the *Telecoms Policy and ICT Development TA's* in FSM, RMI and Palau

Water and Sanitation	***Access:*** Gendered difference in water/sanitation access and rural disaggregation ***Quality***: Water quality and pressure in water supply systems	Provide assistance to PWWA in the implementation of water utilities benchmarking exercise in the next 2 years, until fully sustainable.	Fill data gaps progressively through ongoing studies and programs. Projects for rural water and sanitation to include PIPIs. Work with SOPAC. Could be achieved by extending existing and upcoming programs such as the: ▪ ADB-led *South Tarawa Sanitation Improvement Project* and *Tonga Integrated Urban Development Sector Project* ▪ NZMFAT's *Kiribati Urban Development Project* ▪ EC-led *Samoa Water and Sanitation Sector Policy Budget Support Project* ▪ The ADB's potential *Pacific Water Utilities Twinning Program* and the *Sanitation in the Pacific Study* ▪ AusAID directed *Solomon Islands Access to Clean Water Supply and Sanitation Initiative.*
Solid Waste Management	***Access***: Solid waste disposal ***Efficiency***: Cost recovery	Disposal of solid waste on outer islands that is environmentally friendly and within bounds of reasonable costs.	Fill data gaps progressively through ongoing studies and programs. SPREP maintains a database on solid waste management in the Pacific region. Work with SPREP

The data gaps in transport are most apparent and most important to address. Currently, 35% of partner investment is directed into the transport sector but there is little data on which evaluation of this investment can be based. There is a particular need to improve information and performance standards for the outcomes of transport, that is, access to markets, employment, services and facilities.

1b Sustainability

To achieve sustainability and wider relevance to PICs, the PIPIs need to be aligned with the mandate and capacity of the SPC. The potential for alignment is set out in Table 3.1b.

In terms of institutionalising and achieving sustainability through SPC, the key challenges to the sustainability of the PIPIs are the availability of data (i.e. supply) and the relevance of the PIPIs to stakeholders (i.e. demand). PIPIs can play a role as an evidence base for justifying investment and monitoring infrastructure activities.

With the adoption of PIPIs as a potential basis of best practice in infrastructure activities, there will be growing demand for this form of analysis produced by the SPC. It is also clear that stakeholders who rely on PIPIs for improved decision-making have an interest and incentive for ensuring data collection. This incentive addresses the challenge of data collection and ensures its sustainability.

Table 3.1b Aligning PIPIs with the SPC

Subsector	Approach 1: Customised Study	Approach 2: Institutionalising PIPIs
All subsectors	Data gaps that are flagged in the raw data tables (Appendix D) should be populated as soon as new data becomes available Data collection points should be firmly established in cooperation with relevant sector associations and respective statistics offices	The SPC is mandated by heads of PIC governments to develop a system (the National Minimum Indicators Database) to annually collect agreed minimum dataset across wide-ranging economic and social indicators against an agreed set of social and economic indicators. It does not include all the infrastructure subsectors but will include the Energy, ICT, Maritime and Water (although not as a separate water sector) subsectors. It is aimed at aligning with MDG targets using Hybrid methodology. This initiative is funded by the World Bank. The SPC will receive a funding line from AusAID over 5 years to strengthen its capacity across the region. This will include working on a Statistics Implementation plan that meets minimum data criteria (i.e. data can be centralized in SPC's repository, definitions to meet international standard). As a result, SPC will upgrade the Pacific Regional Information System (PRISM) with the additional capacity and resource to undertake this.

2 Improving the Monitoring and Reporting of PRIF

The main components of an improved monitoring and evaluation framework for PRIF are:

- Building a database of the specific impacts, in the form of outputs and outcomes, of PRIF activities (e.g. kms of road developed, numbers of people benefiting from activities etc.) as part of the development of simplified activity descriptions and the PRIF pipeline database.
- Progressive updating of PIPIs.
- Ongoing updating of outputs and outcomes of PRIF donor activities.
- Periodic review of PRIF performance (i.e. every three years) including analysis of PIPIs and other performance data and feedback from stakeholders allowing for the alignment of PIPIs and PRIF donor activities with the objectives of PRIF is also central to the monitoring and evaluation process.
- Encouraging cooperation between sector specialists of PRIF donor parties and the PRIF Management Unit to create a dialogue for continuous exchange and updating of data.

Endnotes

[i] "PIC" for this paper refers to the PRIF eligible Pacific countries: Cook Islands, Federated States of Micronesia, Kiribati, Republic of Marshall Islands, Nauru, Niue, Palau, Samoa, Solomon Islands, Tonga, Tuvalu & Vanuatu.
[2] Productive capacity is difficult to accurately define and measure. It can refer to total 'nameplate' installed capacity, or to a lower capacity after a generator has been de-rated. De-rating is common and can be temporary or permanent. For purposes of this report, figures for de-rated or actual capacity have been used where available.
[3] Unfortunately, there is lack of consistent up-to-date data. However, data provides a more or less accurate snapshot of PIC access to electricity.
[4] International Energy Agency (IEA). 2009. *World Energy Outlook*. IEA: Paris. See also www.worldenergyoutloook.org/electricity.asp
[5] United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP). 2008. *Energy Security and Sustainable Development in Asia & the Pacific*. Bangkok: Environment and Development Division (EDD).
[6] Based on ocular inspections made by consultant. David Hill. 2010. *Infrastructure Estimates and Comparison*. An internal report submitted to PRIF/PIAC as input to Solomon Island Stocktake report.
Palau's economy was built around cheap electricity and used far more per capita than it would have if subsidies had been eliminated at independence. Even in recent years, the tariff has been considerably lower than the cost of production.
[8] EarthTrends. 2005. "Electricity consumption per capita," *Energy and Resources.* http://earthtrends.wri.org/text/energy-resources/variable-547.html. Statistics based on IEA data.
[9] Household tariffs based on monthly use of 100kWh. Commercial tariffs based on monthly use of 500kWh.
[10] For customers using 100 kWh/m
[11] Asian Development Bank (ADB). 2010. *Pacific Economic Monitor.* July, p. 19.
[12] Tuvalu is based on tariff information provided by utility but this appears to be far too high and data is being verified.
[13] The countries used various commodity classifications such as Standard International Trade Classification (SITC), Broad Economic Categories (BEC) 1, and Harmonized Commodity Description and Coding System (HS) 2. Due to unavailability of more disaggregated data, resulting fuel imports share could be understated or overstated as it includes other mineral and lubricant products that are not fuel.
[14] United Nations Development Programme (UNDP). 2004. *World Energy Assessment Overview: 2004 Update,* p. 31
Although report is dated 2004, the TOE per capita averages used were for 2001.
[15] *Fixed telephone line* refers to telephone lines connecting a subscriber's terminal equipment to the public switched telephone network (PSTN) and which have a dedicated port on a telephone exchange. This indicator is calculated by dividing the number of fixed telephone lines by the total population and then multiplying by 100. See: International Telecommunication Union (ITU). 2010. *Partnership on Measuring ICT for Development: Core ICT Indicators 2010*, p. 12.
[16] *Mobile cellular telephone subscriptions* refer to subscriptions of portable telephones to a public mobile telephone service using cellular technology, which provides access to PSTN. This includes analogue and digital cellular systems, post-paid and prepaid subscriptions. This indicator is calculated by dividing the number of mobile cellular telephone subscriptions by the total population and then multiplying by 100. See: International Telecommunication Union (ITU). 2010. *Partnership on Measuring ICT for Development: Core ICT Indicators 2010*, p. 12.
[17] *Fixed internet subscribers* refer to the total number of internet subscribers with fixed access, which includes dial-up and total fixed broadband subscribers: cable modem, DSL Internet subscribers, other fixed broadband and leased line Internet subscribers. This indicator is calculated by dividing the number of fixed internet subscribers by the total population and then multiplying by 100. See: International Telecommunication Union (ITU). 2010. *Partnership on Measuring ICT for Development: Core ICT Indicators 2010*, p. 12.
[18] *Mobile broadband subscriptions* are subscriptions to mobile cellular networks with access to data communications at broadband speeds (high speed defined as greater or equal to 256 kbit/s in one or both directions), services typically referred to as 3G or 3.5G. This indicator is calculated by dividing the number of mobile broadband subscriptions by the total population and then multiplying by 100. See: International Telecommunication Union (ITU). 2010. *Partnership on Measuring ICT for Development: Core ICT Indicators 2010*, p. 13.
[19] This indicator may be over-estimating true level of teledensity in cases where the same person has both a fixed line and mobile phone subscription. Moreover, majority of fixed line users in the Pacific are businesses or commercial users rather than individuals.
[20] Median is a better measure of average performance as it eliminates the influence of PICs that have very high or very low figures that either pull up or push down the average, respectively.
[21] Note that the PICs listed does not include Tuvalu due to lack of available data. It also does not include the bigger countries, PNG and Fiji which would likely present a higher median when included.
[22] Pacific Islands Forum Secretariat (PIFS). 2010. *Review of Pacific Regional Strategy by Network Strategies*. Network Strategies Report No. 29029, pp. 47-51. Data based on tariffs published on operators' websites. In each instance, GDP per capita divided by 12 was used as a proxy for average monthly income.
[23] Given data limitations, some countries are excluded from analysis.
[24] PIFS, *Review of Pacific Regional Strategy by Network Strategies*, 47-51. For lack of Pacific specific usage data, cost for fixed services was calculated based on OECD fixed baskets of usage where high levelusage comprises of 114 calls, 16 national calls and 62 calls to mobiles per month. See: Organisation for Economic Co-operation (OECD). 2006. *Revised OECD Telecommunications Price Comparison Methodolgy.* Working Party on Communication Infrastructures and Services Policy. http://www.olis.oecd.org/olis/2006doc.nsf
[25] ADB, *Pacific Economic Monitor*, p. 23.
[26] *International internet bandwidth* refers to the capacity that backbone operators provide to carry internet traffic, measured as the sum of capacity of all internet exchanges offering international bandwidth. This indicator is measured by the total capacity of international internet bandwidth in bits per internet user.
[27] Secretariat of the Pacific Regional Environmental Program (SPREP). 2006. *Pacific Region Solid Waste Management Strategy*. Apia, Samoa, p. 12.
[28] Observations made by PIAC staff through consultations with RMI ministers and authorities.
[29] Infrastructure for aviation services includes runways, taxiways, aprons etcetera for aircraft movements; navigation and safety equipment including control towers; terminal facilities for passengers and freight movement; and other associated facilities such as fuel storage, vehicle access and parking.

[30] Asian Development Bank (ADB). 2007. *Oceanic Voyages: Aviation in the Pacific*. Philippines: Pacific Studies Series. World Bank (WB). 2006. *Pacific Infrastructure Challenge: A Review of Obstacles and Opportunities for Improving Performance in the Pacific Islands*. Report No. 36031: Working Paper.
[31] This data focuses on the number of operational airports, and does not include other privately used or seldom operated air strips.
[32] Consultation with Christopher Bennett. 2011. Senior Transport Specialist – WB Sustainable Development Department.
[33] Consultation with Christopher Bennett. 2011. Senior Transport Specialist – WB Sustainable Development Department.
[34] WB, *Pacific Infrastructure Challenge.* ADB, *Oceanic Voyages*.
[35] Kiribati receives flights from New Zealand into Tarawa and from New Zealand and Hawaii into Christmas Island.
[36] It is important to note that this data is based on a snapshot from March 2011 and that a ongoing collection of data would provide a more accurate representation.
[37] Some observations made by sector specialists have suggested inconsistencies in the number of inbound flights reported. For example, domestic flights in Tonga and Kiribati which are not noted by the Innovata flight schedules are reportedly quite numerous (approximately 15+ flights per week for Tonga and 10 + flights for Kiribati). As there is no readily accessible source of consistent data for Aviation in the Pacific, there are various sources recording different data. To maintain consistency, the scheduled services data supplied by Innovata has been used in this report.
[38] Search of Skyscanner.com conducted on Wednesday 11 May 2011. Prices are based the highest and lowest one-way economy rate available online through the SkyScanner website.
[39] Other useful indicators could include an assessment of ground handling services and turn-around times.
[40] WB, *Pacific Infrastructure Challenge*, p. 143. Also evidenced with observations made by consultants.
[41] WB, *Pacific Infrastructure Challenge.* Asian Development Bank (ADB). 2007. *Pacific Regional Transport Analysis*. Project No. 36661.
[42] WB, *Pacific Infrastructure Challenge.* Also evidenced with observations from consultants including John Austin of PIAC.
[43] ADB, *Oceanic Voyages.*
[44] Data sourced from John Austin of PIAC.
[45] WB, *Pacific Infrastructure Challenge.* ADB, *Oceanic Voyages*.
[46] Another indicator would be 'international marine containers handled' (million TEU) which represents the volume of containers both landed and shipped off (20 feet minimum length).
[47] The TEU, or the Twenty-foot equivalent unit, is a measure of container ship cargo capacity based on the volume of a 20 foot long intermodal container.
[48] Marshall Islands Shipping Corporation. 2010.
[49] *Ports and Terminals Guide 2011-2012.* IHS Fairplay
[50] These figures include visiting vessels; there may be additional traffic in terms of coastal movements, fishing boats, war ships, etc. However comparable and consistent data for these is not readily available.
[51] Marshall Islands Shipping Corporation. 2010.
[52] ADB, *Oceanic Voyages.* AusAID. 2008. *Pacific Economic Survey: Connecting the Region*. Canberra.
[53] This is a reflection of the main operational ports and does not include all anchorages or jetties.
[54] ADB, *Pacific Regional Transport Analysis.* Data based on a single basic terminal charge levied for lifting a loaded twenty foot container on or off the vessel.
[55] AusAID, *Pacific Economic Survey*.
[56] Consultation with Adrian Sammons (AMSTEC Design Pty Ltd.
[57] AusAID, *Pacific Economic Survey*; WB, *Pacific Infrastructure Challenge;* AusAID. 2004. *Pacific Regional Transport Study.*
[58] Data sourced from: ADB, *Oceanic Voyages;* David Jarvis (ed). 2010. *Ports and Terminals Guide 2011-2012.* IHS Fairplay; Mutz and Kans. n.d.*MV Nivaga II and MV Manu Folau Fare and Freight Table: Tuvalu.*
[59] These ownership and governance models are based on the: World Bank Group. 2007. *Port Reform Toolkit*. 2nd edition, Washington: Public-Private Infrastructure Advisory Facility.
[60] WB, *Pacific Infrastructure Challenge,* 135.
[61] ADB, *Oceanic Voyages;* WB, *Pacific Infrastructure Challenge*.
[62] World Bank Group, *Port Reform Toolkit*.
[63] The Joint Monitoring Program (JMP) of WHO/UNICEF is the official UN mechanism to report progress on the provision of improved drinking water and sanitation globally.
[64] Source: *International Benchmarking Network for Water and Sanitation Utilities* (IBNET). 2006-2011. Department for International Development (DFID) and the World Bank (WB).
[65] *There are however sub-sector efforts towards creating a central data repository. Notable is the continuing effort by SPC to establish the energy security indicators for the Pacific and that there is already a repository of energy sector data at SPC. This is still to be made publicly available online and work is on-going to harmonise with SPC's NMID efforts.*