Infrastructure Maintenance in the Pacific
Challenging the Build-Neglect-Rebuild Paradigm

Summary Paper

Pacific Region Infrastructure Facility (PRIF), 2013.

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PRIF is a multi-development partner coordination and technical facility which supports infrastructure development in the Pacific. PRIF Members include: Asian Development Bank (ADB), Australian Department of Foreign Affairs and Trade (DFAT), the European Commission and European Investment Bank (EC/EIB), Japan International Cooperation Agency (JICA), New Zealand Ministry of Foreign Affairs and Trade (NZMFAT), and the World Bank Group.

Pacific Region Infrastructure Facility

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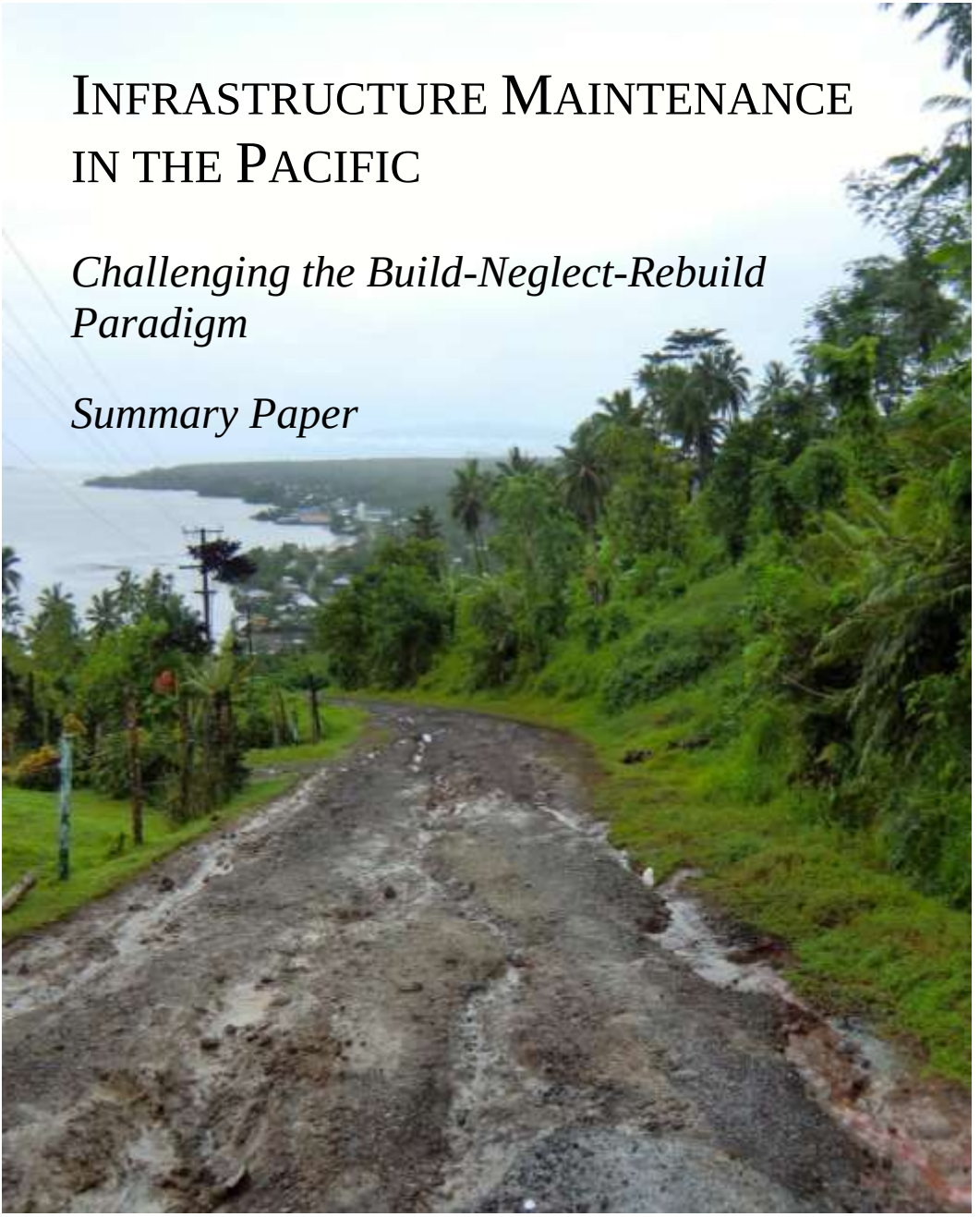

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The full report was prepared by Maria Corazon Alejandrino-Yap (Project Team Leader, PRIF), Matthew Dornan (Individual Consultant, Australian National University) and Kerry McGovern (Individual Consultant, KMcGovern & Associates) with guidance and direction from John Austin (PRIF).

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Copies of the report may be requested from the PRIF Coordination Office – contact details below - or downloaded from the PRIF web site.

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Executive Summary

Inadequate infrastructure maintenance has long been recognised as a challenge. The failure to manage and maintain existing infrastructure assets in Pacific island countries has resulted in a large infrastructure debt – representing the gap between what has and should have been spent on infrastructure. The premature deterioration of infrastructure affects lives. It translates into fewer people having access to health clinics; fewer children going to school; deaths from vehicles colliding when negotiating pot holed roads; and disease resulting from the contamination of water sources because of blocked drains, untreated sewage, and the exposure of hazardous waste.

The lack of preventative maintenance is also costly in a financial sense. It is well known that preventative maintenance provides a better financial return than investment in new infrastructure. This is important given Pacific Region Infrastructure Facility (PRIF) partners alone will be spending an estimated USD1.7 billion investing in core economic infrastructure between 2008-09 and 2016-17.

World Bank estimates of the resources required for infrastructure maintenance range from an average of 2.5 per cent in middle income countries to 3.73 per cent of Gross Domestic Product (GDP) in low income countries. For Pacific island countries, we estimate an average of 3.1 per cent of GDP is required for the maintenance of existing infrastructure, equating to USD634 million per annum. Pacific island countries must also address the backlog of delayed maintenance and budget for the maintenance of planned infrastructure. Data on current maintenance spending are not available, but there is common agreement that maintenance is being avoided within the 'build-neglect-rebuild' paradigm.

Image: © World Bank.

The maintenance of infrastructure depends on the availability of resources, the capability of organisations managing infrastructure, and the incentives of staff. These factors determine whether Pacific island countries, in partnership with development partners, are able to deliver sustainable infrastructure services. There is no silver bullet to ensure all three factors are in place for good asset management. Rather, a range of initiative and reforms are required for the effective delivery of services. Careful planning of delivering service to local areas, urban and rural, and collaboration among service providers is also required if Pacific island countries are to meet the Millennium Development Goals (MDGs).

Financial resources are required for the ongoing management and maintenance of infrastructure assets. These are not always available. Resource constraints in Pacific island countries are especially evident in agencies dependent on allocation from government budgets. The Pacific is one of the most aid-dependent regions in the world, with many Pacific island governments reliant on development assistance for their operations. The resource constraint challenge is especially problematic where new infrastructure does not increase the productive capacity of the economy. There is often an implicit assumption in the design of infrastructure projects that core economic infrastructure will 'pay for itself' by generating economic growth. This assumption can be problematic in Pacific island countries, especially in microstates, which are remote and unable to take advantage of economies of scale.

Resource constraints on asset management can also result from institutional arrangements. A problem prevalent around the world is that governments, despite having adequate resources, fail to allocate necessary funding towards maintenance. Another common challenge is that user fees set by government or regulatory agencies are not high enough to cover service provision costs. The end result is poor service provision, as lack of maintenance leads to the premature deterioration of infrastructure. This can create a vicious circle, as customers are unwilling to pay more for a service that is sub-standard. As a result, agencies find it difficult to increase user fees or refuse to provide services to non-paying customers.

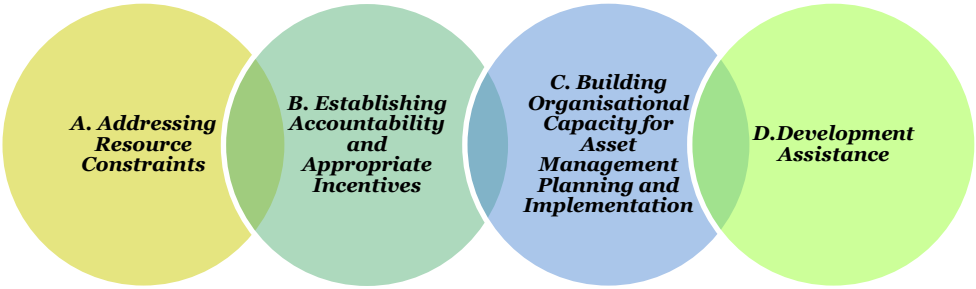
Organisational capability is also necessary for sound asset management and maintenance. Capacity constraints among infrastructure service providers that can result in inadequate maintenance include poor forward planning of maintenance; a limited long-term pool of trained maintenance staff with the technical capacity to maintain new and old infrastructure; and weak internal systems and processes that fail to ensure maintenance staff have the equipment and stores required to regularly maintain all infrastructure. Unclear roles and responsibilities, which lead to lack of accountability, are also problematic.

A common issue in the Pacific relates to the division of responsibilities among national and sub-national governments, and community organisations. Sub-national governments in larger Pacific island countries are responsible for service delivery, but

are provided with insufficient funding by the national government. Much community infrastructure is provided by community organisations that have limited access to a pool of maintenance personnel.

Incentives are interlinked with many of the reasons for poor asset management already discussed. Managers must be motivated and provided with support to undertake asset management activities. Clear roles and responsibilities for which managers are accountable are important for establishing such incentives. Communities must also value infrastructure services for their provision to be a success. A common reason for the failure of service delivery in rural areas is that communities are not involved in the planning for and design of infrastructure services.

There are a number of steps that Pacific island governments, infrastructure service providers, and development partners can take to address the three barriers to sound infrastructure asset management. These are grouped into four categories:



A. ADDRESSING RESOURCE CONSTRAINTS

1 Improve budget preparation through better data on infrastructure assets, and scope and cost of work to be completed. Forward looking budget estimates can help improve planning for maintenance, but must be based on sound inputs from line departments.

2 Revenue sharing between national and sub-national governments could be improved. A first step is to improve the budget submissions of sub-national governments.

3 Consider earmarking government revenue for the management of assets in certain infrastructure sectors, subject to stringent conditions.

4 Ensure that user fees are adequate to cover routine maintenance as well as the operation of the infrastructure and its replacement, when combined with formal government subsidies.

5 Governments should assume financial responsibility for provision of basic services to some households where affordability is a problem.

B. ESTABLISHING ACCOUNTABILITY AND APPROPRIATE INCENTIVES

1 Asset managers should be required to set targets for performance of infrastructure, including the level of service required.
2 Moving service provision from government departments to an independent body has the potential to improve asset management, although economies of scale in smaller island states also need to be considered. Experience in the Pacific suggests that independence from political direction leads to better infrastructure services. Arms-length contractual arrangements underpinned by good corporate governance are necessary.
3 State-owned enterprises (SOEs) need to be provided with clear objectives to deliver infrastructure services to a pre-determined level of service. The performance of SOEs should be monitored against key performance indicators.
4 The roles and responsibilities for infrastructure service provision of different organisations, and of sub-national and national level governments, must be clearly specified in legislation.

C. BUILDING ORGANISATIONAL CAPACITY FOR ASSET MANAGEMENT PLANNING AND IMPLEMENTATION

1 Infrastructure service providers need to estimate the maintenance requirements of infrastructure assets in future years. These figures can be used for budget submissions and in determining tariffs.
2 An asset register is an essential first step in improving asset management, and can help to generate 'capital-consciousness'.
3 Infrastructure service providers can benefit from the use of an asset management system, which includes detailed inventories of the condition and function of all infrastructure assets and their components.
4 The appropriateness of asset management systems is context specific. Smaller operations may benefit most from simple systems using commonly available software solutions (e.g. Open Office or Microsoft Excel).
5 Infrastructure service providers should adopt a risk-based approach to asset management, prioritising maintenance by assessing the impact of potential service failure.
6 An organisation should have in place appropriate technical and financial skills for good asset management, with clearly defined roles and responsibilities.
7 Outsourcing of asset management activities, including maintenance, should be considered where this can decrease costs, improve service, or address capacity constraints within an organisation.

D. DEVELOPMENT ASSISTANCE

1 Development partners need to consider sustainability in the design of all infrastructure projects. This should include analysis of the asset management liabilities associated with new infrastructure.
2 Development partners should direct more resources towards rehabilitation and maintenance of existing infrastructure rather than new projects, given that on average, this is a more efficient use of scarce resources.
3 The use of long-term maintenance contracts by development partners can ensure good asset management for a period of time, and can assist in the development of private sector contracting capabilities.
4 There needs to be a greater focus on construction arrangements and standards.
5 Development partners can provide useful technical assistance in a number of areas, including regulatory arrangements, public financial management, public-private partnerships, and asset management at the level of the organisation.
6 The use of earmarked funding can be appropriate in some circumstances.
7 Development partners should continue to reform their assistance in line with commitments made under the Paris Declaration, Cairns Compact, and similar agreements. This should lead to better donor coordination, as well as the alignment of assistance with government objectives and systems. Direct budget support arrangements can be extended to include funding for maintenance.

1 THE CHALLENGE

The problem of inadequate maintenance is essentially one of poor asset management.

Inadequate maintenance of infrastructure has long been recognised as a challenge (World Bank 1994:5-15). Failure to maintain physical infrastructure has led to its premature deterioration around the world in what is sometimes termed the 'build-neglect-rebuild' (BNR) cycle (Mohanty 2005), given that deteriorated infrastructure assets are commonly rebuilt. The problem of inadequate maintenance is essentially one of poor asset management (World Bank 1994:6). Limited attention is given to the management of infrastructure assets, resulting in insufficient resourcing and planning for ongoing maintenance requirements.

Pacific island countries in the 1960s and 1970s had a proud emphasis on infrastructure, including new: water treatment plants, sewage systems, roads, airfields and ports.

Asset management is also a challenge in the Pacific. Pacific island countries in the 1960s and 1970s had a proud emphasis on infrastructure, including new water treatment plants, sewage systems, roads, airfields,

and ports. However, funding for the ongoing maintenance of infrastructure has suffered as a result of efforts to maintain a sound fiscal footing and due to competing expenditure priorities. Pacific island governments have generally prioritised new infrastructure projects over the ongoing management of existing infrastructure.

The failure to manage and maintain existing infrastructure assets has resulted in a large infrastructure debt – representing the gap between what has and should have been spent on infrastructure. The premature deterioration of infrastructure affects lives. It translates into fewer people having access to health clinics; fewer children going to school; deaths from vehicles colliding when negotiating pot holed roads; and disease resulting from the contamination of water sources because of blocked drains, untreated sewage, and the exposure of hazardous waste. In rapidly expanding urban centres of the Pacific, lack of maintenance prevents the expansion of infrastructure services and is leading large numbers of people to live without access to basic infrastructure services, often in informal settlements.

The lack of preventative maintenance is also costly in a financial sense. It is well known that preventative maintenance provides a better financial return than investment in new infrastructure. De Sitter's Law of Fives estimates that in the case of concrete structures, "every dollar of routine maintenance that is deferred will end up costing $5 in repairs, or ultimately, $25 in rehabilitation or replacement as the asset declines overtime"(De Sitter 1984).

The accumulation of an infrastructure debt results in significant expense in the future, with rehabilitation being a costly exercise when compared to routine maintenance. Poor asset management in one sector also affects other infrastructure sectors. Poor road conditions hamper rural electrification and water and sanitation initiatives in many Pacific island countries. The value of preventative maintenance is demonstrated using a number of case studies in this report.

One feature of the Pacific that has sometimes augmented the problem of inadequate maintenance is the funding of core economic infrastructure by development partners. Provision of funding for new capital expenditure can distort decision-making, with infrastructure capital treated as if it were a 'free' good. This alters asset management practices and reduces incentives to consider the impact and management of infrastructure over its asset life-cycle. The future liabilities created by donor-funded infrastructure can also be a problem. The implicit assumption is often that economic infrastructure will lead to economic development, thereby generating income to pay for ongoing infrastructure maintenance. However, in many cases this is not true, with infrastructure often constructed for social objectives or for motivations of 'national prestige'.

The problem of poor infrastructure asset management is therefore important for many reasons. Infrastructure facilitates access to services that are essential for livelihoods and economic activity. The premature deterioration of infrastructure affects these

services, placing lives at risk. The lack of maintenance also has a financial impact. The premature deterioration of infrastructure is costly to Pacific island governments and other infrastructure service providers over the long-term.

The infrastructure asset management challenge in the Pacific has never been more important than today. There is a considerable pipeline of infrastructure investment forecast for the region which will require ongoing management. It is estimated that assistance from PRIF development partners alone will lead to approximately $1.7 billion of investment in core economic infrastructure between 2008-09 and 2016-17.[1] Additional funding for new infrastructure is likely to come from other donors and from global initiatives to address climate change. Effective asset management is necessary to maximise the economic benefits of new infrastructure investments.

2 INFRASTRUCTURE SERVICES IN THE PACIFIC

The quality of infrastructure service provision is closely linked to infrastructure asset management and maintenance.

The provision and maintenance of economic infrastructure has a mixed and often unsatisfactory record in the Pacific. The poor state of infrastructure services can be partly explained by levels of economic development (World Bank 2006). Low income levels impose constraints on the maintenance activities that can be funded out of government revenue and through direct fees and charges.

Another challenge for Pacific island countries in delivering infrastructure services is the region's geography and size. Pacific island countries (with the exception of Papua New Guinea (PNG)) are among the smallest nations in the world, distant from major markets and vulnerable to natural disasters which frequent the region. Provision of infrastructure services is difficult in these circumstances.

Pacific island countries also face a number of new challenges in infrastructure service provision. Climate change is expected to lead to an increase in the occurrence and severity of natural disasters in the South Pacific, adversely affecting infrastructure (IPCC 2007). The rapid expansion of urban centres is also a challenge, requiring a rapid expansion of infrastructure services. The Asian Development Bank's (ADB) *State of Pacific Towns and Cities* report notes that "under-provision and poor maintenance of physical infrastructure and services" is a significant problem (Asian Development Bank 2012).

[1] PRIF development partners include the ADB, AusAID, EU, EIB, New Zealand Aid Programme and the World Bank. JICA is an observer.

Demography, migration, size, income, and natural disasters all impact the quality of infrastructure services in the Pacific. However, they are not the only determinants. The World Bank's *Pacific Infrastructure Challenge* report points out that:

> "Pacific countries demonstrate worse infrastructure performance than could be expected for their level of GDP ... [with] infrastructure performance worse than in comparator countries (such as the Caribbean islands) with similar levels of income, and which share some 'disadvantages', such as small scale or vulnerability to natural disaster" (World Bank 2006).

There is also great variation in the quality and performance of infrastructure across countries. Electricity provision in Vanuatu is among the most efficient in the region, despite low levels of income. Similarly, shipping services in Fiji are efficient and cost effective despite serving dispersed islands on what are often non-commercial routes (government subsidies are used to attract private operators to routes that would otherwise not be served) (World Bank 2006).

The quality of infrastructure services can therefore not be explained by simple reference to income, geography, population, and vulnerability to climate change and natural disasters. Institutional arrangements are also important. The next section discusses underlying reasons for why maintenance in the Pacific is suboptimal.

3 BARRIERS TO INFRASTRUCTURE MAINTENANCE

The quality of infrastructure service provision is closely linked to infrastructure asset management and maintenance. There is no single explanation for suboptimal asset management. A number of interrelated factors are responsible, as highlighted by the UN Human Settlements Programme (UN-HABITAT):

> "The problem results largely from a lack of awareness of the importance of maintenance and the insensitivity to this issue at the decision-making level; from unclear institutional responsibilities and the resulting lack of accountability; from a lack of trained staff, particularly at the middle-management levels; from a lack of incentives to foster good maintenance; from a lack of planning and rational budgeting; and perhaps most critically, from a lack of financial resources" (UN-HABITAT 1993).

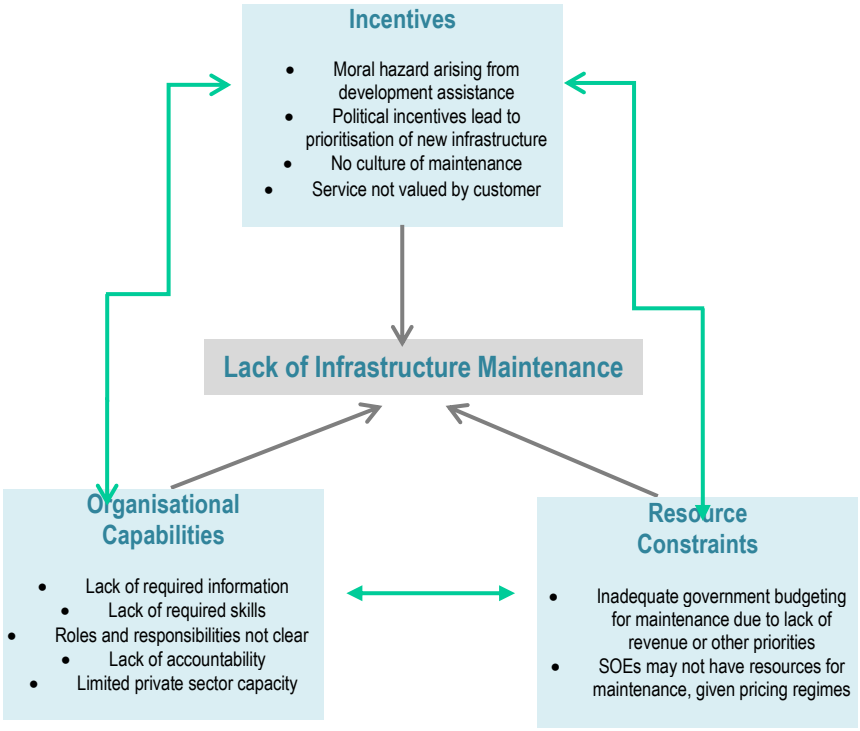
Factors responsible for poor asset management and lack of maintenance that are identified in the literature can be grouped under three headings:

i. **Resource constraints.**
ii. **Organisational constraints**, including lack of reliable information and requisite skills.

iii. **Incentives.**

These factors are illustrated in Figure 3.1, and discussed thereafter.

Figure 3.1: A Framework for Understanding Poor Asset Management



Resource constraints

Resource constraints provide an important explanation for why asset management is often suboptimal in the Pacific. In countries where incomes are low, there may be insufficient financial resources available for maintenance activities. Resource constraints in Pacific island countries are especially evident at the fiscal level. The Pacific is one of the most aid-dependent regions in the world, with many Pacific island governments reliant on development assistance for their operations. Development assistance regularly accounts for over 30 per cent of government expenditure in Kiribati, approximately 50 per cent in Nauru, and 65 per cent in Tuvalu. In 2011, the Government of Tuvalu's recurrent budget alone was equal to 148 per cent of its revenue. The precarious fiscal position of many Pacific island governments highlights the importance of considering liabilities being created by new infrastructure, as done for selected countries in Figure 3.2.

Figure 3.2: Future Liabilities Generated by Planned Infrastructure Investments (AUD million)

	Nauru	Samoa	Tonga	Tuvalu
Capital cost	73.11	246.27	84.62	71.29
Total life-cycle cost	198.97	446.78	140.65	377.87
Estimated annual operation & maintenance costs	6.293	6.864	6.612	7.78
Annual government revenue [1]	18.66	101.47	49.50	19.44
Est. annual operating + maintenance costs as a % of govt revenue (%)	**33.72**	**6.76**	**13.36**	**40.02**

Notes: 1. Nauru 2009/10 (actual budget expenditure, which is 66 per cent of the budget estimates); Samoa 2011/12; Tonga 2011/12; Tuvalu 2011. Life-cycle costs are taken from the National Infrastructure Investment Plans of each country.

The resource constraint challenge is especially problematic where new infrastructure does not increase the productive capacity of the economy. There has often been an implicit assumption in the design of infrastructure projects, among both donors and partner governments, that core economic infrastructure will 'pay for itself' by generating economic growth. Such an assumption is problematic in Pacific island countries, especially in smaller states, which are remote and unable to take advantage of economies of scale. These economies are at a distinct disadvantage in global markets, meaning that options for economic growth may be limited (Bertram and Watters 1985; Winters and Martins 2004; Gibson and Nero 2006; World Bank 2011).

The assumption that infrastructure will 'pay for itself' is especially problematic where new infrastructure does not generate economic benefits. The aquatic centre in Samoa is one such example. The Olympic-standard aquatic centre, one of only three in the southern hemisphere, was constructed with donor funding in preparation for the Pacific games. It has barely been used for competition since, has produced little economic benefit, and is now a liability on government finances.

Resource constraints to good asset management can also result from institutional arrangements. A common problem around the world is that governments, despite having adequate resources, fail to allocate necessary funding towards maintenance. This is closely linked to the incentive problems described below. Another challenge that is prevalent around the world is that user fees set by government or regulatory agencies are not high enough to cover service provision costs. The end result of such factors is poor service provision, as lack of maintenance leads to the premature deterioration of infrastructure. This can create a vicious circle, as customers are unwilling to pay more for a service that is sub-standard. Increasing user fees or refusing to provide services to non-paying customers can be politically difficult as a result.

Organisational capabilities

A second set of reasons for poor asset management relate to the capabilities of organisations. Capability constraints at the level of the organisation are numerous and varied. Constraints can include poor forward planning; limited technical capacity and human resources; weak internal systems and processes, including procurement and financial systems; lack of accountability; and unclear roles and responsibilities related to infrastructure assets.

The absence of internal controls is especially problematic. Internal controls are essential to the effective operation of an organisation, forming a framework within which staff members work. Internal controls are activities and procedures that give reasonable assurance to each manager that 'things are going to plan'. In their absence, managers have little assurance that the goals and objectives of an organisation will be achieved. Properly designed and functioning controls reduce the likelihood of significant errors or fraudulent activities remaining undetected.

Asset management planning – a common weakness in the Pacific – is affected by a lack of internal controls, and by human resource constraints. It should be remembered that civil services in the Pacific are relatively young; the life span of many Pacific island countries as independent states is shorter than the life span of much of their infrastructure. Poor asset management planning can mean that ongoing maintenance of infrastructure is conducted on an *ad hoc* basis, and is reactive rather than preventative. Lack of capacity can affect both the public and private sectors.

In context of the budget process, lack of forward planning results in inadequate consideration of recurrent funding needs for infrastructure asset management. It also means that government departments fail to make a strong case to central ministries for budget allocations.

Unclear roles and responsibilities is also a factor that affects the management of infrastructure assets. In many countries, there is a lack of accountability for service provision for certain asset types. This is a challenge in the case of the national road network in PNG, where maintenance activities are managed by various departments or statutory authorities, sometimes leading to conflict about relevant responsibilities.

Funding available to sub-national governments for the maintenance of infrastructure is also often insufficient. This is a problem in many countries in the region, including PNG, Fiji, and the Solomon Islands. In the context of rapid urbanisation, the ADB notes that: "local governments … responsible for road maintenance within their jurisdictions … often have lesser technical and financial resources for carrying out road maintenance than central government" (Asian Development Bank 2012).

Incentives

Incentives are interlinked with many of the reasons for poor asset management already discussed. Managers require incentives for undertaking asset management activities. Clear roles and responsibilities for which managers are accountable are important for establishing such incentives. Similarly, internal controls and monitoring of employee performance are important for developing appropriate incentives among staff.

Communities must value infrastructure services for their provision to be a success. Communities should be involved in initial planning of infrastructure, as this will generate community support for infrastructure services, and where appropriate, may also assist in the maintenance of infrastructure. A common reason for the failure of service delivery in rural areas is that communities are not involved in the planning and design of infrastructure services.

At the country level, it is well established that development assistance has the potential to create perverse incentives and moral hazard. Economists such as the Nobel prize laureate Elinor Ostrom have argued that donor funding of new infrastructure reduces the incentive of recipient countries to adequately maintain that infrastructure (Ostrom *et al.*, 1993; Ostrom *et al.*, 2001; Gibson *et al.*, 2005). In a narrow financial sense, it can be rational to underfund maintenance where recipient countries bear the full cost of maintenance, but only part of the cost of new infrastructure (although such decision-making ignores the broader economic costs associated with lack of maintenance).

Political incentives also influence government provision of infrastructure and management of assets. There is often a mismatch between short-term political incentives, and asset management and maintenance activities that focus on the long run sustainability and performance of infrastructure. Reducing ongoing maintenance funding enables governments to allocate resources to other more politically rewarding areas, such as investments in new infrastructure (Ostrom *et al.*, 1993; Ostrom *et al.*, 2001; Gibson *et al.*, 2005).

Case Study

THE FIJI ELECTRICITY AUTHORITY

Monasavu Dam, Fiji.
Photo courtesy of Matthew Dornan.

The Fiji Electricity Authority has a record of good asset management, which includes complete record keeping, assets being assigned to managers who are held accountable for their condition, annual reporting and regular audit, contestable budgets for maintenance, and adequate funding being made available for maintenance activities.

The Fiji Electricity Authority (FEA) is widely regarded as one of the best performing power utilities in the Pacific. Good performance is based on sound asset management practices, with routine maintenance prioritised by the FEA's management. Routine and periodic maintenance of generation, network, and other assets is planned and budgeted for through the internal annual budget cycle. Each asset is the responsibility of a section within the FEA. Sections prepare an annual work plan for operation and maintenance of assets under their responsibility.

This work plan is submitted to management, along with relevant costings, as part of the annual budget. Work plans are vetted through a number of processes:

- Work plans are first questioned by business unit managers, who are responsible for ensuring that maintenance plans and costings within their unit are sound.
- The work plans of each business unit are then debated in 'challenge sessions' involving management from each of the business units.
- After this, work plans are considered by the Audit and Finance sub-committee of the FEA Board.
- Final work plans and budgets are approved by the Chief Financial Officer, Chief Executive Officer, and the full FEA Board.

Maintenance work plans are developed using an asset management system. FEA assets are recorded in an asset register, which includes details on asset cost, performance, and maintenance history. This enables sections within the FEA to identify when maintenance of each asset is due, based on the age, operation history, and performance of the asset. The asset register is integrated with the financial management system used by the FEA.

Good asset management requires adequate financial resources. The level at which the electricity tariff is set is therefore an important determinant of whether the FEA is able to finance the necessary maintenance of its asset base. Since 2002, electricity tariffs in Fiji have been set by an independent regulator, the Commerce Commission, in a process that requires submissions from the FEA and other stakeholders. FEA submissions to the Commerce Commission include expected expenditure on capital investment, operations, and maintenance for the year ahead. Tariffs have doubled since 2004 under

this regulatory arrangement, in recognition of investment requirements, renewable energy targets, and higher fuel costs. Higher electricity tariffs have facilitated improved asset management, placing the FEA in a financial position to undertake more maintenance activities.

Lessons

The experience of the FEA demonstrates that good asset management is associated with good performance. Asset management at the FEA is sound for three reasons:

i. Adequate financial resources are available as a result of independent price regulation, and are dedicated towards maintenance;

ii. The FEA has the requisite skills and systems in place to manage assets effectively; and

iii. Incentives are in place among both management and staff for asset management. This is the result of both internal and external accountability. Internally, maintenance planning is scrutinised by a number of groups through the internal budget cycle, ensuring that expenditures which are planned are necessary. Externally, the FEA's management is accountable through tariff submissions to the independent price regulator and submission of the corporate plan to its shareholder, the Government of Fiji.

4 ASSET MANAGEMENT FOR BETTER INFRASTRUCTURE

Improving asset management in the Pacific involves a step-based approach whereby the basics of asset management are established before more sophisticated elements are put in place.

Asset management "is a process of guiding the acquisition, use and disposal of assets, to make the most of their service delivery potential and manage the related risks and costs over the full life of the assets" (Leong 2004). Good asset management requires organisations to consider the 'whole-life-cycle' of infrastructure in asset management planning and activities. This means that decisions relating to investment, maintenance, upgrading, and operation of assets should be made with consideration for their benefits and costs over the whole-life of an infrastructure asset.

The importance of taking a whole-life-cycle approach to infrastructure asset management can be illustrated with reference to typical costs at each stage of the life-cycle. Life-cycle costs can be much higher than initial construction/supply costs when operation, maintenance, and disposal of infrastructure are considered.

Asset management is a "process of guiding the acquisition, use and disposal of assets, to make the most of their service delivery potential and manage the related risks and costs over the full life of the assets" (Leong 2004)

Maintenance costs alone are often equal to, or higher than, the initial cost of infrastructure, as illustrated in Figures 4.1 and 4.2. If the useful life of an infrastructure asset is assumed to be 20 years (as in Figure 4.1), this implies that annual spending on maintenance should be approximately two to eight per cent of the non-depreciated value of the asset.

As reliable data is collected, each sector and Pacific island country will develop their own standard costs. The World Bank has developed rough estimates of maintenance needs for different infrastructure sectors: two per cent of the replacement cost of the capital stock for electricity generation, rail and road; three per cent for water and sanitation; and eight per cent for mobile and mainline telecommunications. For buildings, five per cent is used.

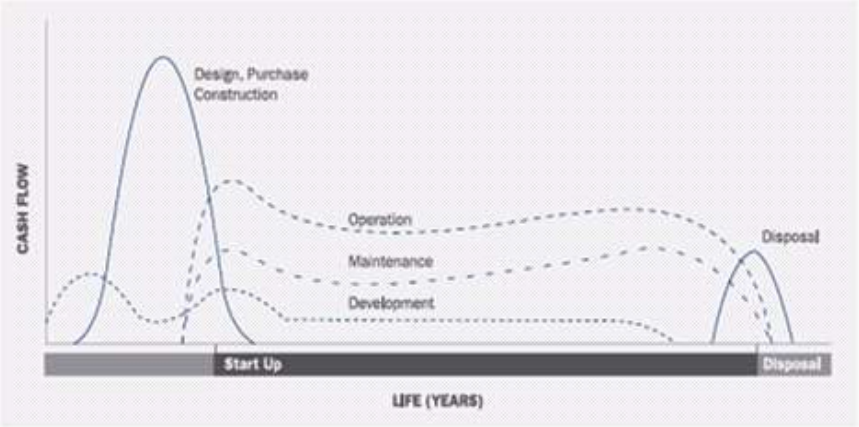
These numbers represent the minimum annual average expenditure on maintenance required to maintain the network's functionality. They do not include maintenance required to rehabilitate infrastructure where routine maintenance has led to its deterioration (Fay and Yepes 2003:10).

Figure 4.1: Indicative Life-cycle Costs of an Infrastructure Asset per $100 of Investment

Stage	Rate (%)	Construct/ Supply only ($)	+ Other Up-front ($)	20 year Maintenance[5] ($)
Concept & planning	2-5		2-5	
Detailed design specification	5-10		5-10	
Construction/ supply		100	100	
Contingency/ escalation	10		10	
Contract supervision	2-5		2-5	
Operating [1]	variable			
Maintenance – Routine [2]	0-5			0-100
Maintenance – Periodic [3]	5-10			10-20
Disposal & decommissioning [4]	variable			
TOTAL		**100**	**120-130**	**10-120**

Source: National infrastructure Investment Plans, various.
Notes: 1. Varies from zero (e.g. for buried pipes) to 20 per cent p.a. for mobile plant and equipment.
2. Varies from close to zero (e.g. for buried pipes) to five per cent p.a. for routine maintenance of assets such as gravel roads.
3. Based on 20 year asset life with periodic maintenance every seven years.
4. Varies from close to zero to 100 per cent (e.g. clean-up of toxic chemical sites)
5. Varies based on the infrastructure in question and across sectors.

Figure 4.2: Infrastructure Asset Life-cycle



Source: Australian National Audit Office 2001:7.

5 THE VALUE OF PREVENTATIVE MAINTENANCE

An important element of asset management is maintenance, which involves activities designed to prolong the useful life of an asset. Maintenance is primarily about service provision: organisations maintain their asset base in order to ensure that they can continue to provide a service or good. The maintenance of infrastructure assets is a central concern of this study, given that poor maintenance has adversely affected infrastructure performance and sustainability in the Pacific. There are various types of maintenance.

- **Routine maintenance** – comprises small-scale work conducted on a regular basis, which is designed to minimise wear-and-tear and maintain assets in a useful condition. The frequency of routine maintenance varies for different asset types. For a road, routine maintenance could occur every few months and involve activities such as vegetation clearing, pothole repair, and cleaning of silted ditches. For a diesel generator, routine maintenance includes oiling of the machine and other basic work, and would be implemented whenever necessary.
- **Periodic maintenance** – involves more substantive work designed to ensure the continuing operation of an asset. Periodic maintenance tends to occur on a large-scale, and often involves technical expertise and specialised equipment. An example of periodic maintenance is the resealing of roads, which might occur once every five or ten years.
- **Urgent maintenance** – or repair work, which is undertaken in response to asset failures. Expenditure on urgent repairs tends to rise where routine and periodic maintenance is lacking.
- **Rehabilitation** – is generally not considered maintenance, and is formally reported as capital spending by accounting convention. Rehabilitation or refurbishment is nevertheless important in prolonging the useful life of assets. It occurs infrequently (say every 20 years) and normally involves major work on an asset. Like urgent maintenance or repairs, rehabilitation tends to occur more frequently when routine or periodic maintenance is inadequate. Rehabilitation is often considered an alternative to investment in a new (replacement) asset.
- **Adaptation/development** – infrastructure is progressively adapted to meet the changing needs of users and to take advantage of technological change so that services stay relevant.

Routine and periodic maintenance are often grouped together under the labels **'preventative' or 'planned' maintenance**. The terms recognise that these maintenance activities prevent additional and more costly repairs or rehabilitation in the future.

MEASURING THE BENEFITS OF PREVENTATIVE MAINTENANCE

The benefits of maintaining infrastructure are well documented. Consider the following cases:

- De Sitter's Law of Fives establishes the general rule that for physical concrete

structures, every dollar of routine maintenance that is deferred results in a cost of $5 in repairs, or $25 in rehabilitation or replacement (De Sitter 1984).

- A study of Longfellow Bridge in Boston found that the total cost of maintaining the bridge in a useable condition would have been $80.8 million lower had an annual maintenance program equivalent to one per cent of the capital cost of the bridge been put in place (Westerly and Poftak 2007).

- The South African National Road Agency Ltd. (SANRAL) estimates that the cost of repairing roads increases to six times the cost of preventative maintenance after three years of neglect, and to 18 times after five years of neglect (Burningham and Stankevich 2005).

Preventative maintenance is equally important in Pacific island countries. Although economic analysis of the benefits of preventative maintenance in the Pacific is limited, several case studies demonstrate the impacts of poor maintenance:

- In Kiribati, a lack of routine maintenance for power generators has increased the frequency of power outages, reducing revenue for the utility, and has led to increased maintenance and repair costs in subsequent years (see the Annex to the full report).

- Delayed maintenance of infrastructure by the Government of Nauru caused an unexpected blow-out in repair costs, which jumped from $187,000 to $2.6 million (or 8.7 per cent of domestic budget expenditure) in 2009-10.

- Our Airline in 2010 had to operate its plane at 50 per cent of load capacity as a result of the inability to store aviation fuel in Nauru, causing a loss of $50,000 every week. The situation arose due to a leak in the main fuel storage tank, caused by lack of routine maintenance.

It is important to distinguish between the financial and economic costs/benefits of routine maintenance. Financial cost-benefit analysis considers the monetary impact of maintenance on the organisation responsible for an asset. Economic cost-benefit analysis is broader, and considers the impact of asset maintenance on society as a whole.

The true value of maintenance from a societal perspective – the point of view of both governments and development partners – should be measured using broad-based economic cost-benefit analysis, with consideration of non-monetary externalities such as impacts on health, education, and the environment. The multi-faceted impact of infrastructure makes undertaking these assessments difficult. Financial cost-benefit analysis or least-cost analysis is more common as a result (see Box 1).

Box 1: Preventative Road Maintenance in Papua New Guinea

Analysis of maintenance of the national road network in Papua New Guinea (PNG) demonstrates the financial benefits of preventative maintenance. The economic impact of preventative road maintenance versus the build-neglect-rebuild approach was compared using parameters on maintenance costs and frequency adopted in the PNG Department of Works and Implementation's Road Asset Management System. In one hypothetical scenario, a one kilometre section of sealed national road is maintained as recommended by the Department of Works and Implementation (i.e. routine maintenance once a year, resealing every 10 years, and more significant maintenance once every 20 years).

In the second scenario, the one kilometre section of sealed road receives no preventative maintenance, where the life expectancy of such a road is seven years and subject to rehabilitation. The results in Figure 5.1 clearly show that preventative maintenance is the more cost-effective strategy for the government. The total life-cycle cost of the road over a 25 year period (the life-expectancy of a road that is maintained well) is significantly lower when it receives preventative maintenance.

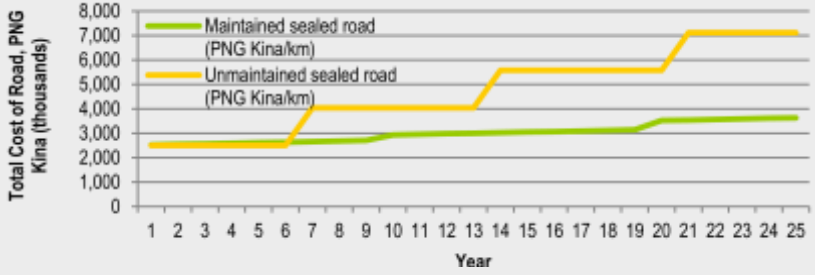
Figure 5.1: Life Cycle Costs of a Sealed Road in PNG (PNG Kina/km): A Least-Cost Analysis

	Assumptions	Maintained road (K)	Unmaintained road (K)
Capital cost		2,500,000	2,500,000
Routine maintenance	22,500K/km each year	562,500	0
Reseal	210,000K/km every 10 years	420,000	0
Program maintenance	150,000K/km every 20 years	150,000	0
Reconstruction/ rehabilitation	1,537,500K/km every 7 years where there is no maintenance	0	4,612,500
TOTAL life-cycle cost		**3,632,500**	**7,112,500**
TOTAL life-cycle cost excluding capital cost		**1,132,500**	**4,612,500**

Notes: Figures are based on assumptions used in the Road Asset Management System model by the PNG Department of Works and Implementation. The expected life of a well maintained sealed road is 25 years. The expected life of an unmaintained sealed road is seven years.

When capital costs are excluded, the cost to government of maintaining the road in a useable condition is K1,132,500 under a preventative maintenance strategy, but K4,612,500 (or over four times as much) under the build-neglect-rebuild scenario. The incremental life-cycle cost of maintaining the section of sealed national road in Figure 5.2 shows that while the strategy involving no preventative maintenance delivers initial savings, these are very small when compared to the eventual impact of this deferral of maintenance on life-cycle cost.

Figure 5.2: Costs of Maintaining a Sealed Section of National Road in PNG in Service



6 IMPROVING ASSET MANAGEMENT IN THE PACIFIC

Asset management is context-specific. Asset management frameworks and systems in place in other countries are often not appropriate for Pacific island countries. The Schick Principles of 'getting the basics right' provide a useful framework for improving asset management practices in the Pacific (World Bank 1998:8; Corrigan *et al.,* 2012). The Schick Principles highlight the importance of the relationship between internal control and organisational performance (see Chapter 2 in the full report). However they also recognise that organisations need to focus first on establishing fundamental controls over assets and expenditure, before progressing to the more complicated task of performance-based monitoring. A recent ADB Technical Assistance program outlined five sequential workstreams for organisations (Corrigan *et al.*, 2012). These are summarised in Figure 6.1 below.

Figure 6.1: Five Workstreams for Improving Asset Management (an application of the Schick Principles)

1. Determine the current state of the asset portfolio of the entity	▪ Identification of all assets under the control of the entity ▪ Identification of locations of all assets ▪ Identification of condition of all assets ▪ Identification of remaining useful life of all assets ▪ Identification of replacement cost and value of all assets
2. Recognise the required standards of service of the entity	▪ Identification of the level of service required by: o Customers o Regulators ▪ Identification of entity status in relation to service levels ▪ Identify capability of asset portfolio
3. Identify the assets that are key to sustainable organisational performance	▪ Identification of how assets can and do fail ▪ Assessment of probabilities and consequences of asset failure (risk management) ▪ Assessment of repairs costs ▪ Identification and analysis of historical and current key asset failures
4. Develop minimum life-cycle costs	▪ Identification of alternative management strategies for key assets ▪ Identification of the costs of rehabilitation, maintenance / or repair of key assets
5. Develop a long-term funding framework	▪ Identification of funding to maintain assets for the required level of service ▪ Identification of charging rates for sustainable system performance

Source: Adapted from *Corrigan et al.* 2012.

An **asset register**, which is an inventory of all assets owned and/or managed by an organisation, is a necessary starting point. At its most basic, an asset register can take the form of a simple excel spreadsheet that classifies and identifies assets, their purchase price, the person responsible for the performance of that asset, as well as the person responsible for maintenance. Organisations with an asset register can more easily manage individual assets and assets as a group. An asset register is an important element in making management aware of the state of infrastructure assets and likely replacement requirements. Once asset management practices are more developed, an asset register can be fully integrated into an asset management system.

A **simple asset management system** enables an organisation to 'know' its assets; including how much they cost, who is responsible for maintaining them, their condition and functionality, and when they require rehabilitation. A simple asset management system focuses on each asset, independent of the system in which they function. A **complex asset management system** is one in which a simple system is expanded to include photographs and plans of all assets, their component parts, their maintenance schedules and details of all activities on the asset since it was designed. It documents the system/s in which the infrastructure delivers it services. A complex asset management system includes an estimate of the life-cycle costs of an asset, the actual depreciation each year, amortisation details, and possible adaption/development to better align the current components to the changing needs of users and their clients. It identifies the related infrastructure systems that affect its ability to deliver the services required, the contact people, and details of collaborative maintenance.

The establishment of asset management systems and supporting processes and structures should depend on fundamental controls over assets and expenditure being in place first. A more sophisticated **asset management system**, which an organisation can use for ongoing management of its asset base, can only be established after an effective stocktake. The appropriate design of an asset management system will depend on the size and technical ability, purpose, and asset base of each organisation. Asset management systems are data-intensive and can require a dedicated staff with skill in using the software application. An organisation needs to have the technical capacity to select and use appropriate systems if it is to improve asset management.

For a small organisation, the upfront costs of establishing complex asset management systems and ensuring that employees learn how to use them can be high. These costs may outweigh the benefits of a complex asset management system. The benefits of an asset management system may also not be as significant as for larger organisations. This may be due to a smaller asset base, and the fact that managers in small organisations are likely to be in a good position to track asset performance and condition without the need for a sophisticated system. The efficiency gains in introducing a sophisticated information management system in a small organisation are therefore likely to be lower. These factors suggest that **for smaller organisations, simpler and less costly asset management systems are likely to be more appropriate.**

Sound accounting and financial management practices are also crucial for good asset management. A good knowledge of the costs incurred, including depreciation, and the future costs of maintenance and replacement enable staff to estimate the full cost of meeting future demand for services. These estimated costs inform plans for infrastructure investments, maintenance, and can help managers schedule the replacement and/or adaptation of infrastructure. For government, the calculation of costs and the accountability for fees, charges, and grant revenue promotes 'capital-consciousness' among policy makers and civil servants.

Good financial management practices rely on capable staff, incorporating regular stocktakes, financial and management accounting, and internal budgeting processes supported by strong internal controls. A basic capacity to control expenditure is essential for the effective operation of any organisation. Good internal budgeting ensures that sections of an organisation responsible for asset management receive the necessary funding for their activities.

7 THE ROLE OF GOVERNMENT IN ASSET MANAGEMENT

Governments play an important role in delivering infrastructure services in the Pacific. Governments provide infrastructure services directly through departments and indirectly through statutory authorities, SOEs, grants to community groups, and contracts with private sector entities. Governments also regulate the provision of infrastructure services.

The role of government in delivering infrastructure services is nevertheless broader than direct service provision and regulation. It encompasses a range of other activities essential for ensuring that organisations deliver infrastructure services which meet community expectations.

> *Installing infrastructure without responding to user preferences or the capacity of users to pay for acquisition, operation, and maintenance operations, are unlikely to be successful (Heller 2009).*

Governments must provide a legislative environment conducive to providing infrastructure services, ensure an adequate skill base, and put standards in place. Governments can help to improve asset management by ensuring that these functions are performed in an effective and consistent manner. Planning is crucial for this to occur.

The United Nations Human Settlements Programme (UN-HABITAT) report on *The Maintenance of Infrastructure and its Financing and Cost Recovery* (1993) provides a

useful summary of the role of national government in improving infrastructure maintenance. These roles are discussed briefly below with reference to Pacific island countries.

Clear legislative and policy framework

A clear legislative and policy framework is necessary for the provision of infrastructure services. In many countries the roles and responsibilities of different organisations and national/sub-national governments are unclear. The situation has adverse impacts on asset management. In the Pacific, cooperative performance audit reports of water and waste management sectors in 2012 found that there were often multiple stakeholders without clear roles and responsibilities. The reports argued that clarification of the legislative and policy framework was an essential first step in improving service provision and achieving the MDGs.

Strengthening institutions

Sound institutional frameworks at the organisational level are also necessary for asset management activities. The UN-HABITAT report argues for "effective coordination between design, construction, operation, use and maintenance of infrastructure". National governments have a role to play in promoting increased financial and managerial autonomy among providers of infrastructure services. Governments can ensure that funding arrangements are sound and that managers are held to account for service delivery.

There is also potential for national governments to improve infrastructure services by providing technical assistance to local level authorities. National governments can assist local governments in the development of asset registers, condition and capacity assessments, valuing assets and assessing depreciation, setting maintenance standards, scheduling, and multi-year planning and budgeting. This is very important in the Pacific given limited institutional and technical capacities among local level governments.

A local skills base in place for good asset management

A range of technical skills are required for asset management activities. The emigration of skilled personnel is a constant challenge in many Pacific island countries. Infrastructure service providers in small countries are often reliant on foreign labour as a result. Small Pacific island countries are different to larger developing countries; foreign labour is likely to be a permanent feature of service provision. However, there are measures that can be implemented in order to increase the local skills base. One approach to technical training in the region that has received considerable interest is the Australia-Pacific Technical College (APTC). The APTC has been training tradespeople in the Pacific for five years. There is considerable scope to use the APTC to develop the

skills necessary for infrastructure maintenance in Pacific island countries.[2] Similar initiatives at the country level should also be considered.

Clear procedures for planning and management of maintenance of infrastructure at the local and national levels

National and local governments must work together to improve infrastructure planning. Local service provision in the Pacific commonly takes place with no overarching plan and is not linked to national development plans. There are few urban plans for cities and towns in the Pacific. Where such plans exist, they often prepared without knowledge of their costs and hence are yet to drive development. Better integration of local and national level planning can improve infrastructure development and coordination across sectors. Coordination can also benefit asset management. For example, when equipment is transferred to Funafuti, Tuvalu for the rehabilitation of local roads, it makes sense to use that equipment for maintenance of the runway (Government of Tuvalu 2012).

Mobilise community participation through local authorities, NGOs and organisations

Planning of infrastructure service delivery can benefit from greater community participation, which can be facilitated by local governments, non-government organisations (NGOs), and community organisations (World Bank 1994:76). A good example of community participation in planning is the Cook Islands Preventive Infrastructure Master Plan (Government of Cook Islands 2007). The Master Plan was prepared in consultation with local communities and enables the national government and development partners to prioritise infrastructure service delivery based on community expectations and needs.

Maintenance at the local level can also be an effective strategy, although some caveats apply. Experience in the Pacific would suggest that local service delivery is effective only where adequate funding and institutional support is provided to local authorities/groups. Effective alliances among government, private, and civil society organisations can result in effective infrastructure service provision. This highlights the importance of national government support for local level authorities and community groups with limited asset management capacities.

Minimise design, equipment, and materials problems

[2] The APTC is a promising initiative. A 2012 survey of employers of APTC graduates found an 80 percent overall satisfaction rating with the outcomes of APTC training. However there is scope for improvement. The trade certificates available through the APTC are still limited. Furthermore, the initial objective of the APTC of facilitating temporary migration to Australia has not been achieved – largely due to disconnects between Australian aid and migration policy.

Existing design standards and practices in the Pacific are not always appropriate for local geological and weather conditions. Infrastructure design should be influenced by the availability of maintenance services. Importing materials is costly and can result in delays to infrastructure maintenance. National governments can help address such problems by providing incentives for improving the quality of locally manufactured materials and equipment (where feasible, and noting that local production is likely to be very restricted in smaller states). Standardisation of equipment can also reduce the cost of infrastructure delivery – as demonstrated in the case of the Kiribati Public Utilities Board (refer to case study 7 in the full report). Standardisation will often require government coordination among infrastructure service providers, in addition to negotiation with development partners.

Another issue of importance is ensuring that parts will be available for any new equipment or infrastructure components, and that manuals are provided in an appropriate language to enable repairs and maintenance to be carried out as intended. There is already some experience in the region of equipment being purchased from other countries (e.g. Japan, Brazil) with manuals written in languages the staff members are unfamiliar with, and without an established system for obtaining parts. It is important that, at the time of purchase, there is knowledge of the timelines and cost for supply of parts, and identification of the components that need to be kept in stock.

Minimise the problems of limited funds

Funding represents a significant barrier to asset management activities in the Pacific. In the Pacific, lack of funding has two primary causes:

i. Inadequate funding being allocated for maintenance through the budget process; and
ii. Failure to recover costs through user charges.

National governments can address the budgeting issue by improving public financial management systems, strengthening cost accounting skills, and ensuring that budget submissions from line departments are rigorous. Governments should also ensure that price regulation is sound so that user charges reflect service delivery costs (excluding any formal government subsidy).

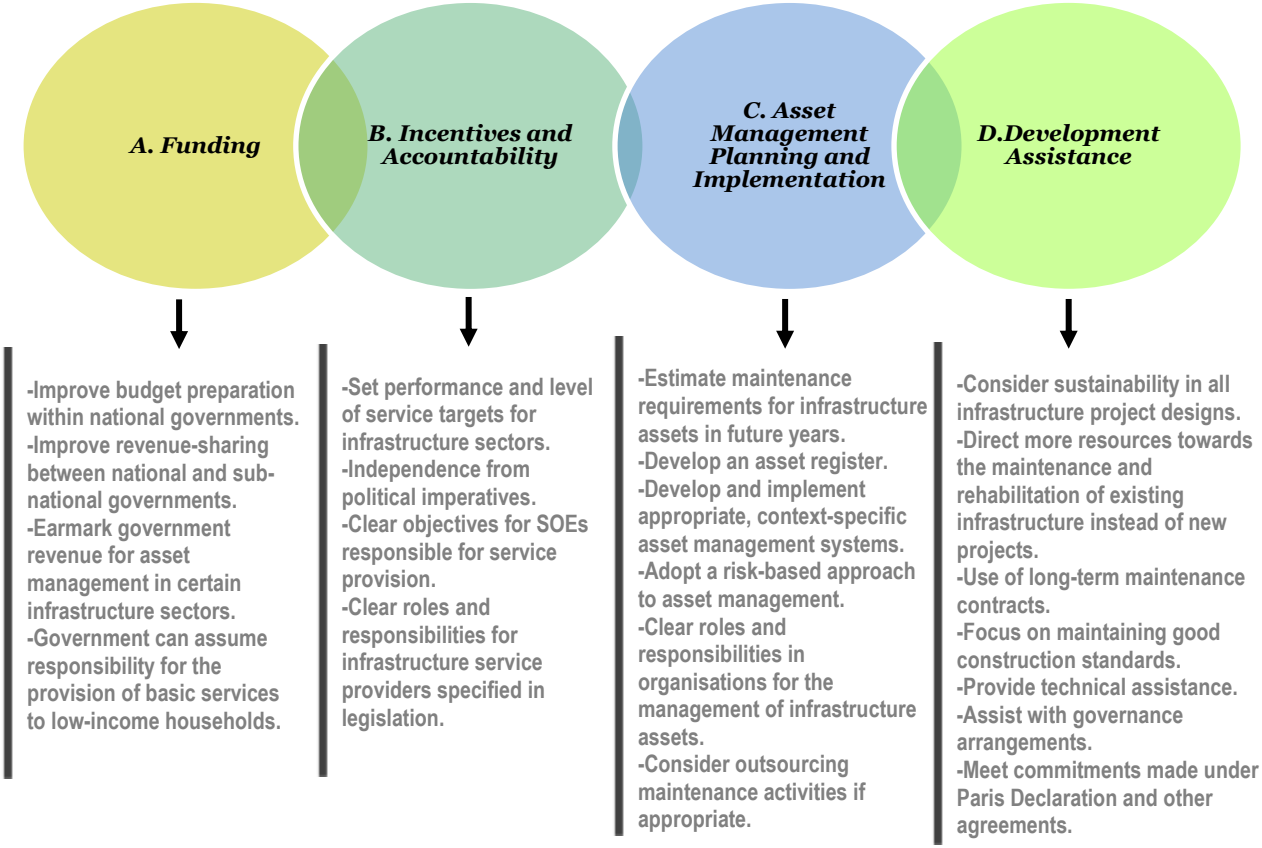
8 RECOMMENDATIONS

Asset management and maintenance continue to be a challenge in the Pacific. This report details how lack of routine maintenance leads to the premature deterioration of infrastructure assets, with adverse consequences for Pacific islanders. Improving asset management is a complex and multifaceted task. Asset management involves any activity that ensures an infrastructure asset provides the service for which it was constructed. Routine maintenance of infrastructure is especially important, and must be adequately funded, planned, and implemented in order to be effective.

A summary of recommendations for improving asset management in the Pacific is provided in Figure 8.1. The recommendations address the three sets of barriers to asset management: resource constraints, organisational capability, and incentives.

The recommendations have been written with Pacific ministries of finance as the primary audience, although many of the recommendations will also be useful for political leaders and managers of infrastructure service providers. Development assistance can also play a useful part in addressing these constraints.

Figure 8.1: Summary of Recommendations



A. FUNDING TO ADDRESS RESOURCE CONSTRAINTS

Financial resources dedicated towards asset management activities are often insufficient in the Pacific. Addressing this requires a number of reforms.

1. Budget preparation within national governments needs to improve.

- Budgeting for maintenance should be informed by good data on infrastructure assets, including information on the condition of infrastructure, and the scope and cost of work to be completed. This requires greater communication between sector managers and budget decision-makers.

- Budget preparation can become more forward looking through the adoption of a medium-term budget framework under which multi-year maintenance plans are developed. However, forward planning is only effective where inputs from line departments are sound. Medium-term budgeting needs to be introduced over time and should only be considered where basic year-by-year budgeting is reasonably effective.

- The introduction of accrual accounting, which incorporates the value of depreciated capital into the budget process, can increase 'capital-consciousness' among civil servants and political leaders. However, accrual accounting is only appropriate in certain countries; it should not be attempted where cash-based accounting is not well developed or where the appropriate skill sets are unavailable within the accounting profession.

2. Local Government often shares responsibility with national government entities (departments and SOEs) for the delivery of waste management and transport infrastructure (in some cases this is also the case for water and power).

The statutory responsibilities of local government to deliver infrastructure services are generally not matched by access to revenue. Revenue sharing between national and sub-national governments needs improvement. A first step involves a focus on sub-national government budget submissions to national government.

3. Earmarking government revenue towards asset management in certain infrastructure sectors can be an effective mechanism for ensuring adequate funding of ongoing maintenance.

Revenue for the fund should ideally be sourced from beneficiaries of that infrastructure, such as the use of vehicle registration fees to fund road maintenance. A number of other conditions also need to be met for an earmarked fund to be effective. First, adequate legislation that specifies for what and how

the funds will be used should be in place. Second, the fund should be managed by an independent board and have appropriate governance arrangements in place. Third, the fund should not contradict broader fiscal policy. Fourth, staff in oversight agencies should have adequate capacity to administer funds.

4. **SOEs need adequate financial resources for asset management activities.** Regulatory authorities should ensure that prices for infrastructure services recognise costs, including the cost of asset management and ongoing maintenance activities, even when price subsidies are then applied.

   - Experience suggests that an effective, independent authority responsible for price regulation can help. A multi-sector regulatory body has proven effective in several Pacific island countries.

   - Regional provision of regulatory services may have the potential to address the high costs of national regulation in small Pacific island countries.

5. **Governments should assume financial responsibility for the provision of basic services to some households where affordability is a problem**.

   This can be done by reimbursing SOEs and private sector entities for the provision of community service obligations (CSOs) that are not commercially profitable. Some indirect cost recovery may be possible, for example through the taxation system. Governments can also open service provision to the market through competitive tender.

B. ESTABLISHING ACCOUNTABILITY AND APPROPRIATE INCENTIVES

Incentives must be in place for the delivery of infrastructure services. It is important that managers are held responsible for meeting performance standards where they have the authority and resources to deliver services to the required standard. Ongoing evaluation of performance is needed for this to occur.

1. **Asset managers should be required to set performance and level of service targets for the infrastructure they are responsible for.**

   Ministries of finance have the role of ensuring management in line departments are accountable for meeting these targets. They can also influence the management of assets by other bodies.

2. **Experience in the Pacific suggests that independence from political direction leads to better infrastructure service provision.**

Infrastructure in many sectors, with the notable exception of roads, is best provided by an organisation that is required to generate a return on the asset (in some cases government subsidisation is also appropriate, in which case this should be done in a formal and transparent manner). Moving service provision from government departments to an independent body has the potential to improve asset management, although economies of scale in smaller island states also need to be considered.

3. **SOEs should be provided with clear objectives to deliver infrastructure services at a pre-determined standard.**

   The performance of SOEs should be monitored against key performance indicators. Ministries of finance can ensure the timely and reliable (audited) production of accrual-based financial statements by SOEs. Management and SOEs should be held accountable for performance.[3]

4. **The roles and responsibilities for infrastructure service provision of different organisations, and of sub-national and national level governments, must be clearly specified in legislation.**

C. BUILDING ORGANISATIONAL CAPACITY FOR ASSET MANAGEMENT PLANNING AND IMPLEMENTATION

There are a range of initiatives that can be undertaken at the organisational level to improve asset management planning and implementation.

1. **Infrastructure service providers should estimate the maintenance requirements of infrastructure assets in future years.**

   For the year ahead, this involves bringing together the results of condition assessments, defining quality and quantity standards, and estimating the cost of maintenance tasks, including labour, materials and equipment, transport, management and administration costs.

   - Infrastructure management departments should use these estimates in budget submissions (the same budgeting software can be used across government departments to minimise cost and improve efficiency).

   - SOEs, statutory authorities, private sector organisations, and not-for-profit entities can use these estimates in the tariff determination process.

[3] In some countries other government bodies may be involved in monitoring of SOEs. These might include ministries of public enterprises or independent holding companies/trusts.

2. **An asset register helps to generate 'capital-consciousness' and is an essential first step in improving asset management.**

   An asset register should be used for accrual accounting by SOEs and private sector organisations. Government departments should also develop asset registers. Information from the asset registers of government departments and SOEs can be fed into a centralised asset register that is managed by the ministry of finance in order to inform infrastructure and budget planning at the national level.

3. **Infrastructure service providers can benefit from the use of an asset management system, which includes detailed inventories of the condition of all infrastructure assets and their components.**

   An asset management system goes beyond asset registers used for financial accounting, containing information on individual infrastructure assets and their condition, performance, maintenance requirements, and annual maintenance program (including materials and resources required to deliver maintenance, and monthly job sheets and reports). Geographic Information Systems (GIS) can form one component of an asset management system.

4. **The appropriateness of asset management systems is context specific.** Smaller operations may benefit most from simple systems using commonly available software solutions (e.g. Open Office or Microsoft Excel).

5. **Infrastructure service providers should adopt a risk-based approach to asset management.** This can identify priorities by assessing the impact of potential service failure and the nature of other risks associated with delivering services.

6. **It is important that roles and responsibilities are clear within an organisation for the management of each infrastructure asset.** An organisation should have appropriate technical and financial skills in place for good asset management.

7. **Outsourcing of asset management activities, including maintenance, should be considered where this can decrease costs, improve service, or address capacity constraints within an organisation.**

   Public-private partnerships for infrastructure service provision are one option that is available. Outsourcing is most beneficial where procurement systems are sound and where outsourced work is subject to ongoing monitoring and evaluation by a capable contracting agent.

D. DEVELOPMENT ASSISTANCE

Development assistance funds a considerable portion of infrastructure in the region. The activities of development partners are therefore also important (and are discussed in more detail in the full report).

1. **Development partners need to consider sustainability in the design of all infrastructure projects,** which should include analysis of the asset management liabilities associated with new infrastructure. This analysis should ideally by conducted by an independent body that does not have an incentive to underestimate the recurrent funding requirements of infrastructure.

2. **It is recommended that development partners direct more resources towards the rehabilitation and maintenance of existing infrastructure rather than new projects, given that on average, this is a more efficient use of scarce resources.**

3. **The use of long-term maintenance contracts by development partners can ensure good asset management for a period of time, and can assist in the development of private sector contracting capabilities.**

4. **There needs to be greater focus on construction arrangements and standards.**

   - A number of partnership arrangements are available in order to ensure good performance from contractors responsible for construction. One involves use of a defects liability period, where the contractor is held responsible for any defects that arise within a defined period. A second involves paying the contractor to maintain the asset for a defined period after construction (potentially through a build-operate-transfer arrangement). A third involves the imposition of performance bonds.

   - Construction standards determined by development partners should also take into consideration the level of service that is required and the institutional context for asset management. In environments where maintenance is likely to be inadequate, it may be appropriate to adopt a 'second best' option involving 'better than normal' construction standards. There may be scope to meet additional costs associated with 'better than normal' construction from climate change financing, or selection of low-maintenance infrastructure options.

   - Standardisation of infrastructure assets can assist infrastructure service providers to plan and undertake maintenance.

5. Development partners can provide useful technical assistance in a number of areas, including:

- Regulatory reform of SOEs, especially around tariff regulation and CSOs.
- Improvement of public financial management systems, including budget preparation and procurement processes.
- Public-private partnerships.
- Asset management at the level of the organisation.

6. The use of earmarked funding can be appropriate in some circumstances (Recommendation A.3).

Development partners can assist with the development of governance arrangements for earmarked funding, and should in certain circumstances consider providing financial support to trust funds.

7. Development partners should continue to reform their assistance in line with commitments made under the Paris Declaration and subsequent agreements.

This should lead to better donor coordination, as is occurring through the PRIF, as well as the alignment of assistance with government objectives and systems. The general budget support monitoring framework can be extended to include the maintenance of infrastructure in Pacific island countries.