Economics of Resource and Environmental Project Management in the Pacific

Padma Narsey Lal and Paula Holland

December 2010

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PREFACE

It is generally acknowledged that managers of environmental or natural resource management projects need to have not only good communication and management skills and a good technical knowledge of the resources they are managing, but also a good appreciation of economic concepts to increase the likelihood of success. While such project managers often have good communication and managerial skills and scientific knowledge, their knowledge of economics and how it can contribute to the success of resource and environmental projects is often limited at best.

To address the gaps in economic expertise in resource and environmental projects in the Pacific, the Secretariat of the Pacific Regional Environment Programme (SPREP), under its Global Environment Facility (GEF) funded International Waters Project, initiated in 2002 a training course on basic environmental economics. The development and the design of the course was largely funded by the United Nations Division of Ocean Affairs and the Law of Sea and the United Nations Development Programme.

Development and delivery of course material occurred under the leadership and guidance of Dr Padma Narsey Lal, then Director of the Graduate Studies Program in Environment Management and Development, at the Australian National University (ANU), in collaboration with Ms Paula Holland, then Resource Economist with the International Waters Programme, SPREP. It also involved the support of the University of the South Pacific, as the designated South Pacific Curriculum Development Unit of the United Nations as well as the UN TRAINMAR Resource Centre in Malaysia.

This book draws heavily on the notes prepared for the course and targets non-economists. The book is primarily aimed at providing assistance to project managers in the Pacific to increase the success of projects.

Key economic concepts, principles and topics covered in this book reflect issues that project managers are likely to encounter during the life cycle of a project. The book is designed to provide a practical and operational approach to considering economics for resource and environmental management, and to guide individuals involved in designing and implementing resource and environment projects in the Pacific. Although the book is written with project managers in the Pacific in mind, and uses case study examples from the Pacific islands, the economic concepts and principles covered in this book are also likely to be relevant to project managers around the developing world.

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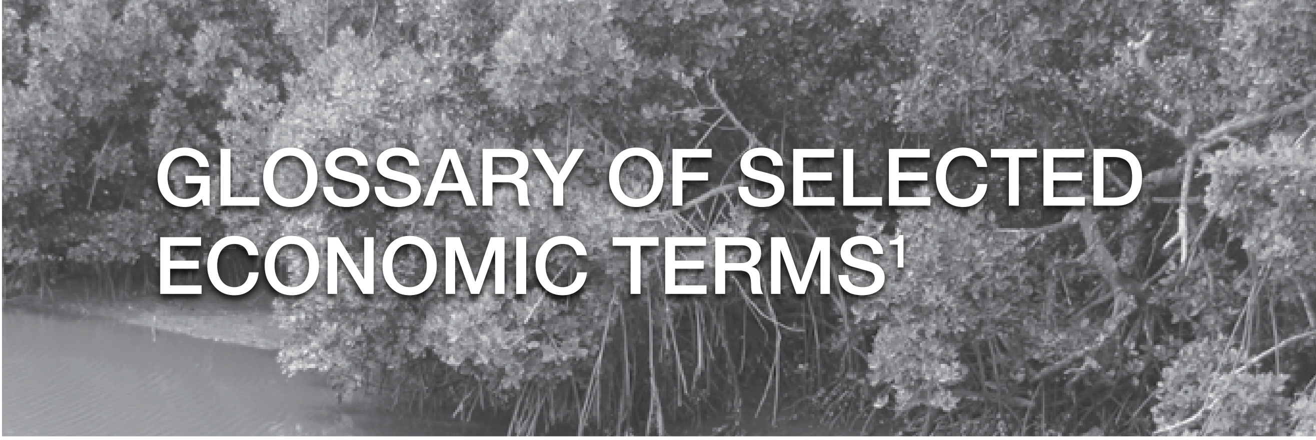


GLOSSARY OF SELECTED ECONOMIC TERMS[1]

Beneficiary pays principle	people who benefit from conservation goods or services should compensate the resource owners/ custodians for the cost of maintaining or providing those goods or services.
Benefit-cost ratio	ratio of the benefits of a project or proposal, expressed in monetary terms, relative to its costs, also expressed in monetary terms. It attempts to summarise the overall value for money of a project or proposal.
Breakeven analysis	calculation of the sales volume required to just cover costs, below which production would be unprofitable.
Club good	good or service that is neither purely private nor public but that is non rival and excludable such that only a small group of people may be able to use the resource.
Command and control management	regulations and restrictions that governments/communities use to correct environmental damage.
Common property resource	a resource which is not controlled by a single agent or source and which is rival but non excludable.
Communal resources	resources that are collectively owned and used by a group.
Contingent valuation	a survey-based technique used to elicit people's preferences for non-market resources.
Consumer surplus	the difference between the total amount consumers would be willing to pay to consume the quantity of goods transacted on the market and the amount they actually have to pay for those goods.
Cost–benefit analysis[2]	method to determine the value to society of economic change. It is particularly useful to value the advantage or disadvantage to society from projects or interventions.
Cost-effectiveness analysis	a method to identify the most efficient method (cheapest) option to achieve a programme or policy goal or outcome.
Demand	the demand for and ability to acquire a particular good or service. The demand curve illustrates the relationship between price of a good or service and the quantity demanded of the good or service.
Depreciation	the reduction in the value of a capital equipment as a result of its use or over time.
Diminishing returns	law stating that, with each increase in the input, there is a smaller increase in output.
Discount rate (or factor)	rate that is used to bring a series of future cash flows to their present value to reflect the lower weight placed by people on income earned in the future as compared to what can be earned today. Use of a discount rate removes the time value of money from future cash flows.
Discounting	the process of removing the time value of money from future cash flows.
Diseconomies of scale	forces that cause larger firms to produce goods and services at increased per-unit costs, beyond a certain production level. In effect, long-run average total cost increase as the output of a firm increases (also called decreasing returns to scale).
Economies of scale	forces which enable larger firms to produce goods and services at reduced per-unit costs. In effect, long-run average total cost decrease as the output of a firm increases (also called increasing returns to scale).
Efficiency	the allocation of resources in such a way as to maximise benefits net of costs.
Excludability	the ability to exclude certain people (such as those who have not paid for ii) from enjoying the benefits of a resource.
Externalities	costs or benefits of an activity that impact society and which are not reflected in the market prices of the goods or services used to generate it.
Fixed costs	costs that do not vary with the level of output produced.
Gross margin	gross income less variable costs.

[1] See Markandaya et. al (2002).

[2] Cost-benefit analysis (CBA) and benefit-cost analysis (BCA) are alternative terms of the same definition.

Hedonic pricing	method to estimate the value of a non-market resource by inferring from a related marketed good, usually land. Commonly conducted using regression analysis to value different attributes of a non-market resource.
Institutional failure	a situation in which existing institutions are not adequate to deal with an environmental problem and which generate incentives for, and causes inefficient use of resources.
Impactor pays principle	people (impactors) who use environmental goods or services in a way that is harmful should pay for the environmental costs that they cause.
Joint production	case where the production of one good or service leads to the production of another.
Marginal benefit	the incremental benefit received from a small increase in the consumption of a good or service.
Marginal cost	the incremental cost generated from a small increase in the production of a good or service.
Market equilibrium	the situation where quantity supplied just equals quantity demanded, and the marginal benefit of consuming that good or service equals marginal cost of producing that quantity of good or service.
Market failure	inefficient use of resources arising because the market price of a good or service does not reflect its true value. Such failure arises where the property rights that govern use or access to a good or service are poorly defined.
Moral suasion	the effort to move others to a particular course of action through appeals to moral values and beliefs.
Net benefits, net economic value	total benefits less costs, technically measured as the sum of consumer surplus and producer surplus.
Opportunity cost	the economic cost of a input or resource in its next best use. It is measured as the foregone economic value from using a productive resource (such as labour, capital or land) to produce one good or service instead of something else.
Performance bond	the amount of money that a firm must put as deposit with a governmental agency as insurance against future environmental damage.
Positive time preference	a preference to experience benefits now rather than later.
Present value	value of benefits or costs in the current day.
Principal agent problem	inefficiency in resource use arising when an agent (such as a chief or manager) acts in his or her interest instead of the interest of the principle, such as the community or shareholders.
Profit	total revenues less all costs, including depreciation.
Private good	usually owned by an agent or person and which is both rival and excludable.
Producer surplus	the difference between the amount that a producer receives from the sale of a good and the lowest amount that producer is willing to accept for that good.
Property rights	the bundle of rights, obligations and entitlements that people have over a resource. This includes any rights or obligations over access, use, management, benefits gained or costs in using that resource.
Public good	a resource that is held by state or public and is neither rival nor excludable.
Rent seeking behaviour	legal activities aimed at creating, maintaining or changing the rights and institutions to generate rents or income above normal.
Rights creation	establishment of a property rights regime – particularly enabling trade – to achieve an efficient allocation of resources.
Rivalry	the extent to which enjoyment of a resource by one person diminishes the amount left for others to enjoy.
Sensitivity analysis	systematic investigation of the effects on estimates or outcomes of changes in data or parameter inputs or assumptions; usually undertaken when there is uncertainty about key parameter values.
Social discount rate	rate that is used to bring a series of future cash flows to their present value from a broad community perspective.
Supply	the quantity of a good or service that a firm or individual wishes to sell at a certain price. The supply curve illustrates the relationship between quantity of good supplied and at a given market price.
Time preference	degree to which people prefer to experience benefits now rather than later.
Total economic value	the sum of use and non-use values with due consideration of any trade-offs or mutually exclusive uses or functions of the resource/habitat in question.
Tragedy of the commons	inefficient use of resources arising because of poorly defined property rights, especially because the rival, non-exclusive nature of common property resources creates few incentives for the individual to curb activities to benefit others.
Variable costs	costs that vary with the level of output produced.

GLOSSARY OF SELECTED PACIFIC TERMS

Term	Origin	Meaning
Bilibili	Fiji	Traditional bamboo raft
Dri loli	Fiji	Black fish (Actinopyga miliaris)
Fa’amo/Tuiga	Samoa	Types of coral found in Samoa
Fale	Samoa	Traditional house
Ifilele	Samoa	Valuable timber tree (Afzelia bijuga)
Itokatoka	Fiji	Kinship group based on common ancestral brothers
Kava	Fiji	Mildly narcotic beverage made from the juice of the dried pepper plant Piper methysticum. This is widely used throughout the South Pacific
Waka/Lewena	Fiji	Another term for ‘*kava*’, where the word is derived from the Fijian term for dried root/base stems
Kerekere	Fiji	Financial / Community obligations, especially loaning money - without payback
Mataqali	Fiji	Primary land-owning unit or clan
Nuqa	Fiji	Rabbit fish (perciform fishes in the family Siganidae)
Papaya	Common throughout Pacific	Also called paw paw, fruit of the Carica *papaya* tree
Qoliqoli	Fiji	Area of inshore coastal and inland waters where customary native fishing rights exist
Sucuwalu	Fiji	White teat fish (Microthele fuscogilva)
Tabu	Fiji	Ban, taboo
Taro	Fiji, Samoa	Edible starchy root of the plant genus Colocasia
Vanua, Whenua, Enua, Fenua	Fiji, New Zealand, Cook Islands, Tuvalu	Highest level of society that may hold land title in Fiji. It also refers to the harmonious concept of environmental, social and economic well being that includes essential respect for tradition
Yavusa	Fiji	Tribe

ACRONYMS

CBA	Cost Benefit Analysis
CPEI	Consumption Production Environment Institutions
EPNV	Expected Net Present Value
ESD	Ecologically Sustainable Development
FOB	Free On Board
HACCP	Hazard Analysis And Critical Central Point
ISO	International Standards Organization
ITQ	Individual Transferable Quota
IWP	International Waters Project
LLMA	Locally Managed Marine Area
MAC	Management Advisory Committee
MC	Marginal Cost (s)
MB	Marginal Benefit (s)
NPV	Net Present Value
PV	Present Value
SPBCP	South Pacific Biodiversity Conservation Programme
TC	Total Cost
TEV	Total Economic Value
TFC	Total Fixed Cost
TR	Total Revenue
TVC	Total Variable Cost
UNCLOS	United National Convention Of The Law Of The Sea
WTAC	Willingness To Accept Compensation
WTP	Willingness To Pay

INTRODUCTION

The Pacific region has experienced major social and economic developmental changes in the last century. During this time, Pacific islanders have shifted from a largely subsistence-based economy to an increasingly market-oriented economy. The region has seen increasing access to better technology and increased trade with the outside world, resulting in higher income levels for many and generally improved health and life expectancy prospects. Most of the Pacific Island states have shown improving human development. At the same time, the rapid or unconstrained development in many Pacific island countries has come at a cost. Increased material wealth has often occurred as the result of increased (often unsustainable) production and consumption of goods, as well as increased use of manufactured rather than natural materials. The result has been increasing resource scarcity and pollution problems on a scale never before witnessed in the Pacific.

In response to these issues, Pacific island countries have increasingly targeted ecologically sustainable development (ESD) through regional, national and community-based environment and development projects. While a variety of definitions for ESD abound, ESD is generally understood to 'meet the needs of the present generation without compromising the ability of future generations to meet their own needs' (World Commission on Environment and Development 1987). Essentially, ecologically sustainable development embraces three critical components. By considering 'the needs of the present generation', it explicitly seeks to increase the well being of people – that is, economic development. At the same time, it embraces the ecological integrity or ecological sustainability of systems, as implied by the phrase 'the ability of future generations to meet their own needs'. This phrase also implies the importance of social goal of equity between (and within) generations.

Figuratively, projects that are consistent with ESD can be envisaged as that indicated in the centre area in Figure 1. This area indicates that projects are sustainable from an economic, ecological and equity (social) perspective. In practice, achieving sustainable development as an outcome is often difficult because it may require tradeoffs between the different pillars.

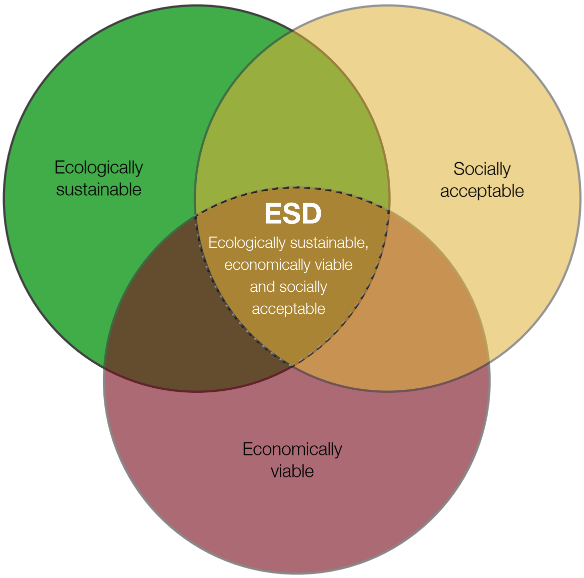


Figure 1. ESD and core principles

Source: Adapted from Diesendorf and Hamilton 1997 and Bromley 1989

This book addresses the economic component of ESD in the Pacific. It is primarily concerned with the role that conventional economic issues plays in the viability of natural resource and environmental projects in the Pacific. As the success of projects also depends on relevant scientific knowledge and appropriateness of an activity, it is assumed in this book that this knowledge and knowhow is already available. The focus of this book is therefore economic considerations only.

Structure of this book

This book follows the structure of the project cycle, with chapters devoted to the economic issues involved at various stages. This approach is taken to ensure that project managers can identify when each economic task should be undertaken and to relate it to previous and subsequent tasks. Before this can be done, however, some fundamental concepts of economics that project managers would need to first understand are presented in Sections I and II.

Accordingly, in **Section I, Chapter 1** briefly summarises key economic factors affecting the success of recent resource and environmental management projects in the Pacific. **Chapter 2** introduces project cycles and the role of project managers, flagging where economics might assist project managers to better identify, select, design and manage resource and environmental projects for success.

Section II takes readers through the nuts of bolts of economics and how economics and markets affect resource use in the Pacific. The chapters in Section II describe key elements of a consumption-production-environment-institutions (CPEI) framework to help project managers consider how interactions between producers, consumers, the environment and institutions affect behaviour. **Chapter 3** introduces basic microeconomic concepts of consumption, marginal benefit and demand, while **Chapter 4** describes the concepts of production, marginal cost and supply. **Chapter 5** discusses markets, values, market mechanisms and outcomes, highlighting the importance of price as a determinant of how people use resources and economic efficiency and markets as a mechanism for managing resource use today. A critical element of the chapter is the concept of economic efficiency that leads to maximisation of economic benefits or economic 'surpluses'. This concept is important when it comes to environmental quality. **Chapter 6** discusses the environment as a source of goods and services, some of which are not traded and exchanged through markets, and the effect this lack of market trade has on the sustainable use and management of the environment. **Chapter 7** introduces the concept of property rights, how both the physical and social attributes of environmental and natural resources determine how they are used and whether this use will be sustainable or not.

Section III discusses the economic causes of resource and environmental problems, including market, government and institutional failures. It also considers the role and relevance of institutional rules and regulations to guide, encourage and/or constrain human behaviour in the use of resources.

Chapter 8 expands the notion of property rights to determine how sustainably people use resources. Readers are provided with some practical tools that can help them identify what elements of property rights are at the root of unsustainable resource use. **Chapter 9** introduces some practical economic concepts that are conventionally overlooked in environmental and natural resource management in the Pacific. These include the concepts of government and institutional failures, including rent seeking and principal agents problems – human traits that can lead to the destruction and inefficient use of resources in the Pacific.

Chapter 10 outlines potential policy (management) instruments that project managers could use to counter the causes of environmental degradation in the Pacific. This chapter considers conventional 'command and control' (regulation) style approaches, economic instruments and information in their various guises. The link between these different tools will also be explored. Towards the end of this chapter, some practical issues in selecting which of the various instruments that project managers and stakeholders should consider adopting are discussed.

Section IV introduces the financial and economic concepts that project managers use to select an activity (policy, project instrument etc.) as well as choose between them. **Chapter 11** outlines the concept of financial feasibility assessments for projects. In the Pacific a large number of projects have been aimed at supporting behavioural change towards the environment by providing income-generation projects in exchange. This chapter provides some Pacific examples of income generating and other schemes and introduces the readers to approaches to assess the financial feasibility of such schemes. With this information, readers will be able to build financial feasibility into their own projects. This is important not just for project success, but also for project donors who increasingly recognise the importance of financial feasibility as the key to project success.

Given that information is never perfect and because information can be particularly challenging in the Pacific; this chapter will also provide some basic tools for assessing the financial feasibility of projects where information on costs, revenues and/or risks is poor. Finally, the chapter finishes with a simple framework for prioritising across different projects or different activities whose financial feasibility differs.

Chapter 12 introduces the concept of cost-benefit analysis as a tool to assess the overall economic contribution of a project to society and thereby to select between different project activities. Step by step, the readers will be taken through tasks necessary to identify what is being measured, to identify and estimate costs and benefits, and to evaluate in different ways the economic value of a change in environmental quality created by sample projects.

In so doing, this chapter will introduce a number of key concepts that affect the economic feasibility of a project or activity including the timing of project benefits and costs, discounting and discount rates, and tools for conducting assessments under uncertainty. This chapter complements the ideas and concepts the readers will have gained in Chapter 11; however, it will also emphasise the differences between financial assessments and economic assessments. Readers will also be shown when and why to undertake financial analysis compared to when to undertake economic assessment.

Chapter 13 provides case studies of financial and economic analysis recently used in the Pacific for different purposes, including to advocate for resource management (improved watershed management in the Cook Islands), to demonstrate benefits of a strategic decision (forest certification in the Solomon Islands), and to assess alternative policy options (mining aggregate in Kiribati), as well as to choose between environmental management options (human waste management in Tuvalu).

Chapter 14 provides guidance on how project managers might compare projects using economic information. In light of the lessons learned in previous chapters, **Chapter 15** will consider how to incorporate financial, economic and other considerations in selecting between activities, policies or other options. **Chapter 16** considers what economic indicators project managers and other stakeholders can collect and analyse to assess the economic progress of their projects and the effectiveness of their projects in achieving the stated objectives. In this chapter the elusive 'perfect' economic indicator will be considered, and 'second best' indicators (that are more practical to use) identified. Indicators will be related to property rights and to financial, economic and social sustainability so that project managers and the communities they serve can monitor progress from a range of angles. Readers will also see how the cost-benefit analysis framework can also be used to assess, expose, the effectiveness of projects in achieving the stated objectives.

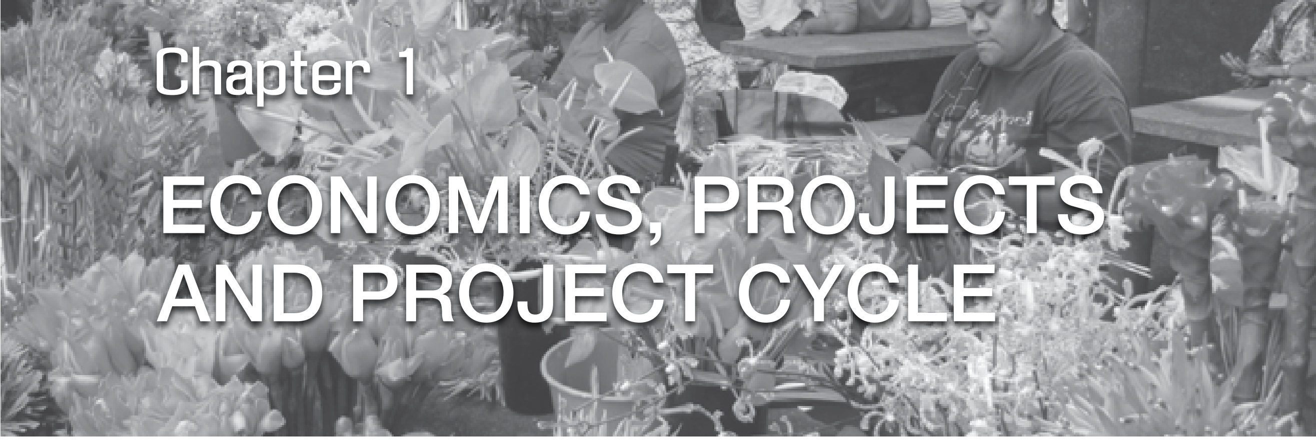
Chapter 17 concludes the discussion on the relevance of economic concepts for sustainable use and management of natural resources and the environment.

Section I

Economics and resource and environmental management

Women selling flowers at Suva market, Fiji. The produce we rely on depends on a healthy natural environment.

Picture reproduced with the kind permission of Sailesh Kumar Sen, SOPAC.



Chapter 1

ECONOMICS, PROJECTS AND PROJECT CYCLE

Economics is essentially about allocating scarce resources in a way that maximises human well being. Economic concepts can be used to understand what motivates people and what determines their decisions to use and manage their resources to meet their needs and aspirations (goals) today and in the future. Economics is also about understanding how individual behaviour is influenced by institutional rules and regulations, including cultural norms. With this understanding, economics can also help project managers understand how changing circumstances – for example, changes in markets, resource tenure or pricing arrangements – can affect people's decisions and affect project success. An understanding of economics in project management no doubt is thus critical for achieving a successful outcome. However, while project managers in the Pacific usually have technical biophysical knowledge and have good community and communication skills, their knowledge of economics is often either lacking at best or entirely absent at worst.

The need to explicitly incorporate economic considerations in environment and development projects, particularly the economic values resource use, has been gradually recognised in the Pacific. This is evident in, for example, regional and international conventions and agreements. For example, SPREP (1999, 2001), noted the need to promote natural resource economics 'to assist environmental officials, national and fiscal planners in taking stock of economic implications of environmental impacts' of development. The participants at the Nature Conservation Conference in the Pacific held in Rarotonga in the Cook Islands in July in the same year, too, identified economic valuation of natural resources as one of the key strategies needed in the region to encourage environmental conservation (Lal 2003). The relevance of economics in, for example, biodiversity conservation and management in the region was also emphasised in the 2010 Pacific Islands Nature Conservation Roundtable meeting.

On the other hand, economics is more than just assigning monetary values to resources. Only by understanding why people make choices, what market and institutional factors influence their decisions, to act in their individual and/or public interests, can managers have a greater prospect of developing, implementing, monitoring and adapting resource and environment projects that are successful.

In this book, basic resource and environmental economics is used to identify and explain issues that determine the success of resource and environment projects. In the next section, we consider the key economic tasks that project managers should conduct in order to maximise the chances of project success, together with the key economic concepts and skills they would need to implement them. These tasks, concepts and skills are considered within a project cycle context.

1.1 Projects

Projects are at the core of resource use and environment conservation efforts in the Pacific, and project managers play a critical role in ensuring their success. Once a project has been designed and implemented, project managers identify specific tasks to be undertaken, manage their resources to undertake those tasks and oversee different activities. Project managers must ensure that any relevant economic issues in a project are addressed to achieve project success. They are therefore the primary target population for this book, even though it may also be relevant to other readers.

1.2 Project cycles and project planning

All resource and environment projects – for that matter, any project – would or should have a clearly identified set of inputs, activities and outputs required to address specific objectives (Sesega 2000). The activities should follow a logical sequence. Gittinger (1995: p. 5) commented that projects require a 'well defined sequence of investment and production activities' to maximise their likelihood of success.

The sequence of activities required in projects form what is commonly known as a ‘project cycle;’ the key project phases that managers normally need to consider when developing and implementing projects. The project cycle provides a rough map of steps to follow for a project to move from an idea to success in reality.

The project cycle begins when an idea for a project is developed and ends when the project is completed and the outcomes have been evaluated. The concept of the cycle is significant because the designs of later development projects should be able to incorporate the evaluation results of previous projects. This is an improvement on early project design which did not make that link to past experience and thus did not use earlier projects as a basis for planning better development projects. In contrast, the project cycle uses the iterative learning processes that well designed development work entails (Overseas Development Assistance 1995).

Standard resource and environment project cycles usually involve some of the following steps:

- identify the issue of interest;
- identify the symptoms and/or causes of the problem;
- identify and select solutions;
- plan for and implement solutions; and/or
- assess progress. (See Gittinger 1995 and Overseas Development Assistance 1995 for examples).

For an income-generating project, the cycle may start with the identification of the need for some economic development projects, followed by the identification of alternative options to meet the objectives. Subsequent steps are then the same as in the case of projects aimed at solving resource and environment management issues; planning for and implementing solutions; and assessing progress.

Stages to monitor progress in a project and to assess successes enable project planning and implementation to be refined during the project lifetime. Therefore, best practice now suggests that monitoring and adaptation are integral to a project cycle. The need for scientific monitoring is usually accepted in resource and environment projects. For instance, a decline in the quality of the environment would normally indicate the need to refine the way in which the project is implemented. The same argument would apply to the situation where there is a decline in economic parameters in a project. While it is critical to incorporate economic (and social) considerations in the design and implementation of a project, it still may not produce the desired outcome if changes in economic effects are not monitored and addressed. Thus rather than adopting a fixed ‘blue print’ for project planning and implementation, wise project managers in the Pacific and elsewhere would recognise the need to maintain a flexible approach to project development and implementation, and undertake economic (and other) monitoring and adaptation of projects.

1.3 Project cycle for this book

While a project cycle may essentially include the general steps indicated above, the names given to the steps in a project cycle may differ from project cycle to project cycle. This is highlighted in Box 1, which describes two project cycles that address environment and development projects. Gittinger (1995), for example, suggested that an analysis of the cause of a problem occurs during a ‘preparation and analysis’ phase, while the International Waters Programme puts this activity under a ‘strategic planning and design’ phase; nevertheless, the activity is the same.

Box 1. Project cycles for environment and development projects

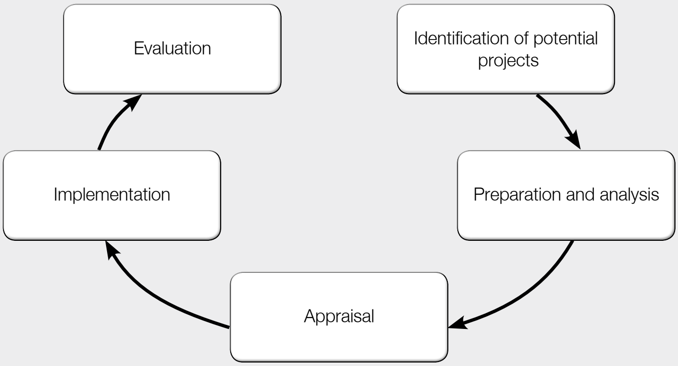
Gittinger

Gittinger (1995) suggests that the sequence of activities required for projects involves the following five steps: (1) identification of potential projects, (2) preparation and analysis; (3) appraisal; (4) implementation; and (5) project evaluation:

1) **Identification of potential projects.** Experience in the field may mean people can see where projects are needed. Alternatively, there may be an analysis of trends, from which people predict an activity will be needed. Another method is to survey people to find out about activities they want and need.
2) **Preparation and analysis.** This step involves conducting a feasibility study to identify whether to begin more advanced planning for the project. Subsequently, more detailed planning and analysis would be undertaken, including baseline activities such as resource surveys.
3) **Appraisal.** This step involves assessing the plans before spending money. It enables plans to be revised before project implementation.
4) **Implementation.** This step involves adaptive management, whereby project implementation may need to be refined to accommodate changes in circumstances (such as changes in staffing and available expertise, political will and demand for goods and services). Such refinement can be important for income-generating activities such as ecotourism projects.

5) **Project evaluation.** This step involves assessing the successes and failures in the project, and identifying how things could be done better in the future. Evaluation may be conducted at stages during project implementation (such as halfway through), as well as at project completion.

Gittinger – project cycle



International Waters Programme

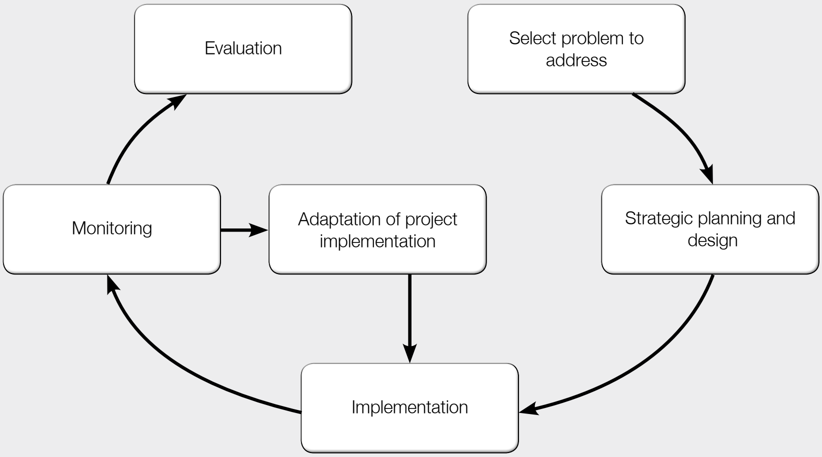
This medium-scale international project aimed to address priority environmental concerns in Pacific island nations relating to:

- marine and freshwater quality;
- habitat modification and degradation; and the
- unsustainable use of living marine resources.

Its integrated coastal watershed management component aimed to address these concerns by supporting a number of community-based environmental management pilot projects in each of the 14 participating Pacific island nations (for more information, see UNDP 1999 and the International Waters Programme n.d.).

The pilot project managers discussed the various activities that were considered important for projects at a meeting. The activities were sequenced and grouped into broad phases (International Waters Programme 2003) that appeared as a project cycle. The resulting project cycle followed a similar format to that of Gittinger (1995), identifying five key stages in the cycle.

Integrated coastal watershed management in the International Waters Programme – project cycle



The strategic planning and design phase was especially critical in the project cycle. It contained a number of critical activities, that included the following:

- community engagement;
- the generation of information on the community (a community context phase), including information on the root cause of the problem;
- the collection of baseline information to support the analysis of root causes (a baseline phase); and
- a feasibility assessment and selection of responses (a phase of selecting objectives and strategies).

Sources: Gittinger 1995; International Waters Programme 2003; Lal and Keen 2002; UNDP 1999.

The project cycle followed in this book (Figure 2) is an adaptation of that developed by Gittinger (1995) and one developed by Lal and Keen (2002). The original project cycle developed by Lal and Keen was developed specifically to highlight the economic issues that affect community-based environment and development projects in the Pacific. In practice, the cycle would probably include up to eight non economic as well as economic steps to enable thoroughly good project design and execution. From an economic perspective, for instance, an important issue is that analysis of root causes (problem identification) should be distinguished from the identification of solutions and that feasibility assessment, implementation and monitoring should be distinguishable as separate stages. The resulting project cycle adopted in this book, Figure 2, contains the following eight economic and non-economic phases, in which phases 2, 4, 6, 7 and 8 explicitly contain the key economic activities or concepts that project managers need to incorporate during the life of a project. Economic concepts of relevance to phase 3 and 5 also include considerations such as design of rules to guide human behaviour, market-based solutions, etc. These concepts are similar to those covered in other phases:

1) Conduct a situation analysis.
2) Identify the economic root causes of the problem (problem analysis).
3) Identify possible solutions and options.
4) Assess the feasibility of possible solutions/options and compare alternatives to select the prefered option.
5) Design accepted solutions in detail (Project design).
6) Implement project.
7) Monitor project.
8) Evaluate project and identify lessons.

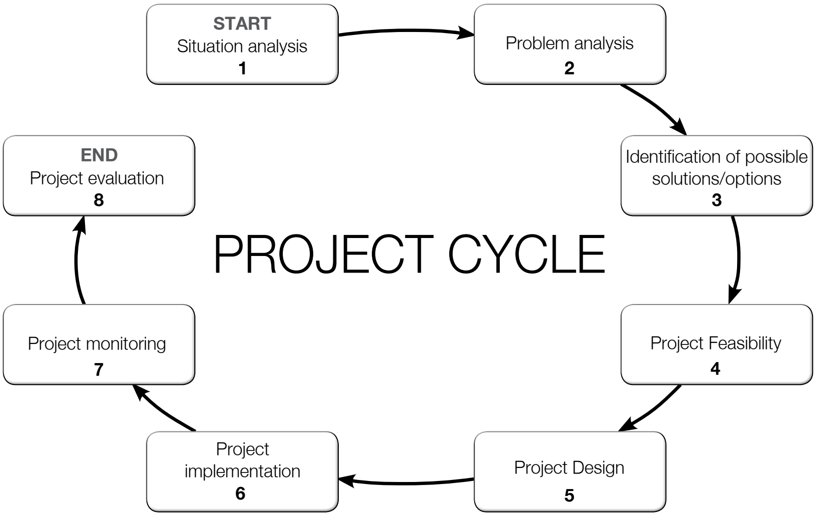


Figure 2. Project cycle for this book

1.4 Project managers and project cycle

Economic considerations are relevant in many of the phases and in the course of a project, project managers will need to ensure that each phase is completed by at least undertaking the following economic tasks under each phase.

1. Situation analysis

Aim: Conduct a social, economic and institutional assessment of the prevailing situation associated with current or potential use of resource for community-based projects.

This descriptive stage of the project cycle is aimed at providing the basic information on the current status of resource use; stakeholder needs and aspirations; and environmental concerns or situation requiring a response. It involves identifying the relevant stakeholders; available resources and resource uses, market infrastructures and rules; and the social environment and institutions affecting resource use. To conduct a situation analysis, it is necessary to undertake a number of tasks that include the following:

- Identify the stakeholder needs and/or environmental concern.
- Construct a community and other stakeholder profiles in relation to the need/concern identified.
- Undertake a resource inventory.

- Identify relevant producers, consumers, markets where goods and services are 'sold' and analyse production – consumption relationships.
- Describe the infrastructure and services that affect input and output markets, production efficiency and the relationship between supply and demand.
- Analyse prevailing institutional rules and regulations that bear on resource use and management; including production, consumption, market structures and market operations.

2. Problem analysis

Aim: Identify the root causes of problems/threats.

- Identify symptoms/issues/social concerns that the key stakeholders (internal and/or external) identify as being related to environment/resource availability, accessibility and so on.
- Support stakeholders to conduct a root cause analysis or needs analysis (that is, to identify drivers and underlying causes of the concern or unmet needs/aspirations).

3. Identification of possible alternative solutions

Aim: Identify possible ways of addressing problems/threats. In a sense, phase 3 in an outcome of phase 2.

- Identify options for addressing the identified problems and/or the community needs and aspirations.
- Narrow the options and select a limited number of solutions for further assessment.

4. Assess the feasibility of possible solutions/options and compare alternatives (Project feasibility)

Aim: Assess alternative options for project.

- Assess and compare the financial feasibility of possible solutions/options using the cost-benefit framework.
- Assess economic feasibility of possible solutions/options using a cost-benefit framework.
- Assess the distributional implications of the options/solutions.
- Assist and support communities in their selection of an option/solution.

5. Design accepted solutions in detail (Project design)

Aim: Design project in detail. Many of the details to be designed in projects will be identified during phase.

- Identify the nature of technical solution and/or management solutions required to address the current situation.
- Identify a key management framework for undertaking the selected option(s)/solution(s) (harmonising rules and regulations, identifying necessary institutional arrangements, identifying roles and responsibilities, identifying access to inputs and markets for products and/or refining any activities).
- Identify, as relevant, necessary economic, command and control and/or moral suasion based instruments.
- Assess and select instruments to encourage behavioural change.

6. Implement project

Aim: Implement the project as necessary.

- Implement project according to the project design.
- Adapt project implementation in light of information gathered during monitoring of the project (if necessary) – see below.

7. Monitor projects for adaptation

Aim: Assess and adapt the project as necessary.

- Identify economic indicators, or their proxy, for assessing progress of the project.
- Use progress assessment information to adapt project as needed.

8. Evaluate projects and identify lessons

Aim: Evaluate the project.

- Evaluate the project outcomes against stated objectives, assessing how they met the stated objectives; and identify lessons learnt that can be used to better design future projects.

Chapter 2

ECONOMY AND ECONOMIC BEHAVIOUR

Resource and environment projects are implemented within the broader context of economy, society and the environment. Many different notions of environment, society and economy are adopted by different people.

In this book, the economy is treated as a social construct developed by humans to meet their material needs from 'scarce' natural resources. Scarcity occurs when people cannot satisfy all their requirements from limited natural resources and they thus must choose how much of a limited resource to use and how much of it to allocate between competing uses. If the economy is a social construct to meet human needs, the way humans use scarce natural resources and affect the environment reflects the social values conferred by society. It follows that, since economic activities are defined by the society in which we live, different societies have developed different types of systems to deal with resource scarcity and exchange and transfer of goods and services in an orderly and acceptable manner.

2.1 Exchange and transfer in society

In traditional Pacific societies, barter systems were the conventional way for owners of goods and services to decide what to do with their scarce resources. Individuals negotiated to decide who should provide and who should access goods or services. In barter-based societies, cultural conditioning and custom determined the flow of resources and goods between people with goods (producers) and people who wanted them (consumers).

In some communities, bartering was undertaken not through individuals but at the village level. This occurred because some traditional communities were managed as a coherent unit in which a chief or village elder decided what goods and services were produced and which family would produce them. Once produced, the goods were shared with other members of the community. This practice is still common in some rural areas. In urban areas, it has largely been replaced by the market system. In some developed market economies, national crises have often forced a return to the bartering system. For instance, the collapse of national economies means that people may resort to using hard commodities – such as cigarettes as currencies of exchange. The village would then barter with other villages for access to goods or service not produced in the village.

Through the traditional barter and exchange system, appropriate signals and responses became instilled as part of the culture. So people could work out how much *taro* to give in exchange for fish, for example, communities developed their own 'numeraire' (that is, currency of some form) for exchange. That is, they developed their own accounting system to reflect the scarcity of different goods and the value of different goods. Scarcity value reflects:

- what people are willing to give up – that is, the amount that people are willing to pay – in exchange for the commodity they want; and
- what people are willing to accept to give up a commodity they possess or produce.

Often, these numeraires led to the development of a common numeraire that was accepted across the whole country. In the Solomon Islands and Papua New Guinea, shell money was used as a common currency for exchange. In Yap and Palau, stone coins were used. In some cases, a scarce commodity was used as a measure of the highest value attached to something. Fijians still use a whale's tooth as the highest valued gift when showing respect or when seeking forgiveness for some wrongdoing, such as rape or family disrespect. In the Lomawai Village on the Coral Coast in Fiji, locally produced sea salt serves a similar purpose. Although traditionally sanctioned rules apply, the exchange is voluntary.

Exchange and transfer in developing Pacific societies

With the development of market economy in the Pacific, money is now the standard numeraire widely recognised as the currency of exchange nationally and internationally. Fuelled by money, markets now determine:

- how much money people require to buy something to satisfy their needs and desires;

- how much money people require to be induced to work in an occupation – that is, money determines the 'exchange of labour';
- how much the inputs cost that are needed to supply a good or service cost – for example, how much ice costs when storing fish for sale;
- how much producers require before they can be induced to give a good or service to consumers – that is, money determines the 'exchange of goods' demanded for consumption; and
- the value of goods and services exchanged and the flow of resources between producers and consumers.

Tangible goods and services that are exchanged through markets are referred to as 'commodities'. Fish for local sale or export can be a commodity, along with beche-de-mer and aquarium trade fish. Ecotourism experiences such as coral reef watching, whale watching and canoeing down a river can also be regarded as commodities when they are supplied by ecotourism operators and bought and 'consumed' by tourists. Because these goods and services are exchanged through markets, they are termed 'market goods and services'.

That said, not every good and service valued by humans is exchanged through markets. Some goods and services are provided direct from the environment and appear 'for free' because no money is exchanged to enjoy them. Examples of such 'free' environmental goods and services are wild fish stocks that can be caught for food, coastal protection conferred by mangroves and reef systems, and allocations for waste dumping (such as the sea or rivers). Because these goods and services are not exchanged through markets, they are termed 'non-market goods and services'.

People may use non-market goods and services directly or indirectly. Direct uses of goods or services occur when people actively seek to use the goods and services. They include the consumption of fresh water or crops for food, and the use of an attractive area for leisure. Indirect uses of goods and services occur when people do not seek a service but benefit from it anyway. They include the coastal protection that people gain from reefs and mangroves, and the ecosystem health arising from biodiversity. Direct and indirect uses of goods and services may be marketed or non-marketed.

Whether a good or service is marketed or not determines the extent to which people will choose to use that good or service in a market economy. It also determines how much people are willing to invest to supply that good or service in a market economy. What people choose depends on their motivation.

2.2 Economics and behaviour

Determining motivation for choices cuts to the core of economics. Economists generally consider that humans behave 'rationally' and that this determines their decision making. Rational behaviour involves acting in one's own best interest (or that of the family). In a choice between two items, economists believe that rational individuals choose the one that makes them the 'best' off. In considering whether to go fishing or do gardening, for example, an individual would choose to go fishing if that generated the most satisfaction either in terms of money or consumption benefits.

When considering what makes a person 'best off', all factors that affect human well being are important from an economic perspective. This is true for improvements in well being that arise because of, for example, changes in access to money, an improvement in the physical environment or improvements in local amenities.

2.3 Economics and efficiency

In considering what makes a person 'best off', the issue of economic efficiency emerges. Economists consider 'efficiency' to reflect the collective level of well being (extent of being better off) that humans experience. From an economic perspective, efficiency occurs when individuals achieve the highest level of well being possible, and no other reallocation of resources can improve the level of collective well being in society (otherwise known as 'Pareto' efficiency). This means that resource and environment projects that aim to increase the collective well being of Pacific islanders by definition aim to increase economic efficiency (thereby contributing to the 'economic component of ESD).

Accordingly, decisions that increase collective well being increase efficiency and those that maximise collective well being achieve economic efficiency. When a particular time period is being considered, efficiency occurs when people achieve the highest level of collective well being possible over that period.

In relation to natural resources, economic efficiency means that people are expected to use resources in a way that maximises well being in society. An efficient allocation of resources therefore occurs when resources are used to produce the types and amounts of goods and services that maximise collective well being.

2.4 Efficiency and other societal goals

While efficiency in resource use appears to be a logical goal for societies and project managers, it is not the only consideration in resource use and management. Other issues such as equity and ecological sustainability are not necessarily captured in economic values as discussed below. These issues are explicitly recognised under ESD, which puts the issue of society (equity) on an equal footing with the need for economic development and biological sustainability. It is for these reasons that some tradeoffs between the components are inevitable.

Equity

Economic efficiency will not necessarily mean achieving an equitable distribution of income among people at the same time nor over time. Equity in the distribution of wealth refers to the distribution of wealth within a generation (intra-generational equity) and across generations – or time (inter-generational equity). Economic efficiency occurs when the total benefits of all individuals is maximised. Critically, this may occur even when some individuals become better off than others – or if some people become better off at the expense of others. That is, resources may be said to be efficiently used even if they are inequitably distributed. Therefore, project managers may be confronted with projects that increase total well being at the expense of some groups of people currently, or at the expense of future generations.

Conventionally, the distribution of wealth or benefits across a community has been a secondary consideration from an economic perspective. By comparison, equity may be the primary consideration in how resources are used from the village/district perspective. In particular, distributional (equity) issues may affect whether village/community members participate in a project (Holland 2004) or whether the project creates social tension and conflict (Lal and Keen 2002). This is particularly relevant in the Pacific where many resources are held communally and current generations are seen as custodians of the resources for future generations. If the rules about sharing of costs and benefits are not addressed at the outset of resource and environment projects, then frustration, bitterness, jealousy and conflict within the communities can result (Sesega 2000). This is particularly evident if there is a belief that the communal resources 'belong to everyone; therefore the whole community should benefit' (Sa'anapu–Sataoa CAP 1997, p. 12). Experiences in the Pacific islands suggest conflicts often develop in a community if such issues are not adequately predicted and managed at the outset (see, for example, Centre for International Economics 1998; Tacconi 1997; Whyte et al. 1998). Accordingly, the effect of resource use on income distribution (equity) is critical when considering whether one set of rules or actions to manage resource use should proceed. Although equity does not conventionally form part of economic analyses, it is a fundamental element of modern economics.

Ecological sustainability

Economic efficiency also does not necessarily always imply ecological sustainability. When considering, for example, whether it is efficient to conserve a forest, economists would consider the extent to which people are better or worse off each year as a result of conserving it. If the gains and losses that people experience each year as a result of conservation were summed, efficiency would be achieved only if total well being, net of costs, was higher overall by the end of a certain period. (That is, the gains outweigh the losses – or in, economic jargon, the 'benefits' outweigh the 'costs').

People tend to presume that ecological sustainability is synonymous with economic efficiency. That is, they presume that humans are better off if natural resources are maintained forever to at least some degree. This is true in the majority of cases since humans can continue to benefit from a resource the longer it continues to exist. Therefore most of the time, economic efficiency in resource use and biological sustainability go hand in hand. Nevertheless, there are a few cases where economic efficiency in resource use can conflict with ecological sustainability. This usually occurs where the economic value of a natural resource is so high that people are actually economically better off to capitalise on the value by mining the resource to extinction, banking the profits and living off the interest for the rest of their lives. Of course, this argument ignores the intrinsic values of the species or of biological diversity.

Ironically such situations are most likely to occur where the resource at stake is either living but slow to replenish (such as whales or elephants) compared with the interest rate or non living therefore not replaceable. This is because the benefits to people of waiting for the resources to naturally increase to that point where they can be sustainably harvested are low compared with immediate exploitation and banking the profits – especially when the interest rates are high. Today, the scope for resource mining to be economically efficient while being ecologically non sustainable is lower than it was in the past. This is because of:

- improved information on the potential value for resources that might have otherwise been mined – it is for this reason, for example, that gene banking and bioprospecting are of increasing interest today
- Increased awareness among the broader public leading to a recognition of the 'scarcity value' of many threatened resources. For this reason, a resource is likely to become economically unfeasible to exploit to ecological extinction.

The rare potential still exists for resource use to be economically efficient but unsustainable; however, since it is rare, the examples used throughout this book will presume that efficient resource use and sustainable resource use are complementary – unless otherwise explicitly stated.

Section II

Integrated economic framework: consumption, production, environment and institutions

Supply of and demand for natural products in the Pacific.

Picture reproduced with the kind permission of Sailesh Kumar Sen, SOPAC.

It was noted in Section I that economic concepts are useful to identify why resources are devoted to different uses. The influence that economic drivers have on the use of resources and the quality of the environment can be most easily visualised through a consumption-production-environment-institutions framework – or CPEI framework (Figure 1.2) which comprises the following key elements:

- **Consumers, consumption and demand** – what people want, what they consume, how much are they willing to pay (demand), what factors influence consumption decisions (Chapter 3).
- **Producers, production and supply** – what (and why) people produce certain goods and services, what payment they expect and require (supply), what factors influence production decisions (Chapter 4).
- **Markets, market values and outcomes** – market transactions and market outcomes, what determines the outcome of interaction between consumers and producers (that is, markets and market structures) and the role of market prices in the use, and abuse of natural resources (Chapter 5).
- **Environmental goods and services and non-market values** – nature of environmental resources, and their non-market values and how the absence of market prices for some goods and services determine the use of goods and services (Chapter 6).
- **Institutions, incentives and sustainable development** – what institutional rules and regulations (including cultural norms) encourage and/or constrain human interaction with each other and the environment, the property rights and physical characteristics of environmental goods and services, and market mechanisms (Chapter 7).

From an anthropocentric perspective, these components are integrally connected and interdependent and together determine the market outcomes.

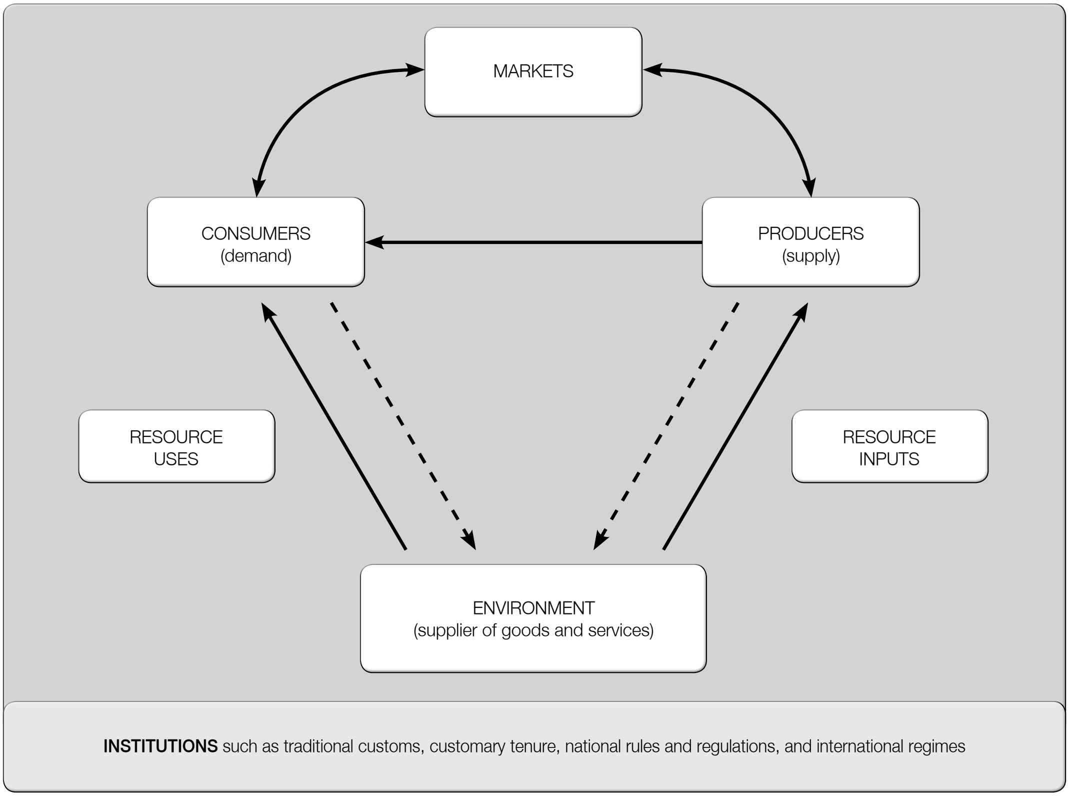


Figure 3: CPEI framework (arrows show the material flow)

Chapter 3

CONSUMPTION AND DEMAND

The Concise Oxford Dictionary (Fowler & Fowler 1990, p. 247) defines the verb ‘to consume’ as ‘to eat or drink’ or ‘completely destroy’. It defines ‘consumer’ as a ‘person who consumes, especially one who uses a product’ or a ‘purchaser of goods or services’. These definitions only partly capture what economists consider to be consumption. In an economics context, consumption is defined as the use of resources to satisfy one’s needs and wants.

When people eat fish, for example, economics considers that they ‘consume’ fish for nourishment. Equally, a person ‘consumes’ forest products when using them for housing or as firewood for the generation of needed or wanted energy. Similarly, people who enjoy having different types of fish and coral in their aquarium ‘consume’ coral reef fish and non-fish products harvested from the tropics and elsewhere.

When people enjoy the natural beauty of an environment, they are ‘consuming’ it for emotional and/or spiritual needs, even if that consumption does not destroy the good. When a diver enjoys the species diversity of a dive spot in the Solomon Islands, for example, that diver is consuming the natural beauty of the dive site.

In other words, people consume a good or service to satisfy their needs and wants. Consumption may involve extracting or destroying resources (extractive use) or not extracting resources (non-extractive use). The amount that a person consumes of a good or service depends on, among other things, the amount of benefit, joy or happiness (which economists call ‘utility’) that the good offers, and the price of the good. The quality of the environment is the result of individuals’ decisions about how to satisfy wants. This section explores how people’s desires (wants) translate into value (willingness to pay), and how value relates to price. Price is a critical factor in determining the amount of a good or service that is consumed and produced.

3.1 What is demand?

What makes people choose to use a good or service is the need for that good or service to continue their survival or, in some cases, to simply increase enjoyment. The economic term used for these needs or desires is ‘wants’. Wants are unlimited desires or wishes that people have for goods and services; however, people cannot usually satisfy all of their wants because the required resources are not infinite. Consequently, people must choose which wants to satisfy at the expense of other wants. The wants selected for satisfaction are reflected in ‘demand’. Demand derives from decisions about which wants to satisfy, so it is not the same as wants: while wants are unlimited, demand reflects the limited choices that people make (Figure 4).

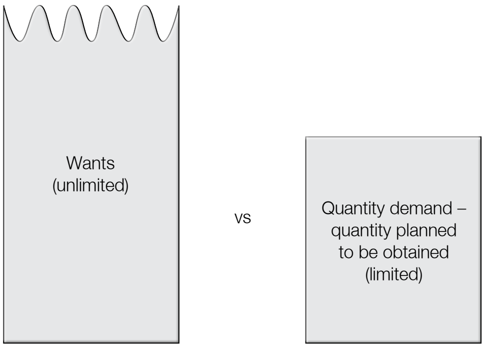


Figure 4. Wants versus quantity demanded

Demand and price

Demand for a good reflects an individual’s want and the sacrifice that individual is prepared to make (and can afford to make) to acquire that good. In a subsistence economy, the demand for a good or service is often reflected in people’s willingness to toil for an item. A Fijian may like fish generally but prefer *nuqa* (rabbit fish) specifically. This person may thus go out to the reef specifically to catch fresh *nuqa* for dinner, rather than catch any fish from the nearby waters. This behaviour demonstrates a willingness to spend extra time, energy and resources to satisfy demand for *nuqa*.

The extent to which people are willing to toil for an item reflects the degree of satisfaction that they gain from consuming it. People in the bush who are thirsty are willing to spend more time collecting coconuts than when not thirsty. Logically, the more coconut juice they consume that day, the less thirsty they become because their wants are satisfied. Consequently, there is less want for additional coconuts. Demand for coconuts thus falls as the group becomes increasingly satisfied, until they no longer want any more coconut juice that day.

In a subsistence economy, the fall in satisfaction gained from consuming more of a good (coconuts) means people are less willing to toil for additional amounts of the good. This fall in willingness to toil directly reflects the reduction in satisfaction gained as demands are met. In a monetary economy, the demand for a good or service is more commonly reflected in people's (maximum) willingness to pay for an item:

> ... Mrs Mafi and her husband like the taste of giant clam meat very much. She would buy it on a regular basis taking about 1 kg/week; however, this would depend on its price. Mrs Mafi is not specific about the price she would be willing to pay for giant clam meat, except that she would pay a bit more for it than the price for mussels. To a Tongan, she says, clam meat is superior to the mussel. Thus she would be willing to pay a premium for clam meat. (Tacconi and Tisdell 1992, p. 25)

The more keenly people want an item, the more they are willing to pay to acquire it. When celebrating the birth of a child or a wedding, therefore, people are generally willing to pay more to acquire lobsters, mangrove crabs and fish than they are willing to pay on an ordinary day.

The amount that people are willing to pay for an item reflects the degree of satisfaction – or, in economics terms, utility – that they gain from consuming it. When people are hungry, they are willing to pay more for food than when they are full. The more of a good that people consume in a single time period – for example, the more burgers that they consume for lunch – the more satisfied they become. As a result, they are willing to pay less for a second burger in the same period because they have already satisfied part of their desire. With each subsequent burger during the same period, they are willing to pay less and less as they become increasingly satisfied (until they are not willing to pay anything if someone offers more burgers). The fall in the maximum willingness to pay for each additional item directly reflects the reduction in satisfaction gained as demands are met (Figure 5).

The same principle applies to consuming products that satisfy people in other ways. For instance, the more exotic or rare an item, the more satisfying it may be to consume it compared to the mundane day-to-day items available. Mrs Mafi may be greatly satisfied with giant clam meat for the first few days that it is available but, if she had to face it every day, she may be quite bored of it by the end of the month and may long for fish as a break. The satisfaction she gains from additional units of the commodity – termed 'marginal' units in economics – then determines how much she is willing to pay to acquire them.

Marginal benefits

The satisfaction that a person gains from consuming an additional (marginal) unit of a good or service is termed the 'marginal benefit'. The maximum amount that a person is willing to pay per extra unit of that item reflects the marginal benefit they gain from it. In a market economy, marginal benefit is also equivalent to the price that a person pays for the good.

As noted earlier, diminishing satisfaction means people are willing to pay less for (or have less marginal benefit from) additional units of a good or service. Thus, as the price of a good increases, the quantity demanded decreases. Conversely, people acquire more goods when the price decreases. This relationship between the price and quantity demanded is called 'demand'. Table 1 summarises the quantity of a good demanded at different prices is called a demand schedule.

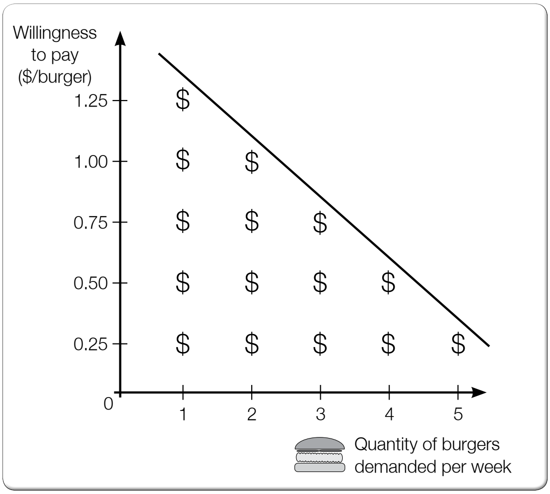


Figure 5. Diminishing willingness to pay for burgers.

Table 1. The demand schedule for burgers

Price ($)	Quantity of burgers demanded per week
1.25	1
1.00	2
0.75	3
0.50	4
0.25	5

If plotted on a graph that displays the price of a good or service in relation to the quantity demanded, demand for goods and services appears as a downward sloping curve called a 'demand curve'. A demand curve thus graphically summarises the relationship between the price of a good and the quantity demanded (Figure 6).

Looking at it another way, the demand curve reflects the maximum that a person is willing to pay for each additional quantity. It also reflects the additional or marginal benefit derived from each additional quantity of a good. These terms – willingness to pay, marginal benefit and price – are thus often used interchangeably, depending on the context and focus of analysis.

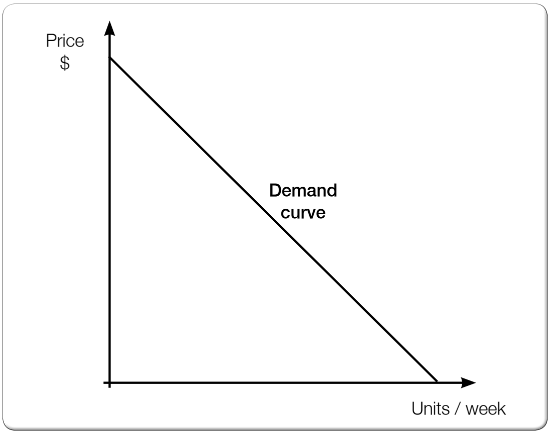


Figure 6. The demand curve.

Law of demand

The law of demand states that the quantity of a good demanded will increase as its price falls. Conversely, the higher the price, the less quantity is demanded. A family may buy only one bundle of trevally per week, for example, when the price is $5 per fish. A second bundle of trevally might be nice to eat in that same week but might also be a bit boring, given that they have already gone through a bunch. So, for the family to buy a second bundle of trevally, the price may have to fall to $4. To buy a third bunch, they may be prepared to pay only $3, and so on (Figure 7).

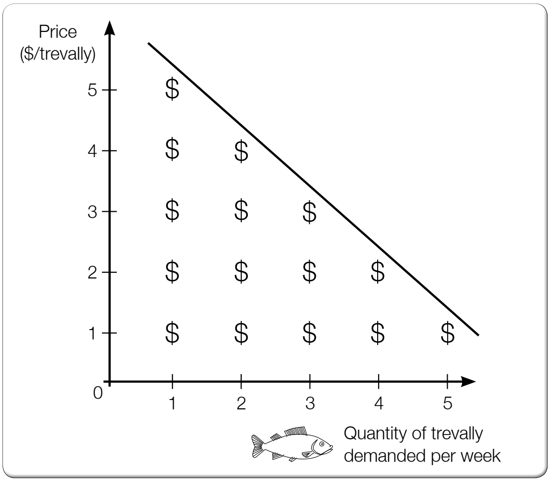


Figure 7. Demand for trevally by one family.

This law of demand applies to the majority of goods and services that involve the use of environmental resources. (Exceptions to this law are luxury goods, for which demand depends on their high price. Examples are pearls, fur coats and Porsches.)

Figure 8 summarises the law of demand for a generic good or service. Any single point along the demand curve indicates the quantity demanded at a single price. Imagine the original price for this good or service is P_1. At this price, the quantity demanded is Q_1. If the price of this good or service increases to P_2, then the quantity demanded declines to Q_2. If the price falls to P_3, then the quantity demanded increases to Q_3.

It is important to note that when the price of a commodity changes, only the quantity demanded changes, assuming everything else remains the same. A change in price does not alter the 'position' of the demand curve; it only initiates a 'movement' along the existing demand curve.

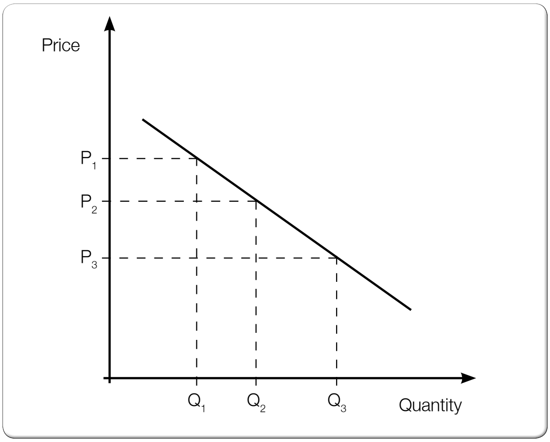


Figure 8. Relationship between price and quantity demanded.

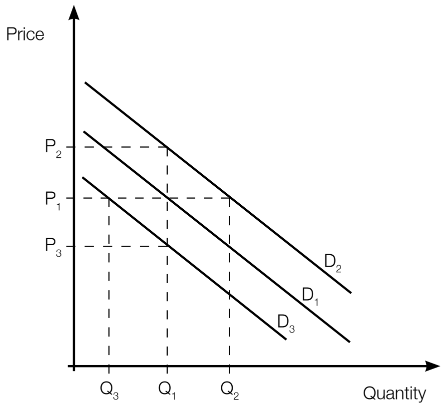
3.2 Determinants of demand

Earlier, it was noted that the change in quantity demanded is directly related to the price of the commodity. This relationship causes a movement along the demand curve when either the quantity or price changes. A change in the relationship between the price and quantity of a good shifts the position of the demand curve.

The determinants of such a shift in demand include income, the price of related goods, preferences (that is, individual characteristics of the good – such as quality – and consumer tastes). When such factors change, the price that people are willing to pay and the quantity that they want to purchase also changes.

Income

Ability to pay (or income) is an important determinant of the price that a person is willing to pay and the quantity of good demanded. Generally, the higher the income, the greater the quantity of a good demanded (when everything else remains constant). When viewed as a graph, an increase in demand appears as a right shift in the demand curve. When people acquire more income, therefore, they become willing to buy more of the good at the same price. This appears as a rightward shift in the demand curve, highlighting that people demand and consume more units of a good at lower prices. The reverse also applies.



For the same price:

Demand D_1, at income level I_1 is the original demand
Quantity demanded = Q_1

As income increases to I_2, demand increases to D_2
Quantity demanded = Q_2

As income increases to I_3, demand increases to D_3
Quantity demanded = Q_3

For the same quantity:

Demand D_1, at income level I_1 is the original demand
WTP price = P_1

As income increases to I_2, demand increases to D_2
WTP price = P_2

As income increases to I_3, demand increases to D_3
WTP price = P_3

Figure 9. Changes in price and quantity demanded.

Imagine a family lives in an urban area and wants to eat fish. Their demand for fish is initially illustrated in Figure 9 by curve D_1. With this demand, the quantity demanded at price P_1 is Q_1. One member of the family is promoted, the family income rises. With increased income, the family can afford more fish, and the quantity of fish demanded thus increases to D_2 so they demand Q_2 fish at the same price P_1.

Now imagine the family household income decreases when someone loses a job. The demand for fish thus falls, resulting in a leftward shift of demand to D_3. In this case, the quantity demanded at price P_1 declines to Q_3.

The above scenario can also be discussed in terms of the price that people are willing to pay for the same good. At a higher income, people are generally expected to be willing to pay more for the same quantity of good demanded (Figure 9). So, with a rise in income, demand might shift from D_1 to D_2 such that, for Q_1 fish, the family might now be willing to pay the higher price of P_2, while at a lower demand (D_3), they might only be prepared to pay P_3 for the same quantity.

This same principle can be used to illustrate that Pacific Islanders living abroad, who often have a higher earning capacity than that of those in the islands, are willing (and able) to pay a higher price for goods such as reef fish, giant clam and mangrove crabs.

Increases in income do not always lead to an increase in the demand for most goods, however. Goods that increase in demand as income rises are called 'normal' goods. Goods that decrease as income rises are called 'inferior' goods, as exemplified by the demand for goods such as rice, vegetables and local fruit in the Pacific. As people become more affluent, their demand for these goods decreases because they switch to higher status goods such as diary products and meat.

Tastes and preferences

At a given income level, the amount that people are willing to pay for a good is strongly influenced by its characteristics, such as quality, colour and size. Generally, preference determines demand for a good. A person who prefers fresh fish over any other meat has different demand curves from those for a person who hates fish. Similarly, a person who prefers Spanish mackerel over mullet is probably willing to pay a higher price for mackerel than for the same quantity of another fish, compared with a person who does not care about the type of fish that they eat.

Tongans living in New Zealand, for example, are willing to pay more for fresh giant clam meat than for clams that are stale and have lost their colour (Tacconi and Tisdell 1992). Aquarium trade importers pay for coral according to the size and shape of the live corals. *Kava* is sold according to quality. A person might pay $30 per kilogram for a grade A *kava* (termed *waka* in Fiji), whereas the price might be $15 per kilogram for *kava* made from the stem (termed *lewena*), which makes a poorer quality drink. Many goods are sold according to their quality because consumers are generally willing to pay more for quality – for example, copra, smoked and dried beche-de-mer, vegetables and *kava*.

Suppose a person demands only grade A beche-de-mer. That demand is illustrated in Figure 10 by the demand curve D_1. With this demand, the quantity demanded at price P is Q_1. If the quality of beche-de-mer decreases, then an importer is probably willing to pay less for the same. This results in a leftward shift of demand to D_2. In this case, for given quantity Q_1, the importer would only buy the same quantity if the price decreases to P_2. Conversely, at the given price P_1, the importer would only buy quantity Q_2.

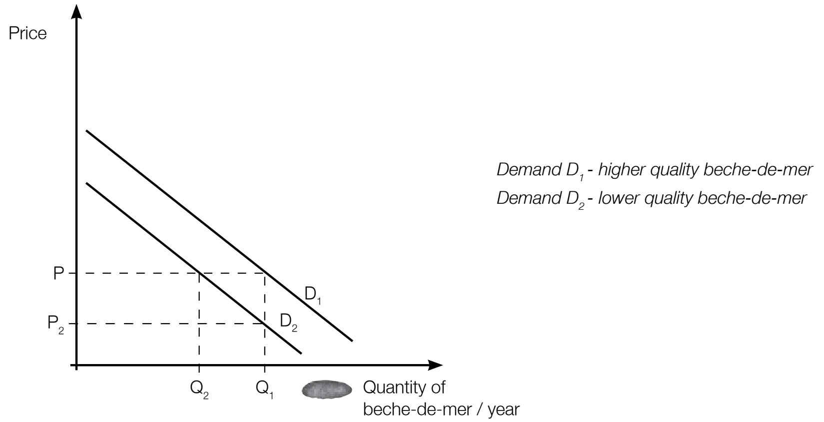


Figure 10. Change in demand due to quality changes in beche-de-mer.

Tastes and preferences can change over time. The demand for many traditional foods such as coconut juice has fallen in the Pacific, for example, as people have developed a taste for Coke and Pepsi. That is, due to the change in tastes, the quantity demanded at each price for coconut juice is lower than before. In other words, the demand for coconut juice has decreased.

Price of closely related goods

There are two types of closely related good: substitutes and complements. Substitutes are goods that are very similar and thus can replace the original good. Examples are frozen fish for fresh fish, coconut juice for coke, and Fiji Bitter for Fosters beer. Complements, on the other hand, are goods that are demanded at the same time as the original good. Examples are fish and lolo (coconut milk), *taro* leaves and coconut cream (when making palusami), shoes and socks, and betel nut and lime.

If the price of substitute goods or services falls, then the demand for the original good falls as people switch to buying the cheaper substitute. Similarly, if the price of substitute goods increases, then demand for the original good increases as people switch to the cheaper original option. Mangrove fuelwood, for example, is often cheaper than kerosene for people to access because it can be bought locally. If mangrove firewood becomes more available at a cheaper price, people are likely to increase their demand for firewood and the demand for kerosene would fall (shift downwards).

The same principle can help explain what happens to the number of tourists who visit Fiji when another country promotes a similar holiday experience. Suppose Vanuatu promotes itself as a unique tourism experience and competes against Fiji for tourists from Australia. To attract the tourists, suppose that the Vanuatu Tourist Bureau offers a flight and accommodation deal that is half the price of a similar visit to Fiji. Given that a Vanuatu holiday is a close substitute for a holiday in Fiji for most people, the number of tourists visiting Fiji is likely to decrease if Fiji retains its pricing structure.

On the other hand, when the price of a good increases, then the quantity demanded of its complementary good decreases. If, for example, the price of cars increases, then not only the quantity of cars demanded falls, but quantity of tyres demanded also falls. Similarly, if the price of hotel accommodation increases, then the quantity of people going on tours will decrease, because tour and hotel accommodation in many Pacific Islands are complementary goods.

Population

As the population increases, the total quantity demanded of all goods and services increases, resulting in a rightward shift in the demand curve. This illustrates that more people want to buy goods at the same price or, conversely, that for the same quantity they would be willing to pay more. Conversely a decrease in population would result in a leftward shift in the demand curve, indicating that people would be willing to pay less for the same quantity of goods or, for the same price, would be willing to buy less.

3.3 Individual demand versus market demand

Because the demand for a good or service by one person is represented by that person's own demand curve, the total demand for a good or service over an entire market is the sum of all individual demands. The total quantity of a good demanded at respective market prices is thus equal to the sum of the quantity demanded by each person at the respective price.

In other words, the individual demands of all people for a single good or service can be summed to generate a demand curve for a good or service for a community or society as a whole. Suppose two regions in Japan have different demand schedules for *papayas* imported from Fiji, as indicated in Table 2. Market demand for *papaya* is the sum of the two region's demand. Figure 11 illustrates this graphically.

Table 2. Market demand for *papaya*.

Price of papaya ($)	Quantities demanded by region A	Quantities demanded by region B	Quantities demanded by regions A and B
2	2500	4000	6500
4	1000	2000	3000
6	500	1000	1500
8	50	500	550

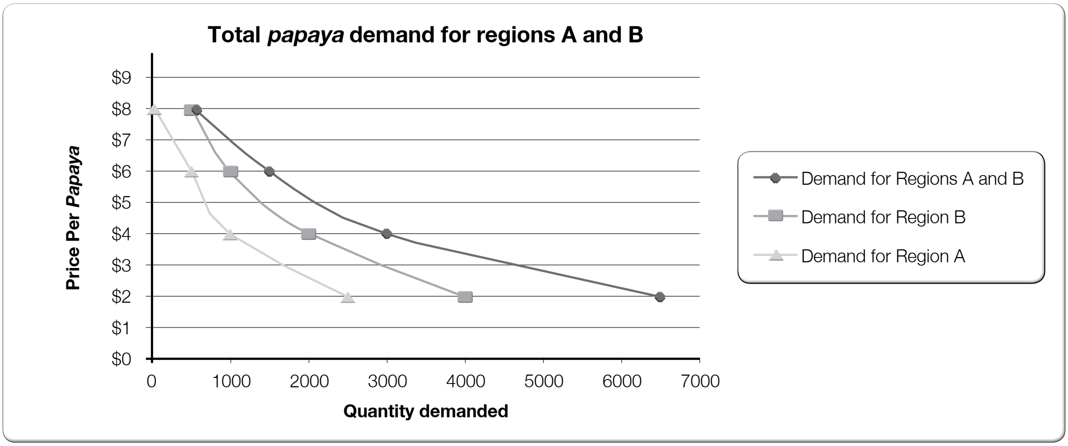


Figure 11. Market demand for *papaya*.

Other factors that may affect the demand include expectations of future changes in prices, such that people may buy a lot more of a product if they expect that it will become more expensive (and therefore less accessible to them) in the future.

Price responsiveness

The relationship between the amount demanded – termed 'price elasticity of demand' (Figure 12 and Box 2) – and the price of a good is visually illustrated by the slope of the demand curve. The flatter the curve, the more responsive the quantity demanded to changes in price, and vice versa. The steeper the demand curve, the more inelastic is the demand and thus the less responsive is the quantity demanded to a proportionate change in the price of the commodity.

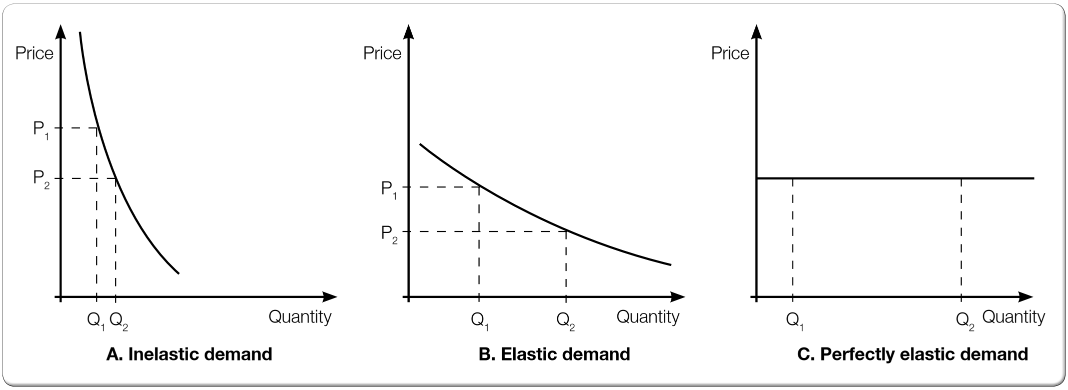


Figure 12. Price elasticity of demand.

Box 2. Price elasticity of demand.

Elasticity is a measure of how sensitive one factor is in relation to another. The elasticity of demand is thus a measure of how sensitive the quantity demanded of a good is to changes in its price. It is defined as the ratio of the percentage change in quantity demanded over a percentage change in price (ie $\frac{\Delta Q/Q}{\Delta P/P}$).

A good is price elastic if the quantity demanded falls more than the proportionate increase in price. Conversely, a good is price inelastic if a change in the quantity demanded is less than the proportionate change in the price.

Elasticity in demand is reflected graphically by the slope of the demand curve (Figure 12). The higher the elasticity, the flatter is the curve. Flatter curves suggest that even a minor change in price generates a large change in quantity demanded (see Figures 12 B and 12 C). Goods or services that demonstrate high elasticity tend to be those that are nonessential (luxuries) – that is, goods/services that tend to be costly or have plenty of substitutes. They include leisure, such as a holiday.

Price inelasticity is reflected graphically in demand curves that are steep (Figure 12 A). A steep demand curve indicates that even a large variation in price produces only a minor variation in quantity demanded. Goods or services that demonstrate high inelasticity tend to be those that are essential, have fewer substitutes or cost little. They include matches and drinking water.

At the extreme, an inelastic demand curve suggests the quantity demanded does not change with price. On the other hand, a perfectly elastic demand (Figure 12 C) suggests a slightest change in price leads to a marked change in the quantity demanded.

3.4 Total consumer benefit and consumer surplus

Consumers generally pay less for a good or service than the total benefit that they derive. To understand this concept, see Figure 13, which illustrates the demand curve of fish.

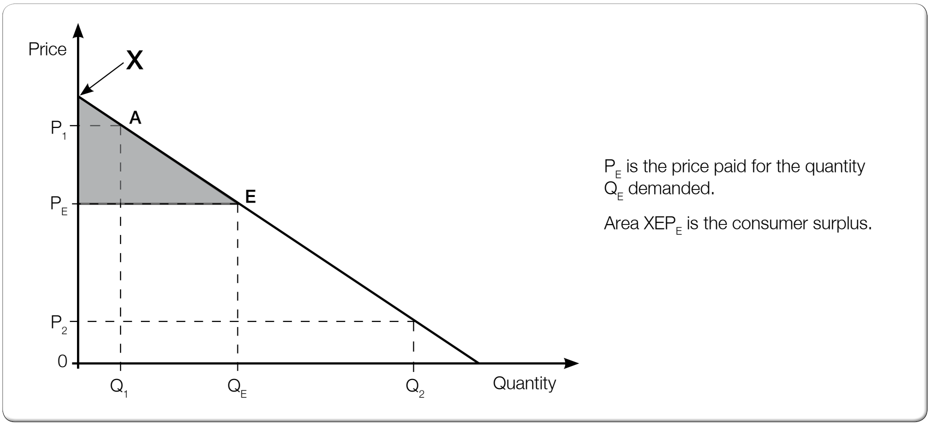


Figure 13. The demand curve and consumer surplus.

At price X, no-one is willing to buy fish because the price is too high. In a market, at price P_1, perhaps only one person is willing to buy the first unit of the good Q_1 (Figure 13). Only when the price decreases are other people in a community willing to buy any fish. As price decreases, more and more people buy fish. The quantity demanded thus increases as prices decrease. Imagine the price for fish is P_E, when the quantity of fish bought is Q_E. Logically, the total amount that the consumers pay (that is, the cost of obtaining Q_E fish) is P_E multiplied by Q_E. Nevertheless, some consumers would have been willing to pay a much higher price, P_1, and to consume Q_1. Equally, only when the price decreases to P_2 do more people buy fish, and the total amount of fish bought is Q_2. Nevertheless, again, some consumers would have been willing to pay a much higher price for some of the fish.

Graphically presented, the total amount that consumers are willing to pay at price P_E for Q_E amount of fish is equal to $0XEQ_E$. This means some consumers derive additional benefits above what they paid for the good. That is, they derive a net consumer benefit equivalent to the area XEP_E. This net benefit derived by consumers is called the 'consumer surplus'.

The same principle applies at the individual level. Consumer surplus is the total benefit (or value) derived by the person minus the amount for which the person actually pays. Consumer surplus captures the 'bargain' value achieved when an individual gets something really cheap. Each individual thus attempts to maximise his/her consumer surplus.

The existence of consumer surplus explains why, in a market where bargaining is acceptable, people tend to negotiate down a price, even though they may be willing to pay more. In economic terms, consumers may be said to try to maximise their consumer surplus and pay as low a price as possible. This is because maximising consumer surplus maximises the net benefit to consumers. Decisions made by rational consumers will be expected to lead to the maximisation of net consumer benefits in a community.

3.5 Concluding remarks

What people want and the price they are willing to pay for an item are important determinants of how they behave in a market environment. These also determine total benefits, or consumer surplus, they derive over and above what they pay to consume the goods. The willingness to pay, or price of a good, provides important signal to those who wish to produce and supply those goods as discussed in Chapter 4.

Chapter 4

PRODUCTION AND SUPPLY

To understand what is produced for human consumption and the effect that has on natural resource and environmental conditions, it is important to understand what constitutes production – to understand the relationship between production costs, prices and determinants of what is supplied; and the quantity supplied, including peoples' incentives and production benefits.

4.1 What is production?

People produce things to fulfill their wants and needs. Production is the act of producing, manufacturing and/or providing things valued by humans to meet those wants and needs. Production involves applying inputs to some form of process. Inputs may be extracted directly from nature (such as timber, fibres and fish) or they may take the form of manufactured items, human labour or financial capital. The combination of processes and inputs results in the production of goods and services that can be used to fulfill wants.

Some Pacific Islanders 'produce' fish for home consumption by combining inputs (traps made from mangrove wood or bamboo, together with time and effort, or 'labour'). Similarly, some families produce their own vegetables by combining land, water, fertiliser and labour. Figure 14 shows the steps in a simple subsistence production process for fish.

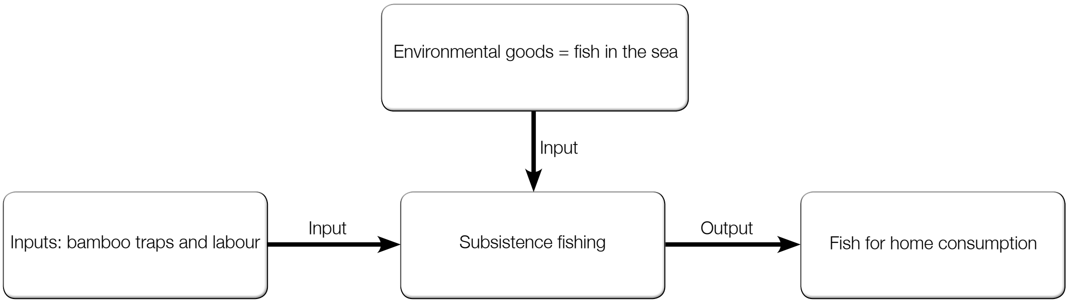


Figure 14. Simple subsistence production process for fish.

Commercial activities often involve not only labour and minor physical items, but also financial and physical capital (machinery and other equipment). Commercial inshore fisheries production, for example, usually involves the use of outboard boats, gill nets or fishing lines. Additionally, inputs bought or obtained from the environment may be used to produce goods and services such as fish. Natural inputs to the fishing process may be bait in the form of small fish or worms.

The extraction of live coral is also a form of production. In this case, local villagers use *bilibili* and crow bars (low technology capital equipment) to break the live coral off the reefs within the shallow lagoons or outer reefs. For many products, the production process involves more than the mere extraction of goods from the environment. The production of smoked and dried mullet, for example, involves taking mullet from the wild or aquaculture ponds, then adding inputs such as firewood, labour and a simple smoking technology. Figure 15 shows the steps in a simple commercial production process for fish.

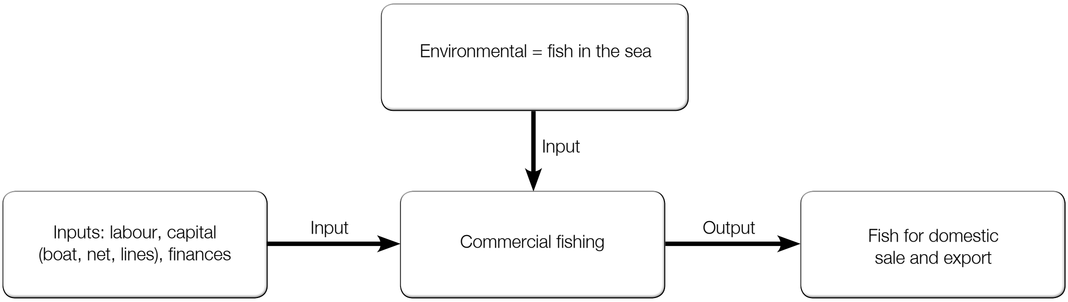


Figure 15. Simple commercial production process for fish.

A similar notion of production can be used to describe non-extractive uses of the environment, such as dive operations or ecotourism. A dive operator produces 'units' of dive experiences (person trip numbers) for people interested in enjoying the sea. The inputs used by a dive operator may include the boat and dive gear, people's time (labour) and the use of the natural environment, such as a coral reef. Similarly, ecotourism produces a number of eco-tour experiences using inputs such as four-wheel drives, fuel, and the natural habitat.

The number of dive experiences produced by a commercial dive operator depends on the number of boat trips made, the area of the coral used for diving, the number of dive gear items on board and the size of the boat used.

In some cases, the output of the production process may involve the provision of a service, such as waste collection or waste recycling. In waste collection and disposal, a producer supplies the output – a waste removal service – using labour, a collection truck and land for storing the waste collected. Producers thus produce goods and services that consumers demand. At times, consumers are also the producers. An example is any subsistence activity where people work to produce a good and then consume it themselves.

The relationship between inputs and output is formally expressed in terms of the production function (Box 3).

Box 3. Production functions for selected commercial products.

A production function summarises the relationship between the quantity of a good or service produced and the inputs involved in its production. People can supply an infinite number of goods and services, so there is also an infinite number of production functions that can exist.

Below are some simple examples.

1. Commercial fisheries – product = fish for food

The volume of fish (Q) caught depends on:

- the number of people – or how much labour (L) – involved in fishing;
- the type and size capital equipment (K) used, such as the size of the fishing boat;
- the amount and type of fishing gear (Z) used; and
- the quality of the coastal environment (E).

The production function

$Q = f(L, K, Z, E)$

2. Commercial live coral harvest – product = live coral for export

In the production of live coral for export market, villagers use a bamboo raft (or *bilibili*), labour, chisels and hammers to chip off coral and sell it. The volume of live coral (W) supplied depends on:

- capital equipment (K) such as *bilibili* and crowbars;
- labour (L); and
- the coral reef (E).

Production function

$W = f(K, L, E)$

3. Dive ecotourism – product = dive experiences

Tour boat operators supply dive experiences. The number of dive trips supplied (Q) depends on:

- the number of people – that is, the amount of labour (L) – available;
- the number of boat trips (T);
- the dive gear used (K); and
- the quality of the coastal environment (E).

Production function

Q = f (L, T, K, E)

4. Waste collection services

The local council provides the waste collection services using a garbage truck, labour and land. The number of collections (Q) supplied by the local council depends on:

- the number of garbage trucks (K);
- the number of people available (L);
- the land (R) available for dumping waste; and
- household waste (Z).

Production function

Q = f (K, L, R, Z)

5. Waste produced by a fish shop

The amount of waste produced (Q) by a fish cooperative depends on:

- the amount of fish (F) processed (cleaned and filleted);
- the size of the building (the fish processing plant) where the cleaning and filleting occurs (K);
- the amount of water (W) used;
- the labour supply (L); and
- electricity (e).

Production function

Q = f (F, K, W, L, e)

Goods supplied and price

According to the Concise Oxford Dictionary, the word 'supply' means to provide or furnish. People supply goods that others want and for which they are prepared to pay. Ecosystems such as reef and mangroves produce many goods that humans use. They also provide important ecological services that support marine life. Ecosystems thus supply goods and services that support marine life and that are extracted or used to produce what people want and demand. Similarly, governments provide essential services (such as health and education) to the public. In this way, governments are suppliers of such services. In other words, producers use environmental goods and services and other inputs to supply goods and services that consumers want.

People supply goods and services only if the technology is available to produce them. When an individual or a company decides to produce a good, it uses inputs or 'factors of production'. The use of factors of production often incurs costs. To be induced to supply goods and services, therefore, producers need to expect to earn some benefit – or profits, not just cover costs. In economic terms, the quantity supplied of a good is the amount that producers plan to produce and sell (and/or consume). It is determined primarily by what is demanded (and thus willingness to pay) and the cost of production – where production cost includes some notional level of normal profit. If the price consumers are willing to pay is less than what it costs to produce the good, then the good will not be produced.

Since people's actual willingness to pay is often not known, producers make decisions about what the demand may be and thus the quantity to produce and at what price. The higher the price of a good consumers are willing to pay, the greater the incentive for producers to produce and sell more in an attempt to secure greater profits. The quantity of goods supplied at what price is determined by the cost of production – and if the benefit of doing so is greater than the costs (that is, a profit can be made).

4.2 Total production costs

Having made a preliminary decision about what to produce and the expected sale price of the goods, a producer needs to make the following three key decisions before production may actually occur:

1) What plant, equipment and/or production processes to use?
2) How best to use capital, machinery, labour and other inputs, and how much of each input to use?
3) How much of the good to produce?

Producers also need to choose the methods and/or technologies that are appropriate. This decision will determine the scale of production and the amount of resources used in the process. In other words, the producer needs to consider the production process, the scale of production, and the factors of production. In subsistence economies, families (or chiefs) address such questions in relation to their assessment of what they want and what they are willing to pay (as discussed in Chapter 3). In commercial economies, business owners or business managers more commonly address what consumers want and what they are willing to pay.

Total, fixed and variable costs

Inputs to produce goods and services may be financial or non financial in nature. Some inputs such as fuel or chainsaws may have to be bought and incur a financial cost. Otherwise, like bait, might be supplied from the sea 'for free' – so incur no financial costs as such – but require labour to collect. Inputs like labour cost time because they might have been spent elsewhere. Financial costs may be fixed or variable.

Fixed costs

Some factors of production are large and expensive, such as production plants and equipment (such as for large-scale fish production and storage). These inputs cannot be changed in the short term and often do not change with a change in the quantity of good/output produced. They are thus regarded as fixed inputs and their costs are fixed as well.

Plants, buildings and equipment (capital equipment) involve fixed costs because it is usually difficult and expensive to vary such fixed inputs in the short term. Where capital items (fixed cost items) are involved in the production process, the scope for varying supply levels in the short term is relatively limited because it is time consuming and expensive to vary the level of capital investment. A community cannot build a new resort overnight, for example, if it suddenly wants to attract more tourists. It needs to plan, finance and construct the building, which could take years. Consequently, the supply of rooms that it can provide is fixed in the short term. The company can alter only the variable costs involved in the production process, so it may choose to lease additional rooms from another establishment.

Similarly, for the culture of giant clams, initial investment in the hatchery is fixed. People can increase supply only by increasing variable costs related to small inputs (such as the amount of seed stock used in breeding, or the amount of chemicals used to minimise the risks of clam mortality).

Variable costs

Where some inputs to a production process are fixed, any increase in the supply of goods or services can be achieved in the short term only by varying the amount of other non-fixed inputs, such as cash, labour and electricity. Factors that can be changed in the short term are called variable inputs, and they give rise to variable costs.

Increases in quantity supplied and fixed and variable costs

While variable costs can be increased to change the level of supply of goods and services, they cannot be increased indefinitely to increase production. They are eventually limited by the scale and efficiency of the fixed equipment that uses them. More fuel may be added to a generator to provide electricity to the tourists at Samoan *fales*, for example, but the power generator that services them will eventually work at capacity, at which stage the electricity supply cannot be increased further. The generator requires maintenance over time, needing more and more servicing the longer it is used. The generator's fuel and maintenance costs (the variable costs) thus start to increase as the supply continues. Eventually, the generator will need to be serviced and replaced if supply is to continue in the long term. As a result, the increase in electricity supply is still relatively limited in the short run until the owner updates or expands the capital investment.

Similarly, the amount of land available to produce *taro* is fixed. A farmer can add fertiliser to the land to increase the supply of *taro* in the short term, but the extra fertiliser eventually stops increasing the amount of *taro* supplied because the land is working at full capacity.

This limit to increased supply is termed 'diminishing returns' in economics (Box 4). This concept explains that the only way in which people can continue to increase the supply of goods and services beyond a certain point is to change their production base by altering their fixed inputs as well as their variable ones.

Box 4: The law of diminishing returns.

Generally, as a producer increases the amount of inputs, the output (that is, the total product) increases. The output is the total number of units produced with a given quantity of inputs (land, labour, capital and so on) over a given period. Subsequently, as more and more inputs are used, the output increases but at a decreasing rate. That is, there is a diminishing marginal return to a point, beyond which an additional input reduces the total product.

The law of diminishing returns explains that additional variable inputs added to a fixed quantity of other inputs beyond a certain point will result in smaller and smaller increases in output.

In the short term, producers continue to increase the supply of goods if they can make some profit. The cost of capital equipment is fixed during this time. Already paid for, capital equipment can be considered a 'sunk cost' – that is, it is unavoidable and cannot be recouped. The only financial costs that affect production levels, therefore, are variable costs.

Where capital items are used in the production process, there is usually scope for an increase in supply to a certain point. This scope exists because, where production levels are low, the fixed factors of production have excess capacity. A family may buy a truck, for example, so it can carry logs from its forest to the local market. If it uses the truck only once a week, it is not getting the best use out of the investment. The more it uses the truck, the greater is the family's return on its investment and the lower is the cost per unit of output, up to a certain point. In economics, this is termed 'increasing economies of scale' (Box 5).

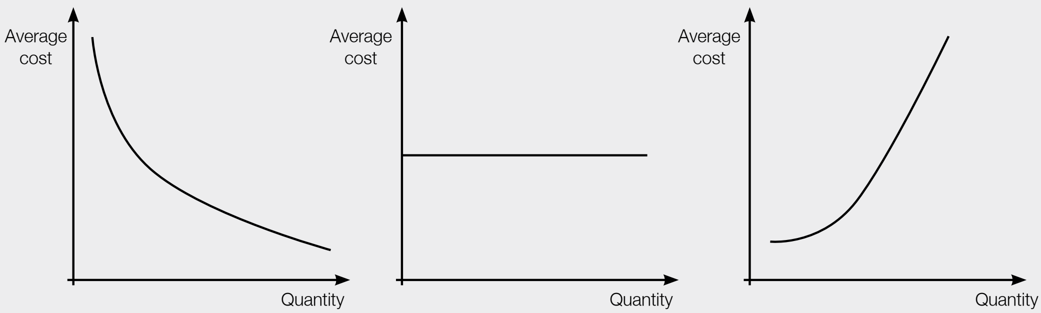
Once capacity is reached, however, additional levels of inputs do not necessarily increase the output at the previous rate of increase. An increase in the unit cost of production occurs as supply levels increase beyond a certain point. In economics, this is termed 'decreasing economies of scale' (Box 5). This suggests the law of diminishing returns is underway. Where decreasing economies of scale (or diseconomies of scale) occur, families or companies need to consider modifying or expanding their base.

Costs (fixed and variable) thus determine the scale of operation. The smaller the scale, the smaller is the capacity to produce and, often, the lower is the unit price of a quantity of goods supplied. Conversely, as a business wishes to expand beyond the current capacity of its fixed inputs, it will have to invest in larger equipment in the long term. The fixed costs of larger plants are higher, which means that the unit cost of production is higher and the company needs to charge a much higher price to be induced into producing more. This is the reason for the upward sloping supply curve discussed above.

The supply of goods and services in the short term is a function of variable costs. In the long term, supply of goods and services is a function of fixed and variable costs arising from the use of different factors of production.

Box 5. Economies and diseconomies of scale, constant returns to scale.

The average total cost of production initially decreases as the output increases (Figure A). That is, a company experiences increasing economies of scale (or increasing returns to scale) up to an optimal output level (Figure B), beyond which the average cost increases (Figure C). The average cost of production increases because the company has already used its capital to full capacity and has to invest in larger equipment to increase output; that is, decreasing economies of scale (or decreasing returns to scale) set in after a point. The ideal is when the average cost remains constant – that is, there are constant returns to scale.



A. Increasing economies of scale **B. Constant returns of scale** **C. Decreasing economies of scale**

4.3 Supply, marginal cost and price

The relationship between the amount of goods supplied and the price received for the good is termed 'supply'. The supply of a good reflects the compensation (money or other items) that an individual has to be offered to produce that amount of a good and hand it over. This is also referred to by economists as the 'willingness to accept compensation' (WTAC). Willingness to accept compensation is a minimum amount a person needs to be paid to supply a good. In a subsistence economy, the supply of an item depends on the amount of other items (such as payment in kind) that suppliers may be offered in return for goods.

By comparison, the supply of a good or service in a monetary economy is more commonly reflected in the amount of money that people are willing to accept in exchange for a quantity of the item. That is, the quantity supplied depends on the cost of supplying the good and thus the price the supplier is willing to accept for that good.

Generally, the higher the price that people are offered for an item, the greater their incentive to produce more for sale. This occurs because supplying an item involves time and labour, as well as other inputs. The supply also reflects the costs of producing each unit (discussed below).

The higher the price offered for a good, the more producers can cover the costs of the good's inputs, as well as make profits (Table 3). By comparison, lower prices generally mean individuals have less incentive to produce goods and services. As a result, fewer resources will be used in the production process. The relationship between the price of a good and the quantity supplied is called the supply schedule (Table 3).

If plotted on a graph that displays the price of a good or service in relation to the quantity supplied, the supply of goods and services appears as an upward sloping curve called a 'supply curve'. (See Figure 16 as an example using the supply schedule from Table 3). The supply curve illustrates the relationship between the price of a good and the quantity supplied. It includes costs and a built-in level of profit that suppliers need to induce them to supply goods.

A standardised example of a supply curve is given in (Figure 17).

Table 3. Supply schedule for burgers.

Price ($)	Quantity of burgers supplied
1.25	5
1.00	4
0.75	3
0.50	2
0.25	1

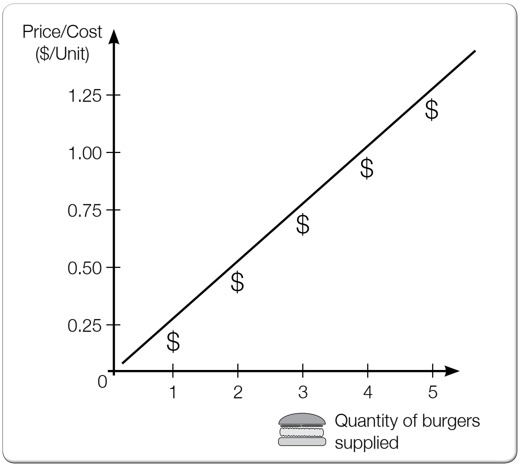


Figure 16. Quantity supplied and price.

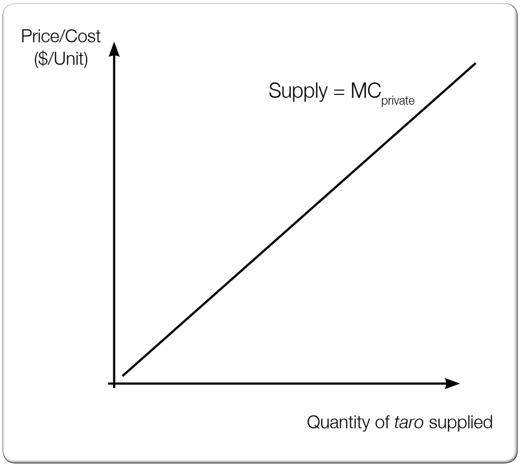


Figure 17. Quantity of good supplied and price (supply curve).

Supply and marginal cost

In the short term, people can be expected to continue supplying additional units of a good or service so long as the price they receive for it covers the cost of producing it. In economics, the additional cost of producing the next unit of a good or service is called the 'marginal cost'. Note that the marginal cost also contains a built-in minimum profit level that producers need to earn to be induced to produce the goods.

The relationship between the quantity supplied and the marginal cost is thus the same as the supply curve for a company (recalling that supply is the relationship between the quantity supplied and the price). The same principle also applies in the long term for each company: the long-term supply curve reflects the long-term marginal cost to producers of supplying additional goods. Box 6 summarises the types of costs involved in the production process.

Figure 18 displays the supply of *taro* by a village, illustrating the relationship between price and quantity supplied, and also revealing the marginal cost (MC) to villagers of producing *taro*, $MC_{private}$. The supply curve is thus often known as the producer's MC curve – or the private MC curve.

Box 6. Different costs and the supply of goods and services

Total cost

The total cost (TC) is the total cost of producing any given level of output. It comprises two components: total fixed costs (TFC) and total variable costs (TVC).

TC = TFC + TVC

Where

TC = total cost

TFC = total fixed costs

TVC = total variable cost

Note: Fixed costs do not vary with the level of output, whereas variable costs do vary with the level of output.

Average total cost

The average total cost (ATC) is the cost per unit of output.

ATC = TC/Q

Where

ATC = average total cost

Q = output

Marginal cost

The marginal cost (MC) is the incremental change in total cost resulting from the production of one additional unit of output. In the short term, the marginal cost also reflects marginal variable costs.

MC = change in total cost with a change in output

Where economies of scale occur in production, higher production means cheaper outputs. That is, where economies of scale occur, each additional unit of a good is progressively cheaper to produce (because costs are spread over a greater output). The existence of economies of scale means the MC of producing an additional unit is less than the ATC. At the point of minimum average cost, the MC equals ATC. This is also the point at which constant returns to scale occur and the business is running at its capacity.

Law of supply

The law of supply states that the higher the price of a good, the more of a good an individual, family or company supplies. This occurs because it is more profitable for a company to supply more at a higher price. The law of supply is summarised in Figure 18.

Any single point along the supply curve indicates the quantity supplied for a given price. When the price of a good or service changes, the quantity supplied changes too. A change in price does not alter the position of the supply curve; instead, it results in a movement ('expansion' or 'contraction') along the supply curve. Imagine the market price of a product is P_E. The quantity supplied is thus Q_E. If the price increases to P_1, then the quantity supplied is expected to increase to Q_1. If the price falls to P_2, then quantity supplied is expected to decrease to Q_2.

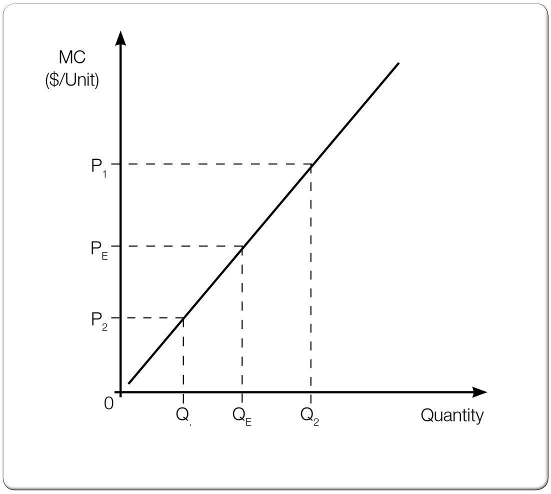


Figure 18. Law of supply.

Market supply

Just as the supply of a good reflects the relationship between the price of a good and the quantity of that good supplied by an individual, the market supply reflects the relationship between the price of a good and the quantity supplied by all producers for a market. For most common goods (more specifically, private goods as discussed in Chapter 7), the market supply is the sum of the individual supply curves. That is, at a given price, the quantity supplied by the market as a whole is equal to the sum of the quantity of a good supplied by each producer.

4.4 Determinants of supply

The factors that affect the quantity of a good or service supplied (i.e. position of the supply curve) belong in two categories: the conditions of supply and price. As discussed, a change in price affects the quantity supplied: as the price of a commodity increases, producers can be expected to supply additional amounts of that good to increase their profits. (Similarly, subsistence workers would continue to produce additional amounts to increase their welfare.)

The relationship between the percentage change in the amount supplied and the percentage change in price is called the ‘elasticity of supply’ (Box 7). Generally, the slope of the supply curve reflects the elasticity of supply. The flatter the supply curve, the more responsive is the quantity supplied to price, and vice versa.

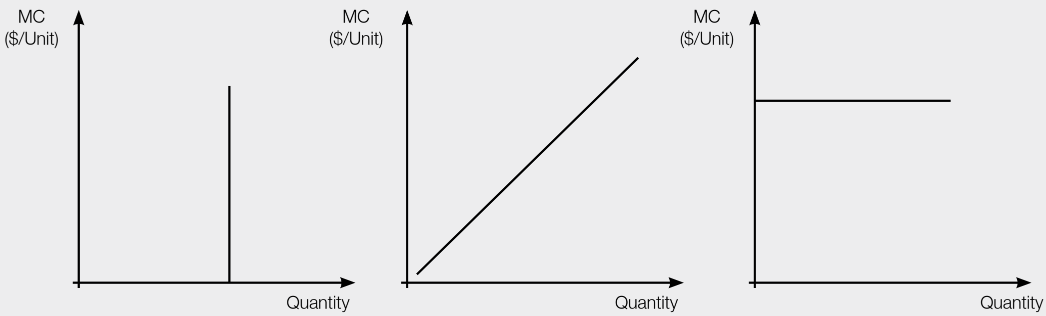
On the other hand, a change in the conditions of supply results in a shift of the whole supply curve, affecting both the price and the quantity supplied. The supply curve of a good is determined by the company’s production function and its cost structure. More specifically, a company’s long-run supply curve is its marginal cost (MC) curve. Anything that influences the marginal cost of output (input prices, or output) will thus cause a shift in the supply curve.

Box 7. Price elasticity of supply.

Elasticity is a measure of how sensitive one factor is in relation to another. The price elasticity of supply is thus a measure of how sensitive the supply of a good is to changes in price. A good is price elastic (Figure B) if the quantity supplied increases more than a proportionate increase in the price (and vice versa). Conversely, a good is price inelastic (Figure A) if a change in quantity supplied does not lead to a proportionate change in price (ie $\frac{\Delta Q/Q}{\Delta P/P}$).

Elasticity in supply is reflected graphically by the slope of the supply curve. The higher the elasticity, the flatter is the curve. Flatter curves suggest even a minor change in price generates a large change in quantity supplied (Figure C).

Goods are relatively price inelastic if the change in supply is proportionately less than the change in price. Goods or services that demonstrate high inelasticity (Figure A) tend to be those that are fixed in supply by nature (such as the supply of freshwater), are produced by technology that is not easy to change; or goods that take a long time to be supplied (such as mahogany or mangrove forests). That is, price elasticity of supply depends on technical conditions, time and whether inputs are human made or naturally produced.



A. Inelastic supply **B. Elastic supply** **C. Perfectly elastic supply**

The conditions that affect supply reflect all the factors that affect the marginal cost of production. These factors include technology, the costs of inputs or factors of production, the costs of related goods, environmental factors, the number of producers and expected future prices. These factors cause a shift in the position of the supply curve.

Technology

Technological change often improves productivity of inputs. Suppose supply curve S_0 in Figure 19 illustrates the relationship between the quantity produced and the marginal cost of production of that unit of good using an old technology (such as old nets or a rowing boat). Using the old technology, the family can produce Q_0 fish for a cost of MC_0. If a new technology leads to an increase in the productivity of fishing, this will increase the level of outputs produced by a family. This means the average cost of output decreases and the marginal cost for the same level of output is also lower than when using the old technology (now MC_1). Alternatively, as a result of new technology (say, stronger nets or motor boats), the family can achieve a higher level of output at the same cost. Graphically, this is represented in Figure 19 as a rightward shift in the supply curve from S_0 to S_1. For the same cost, the family can now produce a greater quantity of fish, that is, Q_1.

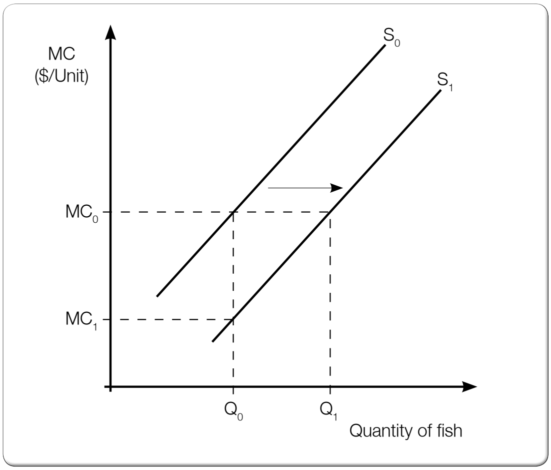


Figure 19. Effects of technological advancements on supply.

Cost of inputs

When input prices change, the total cost of supplying a good can also change. An increase in fuel costs, for example, causes an increase in the total cost of fishing. When the total cost of production increases, the per unit average and marginal cost of producing goods and services also increases. Imagine the price of fuel increases, increasing the total cost of going out to fish in a motor boat. The increase in fuel costs means fishers have to spend more money to fish for the same amount of time. The cost of catching the same amount of fish thus increases. Graphically, this is illustrated as an upward shift from the original supply schedule, S_0, to the new supply schedule, S_1 (Figure 20).

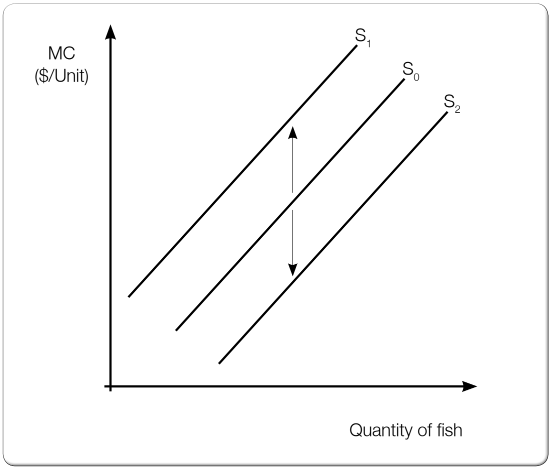


Figure 20. Changes in the cost of inputs and the cost of supply.

By comparison, a decrease in the cost of inputs causes a decrease in the total cost of production. Consequently, the average and marginal cost of supplying a good or service falls for the same output. Graphically, a decrease in the marginal cost of production for each quantity of good supplied appears as a downward shift in the supply curve. In Figure 20, a decrease in input price (for example, a fall in the cost of bait) appears as a downward shift from the original supply schedule, S_0, to the new supply schedule, S_2.

If changes occur in the price of one input (cost), producers may adjust their use of other inputs, substituting inputs. The marginal cost of output may not change much, therefore, and a producer may continue to produce the same level of output.

Subsidies and taxes

Sometimes governments provide subsidies to rural communities to encourage production. Subsidies to communities work by lowering the costs to them of supplying a good or service. The Fiji Government, for example, has provided rural Fijians with a boat subsidy that reduces the cost of buying boats used for artisanal and deep sea fishing. The reduction in costs makes it cheaper for Fijians to operate in the fishing sector.

The effect of subsidies is to lower the total financial cost of producing/supplying a good or service. The cost reduction means the average and marginal cost of supplying the same amount of a good falls. When the price at which the good is sold remains the same, the input cost reduction can result in an increase in production levels. This concept is illustrated in Figure 21. S_0 represents the costs of artisanal fishing in Fiji before the subsidy is introduced. With the introduction of the subsidy, the cost of supplying fish falls. This fall is reflected by a rightward shift in the supply curve to S_1, indicating that more fish can be supplied for the same cost (or that the cost of supplying the same amount is lower). Subsidies thus often cause an increase in use of resources and, at times, an overexploitation of natural resources.

Governments may also choose to tax producers, for a number of reasons. Governments often use taxes to raise revenue, as part of a fiscal strategy by Treasury or as part of an effort by government departments (such as Fiji's Department of Fisheries) to recover management costs. Compared with subsidies, taxes raise the cost that producers face when supplying a good. This increase appears as a leftward shift in the supply curve, indicating that the quantity of a good supplied falls for the same production cost. In Figure 21, S_0 represents the supply of fish without taxes or subsidies. Q_0 fish are supplied at a cost of MC_0. If a tax is imposed, the supply curve will shift left to S_1, meaning that the same quantity of fish will cost more to supply (MC_1 instead of MC_0). Alternatively, fewer fish would be supplied at the same cost. By comparison, if the government introduced a subsidy on fishing, supply would effectively become cheaper. Producers would be able to supply the same quantity of fish at a lower cost of MC_2 – or alternatively, supply more fish at the original cost (Figure 21).

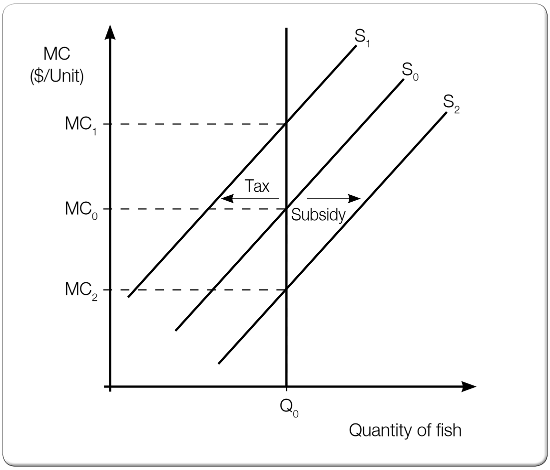


Figure 21. Subsidies, taxes and the costs of supply.

Price of related goods

Where producers produce closely related goods, the price of the second good can affect the supply of the first good. A fisher farms sponge and coral in the same area of costal water, for example. If the price of sponges increases, then the fisher will divert effort towards the production of sponges, thus affecting the quantity of coral supplied. Similarly, if the pink coral and white coral are close substitutes for the aquarium trade, and if, say there is a change in preference for pink coral and people are willing to pay more such that the unit price of pink coral increases, a villager would be expected to put most effort into producing the pink coral. As a result, the quantity of white coral produced will fall.

Natural factors

In many cases, a production process involves working out in the field under the natural elements or relying on natural endowments of ecosystems such as coral reefs, wetlands and forests. Any changes in these natural environments will thus shift the supply curve.

Climate

Weather and other biophysical conditions affect the amount of many natural goods or services that people can supply for a given set of inputs. For example, for the same cost, agricultural production is often higher under favourable weather conditions, resulting in a lower average cost of production and a lower marginal cost of production. Suppliers of goods and services can thus achieve higher profits for the same investment. On the other hand, bad weather or diseases cause a decline in output, resulting in a higher per unit (average) cost of production and a higher marginal cost.

Imagine a community is engaged in commercial *taro* cultivation, and farmers experience increased drought months due to climate change, and crop yield decreases. The unit cost of production will increase and the farmer will experience reduced profits, or even a loss. Similarly, a pest (such as the *taro* leaf blight that decimated the *taro* crop in Samoa) can result in a decline in supply. Graphically, these falls are illustrated as a leftward shift in the supply curve, indicating that fewer goods and services are produced for the same cost.

Natural endowment

Activities that negatively affect the quality of the environment (that is, its natural endowment) reduce the amount of goods or services that people can produce and thereby raise the average and marginal costs of production. Graphically, this would appear as a leftward shift in the supply curve.

Imagine a mangrove area is reclaimed and the breeding and nursery grounds for the local fishery are destroyed. As a result, the local fish population decreases and the time to find additional fish increases, thereby raising the marginal cost of supplying additional units of fish. At the same time, the average costs of catching fish are higher because the same amount of effort renders fewer fish. Graphically, the reduction in fish caused by mangrove destruction is illustrated in Figure 22 by a leftward shift from supply curve S_0 to S_1. This means a reduction in the quantity of fish supplied from Q_0 to Q_1 (or alternatively an increase in marginal cost for Q_0 quantity of fish from, P_0 to P_1).

Since the per unit cost of fishing increases in these cases, the price at which fish are sold has to increase if producers are to maintain profits. Tacconi and Tisdell (1992, p. 11) noted that Fijian women claim that the price for giant clams is high because the clams are difficult to find. In other words, the price relates to the difficulty (and, consequently, the cost) of supplying goods.

Changes in natural endowments may be a direct result of a competing use. For a given forest area, for example, building a resort for tourists (to supply tourism services) would reduce the amount of land available for wildlife habitat and recreation.

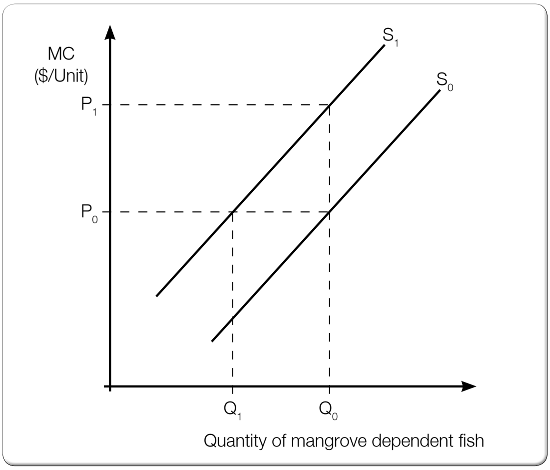


Figure 22. Natural resource endowments and supply costs.

Increase in the number of producers

Recall that market supply is the sum of supplies of individual producers. If the number of producers increases, the market supply will also increase. With the increase in the number of producers, figuratively, the market supply curve shifts to the right indicating that the quantity supplied at each market price increases.

Joint supply – a special case

At times, the supply of one good is affected by the supply of another good. While aiming to catch fish with gillnet, for example, fishers may also catch different types of sponge. The quantity of sponge supplied at the market, therefore, depends on the quantity of fish supplied. Similarly, the amount of pollution resulting from pesticide use in a village depends on the amount of a good that the villagers try to produce using the pesticides. The more tomatoes, for example, that a village tries to produce for sale will affect the amount of pesticides that the village uses and, in turn, the amount of pollution in the local rivers. It is thus possible to develop a supply curve for the joint item, using information about the supply curve of the marketed goods and also technical knowledge about the relationship between the marketed good and the associated item, such as pollution.

4.5 Producer benefits and producer surplus

Recall that the supply curve reflects the minimum price that a producer needs to cover the marginal cost of producing the respective quantity of a good. That is, it costs P_e to produce each unit of the Q_e amount of fish. The total cost to the producer to produce the Q_e amount of fish is thus equal to the area $0YXQ_e$. That is, total revenue equals P_e multiplied by Q_e (or area OP_eXQ_e); however it costs only $0YXQ_e$, so a producer makes an extra profit (above the normal profit that the MC curve already accounts for) equal to P_e multiplied by Q_e, or OP_eXQ_e minus $0YXQ_e$ or an area equivalent to YP_eX. This is known as the producer surplus. In a market economy, producers try to maximise their net benefits, or producer surplus (Figure 23).

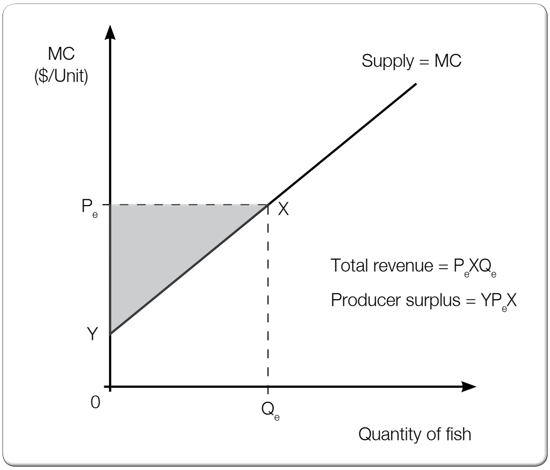


Figure 23. Producer surplus.

4.6 Concluding remarks

Production technology and the cost of inputs determine the production costs which, in turn, affect the quantity of goods supplied by producers. In the short term, fixed costs are effectively ‘sunk’. In this case, producers, will continue to produce a good as long as the variable costs of producing the additional units of the goods are covered by sales. In the long term, however, a producer must cover all the costs, fixed and variable costs, of production.

External factors though also affect the cost of production, such as government taxes and subsidies, as well as environmental conditions such as climate, pests and pollution; and thus the quantity of goods supplied and at what price. Ultimately, the amount consumers are willing to pay for a good or service determines the quantity of goods supplied.

Chapter 5

MARKETS, VALUES AND OUTCOMES

All societies have some form of system to guide the exchange of goods and services between people. In traditional societies, the exchange of goods between individuals was achieved first through barter. In some societies some common numeraire was also used, particularly for highly-valued goods or services. Today, however, money is most conventionally used in the exchange for goods and services traded through markets. Financial values therefore guide how resources are allocated in markets.

5.1 What is a market?

A market brings together consumers who want to acquire goods and sellers who want to sell them. Markets can be in person at a market place or can be virtual markets – that is, on the Internet. Regardless of the nature of the market place, a market transaction involves the exchange of goods and services for money between the two parties, governed by accepted rules or conditions.

In Chapter 2 it was noted that individuals acted in their own interests choosing the option that makes them ‘best off’. Producers, acting in their own interests, are therefore expected to produce only the amount of goods demanded by consumers, to produce goods at minimum costs and to sell goods for the highest price that they can secure. That is, producers aim to maximise their benefits or producer surplus, including profits. At the same time, consumers act in their own interests, so they are expected to consume only the quantity of goods that maximises their ‘well being’, or satisfaction level after paying for the goods, or consumer surplus.

In a market economy, individual decisions are considered to be ‘sovereign’. This means that producers respond to consumers’ wants and produce the goods demanded, for as long as it is profitable to do so. In light of this, this chapter considers:

- the meaning of markets and market values;
- market transactions and market outcomes; and
- the outcome of interactions between consumers and producers.

In the broadest sense, markets provide a medium through which consumers and producers ‘come together’ and exchange information about goods and services, as illustrated in the CPEI framework (Figure 3).

Price information is critical, facilitating the exchange of goods and services:

- Price conveys to consumers the cost of goods and services and thus how much of the good can be supplied.
- It conveys to producers how valuable goods and services are to consumers and thus how much those consumers are likely to demand.

Market transactions are facilitated by the transfer of some form of payment, money or goods, according to accepted rules or conditions. The rate of exchange is determined by barter or through a market system established by governments or communities. The emphasis here is on the interaction between the demand for (consumers) and the supply of (producers) goods and services.

The exchange of goods or services between consumers and producers is a way for societies to decide how best to use scarce resources (known in economics as ‘the problem of scarcity’).

Given that markets rely on information exchange on the demand and supply of goods and services, the existence of quality is critical for markets to work effectively and efficiently. Equally important is the expectation that consumers and producers act in their own interests.

5.2 Market outcomes

Market outcomes are based on the freedom of consumers and producers to choose and determine the allocation and distribution of goods and services. In a sense, the price of goods and services acts as a rationing device – that is, a signal to producers and consumers about how much to produce and consume respectively, and how resources are allocated. Figure 24 illustrates how price signals to consumers affect how much of a good to buy, and how it signals to producers how much to supply. Suppose villagers catch fish that they sell at the local market. The demand for fish is represented by the demand curve that slopes downwards to the right, indicating that people demand more fish at lower prices (and less fish at higher prices). The supply of fish at the market is represented by the supply curve that slopes upwards to the right, indicating that producers can supply more fish at higher prices and less fish at lower ones.

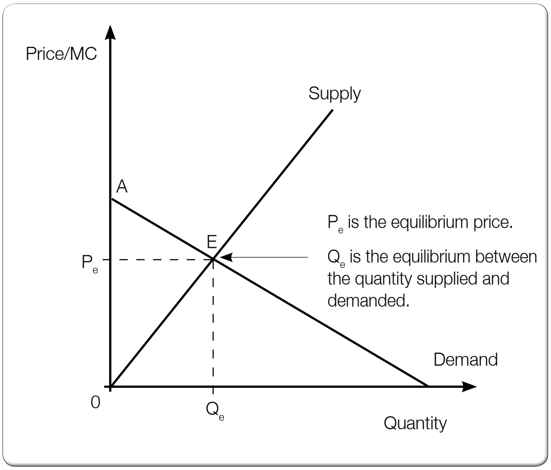


Figure 24. Equilibrium and the trade of goods in the market place.

Market equilibrium

Interaction (or exchange) between producers and consumers occurs in markets at that point where the amount demanded by consumers for a given price equals the amount that producers are willing to supply at that price – point E in Figure 24. At E, the quantity of fish demanded by consumers, Q_e, equals the quantity supplied by producers, Q_e. Also at E, the price at which consumers demand the fish, P_e, equals the cost of producing that additional unit of fish, P_e. At prices below P_e, consumers have an incentive to buy more fish because the price is lower than they are willing to pay; however, beyond P_e, consumers have no incentive to buy more fish because the price exceeds the amount they are willing to pay. Also at quantities below Q_e, suppliers have an incentive to supply more fish because consumers are willing to pay more for the fish than it costs to supply them; however, beyond Q_e, producers have no incentive to supply more fish because the price that consumers are willing to pay will not cover the costs of supplying more units.

Equilibrium in the market place is thus achieved when the quantity demanded at one price equals the quantity supplied for the same price. At this point (P_e and Q_e), there is neither a surplus nor a shortage of goods provided. The quantity demanded just equals the quantity supplied and the price consumers are willing to pay just equals the price producers are willing to accept to supply that quantity of the good. The market price at which the market is in equilibrium is sometimes called the 'market clearing price'. At the market clearing price, or when the market transactions results in an efficient allocation, there is no shortage or surplus. It is 'just right'.

Surpluses, shortages and price effects

Surpluses

In some cases, the market price of goods is higher than the equilibrium price. This may occur as a result of government policies (when the government sets an artificially high price for goods) or sudden troughs in demand. When the market price is higher than the equilibrium price, the quantity of goods supplied will exceed that demanded. There will be temporary surplus. In Figure 25, suppose the government decides to set a floor price for timber to protect the income of the country's timber producers. Without interference, the natural equilibrium of the market would occur at supply Q_e price P_e; however, if the price for timber is set at P_1, consumers would be willing to purchase fewer units of the good – they could afford to buy only Q_1 units of the good. By comparison, producers would be able to expand supply from Q_0 to Q_2. A market surplus of Q_2 minus Q_1 would occur.

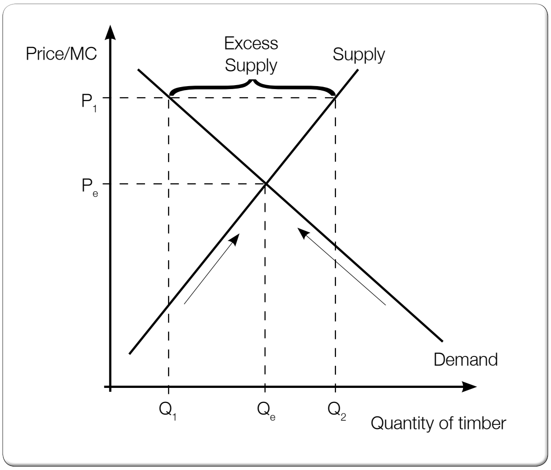


Figure 25. Market surpluses and price.

If the market price was allowed to resettle naturally, it would cease to be profitable for producers to continue to supply Q_2 of the good because the market price would fall. In this case, the market quantity sold would eventually decrease to Q_e.

Shortages

Sometimes, the market price of goods is lower than the equilibrium price. This may occur as a result of government policies (such as a government imposed ceiling price on goods) or sudden peaks in demand. When the market price for a good is lower than the equilibrium price, the quantity of goods supplied will fall short of that demanded. In many countries, the government uses price control on commodities such as milk and bread. As a result, the quantity demanded by consumers is more than the quantity that producers are willing to supply at that price, resulting in an economic shortage.

This situation is illustrated in Figure 26. In this case, the supply of milk is indicated by the curve marked 'supply' that slopes upwards to the right, indicating that higher quantities of the milk are supplied at higher prices. In a natural equilibrium, producers supply Q_e units of milk at price P_e; however, when the price is suppressed to P_1, producers have no incentive to expand production to Qe because the costs of supplying more goods are higher than the price that they receive. They would supply only quantity Q_1.

By comparison, when price is held at P_1, consumers have an incentive to buy additional milk because cost to them is less than what they would have been willing to pay. As a result, they will continue to expand their demand for milk, demanding Q_2 units. As producers will be willing to produce only Q_1 amount of milk, a market shortage of Q_2 minus Q_1 will occur. If the market price were permitted to resettle naturally, it would become profitable for producers to expand the quantity supplied to Q_e because the market price would increase. In this case, the market quantity sold would increase.

Table 4 provides a brief summary of the conditions related to the choices of consumers and producers, and how the market price adjusts to allocate goods and services efficiently.

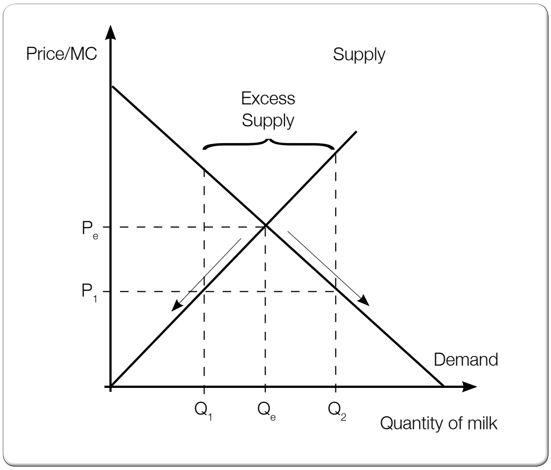


Figure 26. Market shortages and price.

Table 4. Market conditions and price.

Condition	Description	Longer term effect
Quantity demanded is greater than quantity supplied	Shortage	Price rises
Quantity demanded is equal to quantity supplied	Equilibrium	Price remains the same
Quantity demanded is less than quantity supplied	Surplus	Price falls

5.3 Market efficiency and 'perfect' markets?

When a market is perfect, an efficient resource allocation is expected. Perfect market conditions occur when competition exists in both supply and demand and there is good information flow between consumers and producers. In a competitive system, there are many buyers and sellers, the cost of getting the information is low, and information flow allows buyers to know what goods (products) or services are on offer and at what price, and producers to know what is demanded and at what price. Further, there are no barriers to entry, so sellers can enter and leave the market as they please. As a result, industry adjusts according to the quantity demanded and the quantity supplied.

From an economic perspective, this quantity of goods on offer in the market is considered to represent an 'efficient allocation of resources' (Figure 27) because it maximises the joint value of producer and consumer surplus:

- Until Q_e, producers gain additional profit (producer surplus) on all units of the good produced because the price that they receive is less than the cost of supply (Box 8).
- Until Q_e, consumers gain the good at prices lower than they are willing to pay, so they derive a net gain (consumer surplus) from purchasing the good. By Q_e, they are maximising their net benefit from the market (Box 8).

The total gain to producers and consumers is maximised when the market equilibrium occurs. Market conditions are considered to produce the most efficient allocation of resources. That is, markets are considered to generate the most efficient type and amount of goods and services produced from the scarce resources available.

Net economic benefits

As illustrated in Figure 27, where markets are 'perfectly' competitive, they can generate the most efficient allocation of scarce resources between consumers and producers. This allocation confers the highest collective economic benefit for society.

It must be recognised, however, that producer and consumer surplus may not always exist. In highly competitive markets where there are many substitutes for a good, demand is highly elastic. In such cases, the market price equals what consumers are willing to pay. In this case, no difference exists between what consumers are willing to pay and the price that they have to pay so consumer surplus is zero. In other cases, supply may be highly inelastic. Take, for example, the natural supplies of mangrove habitats. The supply of a habitat in the wild is fixed, regardless of the price that people attach to that habitat. The use of wild mangroves produces mainly consumer benefits, because nature supplies a fixed quantity of habitat. In this case, producer surplus would not exist.

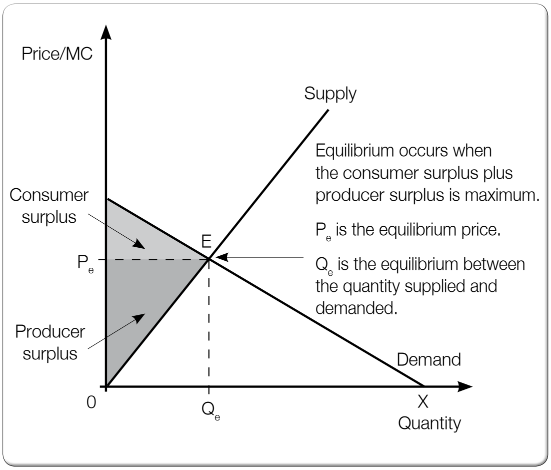


Figure 27. Equilibrium and the trade of goods in the market place.

Nevertheless, where markets are 'perfect', they should still generate the most efficient allocation of scarce resources by creating price signals that encourage producers to supply that quantity of goods that covers their costs and generates at least 'normal' profit; and that encourages consumers to demand that quantity of good where price equals their willingness to pay.

Box 8. Market equilibrium and economic surpluses.

Market equilibrium

In a 'perfectly' competitive market, market equilibrium is achieved and net economic benefit is maximised. This occurs when collective consumer surplus plus total producer surplus is maximised.

In Figure 27, the demand curve represents the amount that consumers are willing to pay to acquire progressive amounts of a good. The total amount that consumers are willing to pay is represented by area AX0.

The amount that consumers have to pay is P_e, at which they consume Q_e units of the good. To purchase Q_e units of the good, they pay producers P_e multiplied by Q_e, or the area represented by $0P_eEQ_e$. The difference between what consumers are willing to pay for Q_e ($OAEQ_e$) and what they have to pay ($0P_eEQ_e$) is AEP_e – the consumer surplus.

In the following Figure, the supply curve represents the cost that a producer will incur when supplying goods. At Q_e level of supply, the producer incurs $0EQ_e$ costs but receives $0P_eEQ_e$ worth of payments. The difference between the cost that producers incur ($0EQ_e$) and what they receive ($0P_eEQ_e$) is $0P_eE$ – the producer surplus.

The market is in equilibrium when quantity supplied just equals quantity demanded, when MB (marginal benefit) equals MC (marginal cost), which equals price (market outcome), and when net economic benefits are maximised.

Net economic benefits

Net economic benefits in Figure 27 equal the area AEP_e (consumer surplus) plus the area $0P_eE$ (producer surplus): $AEP_e + 0P_eE$.

Any net benefit to society (producer and/or consumer surplus) generated at market equilibrium may be shared among consumers, producers, resource owners and/or governments (depending on the competitiveness of the market, the availability of information and the ability of governments to extract the producer surpluses from producers) (Box 9).

Box 9: Estimation of economic surplus – Papua New Guinea Forestry

Estimation of producer surplus may be attempted in a variety of ways – including, for example, estimating demand and supply curves and their point of equilibrium or using proxy values. In the case presented below, a crude estimate of producer surplus can be made by looking at taxes and royalties levied on timber producers in Papua New Guinea.

In this case, in 1993, Papua New Guinea exported 1 445 000 cubic metres of log.

Costs

The estimated cost of logging at the time including normal profits was K50 m^3. The company also paid royalty charges of K14/m^3 and export taxes of K34/m^3 (or 20%).

Revenues

The reported free-on-board (fob) price was K167/m^3.

Economic surplus

Total economic surplus	= TR – Logging cost
	= K (167 – 50)/m^3
	= K117/m^3

Economic surplus paid by the logging company

The logging company paid export tax (K34 m^3) and royalty charges (royalty, premiums and levies = K14 m^3):

Royalty, premiums and levies	= K14 m^3
Export tax	= K34 m^3
Total producer surplus that the government extracted from the company	= K48/m^3

Summary

Producer surplus retained by the logging company	= K69/m^3 (K117 – 48)/m^3
Total economic surplus retained by the company	= K99.7 million
Total economic surplus going to the nation's economy	= K69.4 million

Note: If the price were to decrease, then the net economic benefit would decrease. Conversely, if the fob price were to increase, then the net economic benefit would increase.

Source: Adapted from Duncan 1994, pp. 17–18.

In reality, markets are often not perfect, so efficient allocations of resources may not occur. Later on we will see when market transactions do not produce maximum economic net benefits and thus inefficiency occurs in resource use.

5.4 Types of markets and market structure

So far, supply and demand have been discussed as if only one market exists for a single good. In reality, there are many different types of markets – wholesale, retail, domestic, import and export. Goods produced in a nation can be sold locally in the domestic market or exported overseas. The buying and selling of vegetables at local markets and shops is an example of a domestic market. Goods produced locally can use inputs sourced locally (such as local fertilisers and seeds) or purchased from abroad. Goods may also be imported, even if produced locally. While *kava* is produced locally in Fiji, for example, it may also be imported from other nations (such as Tonga and Vanuatu). Pacific Islanders import many goods from other Pacific islands, Australia, New Zealand and elsewhere.

Regardless of whether goods are produced or consumed locally or overseas, similar principles of demand and supply, and the importance of price prevail. The marine aquarium trade discussed in Box 10 is an example of domestic and export markets. This case also highlights the relationship between the two markets.

Box 10. Market transactions involving marine aquarium products.

The Fijian marine aquarium trade involves domestic and foreign buyers and sellers. Local traders assess the quality and quantity of products demanded in the different export markets. They convey this message to the local collectors, who then produce the quality and quantity of products required. Many of the products are collected from the wild with the use of crowbars, screwdrivers and iron bars, then transported from the reefs to shore.

Fijian exporters have supply contracts with villages that own customary fishing rights in areas within easy access to the Nadi Airport. The terms and conditions of the supply contracts are not known, although it is understood that the contract is often between the exporter and the chief representing the *qoliqoli* members. In turn, chiefs may have a separate contract or informal understanding with the villagers engaged in the collection of coral products.

The price that exporters pay for coral depends on the quality of the coral. Consequently, it is in the interest of the villagers to produce high quality products to secure high prices from the traders. At each stage of the aquarium trade chain, therefore, producers and consumers (the exporters) engage in market transactions to ensure supply of what is demanded at the quality and quantity required.

Source: Lal and Cerelala 2006

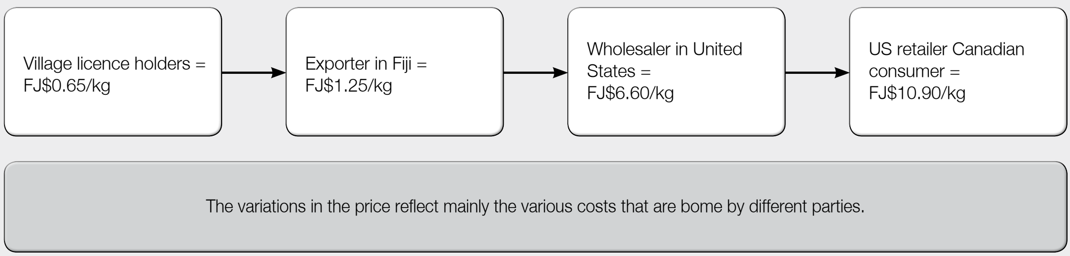
The existence of domestic and international markets means there are more steps in the production process (Box 11) than those in the simple production processes noted in Chapter 4. In the country of destination, the 'chain of custody' may involve several players – importers/ wholesalers, retailers and households that purchase the marine organisms for their aquariums. In turn, a series of transactions (and market prices) occurs between traders across the life of the product. From an economic perspective, competitive market transactions should result in an efficient supply of goods (in terms of quantity and quality) at each stage of the domestic and international production process.

In the live coral market in Fiji, for example, villagers and exporters negotiate the prices and quantity of the coral collected. The exporters respond to the price and quantity signals conveyed by the international consumers (through the retailers and the wholesalers in the importing countries). They subsequently decide whether they can meet the quality and quantity demanded and at a price that the importer is willing to pay.

Once agreed on the terms and conditions, exporters and importers enter a supply – purchase contract. Sometimes, they form a long-term relationship built on a positive and timely supply of quality coral at the right quantity, plus timely payment for the goods. The reputation of both exporters and importers plays an important role in the commercial relationship being maintained over time.

From an economic perspective, all local and foreign traders (villagers, exporters, wholesalers and retailers) along a custody chain are considered to behave 'rationally'. That is, they respond to prices and quantity demanded in such a way as to maximise their gain from the transaction. In the case of a commercial production process such as the aquarium coral market in Fiji, this behaviour is manifest as a drive to maximise profit – that is, to maximise revenue net over all costs. Both the price of products and the cost of goods along the chain thus determine the size of trader operations and the quantity of the coral products produced for the market.

Box 11. Market price variation along 'chain of custody' for live coral.



Sources: Baquero 1999; Lovell and Tumuri 1999.

The retail price received for the coral product is determined by the product (good) that the aquarium hobbyists demand (including the species, quality, size, shape, colour and so on) and how much they are willing to pay for the good. Ultimately, therefore, the final retail price of coral products is a function of how much aquarium hobbyists are prepared to pay and how much it costs to extract, cure and transport the good to the final point of sale to the consumers. The costs include:

- the cost of delivering the product from the wholesalers to the retailers;
- the wages paid to the local *qoliqoli* members for harvesting the coral products;
- the cost of local transport in Fiji, with the storage, sorting and packaging to be covered by the exporter from the fob export price;
- the cost of shipping the product from the exporter to the destination nation; and
- the cost of capital (such as interest on loans).

Monopolies

'Perfect' competitive market conditions rarely exist in practice. In the Pacific, there are many instances of only a single producer in a market. There is only one local brewery in Samoa, for example. Similarly, there is only one domestic airline serving the main passenger routes in Fiji. Such situations may reflect the small size of the markets, the nature of the goods or the high capital investment required for families or companies to enter the market.

A single supplier of a good or service may behave as a 'monopolist'. The absence of competing suppliers means a monopolist may have an incentive to maximise profits by controlling the market. A monopolist can capture abnormal profits by producing a lower level of output than many producers would supply. This reduced level of output (lower supply) results in a higher price to consumers and greater profit to the monopolist. Monopoly profits are good for monopolists but do not result in the most efficient use of scarce resources. A more efficient outcome would occur if supply was increased to a point at which market equilibrium is reached.

5.5 Concluding remarks

So far this chapter has discussed markets, values and outcomes for goods that are bought and sold, and for which prices are determined, through the interaction of consumers and producers in a 'perfect ' market environment. Individual consumers and producers act in their own interest to maximise their respective benefits. Collective outcome of the decisions of producers and consumers results in maximisation of benefits, consumer surplus and producer surplus, resulting in efficient use of scarce resources. Market outcomes may not result in efficient allocation where competitive market conditions may not exist, or where non-market environmental goods and services are involved, as discussed in the next chapter.

Chapter 6
ENVIRONMENTAL GOODS AND SERVICES, AND MARKET AND NON-MARKET VALUES

While goods and services are conventionally exchanged through markets, individuals may also demand goods and services that are sourced directly or indirectly from the environment and which are not exchanged through markets – that is, they are 'non-market'. This means that the goods and services appear to have no market values and there is no price to coordinate their production and consumption.

The presence of non-market goods and services influences the nature and level of their use, affecting the state of the environment. As a result, the amount of some of the goods or services consumed from the environment may be excessive, or their supply may be insufficient. The focus of this chapter is goods and services supplied by the environment, their non-market values and the effect of non-market values on the quality of the environment and natural resources.

6.1 Environmental goods and services

Pacific Islanders have traditionally lived directly off the land, freshwater and marine resources. These resources have provided many goods and services, including:

- produce that islanders harvest for food, clothing and shelter;
- produce used to make other things valued by humans, such as the bark of mulberry trees used to make ceremonial cloth (tapa);
- places where islanders discard their (human) waste;
- places that are appreciated for their natural beauty; and
- places that give islanders identity and provide spiritual values.

These basic categories of use have not changed over time, although the specific items (the goods or services produced) have changed. Many of these goods and services sourced from the environment are today bought and sold in the market place – for example, commercially caught fish and timber. Nevertheless, many others – such as coral reefs used to source coral for aquariums – have conventionally been taken from nature 'for free' and have never been traded through markets. The goods and services are 'non-market' in nature.

Other examples of non-market goods and services are:

- coral reefs which provide free services, such as coastal protection from storms and a habitat for fish enjoyed during recreational diving; and
- waste assimilation whereby some Pacific communities use coastal areas for 'drop toilets', taking advantage of the ability of the environment to break down and assimilate human wastes. In urban and peri-urban areas, the environment also serves as a sink for industrial pollutants.

While such services are not conventionally purchased from a seller, they remain a valuable service nevertheless as they confer benefits on the community.

Natural ecosystems provide Pacific Islanders with more than just extractive and non-extractive 'material' goods and services. The environment is part of local identify and culture, with humans viewed as inseparable from the environment. Pacific Islanders essentially derive their individual and community identity from this association. Different terms are used to describe this integration – for example, *vanua* (Fiji), *whenua* (New Zealand), *enua* (the Cook Islands) and *fenua* (Tuvalu).

This nature/people relationship includes strong spiritual dimensions, whereby people recognise gods and spirits embedded within nature and/or hold beliefs about the powers of these gods and spirits over humans and the physical environment (Lal and Young 2001). Like the untraded ecological services of the environment, the provision of these cultural services to communities is 'free' and not exchanged in markets.

6.2 Direct and indirect uses

The different non-market goods and services provided by the environment are often categorized as 'direct', 'indirect' or non-use in nature, depending on how people 'consume' them (Box 12).

Box 12. Direct and indirect goods and services and their values.

Direct use

Direct consumption of the environment involves action that individuals take to consume a good; for example, to consume fish, people actively harvest the fish; and to swim, they go into the sea. Direct use can be distinguished between extractive and non-extractive uses, depending on whether the good is extracted from the environment (such as fish caught to eat) or used in situ (such as a beach used for recreation). Further, use can be subsistence based and/or for commercial purposes; for example, fish harvested for commercial or home use. Some direct uses of goods and services may be traded. Commercially caught fish are sold at the market, for example. Other direct uses, such as subsistence fishing, swimming and picnicking on public beaches, are not traded.

Coral reefs, for example, produce many goods that are used for different purposes.

Extractive uses include

- the subsistence and commercial harvest of finfish, clams, beche-de-mer and seaweed;
- the harvest of fish and hard and soft coral for the aquarium trade;
- the harvest of coral as a source of lime (an ingredient used in betel nut chewing);
- the extraction of carbonate sand for cement making and agricultural lime;
- the use of coral for dental and facial reconstruction;
- the use of coral for bone repair; and
- the use of coral in sewage soaking pits.

Non-extractive uses (mainly based on ecological services) include:

- tourism;
- diving, snorkeling and swimming; and
- the aesthetic value of the fringing reef systems.

The direct use of goods or services generates direct use values. Where direct uses are traded, they produce direct market values. Where goods and services are not traded, they do not have market values and thus their values are categorised as non-market values.

Indirect use (also based on ecological services)

Indirect consumption of the environment involves consumption without any action. People benefit from the coastal protection of the reef, for example, without having to do anything. These are largely based on ecological services supported by the coastal ecosystems, including:

- nutrient filtering;
- flood control;
- a storm buffer;
- shoreline stabilisation;
- microclimatic stabilisation; and
- biodiversity maintenance.

Many indirect uses of goods and services are not traded. Where indirect uses are traded, they may generate indirect market values.

Non-use values

Some values associated with the environment involve 'non-use values'. These values arise when people benefit from the knowledge that environmental goods and services continue to exist (an existence value) or that environmental goods and services persist for future generations (a bequest value).

Although not marketed, non-market goods and services nevertheless confer well being on a community and economy. Healthy habitats, for example, support commercial and subsistence fisheries, and coastal waste removal can maintain human health and healthy ecosystems. All confer benefits on society.

6.3 Total economic value

The total economic value of a resource is the sum of the market and non-market benefits that it confers. The total economic value of consuming a resource such as coral reef, therefore, is the sum of the market values of all direct and indirect uses plus the non-marketed values of the reef's ecological services and cultural functions (Table 5).

Total economic value	=	Market value	+	Non-market value

Table 5: Direct and indirect uses from coral ecosystems.

TOTAL ECONOMIC VALUE (TEV)			ECOLOGICAL PROCESS VALUES	CULTURAL FUNCTION VALUES
USE VALUES		NON-USE VALUES		
DIRECT USE VALUES • Extractive uses • Seafood – fishes, clams, beche de mer, etc • Aquarium fishes • Hard and soft coral for aquariums • Coral as a source of lime as an ingredient used in betel nut chewing • Carbonate sand for cement making and agricultural lime • Coral used for dental and facial reconstruction • Coral used for bone repairs • Coral as sewerage soakage pits • Non-extractive use • Tourism • Diving, snorkeling and swimming	**INDIRECT USE VALUES** • Nutrient filtering • Flood control • Storm buffer • Shoreline stabilisation • Microclimatic stabilisation • Biodiversity maintenance • Education and research	• Bequest • Existence	• 'Ecological glue' • Primary value of aggregate life support functions	• Cultural 'glue' value – *vanua*, *enua*)

Source: Lal 2001

6.4 Concluding remarks

This chapter introduced the notion that some environmental goods and services are not traded in markets, and are thus accessed 'for free'. Given they have no market price, the value of these goods and services to consumers or producers is not immediately apparent. The absence of an accurate price to reflect the value of resources to consumers or producers will also make it difficult to compare the value of a resource in one use to its worth in another. Subsequent chapters show how far this lack of market value can contribute to environmental degradation and unsustainable uses; however, before that, Chapters 7 and 8, will consider the reason that markets do not exist for some environmental goods and services.

Chapter 7

INSTITUTIONS PROPERTY RIGHTS, GOODS AND MARKETS

The interaction between consumers and producers is influenced not only by market forces, but also by the institutions that societies have designed. Fowler and Fowler's Concise Oxford Dictionary (1990) defines an institution as an established law, custom, usage, practice, organisation, or other element in the political or social life of a people; a regulative principle or convention subservient to the needs of an organised community or the general ends of civilization.

From an economic standpoint, one of the key institutions that govern natural resource use are termed property rights. These confer the rights and responsibilities that individuals and groups have over natural and environmental resource use. That said, before considering the types of property rights societies have constructed over resources, it is important to understand how the physical and institutional attributes of resources create certain incentives and underpin the type of property rights observed in society. An understanding of physical and institutional attributes, incentives and property rights can help people understand the underlying reasons and root causes behind many environmental problems. It can also help identify possible solutions to create incentives to address those resource and environmental problems. Matters discussed in this chapter thus fit into Steps 2 (problem analysis) and 3 (identification of possible solutions/ options) of the project cycle.

7.1 Physical attributes

The fundamental physical attributes of a resource determine whether it can be marketed and thus have a market value or not. These include:

- whether the good/service is rival ('rivalry'); and
- whether the good/service is excludable ('excludability').

Rivalry

Rivalry in goods or services refers to the extent to which enjoyment by one person diminishes the amount left for others to enjoy. A good is rival when use by one person reduces the ability of others to enjoy it. Once a fish has been captured in a subsistence or commercial fishery, it is rival because it is no longer available for others to catch. Another example of rival good is the coral extracted for aquarium trade. Rival goods are thus consumable, and to be consumable, they are often also divisible.

Many environmental goods and services are non-rival, which means they continue to be available for others to enjoy even though they are already used or enjoyed by some people. Fish viewed for dive experiences, for example, are non-rival because they continue to exist even though they have been enjoyed or 'consumed' by other divers. Other examples of non-rival items are natural scenery and biodiversity. After one person enjoys a beautiful view, that view remains for others to enjoy. Likewise, if one person enjoys the knowledge that biodiversity is maintained, others can also enjoy the benefits from that knowledge. Non-rival things are 'non-consumable' and usually non-divisible, and those in nature are usually non-divisible services rather than goods. Many environmental services are non-rival.

Excludability

The excludability of a good or service refers to the ability of people to prevent others from enjoying it. A good or service is excludable when it is physically (and legally) possible and practical to prevent others from using it. Examples of excludable resources are a home garden and a private stretch of beach in front of a private house. In these cases, it is possible to put a fence around the good and exclude others from accessing or using that resource. Other excludable goods may be a small fishery in a communally-owned sheltered bay where local villagers can (and are permitted by law) to exclude neighbouring villagers or outsiders from accessing the fishery. This situation is evident in Fiji, where *qoliqoli* owners can prevent non-*mataqali* members from fishing in their *qoliqoli*. Likewise in Samoa, land owners can prevent outsiders (particularly foreign tourists) from using their beach without permission (usually also requiring outsiders to pay a fee if they do).

By comparison, many environmental goods or services are not excludable. High seas fisheries are non excludable in the wild because no country or person has sufficient time, resources or manpower to prevent others from using them.

Types of 'goods'

Depending on whether goods or services are excludable and/or whether they are rival, four types of good and service exist in a society: (1) rival and excludable ('private goods'), (2) rival and non excludable (common property resources'), (3) non rival and excludable ('club goods') and (4) non rival and non excludable (usually found to be 'public goods'). These are summarised in Table 6 and discussed below.

Table 6. Excludability, rivalry and public versus private goods.

	Rival	Non rival
Excludable	Private goods	Club goods
Non excludable	Common property resources	Public goods

The extent to which a good or service is rival and excludable determines the degree to which it can be divided and appropriated by the resource owner or who has the rights to use a resource. This in turn determines the incentive individuals have to efficiently (and sustainably) use the resources. For instance, goods that are both rival and excludable are usually owned by individuals or entities as private goods. Root crops grown in home gardens and fish once harvested from the wild are examples of private goods. When private goods and services are scarce, the owners have an incentive to ensure use of the goods in a way that maximises their benefits. That is, the owners will use the goods – or give them to others to use – only in ways that make the owners the best off. This behaviour occurs because the rival and excludable nature of the goods enables people to own then and to appropriate all the benefits (and costs) of using the goods. Given that owners can appropriate all the benefits, they have an incentive to make informed decisions about which uses of the goods and services will make them the best off.

If resource owners decide to use the goods or services themselves, they have an incentive to do so in the way that most benefits them, including over time. Faced with the choice of using a small garden to grow *taro* or eggplant, for example, an owner will choose to grow *taro* if his or her family relies on that product more for food. That choice means the small garden makes the owner better off than if he or she used it to grow eggplant, which gives less enjoyment. In comparison, when a resource is neither non rival, nor non excludable, individuals may not be able to appropriate all the benefits, nor bear all the costs of using that resource. Such resources are called public goods. Many environmental services' such as biodiversity – the assimilative capacity of natural waters, and natural amenities – are public goods. Some goods are also global public goods, whereby the benefit may accrue to international communities. The biodiversity of the tropical rainforest in Uafato, Samoa, which is unique and contains many endemic species not found anywhere else in the world, is valued by international communities as well as the local village (Box 13).

The non-excludable and non-rival nature of public goods means their owners cannot prevent others from enjoying the goods. Further, the owners cannot capture or appropriate all the benefits of protecting the goods. Consequently, people have little incentive to conserve or protect public goods. If they do not receive all the benefits of looking after a resource, why bother? Consequently, markets do not normally develop for public goods because, once the goods are supplied, other users cannot be excluded from benefiting from those goods.

Box 13. Public goods – biodiversity and representativeness in Uafato

Samoa, American Samoa, Wallis and Futuna are part of the international biogeographic province IX. Uafato, located in a remote part of the north east island of Upolu in Samoa, lies within this region. It is located around 30 kilometres from Apia.

This biogeographic province contains the *ifilele*, a particular species of hard wood tree. Uafato contains the largest single stand of the region. In addition to being large, the stand of *ifilele* in Samoa is considered to be 'relatively intact' (SPBCP, no date). The size and completeness of the Uafato coastal rainforest is thus significant as a representative biodiversity in the biogeographic province IX, and globally. This significance is particularly important because large areas of *ifilele* in other areas have been harvested and reclaimed for agriculture and/or human settlement..

In Samoa, the *ifilele* stand was under some pressure because a large number of trees were being harvested to produce crafts for the local market. The rate of exploitation was considered to be unsustainable, and there was a risk that the forest (and its representativeness) would be harmed. Nonetheless, from an economic perspective, the incentives for locals to refrain from logging to protect biodiversity were not high because biodiversity is non rival. The preservation of the stand to protect biodiversity would confer a public good that everyone enjoys, but for that protection, the local villagers alone would have to sacrifice the economic benefits possible from the harvest of the *ifilele*. Hardly surprisingly, insufficient individual effort had been made to preserve the species. More recently, a Uafato conservation area has been established (using South Pacific Biodiversity Conservation Programme funding) to protect the large tracts of *ifilele*.

Source: SPBCP, no date.

Where goods are non rival but excludable, they are termed club goods. The non-rival nature of the resource means several people can enjoy it without depleting its supply or quality while the excludable nature means that people can have an incentive to use them sustainably, providing a beneficial arrangement can be made between some users (see below). Examples of club goods are memberships at private golf courses and tennis clubs. Locally managed marine areas belonging to communities, environmental trusts and/organisations are examples of a ‘club good’, whereby some of the benefits of conservation accrue to only the members.

Resources that are rival and non excludable are termed common property resources. They may be non excludable as a result of their physical nature and/or everyone being able to access them because it is too costly to exclude others from enjoying the resources. An example is forests or coastal fisheries where the resources are rival (once used and gone forever) but where it is not possible to prevent others from accessing them.

7.2 Incentives for efficient use

When there is more than one individual involved, the physical attributes of a resource also determine the incentives that multiple users have to use a resource efficiently. This is because the physical attributes of a resource dictate the degree to which people are able to negotiate (exchange or trade) how the resources are used to maximise their individual welfare in a group situation. Negotiated outcomes effectively form the basis of a market transaction with payment in money or in kind in exchange. Ultimately, the physical attributes of resources – that is whether a good or service is rival and excludable – determine:

- the likelihood that a ‘negotiated’ – or market outcome – can develop for the good or service; and
- the ability of such markets to ensure an efficient use of the good or service (as discussed in Chapter 5).

To examine the importance of rivalry and excludability in enabling the trade of goods and services, and in ensuring efficient outcomes, each of the four types of good is considered below:

Private goods, markets and efficiency

When scarce, private goods (rival and excludable) encourage the development of markets for their use, because their excludable and rival nature enables owners to prevent others from enjoying the goods unless they are willing to pay a price or contribute in-kind in return. That is, owners can appropriate the benefits of transferring the good or service to someone else, so they have an incentive to transfer it so long as it is in their interest. Consequently, the excludability and rivalry of private goods encourage resource owners to negotiate with those who want a good or service, to determine who has access to it.

The resulting ‘transactions’ form a market (with payment occurring in money or in kind). Most of the goods normally bought and sold in a market place are private goods. The fact that resource owners can charge others for access to goods and services creates incentives for efficient use, because people have an incentive to maximise their benefits from a resource over time.

Public goods, markets and efficiency

Unlike private goods, markets for goods or services that are non rival and non excludable, (public goods) do not normally develop. This is mainly because people cannot appropriate the benefits of conserving or improving public goods. They cannot prevent others from enjoying the public goods, and they cannot ‘fence’ the resources and impose a monetary charge or in-kind contribution for access. Consequently, markets for public goods such as environmental conservation do not emerge and they are often under supplied. Public goods also tend to be treated as free goods, such as the biodiversity contained in the *ifilele* trees in Uafato, Samoa. They thus have a tendency to be over used, as seen in Box 13.

Club goods, markets and efficiency

While club goods are non rival in nature, their excludable characteristic means that people can be excluded from enjoying them. Club goods emerge because it may be too expensive for single families or individuals to maintain a good or too impractical for one person or family to exclude many others from its use; however, collectively, many individuals may be able to exclude others and jointly pay for the good. The excludable nature of club goods means those who own such a good can charge non-owners for access, thereby creating a market.

Given that all who pay can appropriate benefits from using club goods, incentives exist to maintain the quality or supply of the good. Further, because users can be charged for access, provision becomes profitable. Usually, club goods are voluntarily provided by a group of individuals who derive mutual benefits from sharing goods characterised by excludable benefits. The incentives for sustainably using club goods are thus relatively high, therefore, because the individuals can meet the total costs of providing the good. The individuals can do this because their costs are low and because they can realise the benefits of club goods and ensure their sustainability over time.

An example of an environmental club good provided in the Pacific is the marine protected area that has been established in the Aleipata and Safata districts. The families of the two districts are managing the marine protected area, using projects funds from the International Union for Conservation of Nature (IUCN) and the World Bank. The community thus protects the coastal resources and each family that benefits from the use of the site pays a small contribution to the operations of the marine protected area. Any benefits generated from the ecotourism are equally shared by the villagers from the two districts (IUCN 2000).

The excludable nature of club goods thus means that markets for its access and provision may develop, under the following conditions:

- The market generates sufficient income or benefits to the owners to make it profitable to supply or maintain the good or service.
- The owners of the resource can restrict access to the good or service to those people who are prepared to pay for its use.

Common property resources, markets and efficiency

Given the non-rival nature of common property resources, there is an incentive to 'race' to plunder these resources before they are used up by others. This race often results in the over-exploitation of the resources – for instance, operators race to catch fish before their competitors and stocks become depleted. Consequently, the incentive to conserve common property resources is generally poor, and a 'free rider' problem with no-one having an incentive to curtail their resource use. The result is commonly over-exploitation of resources, referred to in economics as the 'tragedy of the commons'. It means the resource is used by all but no-one takes responsibility for controlling their exploitation level.

The tragedy of the commons can be seen at work in the case of beche-de-mer, giant clam and trochus stocks which are generally over fished in the Pacific. This is despite the fact that such resources are conventionally customary in nature and communally-owned, such that outsiders may be prevented from fishing for them. When the fishing effort of customary owners in communally owned fisheries is not controlled, over-harvesting still commonly occurs because no-one has the incentive to fish the stocks conservatively in the greater interest. Without rules to control individuals, free riding creates a disincentive to protect or conserve resources, although everyone would benefit from conservatively using resources, but no-one bothers to do it. In a sense, everyone believes someone else should make the sacrifice, so it never happens.

Markets do not develop for common property resources because these resources are often non-excludable. As a result, common property resources are susceptible to inefficient use of the resource, and as discussed later to unsustainable resource use as well.

A particular form of common property resource is an open access resource; that is, a resource that is open to everyone without limit because it is non excludable. The standard example of an open access resource is fish on the high seas. At times, even where others can be excluded, but in reality it is too costly to exclude others from accessing the resource, as is the case in the Pacific island nations' EEZs, foreign fishing vessels often take advantage of this reality and poach valuable species (such as giant clams and live reef fish) from within the national EEZ because these cannot be adequately monitored and national rules enforced. There are thus difficulties in developing appropriate markets for resources for which excludability is an issue (such as foreign fishing vessels will be reluctant to pay appropriate fees to access the resource when they know they can have 'access' without paying). In some cases, markets may be said to exist (for example, the market for fish once caught in a fishery), but they are only partial because non owners cannot be excluded from poaching the stock.

In summary, the incentives communities face to sustainably use resources depend to a large extent on their physical attributes (Figure 28).

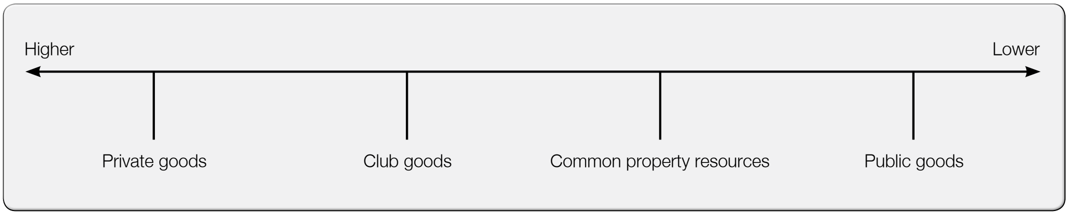


Figure 28. Incentives for sustainable use with different types of good.

7.3 Institutional attributes

Given the non-rival and/or non-excludable nature of resources, and the incentives these physical attributes ultimately generate for their use, societies design rules and social norms to influence the use of the resources. These 'institutional' arrangements include cultural norms, beliefs and rules for use, as well as legislation and regulations. Societies develop their own rules and regulations to manage resource use. These rules may be formal or informal and may define resource ownership, access to a resource, resource use and/or rights over how a resource is managed. Institutions may be designed to recognise different types of resource ownership, to define nature or degree of access and define management regimes. Such regimes dictate what people may or may not do with resources, and how they may interact with each other and under what terms and conditions. Pacific countries have three dominant resource ownership regimes: private property systems (fee simple); state ownership (state resource) and customary resources.

Private ownership

Under a private property system, ownership and use rights over goods and services are vested with an individual or an entity (company or family). Private ownership can provide an incentive for people to use resources in a way that maximises their value to the owner. Such rights are recognised in a nation's Constitution and legislated. For example, in many countries, land (particularly that alienated from the traditional owners during colonial periods) is often owned by private individuals.

State resources

Under the state rights system, the resource ownership is vested in the government (usually on behalf of the people). In most countries, particularly ex-British colonies, the government owns the coastal resources below the high water mark and up to 200 nautical miles offshore. In some Pacific nations, such as the Solomon Islands, Papua New Guinea and Fiji, the state may own the coastal resources but the use rights still belong to the local communities. State rights may be devolved to sub-national units (such as provincial governments). Private citizens need to lease state owned resources for their own use.

Customary resources

Customary resources reflect traditional institutions that recognise and regulate communal ownership of a resource and group and/or individual access and use rights over a resource. Customary use or ownership rights are commonly recognised in the Pacific. Notable examples include the rights recognised in Samoa, Fiji, Vanuatu, Papua New Guinea, the Solomon Islands, Kiribati and Tuvalu. In some countries customary rights are explicitly recognised in nations' constitutions. The Constitution of Samoa, for example, explicitly recognises customary ownership of land, declaring that Samoa is an 'Independent State based on Christian principles and Samoan custom and tradition'. The Constitution of Vanuatu states that 'All land in the Republic belongs to the indigenous custom owners and their descendents' and 'only indigenous citizens of the Republic who have acquired their land in accordance with a recognised system of land tenure shall have perpetual ownership of their land'. It also states that 'the rules of custom shall form the basis of ownership and use of land'. In the Pacific, more than one regime may occur, particularly in situations where there is ambiguity about the extent to which customary systems remain intact after alienation of resources during colonial times, and at the time of independence.

7.4 Property rights

The combined physical and institutional attributes of goods and services determine the nature of property rights people may enjoy, and which in turn determine efficiency and sustainability in their use, as discussed in sections 7.1 and 7.2. Property rights in essence describe:

- what people are allowed to do ('entitlements');
- what people are not allowed to do ('restrictions'); and
- what people must do ('obligations').

There are five key features of property rights over resources that underpin incentives for its efficient and sustainable use. They also help explain specifically where incentives for efficient and sustainable use break down and could provide managers with opportunities to therefore target specific solutions. The five key characteristics are:

- exclusivity (appropriability);
- enforceability;
- duration;
- divisibility; and
- transferability.

Exclusivity describes the extent to which an individual holder of the rights can obtain all the benefits and bear costs from using the resource. It is sometimes called 'appropriability'. Exclusivity also defines the extent to which non-rights holders can be and are excluded from acquiring any benefit from the use of the resource. This characteristic is closely tied to the physical characteristic of excludability, that is the degree to which people can be excluded form benefiting from the resource. It also depends on the social institutions governing resource use (for example, whether villagers under customary ownership of resources are culturally and/or legally permitted to exclude other users). If the users of goods and services experience (or 'appropriate') all the costs and benefits created by the use of a resource, they have an incentive to choose to use resources in the way that creates the highest overall benefits to them. By comparison, if some of the benefits or costs of using the good or service accrue to someone else, a user will not account for those costs and benefits when deciding whether to proceed with the resource use.

Imagine a family uses part of the local river to dump household waste (used-diapers, tin cans, broken glass, old batteries and so on). Over time, this dumping may cause pollution downstream. If the river is used by others downstream for water or bathing, the costs of pollution are not 'exclusive' to the family dumping rubbish; rather, the costs are not appropriated or experienced by the family (just by others downstream). Consequently, the family has little incentive to stop dumping, even if it knows that dumping causes pollution downstream. By comparison, if the same family uses the lower river daily for drinking water and bathing, any pollution would harm the family's quality of life by making them sick. The family would thus have a big incentive to stop dumping waste in the river because the family would appropriate the impacts of that dumping. The family would certainly think twice before using the river as a bin in future, because it would have to deal with the consequences.

Enforceability describes the extent to which people can enforce their rights over a good or service. It is largely a function of the dominant social regime over resource use (private, state, customary) and the robustness of the national, local or international institutions. Imagine a clan lives on one side of an island and owns a fishery. Traditionally, it has been able to exclude outsiders from fishing there. Being able to stop people from poaching in the fishery, the clan knows that it will benefit from any efforts to protect the fishery in the future. Consequently, local institutions (size limits and seasonal closures) have been developed to ensure the clan's children have continued access to fishery resources in the future.

Now imagine a political crisis (such as a coup in Fiji) leads to a weakening of rules governing traditional property rights. If rights are no longer recognised (say, because the clan belongs to the 'wrong' political or ethnic group), the clan can no longer enforce the rights to determine who can fish, how much fish they may catch, or at what size. No longer being able to enforce rules on others means others do not have an incentive to observe those rules (everyone else would benefit at the cost of the original rights holders). Consequently, villagers will instead have an incentive to plunder the resource before anyone else does with the effect on rapid over fishing.

This situation can also arise with communally-owned resources. If enforceability is poor, then no-one has an incentive to restrict resource use, because the individual would bear the cost while the benefits would accrue to the rest of the community. As a result, the lack of enforceability creates incentives for excessive use and disincentives for sustainable use.

Duration refers to the length of time for which someone has a right to use a good or service, and in essence reflects excludability over time. A land lease for sugarcane growing in Fiji may last 20 year or 30 years, for example, after which they are excluded from the use of that land.

People have a greater incentive to protect the quality of an environmental good or service – or to ensure it is not excessively extracted – if they have continued access to it. Continued access means people can reap the future rewards of any conservation measures made now. On the other hand, short -term access to resources creates incentives for unsustainable resource use. This occurs because there are no incentives to invest in resources if the benefits cannot be reaped.

Divisibility refers to the ability of people to divide up a good or service. It is a function of the physical nature of the resource. Most often, rival goods are divisible, whereas non-rival services are not. Divisibility creates incentives for sustainable and efficient resource use, because these resources can be divided into smaller parts and used incrementally for the activity that creates the highest net benefits. A coral reef, for example, may be valuable to its fishers (who want to catch fish) and a dive company (which wants to use the reef for dive operations). These two uses of the reef may appear incompatible, yet it may be possible to meet both needs by zoning parts of the reef as 'take' (thus allowing fishing) and others as 'no take' (thus allowing dive operations).

Transferability refers to the extent to which the ownership or use of a resource can be sold, leased or loaned to others, essentially allowing exclusive use. It enables competing users to negotiate and reach a settlement for access to a resource. In other words, transferability is a key feature of market transaction. Fishers may have prior rights over a fishery, for example, but a dive company may seek use of the same resource for recreational experiences. If the dive company thinks it can make more money out of tours than the locals make from fishing, then it may have an incentive to pay the fishers sufficient money to 'lease' the dive site for the company's exclusive use. This transfer arrangement would enable the dive operator to maximise income while still meeting the needs of the fishers.

The degree of transferability relies on the social institution governing natural resource access and use. In many Pacific island communities, the actual sale of state or customary resources (that in perpetuity transfer) is not permitted, and thus transferability would rely on institutions that allow temporary leasing of such resources.

The strength of these characteristics associated with goods and services explains the nature of the property rights over those goods and services. The 'property rights wheel' of Devlin and Grafton (1998, p. 40) could be used to illustrate this concept. The length of the spoke indicates the strength of the characteristics. Where exclusivity is high, for example, the spoke extends to the rim of the wheel; if exclusivity is low, then the spoke is short. When property rights are well defined, all the spokes are long (Figure 29).

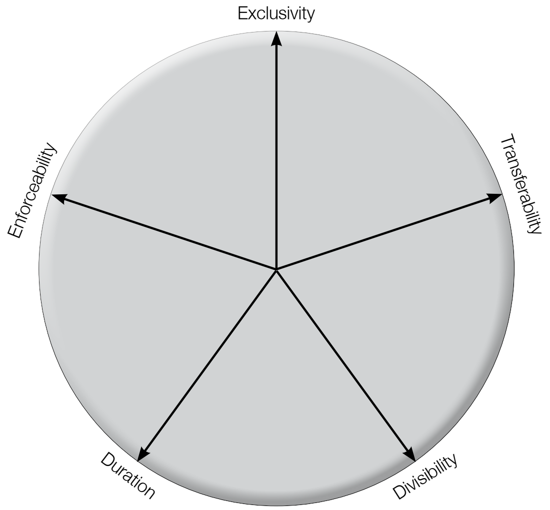


Figure 29. Characteristics of well-defined property rights.

Source: Adapted from Devlin and Grafton 1998.

Well-defined property rights

Private goods lend themselves to the development of well defined property rights because they are rival, divisible and excludable. Figuratively (Figure 29) the spokes of the Devlin–Grafton wheel would appear complete. Further, these characteristics, together with durability, and transferability of rights, clearly define what comprises well-defined property rights. Well-defined property rights are necessary for effective negotiations and market transactions to occur and for resource use to be efficient. The efficient use of private goods can thus be encouraged by ensuring the rights are durable, enforceable and enforced, and transferable. As long as the access and use rights over a resource are clearly defined, and recognised by law, people have incentives to use the resources to maximise their individual benefits, and negotiated and market transactions can maximise aggregate welfare (efficient allocation of that resource).

An example of communally-owned private environmental goods is the family-owned beaches in Samoa. The beach ownership rights of families are recognised in the Samoan Constitution, and local owners can exclude outsiders from accessing these natural resources. In the latter case, a market has developed for the use of the beaches (Box 14).

Box 14. Pacific private communal goods – family-owned beaches in Samoa.

In Samoa, customary rights over the land are privately owned by families who have traditionally inhabited an area. These rights are recognised in the Samoan Constitution. Families traditionally living on the coast of Samoa consequently have traditional ownership rights over the land, and they can exclude the general public from using the beach. In some cases, such as around the Lalomanu Beach, land-owning families exercise their rights and allow tourists access to their beach for a fee. A market for the use of the communally-owned site has thus developed, and families can exclude non payers from enjoying the site.

Swimming in the sea adjacent to the customary land, however, is difficult to restrict. Swimming is non rival, as is the enjoyment of the beach, because the enjoyment by one person does not reduce the level of enjoyment available to others (as long as the beaches are not crowded). The communally-owned Lalomanu Beach thus exhibits properties of both private and public goods.

Section III

Markets, governments and institutional failure

Command and control management in the Pacific.

Picture reproduced with the kind permission of Nigel Dowdeswell.

Section II discussed key elements of the CPEI framework and explained how market mechanisms work to allocate resources that generates the maximum benefits – consumer and producer surpluses. We also saw how institutional constructs, such as private property rights provide appropriate incentives for producers and consumers to maximise their respective benefits from the use of private goods. Chapter 7 on the other hand was used to illustrate that not all goods and services can be claimed as private goods. It stressed that, particularly in the case of many environmental goods and services, complete divisibility and exclusivity in use and appropriability of benefits not transferability can be assured. In such circumstances, goods and services remain public goods and are not traded.

Thus their values are not reflected in market prices, that is they have non-market values. This creates incentive to over use, degrade, or under supply such goods and services. This phenomenon is called 'market failure' in economics. In response to these market failures, governments design management regimes, but which too often do not lead to efficient and sustainable use of natural resources and environment. This phenomenon is known as government or institutional failures.

In Section III, Chapter 8 examines the effects of poor property rights and market failures while Chapter 9 discusses government and institutional failures. Chapter 10 examines different types of management instruments that could be used to address such failures. Managers can use concepts and ideas discussed in these three Chapters when undertaking problem analysis (Step 2), and identification of solutions (Step 3) of the Project Cycle.

Chapter 8

POORLY DEFINED PROPERTY RIGHTS AND MARKET FAILURES

8.1 Poorly-defined property rights and environmental effects

Poorly-defined property rights over resources is often at the core of many resource and environmental problems, e.g. inefficient and unsustainable use. Property rights are poorly defined when one or more of the characteristics are weak or poorly specified, so that people are uncertain about who has entitlements over the resource; and individuals either do not have the incentive for its efficient and sustainable use or do not have the opportunity to trade (negotiate) for a sustainable outcome. This can be demonstrated by using the Devlin-Grafton wheel, with one or more of the spokes being short (Figure 30) – that is, when:

- exclusivity is low and/or;
- enforceability is weak and/or;
- the duration of rights is low and/or;
- divisibility is difficult and/or; and
- transferability is difficult or unacceptable.

For example, in the case of public goods, their non-rival and non-excludable nature (and without any institutions to overcome these) can be illustrated by the Devlin–Grafton wheel as having little or no exclusivity, little or no enforceability, non divisibility and non transferability. In the presence of these poorly-defined property rights, markets cannot develop and public goods thus remain open access, limited open access or common property resources, depending on the level of control exerted by the government (Figure 30).

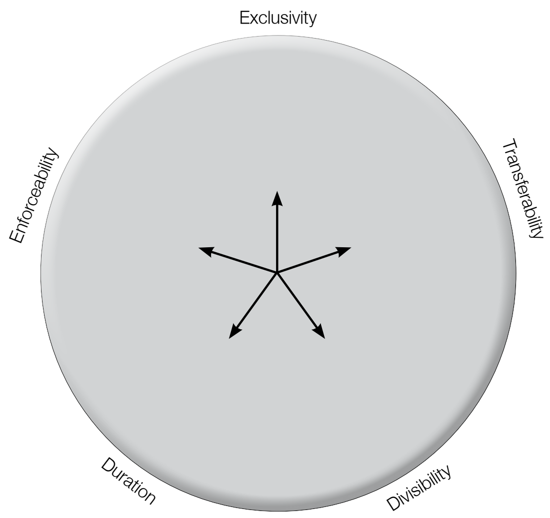


Figure 30. Property rights characteristics and public goods.

Where goods are communally-owned (and no rules exist to curtail the use by members of the group or outsiders), for example, the property rights for fisheries goods may be poorly defined because one family's right to enforce or secure its catches are not certain. Where weakness exists in the characteristics of property rights, communally owned goods take on the characteristics of a common property resource, and thus the incentives for efficient resource use are low. (For example, in Fiji, see Prasad and Reddy 2001.)

Property rights regimes and environmental problems: some examples

In the Pacific islands, persistent environmental concerns include:

- over fishing, and over harvesting of fisheries and forestry resources;
- loss of biodiversity;
- land degradation, including erosion and reduced soil cover due to overgrazing;
- solid waste disposal;
- deforestation; and
- coastal and marine resource degradation, including coastal erosion, coral loss and bleaching.

Over harvesting of giant clams in Fiji

Tubou Village on Lakeba Island in Fiji reported a decline in the giant clam population and catches from their reefs. The island is shared by several small to medium size villages, including Tubou. Although the coastal resources are ‘owned’ by the community, the over harvest of clams still occurred. This overharvest can be explained in terms of the weaknesses in the original property rights system, which creates incentives for excessive clam harvesting by members of the *qoliqoli* (Figure 31).

The weakest characteristic of the property rights regime in Tubou is one of exclusivity. Although the resources are communally owned in perpetuity, there are no restrictions on the *qoliqoli* members’ clam harvest. Tisdell (1992, p. 24) reported that everyone in the village appeared to be entitled to access the clams and to ‘take whatever quantity of clams they wish’. The benefits to individuals from harvesting clams are high; however, the cumulative impact of several families harvesting at once is significant.

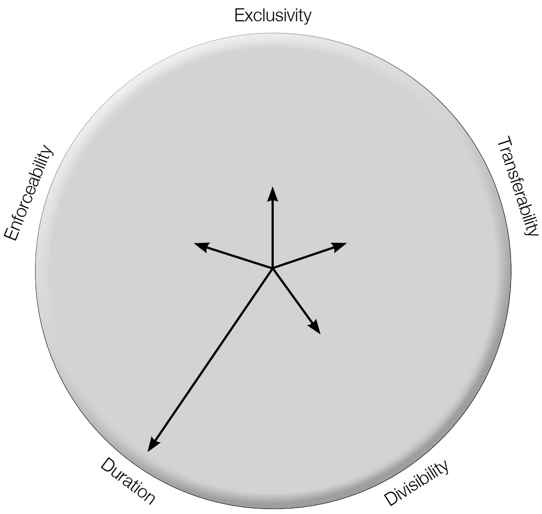


Figure 31. Property rights characteristics of clams in Tubou Village.

Overall catch rates are thus unsustainable, and harvesters have experienced falling catch rates. Weak exclusivity occurs because no family experiences the reduced catch that their share of harvest imposes on other families. Each family is concerned only with its own harvest levels. It has little incentive, therefore, to consider the cumulative effect of falling catches on the village.

There are no restrictions on the community members’ harvest of clams or other resources from the reefs. Tisdell (1992) noted that ‘it is hardly surprising [without any restrictions] that a “race for clams” would arise, resulting in harvesting levels that affect stocks’. Clams are considered to be owned by everyone in the village, resulting in an open access arrangement under which all families have an incentive to maximise the harvest. The tragedy of the commons is thus observed, even though the resources are communally owned.

Loss of biodiversity due to logging in Samoa

Uafato is a remote village on the main island of Samoa. The area contains a significant stand of *ifilele* trees, which are a species representative of the biogeographic province IX (comprising Samoa, American Samoa, Wallis and Futuna Islands). While the *ifilele* trees can be found in other parts of the biogeographic region, they have been largely reduced or degraded. By comparison, the stand in Uafato is relatively ‘intact’ (SPBCP, no date) and large. Protection of the stand is considered globally significant and important for the protection of regional biodiversity. The *ifilele* can thus be considered a global good, conferring international benefits.

Under the Samoan Constitution, members of the Uafato village own the forest area where the *ifilele* stand grows. Until recently, the stand in Uafato was targeted for building timber, carving crafts and firewood; however, the logging rates were estimated to be unsustainable (SPBCP, no date), due to the weak nature of the communal property rights (Figure 32). Eventually, the area was declared a conservation area, using funds provided under the South Pacific Biodiversity Conservation Programme, with only carvers being permitted to log the trees. This protects the biodiversity and representativeness of the area.

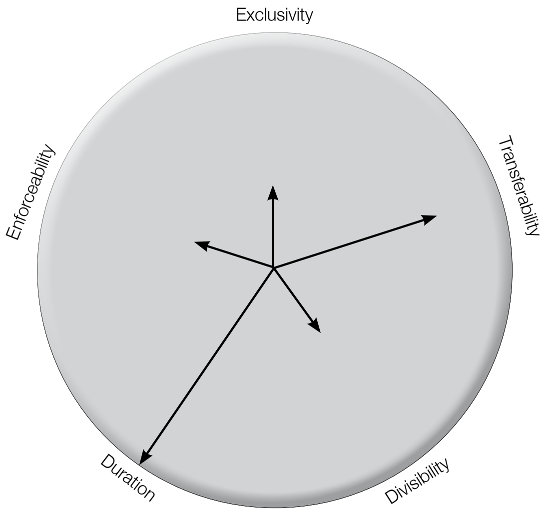


Figure 32. Property rights characteristics for Uafato *ifilele*.

Until the biodiversity conservation solution was reached, the original property rights system had several weaknesses – particularly in relation to exclusivity, enforceability and divisibility – that created incentives for excessive logging.

Biodiversity conservation is a public good; once provided, it is available for all to use. Further, it is not possible to divide biodiversity services (although the entire area could be set aside for the purpose). Nevertheless, the costs of conserving the *ifilele* would be borne by land owners who have to forgo the harvest of the trees for their own use or for sale. Stakeholders (particularly the regional and international community) who may derive existence values and future option values from the conservation of the rainforest would not have to bear the costs of its conservation; they would free ride off the sacrifices made by the *ifilele* owners.

Even if international beneficiaries of conservation could be identified and asked to contribute to paying costs of conservation, they would not necessarily have an incentive to contribute to the conservation of *ifilele* forests because others could free ride off their contributions.

In any event, the ability of the international community to monitor and enforce the conservation would be relatively weak, even if they paid. Some mechanism would need to be established for local land owners to protect the resources and enforce the conservation. In the end, a solution was proposed under the South Pacific Biodiversity Conservation Programme. Using external funds, a protected area was established. Local land owners were involved in the process of establishing the conservation area and identifying and implementing alternative income-generating activities. Funds were also used to subsidise bee-keeping projects to help land owners offset their earnings lost from reduced logging.

Soil erosion in Fiji

Sugarcane farmers in the sugar belt in Fiji's main island of Viti Levu and Vanua Levu, generally cultivate land leased from predominantly indigenous Fijian land owners, usually on a 30-year lease. Land clearing for sugarcane production has caused soil erosion and consequently harmed downstream coastal fisheries. These environmental problems can be explained in terms of several weaknesses in the property rights system governing resource use in the district (see Figure 33).

First, there is weak exclusivity in property rights. Farmers were issued leases over land, and they pay land rent in return. The rental amounts paid reflect the agricultural productivity of the land as defined in the Agricultural Landlord and Tenant Act. Nevertheless, the clearing and farming by cane farmers has resulted in erosion and siltation affecting the local fishery. These offsite costs are experienced not by the farmers, but by villages located downstream. Given that farmers enjoy the benefits of farming but not all of its costs, they have had an incentive to continue to clear and farm beyond sustainable levels.

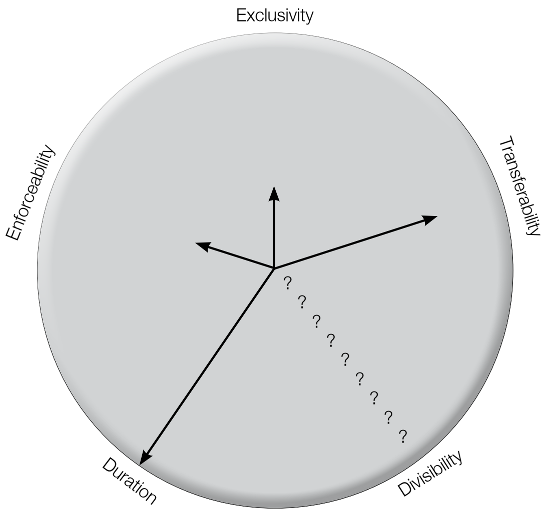


Figure 33. Property rights characteristics for Fiji sugarcane farms.

Second, there is weak enforceability of rights. The land is leased by the Native Land Trust Board, acting as the custodians of native land. The land owners were not directly involved in the decision to lease their land; thus, although there are strict guidelines about allowing agriculture on slopes greater than 11 degrees, these have not been enforced. (There has been a 'principal agent' problem, which will be discussed in the next chapter see Lal (2008).) Further, although the agricultural leases are usually issued conditional on good husbandry practices being followed, these conditions are rarely enforced. Enforceability is practically non-existent.

Third, leases are for a fixed term, usually 30 years. Some have argued that farmers, in not having permanent access to the land, have little incentive to invest in the long-term protection of the soil, because they have no certainty of renewal (Hunt 1997). Current lessees would not necessarily capture any benefits from soil conservation because the benefits take time to emerge, while the cost of conservation would be immediate. Hardly surprisingly, farmers have generally had an incentive to 'mine' the resource while they still have access to it.

Solid waste disposal in Cuvu District Fishery, Fiji

Until recently, the Cuvu beaches of Viti Levu, Fiji, have been subject to the dumping of waste. Waste dumping was common as people sought cheap and easy disposal options for waste not collected by local refuse collectors. Refuse collectors take certain types of waste from houses, but any remaining items are the responsibility of householders. There is a charge to use the official town dump. The State 'owns' the beaches, although the fishing rights belong in perpetuity to the indigenous Fijians at the *qoliqoli* level. Despite these property rights regimes, unacceptable levels of waste disposal have been found on the beaches. This waste disposal problem can be explained in terms of several weaknesses in the property rights system that created incentives for dumping waste on the beach (see Figure 34).

First, there is low exclusivity (or appropriability) related to solid waste dumping. People who dump waste on the beaches benefit from being able to cheaply and easily dispose of their waste. They often come from outside of the Cuvu District, so do not have to deal with the injuries or reduced fish catches resulting from the pollution. These negative effects are borne by the local fishing rights owners and villagers.

The enforceability of the fishing rights in the area is also weak. First, the ability of locals to enforce their rights to stop dumping and retain their clean waste-free environment is weak. Enforcement mechanisms for small-scale waste prevention do not exist. (They only exist for habitat reclamation and large-scale industrial activities that may cause pollution.) The Government has declared the fisheries as compensatory, but this declaration has not necessarily been acknowledged by all. Further, without the means to identify polluters, such rules mean little.

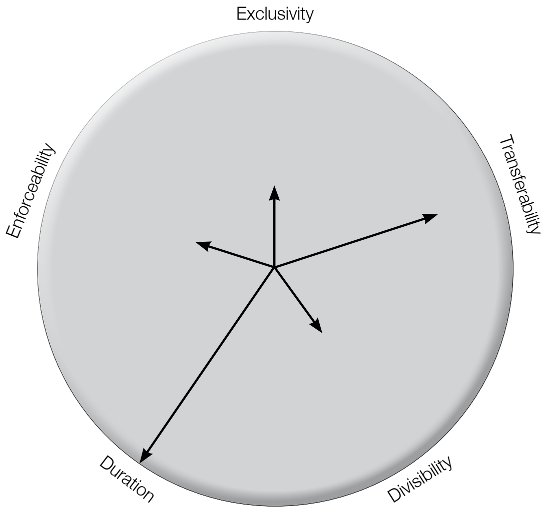


Figure 34. Property rights characteristics for waste, Cuvu District.

The Cuvu District beach is owned by the State, but State enforcement of environmental quality has not been strong in the past. The local town council or the national government frequently lacks the resources to monitor and enforce the rules. (This situation creates incentives for polluters to dump their waste at night when they cannot be seen or reprimanded.)

In addition, the divisibility of the resource to meet the different needs of local users (swimming and fishing) and polluters (waste removal) is low. The assimilative capacity of the inshore waters cannot be separated from the fishery. This makes it difficult for local users and polluters to negotiate whether dumping can be allowed in return for some payment to compensate for lost fishing opportunities. Even if they could, the costs of individually negotiating with many small-time polluters could be very high for the marginal benefit.

8.2 Market failures and resource and environmental issues

Many of these environmental problems can be explained in terms of what economists call market failure, arising form poorly-defined property rights. Recall that markets most effectively allocate scarce resources that are privately owned. Recall also that they can provide the opportunity for multiple users of a resource to negotiate outcomes for sustainable resource use when the property rights governing the goods and services are clearly defined. By comparison, when property rights are poorly defined, markets fail to produce outcomes that reflect the best use of the scarce resources.

There are two effects of poorly-defined property rights that emerge from market failures: negative externalities and positive externalities.

Negative externalities

Negative externalities occur when an individual does not bear the full cost of his or her action imposed on others. The presence of a negative externality results in an over use of a good or service. Consider when a family throws its household waste (disposable nappies, glass bottles, old batteries) into a stream, polluting the water downstream and thus affecting the local fishery. In this case, the benefits and costs of the family's actions are not exclusive – they will be felt by other users downstream. Given that the family does not experience the cost, it does not account for it when deciding whether to proceed with throwing out waste. The pollution caused is external to the family's decision making and it is thus a negative externality – an unaccounted cost borne by others. People disposing of waste in the environment have no incentive to reduce or stop their dumping because this behaviour does not harm them.

This situation can be explained in terms of private benefits and public costs. Take, for example, the waste disposal problem in the Cuvu District, Fiji. The private costs of dumping household waste, that is, the costs faced by polluters, reflect only the time and effort that the polluters incur when they drop off their waste. (The benefits of this action – cleaner homes – are also borne by the polluters). Nevertheless, their actions harm the local fishery, so the fishers experience costs. The true costs of the dumping are thus much higher than the private costs to the polluters (Figure 35). This results in the over use of the local beaches as dump sites.

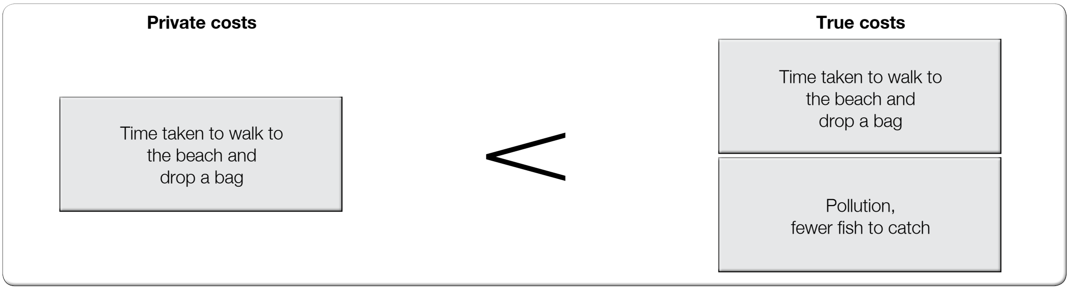


Figure 35. Private versus true costs of dumping on Cuvu Beach.

Graphically, the effect of negative externalities on environmental quality is shown in Figure 36. The demand curve in Figure 36 summarises the relationship between price and the quantity of food demanded. It slopes downwards, indicating that people demand more of the food when the price is lower. The use of packaged foods means more waste (a joint product) is produced as more is consumed. Dumping of waste involves costs. The curve MC (private) illustrates the marginal cost to polluters of disposing of waste. It slopes upwards, indicating that more effort is needed to dispose of higher levels of waste. When polluters do not have to consider the impact of pollution on the fishery downstream, Q_1 units of food is consumed and a corresponding amount of pollution, Z_1 occurs.

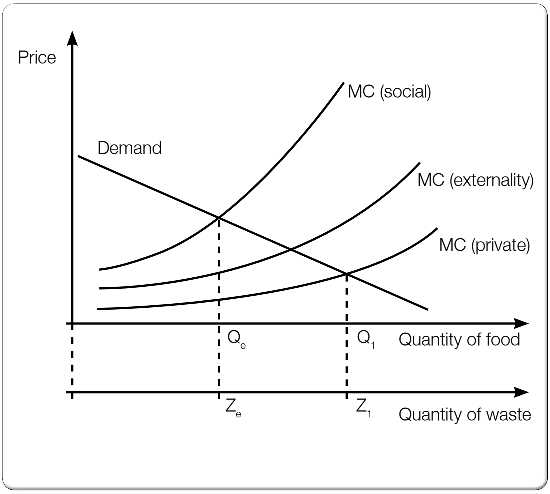


Figure 36. Negative externalities and environmental harm.

In this case, each unit of pollution causes environmental harm, which is summarised in terms of the curve MC (externality). The true costs of dumping each unit of waste are captured by total MC (social) which equals MC (externality) plus MC (private). If polluters were made to pay for the cost of polluting the environment, then only Q_e units of packaged food will be produced and Z_e levels of pollution should occur. Q_e is the efficient level of waste because, up to this point, the benefits associated with packaged food production are higher than the costs associated with each unit of packaged food. How much of a decrease would occur in the quantity of waste produced (and dumped) would depend on the substitutes that are available and their costs. Nevertheless, because polluters do not have to bear these external (externality) costs, more pollution occurs than is appropriate for the area. In this sense, the presence of negative externality results in excessive use of the environment. Box 15 illustrates these issues using externalities in Fiji's Cuvu District as an example of the incentives for people to overuse or undersupply the environment.

Box 15. Negative externalities in the Cuvu District, Fiji.

Three examples of negative externalities are presented here. First, the fish stocks in the Cuvu District are communally "owned" but competition for their use resulted in a race for fish and a fall in fish catches as the stock was damaged. This damage to the stock from excessive harvesting is an effect (or cost) not accounted for by Cuvu fishers. The fishers consider only the costs that they incur from fishing: time, fuel and effort; however, the true costs of their fishing rate include time, fuel and effort plus the degradation of the fish stock, because cumulative catches are too high. Future fishing opportunities will be lost, but the fishers do not account for these consequences. Lost fishing opportunities from excessive harvesting are thus an externality.

Second, sugarcane farmers in the hills around the Cuvu District frequently clear land for farming. This resulted in downstream siltation of the rivers, harming the local fishery. This problem arises because the farmers do not have to account personally for the impact of their clearing on coastal fisheries. If farmers had to account for this impact, then the profitability of clearing land for agriculture would fall and less clearing would be expected to occur; however, while farmers do not consider this consequence in their decision to clear, there is an externality and excessive pollution occurs.

Third, discussions in the Cuvu District revealed that residents were dumping waste in the Rukurukulevu Channel and at Cuvu Beach. For people who chose to dump waste on the beach, the cost of doing so was small – only a little time to drop the bags onto the shore. Therefore, the true cost of dumping included the time taken to drop the bag plus the pollution of the local coastline. The latter cost has been ignored.

Positive externalities

Some actions generate external benefits that are not felt by the person undertaking the actions. These are called external benefits or 'positive externalities'. Examples of activities that generate external benefits are:

- efforts by one family to clean up a dump, which can benefit the whole village;
- efforts by families to tidy up a village where travellers who drive by enjoy the view;
- efforts by a village to replant mangroves where a whole community benefits from better coastal protection; and
- efforts by one nation to conserve its genetic material which may also be valuable to other nations.

All of these activities have positive side effects for other people; however, people are often disinclined to make the effort to proceed specifically for this reason. Where the goods or services that people would be enhancing are nonexcludable, people are reluctant to make the effort because they are unable to appropriate all the benefits of their hard work.

In relation to property rights, an inability to appropriate benefits may occur due to a number of weaknesses. Weak enforceability, for example, may cause the problem. A clan may seed an area with baby clams in its fishery, but then be unable to enforce its private property rights and to prevent poaching. Where services are non rival, the efforts of people to improve those services may mean others experience benefits. Although people may not like their village looking ugly and smelling bad from the rubbish, for example, they may still be reluctant to unilaterally clean up the rubbish because everyone else benefits from the act. In such cases, people may reasonably ask why they should make the effort and spend their money/time to improve the environment when no-one else bothers and others also benefit. In this way, positive externalities deter people from undertaking active conservation because they know other people will free ride.

Weakly-defined property rights thus mean that external benefits can arise from using environmental goods or services. In turn, people have a disincentive to use the resource conservatively, improve habitats and/or clean up. The problem is that some benefits of cleaning up the coastline are not experienced by the villagers who would do the work. The private benefits of cleaning the area – that is, the benefits faced by the initiators – reflect only the improved smell and look of the site that they personally enjoy. Nevertheless, the clean-up would also benefit other villagers who do not contribute. For the initiators, the private benefits are not sufficient to 'cover' the costs, so they may not supply the clean-up service even though the true benefits of conservation to the whole community are much higher than the private benefits (and possibly the total costs) (Figure 37).

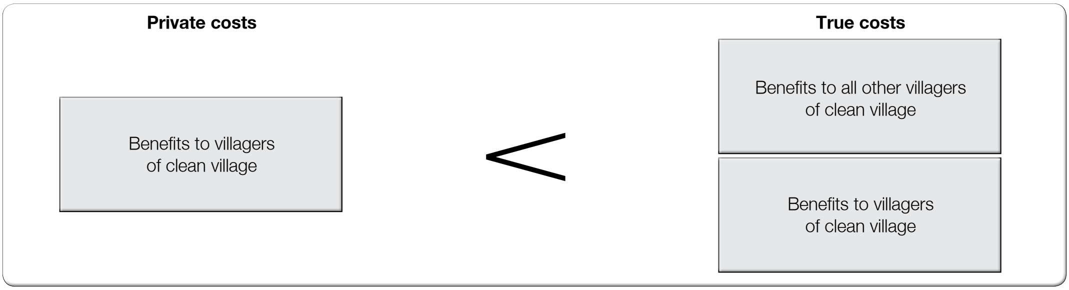


Figure 37. Private versus true benefits of conservation.

Figure 38 illustrates the effect of positive externalities on environmental quality. The marginal cost of cleaning up the environment reflects the time and effort of people cleaning up the litter and taking their waste to a designated safe disposal area. The cost of removing waste and cleaning the village is illustrated by the curve MC. This curve slopes upwards, indicating that more effort is needed to dispose of higher levels of waste. The demand curve $D_{private}$ summarises the relationship between $MB_{private}$ and the quantity of clean and healthy environment, free from pollution. The demand curve slopes downwards, indicating that people demand a high level of quality environment when the 'price' of getting it is lower.

When a family who wants to clean the village does not consider the benefits for other families, it would be prepared to spend up to Q_1 hours tidying up because, to this point, the benefits of cleaning exceed the private marginal costs of cleaning; however, cleaning the village confers an external benefit on other families. The improved environment means healthier happier families, so the true benefits of cleaning the village are much higher. As with all demand curves, higher benefits are illustrated as curves to the right.

In this case, cleaning the village generates true benefits worth MB_{social} in society. The true benefits of cleaning are really $MB_{private}$ plus $D_{environment}$, as captured by D_{social}. If the family can appropriate these benefits from cleaning the village, it would be prepared to spend Q_e hours tidying it. This would be the efficient amount of cleaning because, to this point, people gain more benefit from a cleaner environment than it costs; however, because the family cannot appropriate these external benefits, far less cleaning occurs than is appropriate for the area – that is, Q_1 occurs, not Q_e as desirable. In this sense, the presence of a positive externality results in an undersupply of (cleaning) services to improve the environment.

Positive externalities and public goods

In some cases, public goods and services confer extreme positive externalities. As discussed in Section II, public goods are available for everyone to enjoy once provided by one person, because they are non rival and non excludable. Biodiversity protection afforded by one family, for example, would benefit all other families in a village, as well as all international stakeholders. Suppose conservation of biodiversity is the public good of interest. The conservation of biodiversity involves costs – for example, the sacrifice of agricultural possibilities to protect habitats. The cost of conserving biodiversity is represented in Figure 39 by the conservation supply curve MC. The demand for public goods by family A is represented by $Demand_A$, which reflects the marginal benefits they derive from biodiversity protection. This demand curve slopes downwards to the right, indicating that more conservation is demanded when it is cheaper. Recall that the demand curve could also be interpreted as the willingness to pay for each quantity of conservation demanded. Therefore family A would be interested in conserving biodiversity so long as MC are less than $Demand_A$ (Q_A). Nevertheless, family A will not conserve while MC are greater than their MB_A. Also, if there are two families, A, and B, that value conservation the collective marginal benefits, $Demand_{(A+B)}$ will be greater such that a higher level of conservation (Q_E) would benefit society. This means two households collectively could conserve biodiversity and individually, they would benefit from conservation at pay WTP_A, and WTP_B respectively. Given that, conservation is a public good – that is, it is non rival and non excludable – when one supplies the conservation, others can benefit from it as a positive externality. Nevertheless, since others can free ride off the efforts of the first family, no one has the incentive to pay for the conservation, and vice versa.

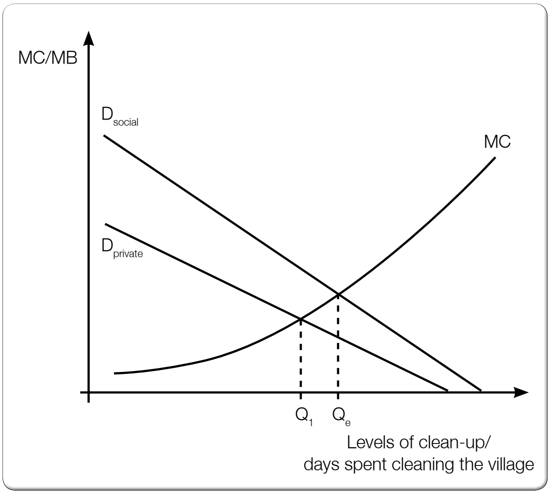


Figure 38. Positive externalities and public goods.

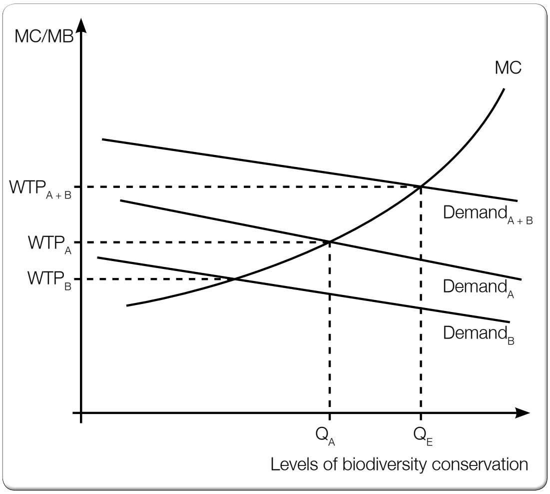


Figure 39. Under supply of public goods and positive externalities.

The existence of external benefits thus means that conservation does not happen at all or that the quantity of conservation supplied is less than what is socially desired. In practice, the following effects occur:

- At best, a less than socially desirable level of conservation occurs, being less than is good for the whole of the village.
- At worst, no conservation occurs at all because each family waits for another to move first so it has less work to do.

When decision makers do not bear the full costs of their action or cannot appropriate the full benefits, market failure is said to occur. Recall that for markets to be effective and efficient in the allocation of goods and services, the marginal cost of supplying the good must equal the amount that a consumer is willing to pay, or their marginal benefit. Given that many goods and services provided by the environment are not marketed, they get treated as free goods. When not incurring the true cost of using goods and services, environmental goods and services are inefficiently allocated, such that environmental quality deteriorates as resources are either over used or environmental services are under supplied. By comparison, referring to Figures 39 and 40, if users had to pay the economic price for using a non-market good, they would have to think twice about using it because it would cost them more money in the process. For example, farming that harms the environment would become less profitable. Fishing that involves destructive fishing methods would also become less profitable. Dumping of waste that causes pollution would become more expensive. Incurring the true economic cost of resource use for non-market goods would decrease people's incentives to use resources unsustainably. In Figure 38, for instance, people would instead have an incentive to only Q_1 units of a good or service, rather than Q_e. Similarly, people do not have to pay to enjoy the benefits of conservation. (They can free ride off the efforts of others.) If people had to pay to enjoy the benefits of conservation (so they could no longer free ride), others could appropriate the benefits of conservation. They would have more incentive to undertake conservation, which would become worth their while. This would increase the benefits of undertaking of conservation to an efficient level (similar to the level Q_e, instead of Q_A, in Figure 39).

The presence of externalities thus means people are not fully accountable for the full costs or benefits of resource use because the environmental goods and services that their actions affect do not have a price (because those goods and services are not marketed). In the presence of externalities and public goods, therefore, markets cannot be relied on to achieve efficient and sustainable use of resources. To put it differently, the root causes of environmental problems, such as loss of biodiversity, water pollution and excessive solid waste disposal, are, in the market economic context, due to the absence of clearly-defined property rights over all goods and services used by humans causing a positive or negative externality. As a result, society has to develop rules and regulations to manage the use of the resources to achieve the desired goals. Responses to market failure are reconsidered in the next chapter which examines how market-based instruments can create incentives for more sustainable resource use.

8.3 Concluding remarks

In this chapter, the root cause of many environmental problems are discussed in terms of poor or incomplete property rights over goods and services that environment supports, causing market failure. The physical and social nature of environmental goods and services are reflected in property rights regimes. The characteristics of property rights thereby define the degree to which people have incentives to use resources in ways that are efficient and/or sustainable.

The physical and institutional attributes of resources directly influence whether markets can and will develop and whether market mechanisms can be relied on for efficient and sustainable use and management of a resource. Private goods that are rival and excludable and that have enforceable rights are commonly marketed. The incentive for sustainable resource use is high in these cases. Non-rival and non-excludable public goods remain non marketed, and the incentive for their sustainable use is therefore low. Resources that are owned communally provide some incentive for efficient and sustainable use where social structures and rules encourage owners to act collectively in the interest of the community; however, if a community is not cohesive and does not function as a community, incentives may exist for individuals to act in their own interest, rather than in the interest of the whole community. In such a situation, resources are often treated as a common property good and people have an incentive to over exploit the resources. Consequently, depending on the type of property rights, people have different incentives to use resources sustainably and efficiently, unless of course a society creates specific institutions to provide appropriate incentives for people to act responsibly, as discussed in the next chapter.

The presence of public goods, and thus non-marketed goods, as a source of market failure also helps to clarify why environmental goods such as clean environment, protection of mangroves and biodiversity conservation are not supplied by people and why government intervention is often required to address such market failures. Nevertheless, as seen in Chapter 9, even where governments have tried to address such market failures, the approaches and instruments used have often also failed, a phenomenon referred to as government and institutional failures.

Chapter 9

GOVERNMENT AND INSTITUTIONAL FAILURE

While some resource and environmental problems may arise due to market failure, others may arise due to inappropriate institutional response from governments and communities. Communities and governments have long been involved in natural resource and environmental management, particularly when individual actions have led to externalities and/or where public goods are present. Governments and communities have often responded to the presence of externalities and public goods by establishing social rules; and form rules and regulations for resource use. The introduction of rules governing resource ownership, use and management has generally been the first response of communities and governments to environmental problems. As discussed in Chapter 7, rules governing resource use may be formal or customary in nature. The power to enforce them may be vested in the community or the State.

9.1 Formal and informal institutional failure

Most commonly, communities and governments have adopted ‘command and control’ approaches to resource management. That is, resource management is characterised by legislation, regulations and bylaws that prohibit and/or restrict resource use (as discussed in detail in Chapter 10). Although regulations have been effective in some cases, many countries continue to report declining resource and environmental quality. This begs the question – why do these problems continue to exist when rules and regulations have been introduced to manage the situation. From a conventional economic perspective, the rules or solutions that governments or communities introduced to manage a problem may not have tackled the root cause of the problem discussed above. That is, the solutions either:

- fail to address the causes of poor property rights and the existence of externalities, so resource users have a continuing incentive to use resources unsustainably or to under conserve resources; and
- create (perverse) incentives to use resources in a way that worsens the problem.

This phenomenon is termed ‘government’ or ‘institutional’ failure. Institutional failure occurs where inappropriate or incompatible rules and regulations create incentives to over use or degrade resources. It may reflect both formal government failure and informal or traditional-style management failure.

The failure of formal rules and regulations to address resource management issues is commonly termed ‘government failure’. This is most commonly manifested in:

- an inappropriate development focus;
- a piecemeal and sectoral approach to resource management; and
- dictatorial policies.

The reasons for government failure could be a government’s past attitudes; a focus on just economic development without also addressing the sustainability issues; the compartmentalisation of issues along sectoral lines; institutional design did not reflect ecological considerations; and/or incomplete information.

In the past, government agencies have tended to manage natural resources in a reactive manner; that is, they have developed management responses to pollution or environmental degradation in a piecemeal manner (developed as the need arose) thereby addressing the symptoms of the problem individually. Accordingly, coastal fisheries resources have frequently been managed by fisheries departments under national fisheries legislation that may have focused on individual species rather than addressing the coastal fisheries from an ecological perspective. Similarly, forestry departments have administered forestry legislation that stipulates rules under which state forests can be logged and on what terms, but without necessarily looking at the ecosystem as a whole. Pollution control in urban areas is thus often handled under Local Government Acts without looking at the underlying incentives that lead to excessive pollution. Such piecemeal sectoral management approach is common, regardless of different resources or sectors being ecologically linked. More importantly, the reactive and piecemeal nature of management means some responses may be inconsistent and may create incentives for continued unsustainable use.

This issue is, for example, evident in the case of the Fiji aquarium trade, where the industry is subject to formal and informal institutional arrangements under a dual tenure system of management (Lal and Ceralala 2006). Traditionally, customary fishing rights are recognised as belonging to indigenous Fijians at the *itokatoka*, *mataqali*, *yavusa* or *vanua* level. Each *qoliqoli* owner claims custodianship of all coastal resources, although under the British system the state owns coastal resources below the high water mark. At a formal level, Fiji's Fisheries Act, Laws of Fiji (Chapter 158) states that the Fiji Government has the right to manage the nation's coastal fisheries. The management of coastal fisheries includes the harvest of coral products for the aquarium trade. Recognising the customary tenure system, the Government issues a fishing licence only after *qoliqoli* owners consent to the use of the fishery and the District Commissioner endorses the application. Enforcement of fishery rules and regulations also occurs at both formal and traditional levels. The Fisheries Department is responsible for enforcing fishery laws, while it also has a network of honorary fisheries wardens who are appointed at the village level at the request of the head of the *mataqali*. In addition, the Ministry of Local Government, Housing, Squatter Settlement and Environment is involved in the management of coral harvests. While the Ministry of Fisheries and Forests is authorised to issue export licences and monitor harvests from a resource perspective, the Ministry of Environment is expected to monitor and report on the status of the resource from the perspective of the Convention on International Trade in Endangered Species (CITES). At the same time, the Ministry of Tourism controls diving activities (a frequent ecotourism use of coral).

It can be seen, therefore, that many rules and many parties affect the management of live coral in Fiji. Despite the presence of these institutions, some inconsistencies remain. For example, although diving is controlled by the Ministry of Tourism, the diving regulations have conventionally made little reference (until recently) to the *qoliqoli* owners or the Fisheries Department's affected by dive operations. In some cases, conflict has subsequently resulted between commercial dive operators and coral harvesters, who usually are also the *qoliqoli* owners. In any event, all these agencies conducted their own duties, having their own legislation with little interaction or coordination. At the communal level, the decision to collect aquarium trade products is often made without due regard for the effects of the harvest on other uses and users of the coral reefs. Only recently has the Government established an informal arrangement to control coral harvests so as to manage the ecological impacts of coral harvesting on fisheries; and there is some dialogue between the Ministry of Tourism and the Fisheries Department over the conflict between harvest of aquarium fishes and recreational use of the coral reefs for diving.

In some cases, government policies are themselves the main cause of resource and environmental degradation. Such policies include subsidies and tax exemptions provided to promote economic development, and policies that directly cause environmental degradation. An example of such government failure is Fiji's experience with mangrove resources (for more details, see Lal 1990 and 2003). The Fiji Government has attempted in the past to counter Fiji's reliance on sugar as a source of foreign earnings. To do so, it has promoted tourism. Approaches used to encourage tourism have included the introduction of tax exemptions for tourism developments. These exemptions reduce the costs of establishing tourist resorts in Fiji and increase the resort developments' profit potential. The tax exemptions have thus provided incentives for large-scale developments in Fiji along the coast, including mangrove areas; mangroves found on the coastal areas are highly prized for tourism development. The effect of the tax exemption policy is to increase the rate of reclamation of valuable mangroves for tourism purposes, as has been the case in Denarau and Vulani tourism developments in Fiji.

The Fijian sugar industry is another example of the perverse effects of subsidies:

> A subsidy [preferential prices for Fiji sugar] is paid to sugar growers in Fiji by the European Union. This boosts the price of 45% of sugar output by 2.5 to 3 times the world price … The distortion caused by [subsidised] price … encourages sugar producers to crop marginal land which would be unprofitable at the world price … [P]rice signals to growers that favoured quality sugarcane production and resulted in processing efficiency are also lacking. Steep hillsides are being brought into production with consequent severe soil erosion. The need for soil conservation works is ignored and the agricultural potential of the marginal land is destroyed. The long term costs are a loss of land productivity and river and inshore water sedimentation leading to reduced coral reef productivity, but there is also a significant short term cost in the dredging of rivers to keep them navigable and an increased incidence of flooding. (Hunt 1997)

The subsidy effects can be illustrated using the concepts of supply and demand, excess supply and joint supply discussed earlier in Chapter 4 as well as Figure 40. If cane farmers in Fiji are paid a price higher than world market price, then those producers are effectively subsidised in their production. This shifts the supply curve to the right. The cane farmers produce more sugarcane than is socially desirable (excess supply equals Q_1 minus Q_e). Soil erosion is jointly produced with sugarcane, so the higher level of cane also results in greater levels of soil erosion than is economically desirable.

Informal institutional failure

Institutional failure may also reflect informal or traditional management failure. At an informal level, institutional failure can occur where customary laws fail to reflect the ecological or non market values of resources. The Constitution of Samoa, for example, explicitly recognises customary ownership of land, stating that, as seen earlier, Samoa is an 'Independent State based on Christian principles and Samoan custom and tradition'. Accordingly, the local land tenure system was considered when a community-based conservation area was established at Sa'anapu–Sataoa in Samoa; however, the rules of joint community project did not adequately address the issues of equitable distribution of benefits between the two villages involved. In other words, the rules established locally to share the benefits of the conservation area did not adequately reflect the contribution of both villagers to conservation. This meant that one village would have been able to free ride off the efforts of the other, creating a disincentive for both villages to contribute equitably to the project. The outcome of this local-level institutional failure was social conflict between the two communities involved and the part failure of the original project. Eventually, rather than the two villages envisaged as being involved, one village managed the project (Lal and Keen 2002).

Similarly, the Constitution of Vanuatu states:

> … all land in the Republic belongs to the indigenous custom owners and their descendents … [O]nly indigenous citizens of the Republic who have acquired their land in accordance with a recognized system of land tenure shall have perpetual ownership of their land … [T]he rules of custom shall form the basis of ownership and use of land … .

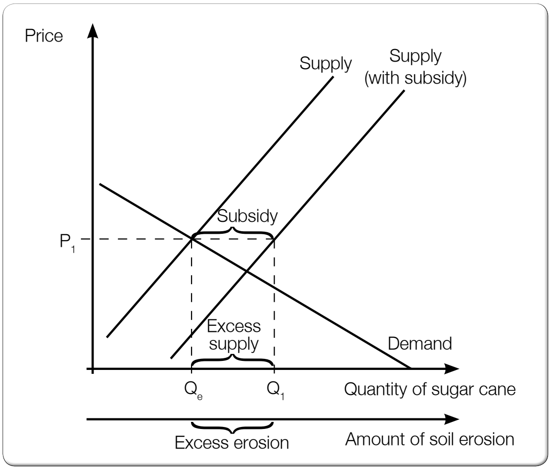


Figure 40. Price subsidies, cane supplies and the level of soil erosion.

Accordingly, a Vatthe conservation area was established in 1994 to protect biodiversity. The area was established over 1000 hectares, recognising the local customary ownership of the Sara and Matantas villages; however, the success of the project was reduced by social disputes over equitable sharing of income from ecotourism and other activities. In other words, the rules established locally to share the benefits of the conservation area did not reflect the contributions of the different stakeholder groups. This created scope for free riding and disincentives to participate. Consequently, the benefits of preservation were not realised (SPBCP 2001a; Whyte et al. 1998).

Some informal management institutions may fail by not reflecting underlying ecological processes. As a result, the rules implemented by one group may not prevent the excessive degradation of resources. Consider the case of coral and 'live' sand harvesting in the Malomalo District, Fiji. 'Live' sand is coarse and fine sand made from calcareous coral reef components for sale to aquarium stockists in Fiji. The extraction and sale of coral and high quality live sand is a lucrative business in Fiji, hence in Malomalo Village several villagers extract these natural products from their reefs for sale to aquarium traders who export the sand to the United States. On the other hand, villagers from neighboring Nadiri Village expressed concern about the harvesting, fearing that the removal of material harmed the fishery. Lovell (2001, p. 12) quoted Nadiri villagers as saying that 'the collection of live rock [live sand] provided short term benefit only, with much of the money spent on food that is less healthy (i.e. corn beef or mutton flaps). Concern has been expressed that the benefits offered by the reef will be denied to future generation, due to destructive activity' today. In this case, the rules permitting Malomalo residents to exploit live sand may not reflect the importance of live sand to the local fishery, and to future generations.

In some cases, institutions may reflect the ecological values of resources but overlook the social issues. This form of institutional failure occurred in the case of the Utwe–Walung conservation area (Box 16). The result was the part failure of the conservation project.

Box 16. Social issues and institutional failure.

The Utwe–Walung conservation area is located on the south west island of Kosrae. The area contains the most pristine mangroves, marine and wetland ecosystems on the island and possibly in the Federated States of Micronesia. It contains unique and deep marine lakes that link the Utwe and Walung harbours. The area has a rich biodiversity and thus a high ecological value.

With the help of external agencies, such as the University of Hawaii Sea Grant Program, the Nature Conservancy and the Secretariat of the Pacific Regional Environment Programme, the Utwe–Walung Conservation Area Project (CAP) was developed under the South Pacific Biodiversity Conservation Programme (SPBCP) Kosrae CAP 2001). Originally, the project focused on delineating the boundaries based on the ecological boundaries of the mangrove, marine and wetlands system; and defined a number of objectives.

First, the CAP was intended 'to maintain the diversity and abundance of living things within the area as a basis for long-term sustainable development'. At the same time, it was intended to be a project based on community input 'which incorporated sustainable development initiatives such as ecotourism'. Community commitment to a conservation project was one of the criteria used for funding under the SPBCP. The original Utwe–Walung conservation area proposal did not meet the criteria for SPBCP funding 'because not enough consultation with the local communities had taken place and the concept was too narrowly focused on tourism' (SPREP 1996a, p. i). The project was intended 'to enable communities to manage and develop their own resources', to use this project as a pilot project, an educational resource and a place of research (SPREP 1996, p. iii).

The CAP was initiated with the desire to focus on more than just ecotourism, although ecotourism was eventually the main activity involved. Mangrove and island tours were developed and marketed in cooperation with the Kosrae Village Resort (KVR) and other key stakeholders, such as representatives from the Utwe and Walung villages.

The project was not entirely successful, resulting from:

- a false sense of exclusive ownership of the CAP by an elite group (especially from Utwe);
- a lack of genuine community participation and involvement in the CAP decision making; and
- marginalisation of the Walung community from the CAP decision making and activities (SPREP 2001, p. 10).

Walung villagers lost interest the project. First, the tourist centre that was intended to generate ecotourism income was sited in Utwe. This created some resentment among the Walung residents. Second, many of the Utwe-based ecotourism traverses the more pristine mangrove areas of Walung (SPREP 2001, p. 11), which seemed to add to the resentment felt by Walung residents. Third, there was an apparent lack of project activities in Walung. Fourth, there is a lack of benefits flowing to Walung. These reasons are frequently cited as 'the root cause [of] the waning interest in this community [Walung] in the CAP'.

Although the conservation area was originally based on sound ecological and biodiversity assessment and project planning (including a careful survey to identify the biophysical nature of the resources), the original objective of the CAP was not met.

The root causes of this failure are institutional. Key economic issues were not adequately considered, including (1) the nature of institutional rules governing the use and management of the conservation area; and (2) the management measures that enabled free riding in the area (that is, the use of the Walung mangrove areas for ecotourism that benefitted Utwe villagers).

Source: Lal and Keen 2002.

9.2 Institutional failure and rent seeking

Institutional failure sometimes occurs because stakeholders influence the development of institutions that govern resource use for their own benefit. Recall from Section I that rational people are expected to seek to improve their own well being. This can mean people try to influence government or communal decisions to implement policies that would be beneficial to them (even if the policies might not be in the interest of the broader community).

Individual behaviour and activities to deliberately influence rules and regulations are termed 'rent seeking' (Baland and Francois 2000, p. 529). Khan (2002, p. 21) describe rent seeking as:

> … a term used to describe [legal] activities which seek to create, maintain or change the rights and institutions on which rents or incomes which are above normal and/or which would have been expected in a competitive environment. (Baland and Francois 2000, p. 529; Khan 2002, p. 21)

The effect of rent seeking is that institutions emerge that benefit some people more than they should. This may be manifested in a number of distorted policies, such as:

- the allocation of lucrative fishing or logging licences to some individuals in preference to others; and
- the provision of subsidies to people who otherwise would not have received them. (The subsidies may subsequently create incentives to over use resources and degrade the environment.)

In some cases, people who rent seek may adopt illegal means to meet their goals. Illegal means may include bribery, illegal political contributions or the misappropriation of money. In these cases, rent seeking becomes corruption.

Rent seeking is done worldwide and by people at all levels. In the Pacific, it is evident in all walks of life, from the national level down to local communities. In the Solomon Islands, for example, log production has increased considerably as a result of the rent seeking behaviour of (1) multinational companies from Malaysia and (2) Korean investors backed by Japanese and Korean buyers of timber products. Dauvergne (cited in Kabutaulaka 1996, p. 145) noted that multinational companies with significant 'corporate power' often:

> …pressure governments to develop policies that maximise [their] profits, construct complex corporate structures that reduce accountability and transparency, evade taxes and timber royalty.

The effect is to reduce the income that the Solomon Islands can gain from allowing the multinationals to use its resources.

At the local level, there are many examples of people in positions of power 'helping' to design rules to benefit themselves or their village/community. Often, the criteria for selecting a village for a proposed externally funded project is 'rigged' by people in the decision making position to suit their own village.

Also at the local level, the payment of sitting fees has become a standard practice in many Pacific island nations, including Samoa, Tonga and Kiribati; whereby, sitting fees can be the target of rent seeking behaviour, with people seeking to maximise their own returns and attend only those meetings that pay the sitting fees. Rent seeking occurs, for example, when government and non-government paid staff insist on sitting fees of up to $50 or otherwise refuse to attend meetings in normal working hours. Under normal circumstances, inputs (labour, capital and land) are used to produce goods and services that consumers demand (as discussed in Chapters 3 and 4). The sale of these goods and services generates a net value or profit (sales revenue less production cost). Usually, a level of profit is normal; however, people sometimes aim to achieve more than the normal profits. Rent seeking can thus be perceived in terms of appropriating more than 'normal' profit or increasing the share of industry profits (Figure 41).

Why is rent seeking bad?

Leaving aside moral issues, there are economic reasons for judging rent seeking unacceptable. First, it involves the transfer

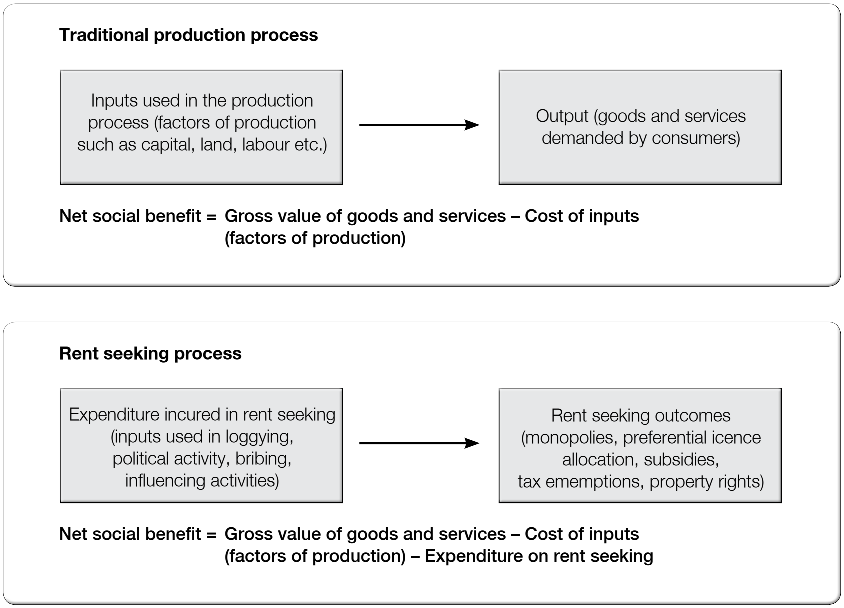


Figure 41. Rent seeking versus traditional production.

Source: Adapted from Khan 2002, p. 23.

of valuable resources to a few individuals away from the intended or valuable uses of those resources. In other words, while a few individuals benefit, the scarce resources are wasted from the perspective of the broader community.

Where rent seeking occurs, the effect is to increase costs (through the time, effort and money spent to influence policy). As a result, society loses, although the individual may benefit. In the case of sitting fees, the cost of holding meetings can become relatively expensive over time if several people undertake this rent seeking behaviour. A monthly meeting of a committee of 10 stakeholders paid US$20 each would cost a program US$2400 per year. In practice, many committees may be needed to support a program, so costs quickly escalate. The use of money to pay inappropriate sitting fees is thus a drain on funds that could be used for essential program activities and that could make a region better off.

Wasteful uses of resources can incur social costs. The former Prime Minister of Papua New Guinea (cited in Koyama 2002, p. 33) noted this issue when expressing concern about the rent seeking behaviour of incorporated land group leaders:

> "I am very concerned that too much time and energy is being spent in getting around established institutions and processes and the laws of the country. This is causing the system to break down and is threatening the interests of genuine land owners, the nation and investors. None of us can afford these abuses of the established systems and procedures."

Second, rent seeking behaviour produces new institutions (new property rights) that support unsustainable or inefficient uses of natural resources. If, for example, a government gives preferential treatment to a logging company by allowing it to be the sole holder of a logging licence, then that company will have no competitors. The company will thus have no incentive to use efficient or low-cost logging methods, keep costs down or keep prices at fair levels (Jomo and Gomez 2002).

9.3 Institutional failure and the principal agent problem

Institutional failure also arises because of what economists call the 'principal agent problem'. An agent is a person, group or organisation that represents the needs of its stakeholders. The stakeholders are the principal. The principal agent problem occurs when the agent acts in its own interest rather than the interest of the principal (stakeholders) that it represents. An example of principal agent problem is where a government acts in its own interest (to survive or win at the next election) but not in the interest of the people that it represents. At the local level, a principal agent problem may be where local law enforcers are bribed to let people overharvest or use banned fishing methods, while knowing the detrimental effect of such behaviour on the resource. Principal agent problems occur if stakeholders are unable or unaware of how to make their agent (the government or community leader) accountable. In the short term, stakeholders are 'stuck' with the representatives they have. But in the long term, they should be able to change their agent or encourage the agent to behave differently.

Ideally, democratically elected governments are open to reselection every three to five years. This creates incentives for governments to 'clean up their act' so they are re-elected. Nevertheless, between elections, it may be difficult to make governments accountable for their actions or to discourage inappropriate policy. In the case of community projects, the ability of villagers to make leaders act on behalf of the whole community is often intertwined with the local social hierarchy, social relationships and power structures.

At times, institutional failures due to principal agent problem and rent seeking behaviour are intertwined. Papua New Guinea's mining industry is, for instance, an example of rent seeking and the principal agent problem being behind institutional failure (Koyama 2002).

Box 17. Principle Agent Problem and Rent Seeking Behaviour in PNG.

In Papua New Guinea, the Incorporated Land Group Act gave communities a legal basis to 'hold, manage and deal with land in their customary names and for related purposes'. To do this, the Act provided for the establishment of a Incorporated Land Group, which is a group of people related to each other who derive their identify from a piece of land. The incorporated land groups can thus be registered in the name of a clan, sub-clan, lineage or family, depending on how the group of people identify themselves. They are used to recognise local customary land owners. The chairperson of each group becomes a member of the Land Owner Association, which is the mouthpiece for land owners and is expected to represent the collective interest of the incorporated land groups to industry and the Government.

When the incorporated land groups were established, there were few rules regarding their operation. Many of the group leaders capitalised on this gap, establishing finance and management rules that benefited themselves rather than their communities. The results included an inequitable distribution of money. In addition, some activities were considered to be corrupt, involving the embezzlement of funds by people in position of power. At the same time, rent seeking and principal agent activities resulted in a splintering of the original incorporated land group and a proliferation of such groups. The group leaders were able to manipulate the system, deregister some groups, divide others and register more groups to boost their support base. Consequently, the 54 incorporated land groups in Fasu and Foe in 1992 had increased to 264 groups by July 2002. In the Kikori area, the number of incorporated land groups doubled between 1998 and 2002.

Part of the incentive to create incorporated land groups was the perception among local communities that benefits could be gained from forming new or separate groups. This perception existed because the incorporated land groups should acquire more power and greater say when dealing with the industry and the Government through the Land Owner Association. Experiences with these groups in the Foe area of the Kutubu illustrate rent seeking behaviour and the problems it can cause. The Foe area is divided into two separate groups: upper Foe and lower Foe. The lower Foe incorporated land groups received higher monetary returns than those of the lower Foe people, because the pipeline went through the lower Foe area. The upper Foe groups were thus unhappy and pressured the system to gain greater control of the total Foe benefits. Some groups were deregistered and new groups from upper Foe were registered, giving the upper Foe greater control in the Land Owner Association that represented the entire region. Foe leaders could make these changes because they had forged alliances with provincial and national politicians to 'circumvent due processes' (Koyama 2002)

Through such rent seeking behaviour, certain leaders could appropriate large sums of money for their personal gain, at the expense of their incorporated land group members. In the Foe area, a prominent leader of one group, together with some other

Foe group leaders, convinced the Treasury Department to directly transfer close to K2.6 million to him from the Incorporated Land Group Trust (a fund kept for the benefit of future generations) for 'community projects'. Little evidence was found of such projects ever being implemented. In Fasu, leaders seem to have been paid about K10.5 million for an office complex in Port Moresby using land owner equity funds. This payment was made without the full consent of the land owners and the sale price was K7 million, leaving an unaccounted-for K3 million. The incorporated land group system subsequently broke down, as noted by the then Prime Minister Haiveta (PNG Government Press Release, 29 December 2000):

> One of the main causes of the breakdown of the distribution system is the practice of interest groups and individuals such as land owner leaders, provincial governments and self-styled consultants and advisors to land owners trying to do special deals with, or obtain favoured status from politicians and officials.

Community-based projects are particularly susceptible to rent seeking behaviour and the principal agent problem. As discussed earlier, these projects involve the active participation of local communities. Participation is critical to allow the identification of local priorities so the development better reflects people's needs and wishes; mobilises local support for development; and minimises the cost of public services by shifting the responsibility to local people and organisations. Community projects also require rational and transparent decision making and an outcome that is acceptable to the community members. This means people need to be comfortable and assured that their interests are foremost and that they are part of a network that is fair to all its members. Community leaders must be transparent, accountable and fair in their decision making. In other words, the potential for rent seeking behaviour and the principal agent problem must be kept to a minimum; however, in any activity that is based on a group of individuals, the potential for rent seeking and/or the principal agent problem is always there – it is human nature to be selfish!

When designing rules and regulations for community-based project management, the project managers thus need to pay particular attention to minimising the scope for rent seeking and the principal agent problem. Chapter 10 discusses the design of appropriate management instruments.

9.4 Concluding remarks

Management responses may be ineffective because of government and institutional failures. Such failures may occur when formal and informal design do not reflect underlying ecological connectivity in an environment or due to rent seeking behaviour of stakeholders influencing government decisions for their own benefits. Often management instruments used, discussed in detail in the next chapter themselves may be inappropriate because they do not address the underlying root causes of poor incentive structures. Governments often also fail because they do not adequately represent the interest of the communities they were elected to serve, resulting in the principal agent problem. Management instruments have often been ineffective because of government failure to enforce; or where enforced penalties have been so low that the penalties do not deter individuals and entities from reoffending.

Chapter 10

MANAGEMENT INSTRUMENTS

In response to resource and environmental problems, Pacific island governments have implemented different types of management instruments. Most countries have most commonly used prescriptive 'command and control' measures, which restrict or control activities and/or prohibit the conduct of activities or the use of certain inputs, products or effects. Such measures have had varying levels of success.

In more recent years, there has been a growing interest in the use of market-based instruments in environmental management. In some countries the use of economic instruments has been primarily seen as a revenue raiser, although such instruments could also play a role in addressing some of the key root causes behind many resource and environmental problems.

This chapter discusses different types of management instruments available to managers. It considers the potential of command and control, market-based and other management instruments to address the root causes of the environmental problems discussed in earlier chapters.

10.1 Command and control management responses

Used by both communities and governments, command and control measures have, as briefly mentioned in Chapter 9, been the most common approach adopted in the Pacific to manage resource and environmental problems. They are intended to directly control human behaviour by stipulating what people can or cannot do; that is, command and control measures effectively say 'do this but not that'. Common instruments used in the Pacific include:

- a ban on practices that are considered to be harmful;
- restrictions on the type and amount of inputs that people can use during resource use;
- restrictions on the type and amount of outputs that people can produce during resource use; and
- standards for, and controls on, the processes for using resources.

Violations of such measures are usually punishable by law or custom.

Bans

Communities and governments commonly use bans to prevent the use of environmentally harmful practices. They aim to counter the desire of people to use harmful practices by threatening to impose costly penalties on those who breach them. Bans are used in almost all sectors of the economy and at different levels. At the level of traditional customary management, communities may ban the use of certain gear. In Sasa Village Fiji, the use of scuba cylinders was banned after they were found to deplete not only sedentary species such as *dri loli* (blackfish) and *sucuwalu* (white teat fish), but also finfish (Fong 1994, p. 46). At the Government level, Fiji's fisheries legislation (Chapter 158, s.9 Regulations) prohibits the use of destructive fishing methods such as:

- the use of any chemicals, including derris and its principal agent, rotenone;
- the use of poisonous extract from plants such as Barringtonia and Euophobia; and
- the use of explosives.

Similar prohibitions in the fisheries sector can be found in other Pacific island nations, such as the Cook Islands' Marine Resources Act. Similarly, the Government of Samoa banned the smashing of corals (*fa'amo* and *tuiga*), the removal of beach sand and the dumping of waste in lagoons (SPC 2001).

Some bans may be permanent. Others may be temporary or apply only at certain times; for example, fishery sectors frequently apply seasonal bans each year to protect juvenile stocks. Other bans may be less frequent. At Ontong Java in the Solomon Islands, harvest bans (or *tabu*) are placed on trochus and beche-de-mer in alternate years (Lam, cited in Huber and McGregor 2002, p. 11). In Kosrae, the trochus fishery is managed via a short fishing season that is closely controlled by the state Government. Some communities place ad hoc restrictions on catches or declare temporary bans when anticipating large harvests for community rituals, such as for commemorating the death of a high chief (Huber and McGregor 2002).

In the Cook Islands, to address the main environmental problems of soil erosion, waste disposal, beach mining and the use of toxic chemicals to stun fish for ease of collection, the Rarotonga Environment Act 1994–95 prohibits:

- the pollution of Rarotonga's waters, including internal waters;
- the dumping of waste into the lagoon or in such a manner that it may be washed into the lagoon;
- the removal of silt, cobble, gravel, coral and any tree from the foreshores or coastal waters of Rarotonga; and
- the indiscriminant disposal of toxic chemicals.

Some bans adopted in Pacific islands have aimed to protect areas of environmental significance by declaring those sites 'protected areas' or 'conservation areas'. Many nations have used marine protected areas, for example, to prohibit or ban fishery activities (Huber and McGregor 2002). The national and state governments in Palau, for example, declared numerous conservation areas that prohibit the harvesting of species (such as trochus), prohibit fishing generally or prohibit people from entering them (Table 7).

Table 7. Selected conservation areas in Palau.

Area and location	Primary authority	Law	Effective date	Approx. size (km²)	Main restrictions
Ngerukewid Islands Wildlife Preserve	Republic of Palau	PDC 201 (24 PNCA 30)	1956	12	No fishing, hunting or disturbance
Ngerumekaol spawning area (reef channel)	Republic of Palau	PL 6-2-4 (24 PNCA 31)	1976	0.3	No fishing 1 April – 31 July
Nationwide (trochus sanctuaries) – areas in each of the 16 states	Individual states	Various state laws			No harvesting of trochus
Ngaraard Conservation Area (mangroves)	Ngaraard	NSPL 4-4	1994	1.8	Only traditional, subsistence and educational uses allowed
Northern reef channels	Ngarchelong, Kayangel traditional leaders	Bul (tradition)	1994	90	No fishing in eight channels 1 April – 31 July
Ngemelis (marine area)	Koror	K4-68-95	1995	30	No fishing
Ngaruangel Reserve (atoll)	Kayangel	KYPL 7-02-96	1996	35	No entry, no fishing (three years)
Lake Ngardok Nature Reserve (watershed)	Melekeok		1998	1	Protecting the integrity of the lake basin

Source: Adapted from SPREP 1996b.

A similar use of bans can be found in Pohnpei, with the declaration of the Lenger Island Marine Protected Area. Waste dumping in mangroves or coastal waters, fishing with explosives or poison, and anchoring on reefs are prohibited activities within the protected area.

In some cases, national and local management measures work in a complementary fashion to address resource management. In Samoa, for example, an AusAID-funded project supported the development of a village-level fisheries management plan. The plan includes bans and restrictions, which can be enforced using village rules. For non-village violators, village rules were formalised using bylaws that allow the bans to be enforced through the court system (Fa'asili and Kelokolo 1999 and AusAID 1998).

Bans on environmentally harmful activities have been used at the international level too. Signatories to the Convention for International Trade in Endangered Species (CITES), for example, have agreed to monitor and prevent trade in the species listed under the convention. Implementation of the convention requires the introduction and enforcement of national laws against the harvest and sale of the listed species. Where this is not followed by governments, moral pressure from international communities may be applied, or in the extreme, international trade bans may be imposed, as had recently been the case with Fiji's coral trade in 2002, when the Fiji Government did not follow through on its commitments under the CITES (Lal and Cerelala 2006).

Input restrictions

Input restrictions control the type or amount of factors of production (inputs) used to produce a good or service. They seek to prevent environmental destruction by limiting the ability of individuals to undertake harmful practices on a large scale. Input restrictions used to control timber harvesting, for example, may include limits on the size or type of saw used so that loggers are able to harvest only limited amounts of wood in a given period. Many nations have also adopted input controls to manage their environment, particularly in relation to fisheries. At the international level, fishing in an exclusive economic zone is usually controlled via the use of licenses issued under national marine resources legislation. The issue of licenses effectively controls how many fishing vessels (an input) are permitted in the zone.

At the national level, fisheries legislation is used to control fishing effort in territorial waters (up to 12 miles). All nations have national fisheries legislation that undertakes this control function. The legislation also usually provides for the regulation and control of fishing methods and/or gear used in fin fishing, shell fishing and/or pearl diving, for example.

Many countries use bylaws and local regulations to control the inputs used in fishing. The Cook Islands, for example, introduced the Manihiki Pearl and Pearl Shell Bylaw and the Manihiki Milkfish Bylaw. These bylaws regulate the harvest of pearl and pearl shells and milkfish in the specified area. In Samoa and Fiji, bylaws regulate fishing by prohibiting the use of inputs such as dynamite, bleach and derris. Also in Fiji, local communities use customary laws to manage their marine resources. In addition, the mesh size of different types of fishing net is regulated under the Subsidiary Fisheries Act (Chapter 158, s.9 Regulations, as summarised in Table 8).

Table 8. Types of input control in Fiji's fisheries

Size of fish fences	Reed gaps of no less than 50 millimetres and/or galvanised wire mesh size of not less than 50 millimetres across the smallest diameter
Mesh size of fishing nets	30 millimetres or more for cast nets 50 millimetres for wading and all other nets
Area closure	As declared by the fisheries officers
Area closures, species restrictions	Used under customary laws to manage *qoliqoli* members

Source: Fiji's Fisheries Act, Chapter 158.

Output restrictions

Output restrictions control the nature, quality and/or quantity of a final product. In a sense, they directly target the symptoms of a proposed environmentally harmful activity by limiting the scale of damage. They may, for example, determine the amount of fish harvested from an area, the length of fish harvesting time or the level of waste produced by a hotel. Output restrictions are commonly used to manage the use of resources that are extracted, such as fishery products, forestry products and water. In Uafato Village, Samoa, community-based output restrictions have been used to control the harvest of *ifilele* trees, which are highly prized timber trees in the region. Under the community established and enforced rules, members of the community may harvest *ifilele* trees only for carving purposes (not for firewood or building purposes) (SPBCP no date). Such an output restriction may prevent harvesting of the timber for low-valued uses, but may not stop over harvesting if, for example, there is a high demand for carvings.

For fisheries, most nations have implemented output restrictions in the form of size restrictions on high-valued species believed to be under threat. In Kosrae, for example, mangrove crabs may be harvested only when they are at least 6 inches long. Also, lobsters may be harvested only when they weigh at least 1 pound or their carapace is at least 3 inches long. Alternatively, fishers may not take or kill any female lobsters with eggs (Kosrae State Marine Resources Act 2000, s.19.416.2g). In Fiji, the harvest of trochus is restricted to product sized more than 90 centimetres. Pearl oysters, mangrove crabs and turtles must be at least 100 millimetres, 125 millimetres and 455 millimetres wide, respectively (Fiji Fisheries Act, Chapter 158, s.9 Regulations).

Communities may also sometimes use output restrictions to manage resource extraction. In Samoa, village-based fisheries management plans have introduced output restrictions, including minimum fish size limits. Output limits may also take the form of quotas that control overall harvest or production levels. At the international level, for example, quotas are used to control the total harvesting of southern bluefin tuna by different countries (Australia, New Zealand and Japan). The use of this quota is intended to ensure stocks are conserved for future use. Similar quota restrictions have been advocated for regional tuna fisheries in the Pacific (Peterson 2001). Peterson (2001) argued that a total allowable tuna catch should be applied to the South Pacific region, whereby each tuna nation could decide to auction its fishing entitlement to other users and thus allow competing fishers to bid for the resource. (See also Section 10.3.)

Standards

Standards refer to minimum or maximum environmental quality levels that people are obliged to meet when using resources. They have been particularly popular for controlling waste problems arising from specific areas or 'point sources'. In the Marshall Islands, the Toilet Facilities and Sewerage Disposal Regulations 1990 set minimum standards for toilet facilities and sewage disposal to reduce pollution and health hazards.

The Federated States of Micronesia's Toilet Facilities and Sewerage Disposal Regulations 1977 established minimum standards for toilet facilities and sewage disposal to reduce environmental pollution, health hazards and public nuisance from such facilities. The standards cover:

- flush toilets connected to a sewerage system available to the public;
- flush toilets connected to septic tanks; and
- pit privies.

Under these Regulations, toilet disposal facilities in all public and private buildings must be approved by the Secretary of Human Resources. The Regulations make it unlawful to dispose of treated or semi-treated sewage into any body of water in the Federated States of Micronesia, unless such activity is clearly demonstrated to be necessary for an economic or social benefit or research, and to pose no public health hazard. Also in the Federated States of Micronesia, the Trust Territory Solid Waste Regulations 1979 established minimum standards for the design, construction, installation, operation and maintenance of solid waste storage, collection and disposal systems.

Standards are also used in relation to industrial water and air pollution, where legislation stipulates end-of-pipe or chimney acceptable ambient pollutant levels. In Fiji, for example, the Traffic Regulation 1974 stipulates the level of pollutants accepted from car and bus exhausts. Similar standards are stipulated under the Pesticides Act and the Public Health Act. Enforcement of such standards are generally poor (Evans 2006).

More recently, standards have also been used internationally to manage the import of products, such as tuna from Fiji on health grounds. The European Union countries, for example, recently banned the import of tuna from Fiji, when exporters from Fiji could not demonstrate that agreed HACCP standards had been complied with.

Weaknesses of command and control management responses

Despite the introduction of legislation, regulations and rules for management of the environment, the use of such command and control measures has had only limited success in managing environmental problems, both in and out of the Pacific. In addition to the institution failure issues discussed in Chapter 9, the key weakness in the application of command and control management has been the lack of enforcement of both formal and customary regulations. Prohibitions, bans and/or restrictions are generally easy to introduce through community agreement or by passing legislation; however, their success relies on their effective monitoring and enforcement – tasks that require considerable levels of resources and administration, and depend on the capacity of governments or communities.

Where funding, time or skills are lacking, monitoring and enforcement can be difficult to achieve. It is often expensive or difficult for government officials to frequent local areas and monitor activities in person. Some governments have thus sought the help of local communities to monitor activities. Nevertheless, penalties may take time to implement because of the manner in which the legal system works. Individual offences may appear minor, and the costs of taking an individual case to court may outweigh the penalties imposed. Consequently, the ability or will to enforce laws and penalise offenders may remain weak, even when offences can be identified. On the other hand, the cumulative effect of non-compliance on the environment can be large, such that the environmental problems arising from many individual misdemeanors are significant. This is arguably the case with the lack of enforcement of rules relating to human and household waste disposal in the Pacific islands.

Another weakness of command and control measures can be the lack of technical expertise needed to set standards or manage ecologically complex environments. In tropical fisheries, for example, a species is commonly managed without adequate scientific knowledge of that species' population dynamics and food web interactions. Without such knowledge, some governments have applied management formula from elsewhere to local situations. The input and output controls or standards recommended have thus been inappropriate in many cases (MIRAG 1999, p. 3). Similarly, some air pollution measures have been borrowed from other nations without sufficient regard for local conditions.

In any event, prescriptive management measures such as those often used in command and control management frequently address symptoms. They do not reflect the economic root causes of the problem, as discussed in Chapter 9.; that is, they do not provide appropriate incentives to individuals and groups to change their behaviour. The key incentive for individuals to observe command and control measures is to avoid penalties for breaking them; however, even where countries have the resources and will to enforce command and control measures, the penalties for breaching them are often too minor to act as real deterrents. Penalties may ‘tax’ environmental destruction and enable some revenue raising for governments and communities; but they may not prevent harmful behaviour. Rather, individuals may continue to respond to the (failed) market signals that encourage them to act in their own interest because this is most beneficial to them.

Further, some nations may lack the capability or commitment to implement global and regional environmental agreements. Only where international agreements are binding and directly affect the economic activities within a nation can the command and control approach of international regimes be effective.

All independent Pacific island nations have signed and ratified the United Nations Convention on the Law of the Sea (UNCLOS), for example. This convention gives each Pacific nation sovereignty over its 200 mile exclusive economic zone, including the right to control foreign fishing in its national waters, charge access fees and demand other types of payment. All nations thus had an incentive to quickly pass their own Marine Resources Act to declare their exclusive economic zone and to establish strategies for managing the marine resources within those zones. Without passing their own legislation, the nations could not take advantage of the new rights provided under UNCLOS. Similarly, once Fiji signed CITES, it was obliged to harmonise its coral and aquarium trade practices. When it did not do so, the international communities placed trade restrictions on the export of coral harvested from Fiji (Fiji Government 2002). Given the extent of the economic loss from such a ban, Fiji immediately responded to the ban and, within less than six months, passed the legislation required under CITES to manage coral harvest for aquarium trade (CITES 2002).

By comparison, other multilateral environment agreements are not binding, such as the Convention for Biological Diversity and the Framework Convention on Climate Change. Consequently, there is very little direct incentive to implement the local changes needed to activate the agreements, even if they have been ratified.

In any case, environment-related international regimes are difficult to enforce because they generate global public goods, which (as seen in Chapter 3) are not commonly marketable and therefore do not usually have market values. On the other hand, trade-related regimes are easy to enforce because they rely on market place sanctions, and the costs are directly borne by countries.

10.2 Incentive-based management responses – economic instruments

Chapter 8 showed that the root cause of environmental problems can be traced to the property rights (physical and social institutions) governing natural resources. Poorly-defined property rights means that market-based outcomes (negotiated solutions) do not reveal the true value of natural resources, resulting in externalities. In these cases, people have limited incentive to adjust their activities to more efficient and sustainable levels. Rather, they have an incentive to degrade resources, resulting in:

- the over harvest of renewable resources beyond their regenerative capacity;
- discharge levels that exceed the assimilative capacity of the environment, resulting in environmental degradation; and
- the degradation of natural habitat.

If the presence of externalities and the absence of an appropriate price for resource use are the root causes of environmental problems, the environmental problems may be reduced if measures are developed to correct prices and thus encourage people to willingly adjust their behaviour and reduce externalities. Such an approach would allow the market mechanism to produce the desired outcome and not rely on governments’ ability to monitor and enforce rules.

Further, if the absence of clearly-defined property rights (and thus the presence of poor or incomplete markets) is the root cause of environmental problems, then the creation (or strengthening) of private property rights could help directly address the incentive problem arising from public goods. The following sections consider the use of incentive (market) based instruments, prices and property rights to make the users of environmental goods and services adjust their behaviour; that is, they consider how to make resource users face the full costs and benefits of their decisions – to be encouraged to ‘internalise’ their externalities and/or how to create rights that can be traded.

Recall Chapter 8 noted that people may not consider some costs and/or benefits of using an environmental good or service because they either overlook (out of ignorance) or ignore these externalities. Where externalities occur as a result of ignorance, the provision of information is likely to improve environmental quality. However, information provision makes a difference only when ignorance is the cause of the problem; but it will fail to induce a change in behaviour if ignorance is not the problem.

To encourage people to stop smoking, for example, numerous anti-smoking campaigns have been conducted across the world, advising people of the danger of cigarettes. The fact that people continue to smoke regardless of this information indicates that ignorance is not the reason that people smoke. Likewise, many families already understand that the use of 'derris' (*Derris elliptica*) to stun fish for easy capture harms habitats; and likewise that clear felling causes erosion. Information campaigns will not change behaviour in such cases. Instead, behaviour change can be achieved only by altering the incentives to use the resources. To change incentives for resource use means removing externalities that people create. People then either:

- bear the full costs of using goods and services, leading them to be accountable and to use resources sustainably and efficiently; or
- appropriate the full benefits of providing goods and services, thus creating incentives for them to maintain environmental quality.

Where people have to bear the full costs of using goods and services, they are said to 'internalise' external costs. Where people can appropriate the full benefits of using goods and services, they are said to 'internalise' external benefits. Such internalising of benefits or costs can be encouraged via:

- charges and subsidies;
- rights creation; and
- moral suasion.

Charges and subsidies

Charges and subsidies can be used to discourage practices that harm environmental quality (to reduce negative externalities) or to encourage practices that increase environmental quality (to appropriate positive externalities). From the perspective of property rights, they involve refining property rights to cause people to adjust their behaviour. The selection of charges and/or subsidies to manage resources can be based on one of two broad principles that ensure people either:

- more impactor pays principle fully bear the burden of any costs that their actions impose (internalise costs), or;
- more fully account for the benefits that they gain (internalise benefits) beneficiary pays principle.

Impactor pays principle

The impactor pays principle states that people (the impactors) who use environmental goods or services in a way that is harmful should pay for the environmental costs that they cause. If people dump old cars in a lake and thus cause pollution from the leakage of heavy metal in the car batteries, those people would, under the impactor pays principle, be made to pay for the damage caused by their action. The impactor pays principle is commonly used to justify the introduction of fees and taxes against people who persist with undesirable practices; however, it often is also linked with other activities that force impactors to bear the costs of their actions, such as:

- rules that require users to change their technology or introduce impact minimising techniques to meet environmental standards; and
- charges on impactors to contribute to mitigation measures – that is, getting impactors to contribute to fixing problems that they cause. Impactors may be required, for example, to contribute to clean-up campaigns by donating their time and effort to clean areas, or by contributing to the cost of bags, brooms and so on.

The impactor pays principle forces people to face up to some or all of the external costs that they would otherwise ignore. It thus raises the cost of choosing to use environmental goods and services unsustainably. The higher cost discourages people from conducting a harmful activity to the extent they would normally.

Figure 42 represents the costs to a community or family of using an environmental good or service in a way that causes external costs. Assume the family clears trees for *taro* gardening – an activity that causes siltation in rivers downhill. The benefits to the family of *taro* are represented by the demand curve D which slopes downwards to the right, indicating that lower prices results in higher demand. The cost to the family of producing *taro* includes the cost of clearing the vegetation for *taro* and tilling the land. The private cost of clearing is represented by curve $S_{private}$, which slopes upwards to the right, indicating that increasing levels of clearing involve increasing levels of effort. On the other hand, the true cost of clearing involves not only the removal of vegetation and tilling, but also the external costs of siltation downhill. The true cost is thus represented by curve $S_{private+externality}$, which is situated to the left of $S_{private}$, indicating that the true cost of land clearing is higher than the private cost. The family will be expected to continue land clearing for as long as it continues to gain sufficient benefits to make the effort worthwhile. If the environmental impacts are not considered, this will mean the family will produce Q_1 quantity of clearing, where D equals $S_{private}$; however, the true cost of clearing is higher than $S_{private}$ by amount *x*. This is the external cost that the community imposes downhill. The desirable level of clearing is only Q_2, which is less than the current amount.

If the local council imposes a new regulation charging anyone who clears with a fine of $*x*/unit area, gardeners would face supply cost of $S_{private+externality}$ cost rather than $S_{private}$. The cost of clearing would increase to $S_{private+externality}$ and gardeners would be expected to reduce clearing to level Q_2 where D equals $S_{private+externality}$.

Similarly, suppose a family prefers to dump its household waste in the local river because that is the easiest way for the family to remove the waste. By dumping waste in the river, the family is causing pollution over time. Given that there has never been sufficient reason for the family to stop its disposal practice (because using the river is easier and faster than having to walk or catch a ride to the local dump), the family thus continues with this unsustainable practice. The village may decide to penalise anyone who dumps waste in areas other than those approved by the village committee. Consequently, anyone found dumping waste in the river is then charged $5. This penalty raises the cost to the family of dumping waste. The family is forced to bear the brunt of some of the pollution costs that it previously ignored. The higher the charge, the more expensive is the undesirable act and the less attractive it is to the family.

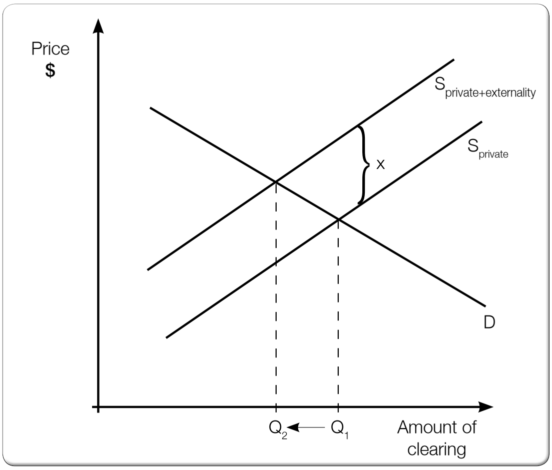


Figure 42. Demand and supply schedule for *taro*.

Penalties established under the impactor pays principle when high enough can be beneficial for the environment in two possible ways. First, higher costs may make unsustainable practices so unattractive that some people stop them. The family may decide that $5 is too much to have to pay for getting rid of its rubbish, so it may choose instead to take the rubbish to the dump. The family may even decide that it is worth paying for transport to the dump, because the transport is cheaper than the $5 fine.

Second, where people persist in conducting undesirable practices, the income raised from the penalties may help pay for mitigation measures. Each $5 fine collected may be used to clean up the river by paying for rubbish bags or for local people to remove the accumulated waste. Nevertheless, the ability of the fine to mitigate environmental damage relies on the government ensuring that the revenues are directed to environmental clean up (rather than to general revenue and being used for any number of other purposes). Additionally, even when such instruments benefit the environment, their effectiveness in doing so depends on monitoring, enforcement and compliance.

Beneficiary pays principle

The beneficiary pays principle is the converse of the impactor pays principle. It states that people who benefit from conservation goods or services should contribute to the cost (in terms of time, materials, effort or money) of providing those goods or services. (See Aretino et al. 2001). If tourists enjoy a public good such as scenic beauty or biodiversity (goods for which traditionally there are no markets and no market values), they should pay for the enjoyment that they derive from that good based to some degree on their willingness to pay (WTP) for it. Alternatively, the user could contribute to the maintenance of the public good, such as by paying a fee to access an area (as in ecotourism).

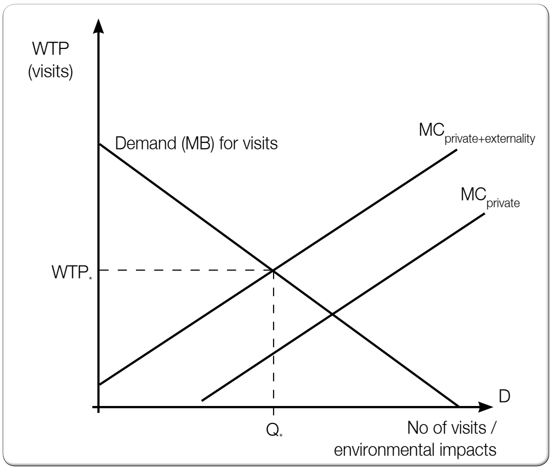


Figure 43. Beneficiary pays principle

By charging people who use public goods, they may be made to realise the extent to which they use resources and have an incentive to constrain the use to that amount which maximises their well being now that they have to pay for its use (cost). This point is Q. amount of public good where the benefits of the good MB equal the costs $MC_{private+externality}$, as illustrated in Figure 43. Therefore, provided that the change is set a the true value of the resource use, the use of the beneficiary pays principle raises the cost of enjoying resources, creating incentives to reduce consumption to more sustainable levels.

Similarly, by charging beneficiaries for the provision of conservation goods and services, providers can appropriate some or all of the benefits of their activities. Recall from Chapter 7 that people using a resource that is non rival and non excludable (that is, a public good) tend to have an incentive to over use it. Alternatively, no-one will be inclined to supply such a good because no-one can adequately appropriate the true benefits derived from its use. Little or no investment is thus made in activities such as biodiversity conservation or the maintenance of public grounds. By charging people who benefit from such a resource, providers can appropriate more of the benefits of conservation and thereby have more of an incentive to supply more of the good or service.

Figure 44 indicates the external benefits to a village of better farm management. The benefits to individual families of better farm management through planting vetiver grass are soil stabilisation and increased farm productivity. The costs of planting the vetiver grass and better farm husbandry are indicated by curve S. This curve slopes upwards to the right, indicating that increasing amounts of revegetation involve higher levels of effort and other input.

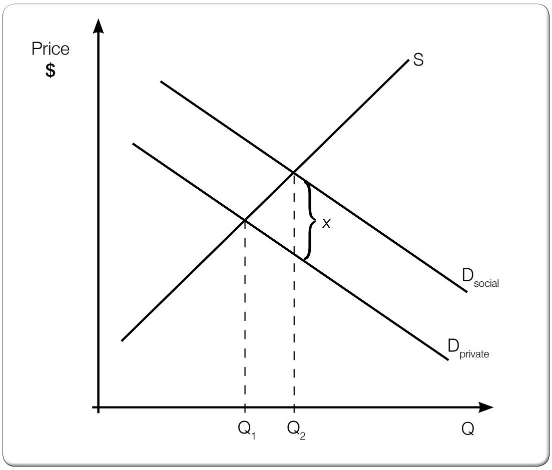


Figure 44. A demand and supply schedule for farm produce.

The sum of the private benefits of replanting the area is indicated by demand curve $D_{private}$. This curve slopes downwards to the right, indicating that participants receive less benefit from progressively replanting because the additional unit effect on productivity falls as more vetiver grass is planted.

The true benefits of revegetation to the village as a whole are higher than the sum of the direct private benefits received by each villager from increased farm productivity. This occurs because the true benefits include an improvement in water quality for all villagers. The true benefits of revegetation are represented by curve D_{social}, which is situated to the right of $D_{private}$ to indicate that the true benefits of revegetation and better farm management for the village are higher than the sum of the private benefits.

Individuals in the community will be expected to continue to plant for as long as they continue to gain sufficient benefits to make the effort worthwhile. If the environmental benefits of planting vetiver are not considered, then this will occur at Q_1 where S equals $D_{private}$; however, the true benefits of planting are higher than $D_{private}$ by amount *x*. This is the external benefit that the gardeners confer on the whole village.

If all the families in the village join together and pay a subsidy (either financial or gifts) worth $*x* to gardeners, then they would face D_{social} benefits rather than $D_{private}$. They would thus be able to appropriate the full benefits of their planting and would have an incentive to continue to plant vetiver grass until Q_2, where S equals D_{social}.

A practical example in many small islands is the disposal of waste. Suppose there is no waste collection service in a village, and waste accumulates in the streets, rivers and gardens. The mosquito and rat populations increase as a result. Everyone wants a cleaner village, but no-one can be bothered to start the clean up because everyone else would benefit but would not contribute to the task. On the other hand, members of the village may be able to make the clean up worthwhile to everyone by providing money, food, title or some other recognition. If this occurs, someone is more likely to have the incentive to make the effort to clean up the village because they can appropriate some benefits. In a sense, the beneficiary pays principle can be seen as ‘bribing’ people to conduct environmentally friendly work.

What is important about the beneficiary pays principle is that it not only provides incentives for people to improve the environment, but also causes beneficiaries to consider the costs of acquiring environmental services. It may take a lot of time to clean a river, so families have no incentive to do so unless they receive significant compensation. The cost of having to contribute to the provision of environmental services means communities become more aware of the cost of fixing the problem and thus the value of avoiding the problem in the first place. As an example, communities have an incentive to tidy up their own streets rather than pay someone else to do so.

Charging mechanisms

Depending on whether the impactor pays principle or the beneficiary pays principle is adopted as the basis for charging, charging systems can be used to internalise both external costs and external benefits and create incentives for more sustainable resource use.

Different types of charges exist. In the case of external costs, charges may appear as a lump sum or unit fees on negative outputs (such as the amount of waste emitted) or on the use of inputs causing environmental degradation (such as the amount of pesticide used). People may be charged a fixed sum for leaving waste at the local dump site, for example. In the Cuvu District of Fiji, locals are charged a fixed fee to dump their household waste at the official dump site. This is also the case in Australia: fees to dump waste in Melbourne and Canberra create incentives for people to minimise the use of public dumps, thereby creating incentives for them to use freely provided recycling facilities instead.

On the other hand, most national or municipal governments often impose a fixed fee for the collection and disposal of household wastes. For example, the Tongan Government in 2008 introduced (Tongan) $10 per household user fee for the collection and disposal of household solid waste.

Fixed charges are not as effective as unit charges. Unit charges apply to each unit of pollution created, thereby creating the appropriate incentive to reduce waste production. The more waste a person reduces, the less that person has to pay. An example is the common use of emission charges for pollution. People are charged per amount of pollution created and released (essentially shifting the supply curve leftwards). The increase in cost means polluters are forced to bear a greater burden of the costs of their pollution. This creates an incentive to minimise fees by adopting cleaner practices.

The Malaysian Effluent Charge System was instituted under the nation's Environmental Quality Act. The system introduced a licence fee of M$100 to discharge waste into public waters, plus a M$10 fee per tonne of organic pollution waste discharged. Together with stricter enforcement, these fees led to a decrease in the total biochemical oxygen demand (a measure of the amount of organic content). This reduction occurred despite a 50% increase in the number of palm oil processing mills and an increase in the amount of palm oil production (World Bank 2000, pp. 42–3).

Rebate schemes can be used to create incentives for people to dispose of waste carefully and receive some benefit in return. Under such schemes, the price of an item contains a small deposit – that is, consumers are made to pay for the 'waste' that they would generate if they did not return the containers. The deposit is refunded to the consumers when they return the item (or a part of it) to the retailer. Rather than throwing away the container, consumers have an incentive to return the container to the retailer so as to access the money. Consumers thus have a monetary incentive to reduce waste. Rebate schemes (sometimes called deposit refund schemes) are most commonly used in the Pacific for the return of reusable glass bottles. Overseas, they have also been used to encourage the recycling of other materials, including paper and cardboard (ABARE 1993).

An alternative form of charging mechanism, performance bonds may be used to either (1) discourage activities that harm the environment or (2) pay for the subsequent mitigation of damage. They are a form of insurance against potential damage. Using performance bonds, companies pay a security deposit (or a bank guarantee) to the government in case their actions result in environmental harm. The bond is deposited in an interest bearing account on behalf of the bearer. The remaining bond (after the government is paid for any environmental damage) and the interest earned are returned to the company at the end of its operations.

Performance bonds have the potential to reduce externality costs by providing:

- an incentive to users of environmental goods and services to maintain environmental quality so as to recoup their deposit; and
- a source of funds to rehabilitate resources if use is not sustainable or causes damage.

Performance bonds have been used to protect the quality of the Australian Great Barrier Reef, which is the largest system of coral and associated life in the world. Under the bond system, users who wish to install any structure in the Marine Park must provide a bond or bank guarantee to cover their liability. The bond (along with the insurance that it confers) applies for the duration of the reef use and for the two years that follow (unless the Great Barrier Reef Marine Park Authority stipulates otherwise) (Lal and Brown 1996).

Performance bonds are not widely used in Pacific island environmental management. They have been used in the mining sector mainly, to encourage companies to rehabilitate the landscape when they cease mining.

Examples of charging systems used in the Pacific to make beneficiaries pay are described in Box 18 and Table 9.

Box 18. The impactor pays principle at work in the Pacific.

Deposit refund schemes in the Pacific Islands

Samoa

In Samoa, the local brewery Vailima supplies beer in small and large glass bottles. The cost of a full bottle of beer is approximately WST$2.40 for small and WST$4.60 for large. The Vailima brewery takes back its used beer bottles from consumers and, after cleaning, reuses them for beer sales. It reimburses WST$0.20 per small bottle and WST$0.40 per large bottle.

Papua New Guinea

PNG Bottle Industry Ltd offers refunds of K1.5, K1.7 and K1.2 per returned Coke bottle, Pepsi bottle and beer bottle, respectively. The use of returnable bottles appears to be cheaper than the use of non returnable bottles, and the same bottles can be reused up to nine times. Aluminium cans cannot be used locally, but there are important overseas markets for aluminium metal. In 1997, Papua New Guinea exported 13 000 tonnes of aluminium cans at a price of US$1050 per tonne.

Palau

In Palau, the aggregation of soft drink containers has been recognised as a major problem facing the nation for some time. To reduce the level of accumulation, the Palau Government developed a draft recycling Bill in 2002. The Bill was intended to lead to the establishment of a tariff of US$0.15 on imported soft drinks. The tariff as to be used partly to fund the establishment of a recycling facility, but also to fund a scheme whereby people who returned their drink containers to redemption centres would be reimbursed US$0.05 per container. The availability of a refund for containers was intended to encourage people to return their containers, which would not accrue as waste because they would be recycled.

Sources: Cox and Elmquist 1991; Crennan and Berry 2002.

Table 9. Impactor pays and beneficiary pays in the Pacific

Countries	Taxes, levies or other charges	Environment fund	Source
Cook Islands	Airport departure tax, pollution tax, processing fees	Environmental Protection Fund, the Takitumu Conservation Trust	Levett and McNally 2003
Fiji	Timber royalties, fisheries licences, *qoliqoli* compensation fees, export levy, entrance fees		Swarup 1983; Lal 1990; Koronyitu Conservation Area Program
Niue	Fuel tax		
Samoa	Litter tax, biodiversity and prospecting fees, water fees		
Papua New Guinea	Deposit refund, timber royalties, mining and petroleum royalties, waste charges	Individual incorporated land group bank accounts	Levett and McNally 2003; Koyama 2002; Duncan 1994; Hunt 1998
Tonga	Logging royalties		
Tuvalu		Tuvalu Trust Fund	
Solomon Islands	10 % bed levy, timber royalties, wildlife export fees, reforestation levy, water permit		Duncan 1994
Federated States of Micronesia	Marine export levy, timber royalties		
Vanuatu	Export fees for threatened or endangered species, waste water charges	CITES Trust Fund	

In the case of external benefits, additional charging systems may be used to ensure service providers can better charge for services and appropriate the benefits of their work. Access fees, for example, can be used to ensure beneficiaries pay. This fee system charges users to access an area, as in entry fees to a conservation area. Users are made to pay for using the non-marketed public good or service. Alternatively, they may be charged for harvesting an environmental resource.

Licence fees are a common example, although they have been treated more as administrative fees than as fees for the use of environmental resource. Pacific island nations charge foreign fishing vessels (from fisher nations such as the United States, Japan and Taiwan) access fees for targeting their tuna fisheries. In the 1990s, Japanese vessels paid a 5% the value of the catch fee to fish in Pacific waters. Hunt (1998, p. 60) noted:

> ...While Kiribati has charged approximately 5 percent of the value of catch under bilateral access arrangements for purse seine fishing, it has also charged the long line vessels of the Republic of Korea and Japan US$181 000 per vessel.

In the Cook Islands, the Government introduced in 1994 an environment departure tax to be deposited in the Environment Protection Fund. (In 2000, this environmental departure tax was worth NZ$5 of a total departure tax of NZ$25.) Although the revenue from the tax went into the general revenue, it was earmarked for activities to conserve and protect the natural environment. More specifically, the funds were assigned for the protection of the reef and foreshore, soil conservation and the protection of land, sea and air from pollution (Levett and McNally 2003, p. 47).

The Republic of Palau introduced diver fees whereby divers pay a weekly user fee of $15 to the local authorities. Of the collected fees, 50% is used to protect and preserve the area and the other 50% is used to compensate the local population for restricting their access to the resources. This dive fee has raised $40 000 per year, on average, and has been used to improve local environmental and social conditions (Levett and McNally 2003, p. 47).

User or access fees can work well for small communities that own natural resources and that wish to manage the exploitation of the associated goods and services. The Marovo Lagoon community in the Solomon Islands (Box 19) applies such a charge as part if its community-based management of the lagoon. Lalomanu residents have imposed a similar user fee on tourists wishing to use their beach.

Box 19. The beneficiary pays principle at work in the Pacific

Charges in Samoa

User fees have been used to help reduce excessive levels of water use in Samoa. In the 1990s, the Government of Samoa recognised that its water consumption per person was among the highest in the world. The high demand for water meant that local supplies were insufficient to service the residents of the capital, Apia. Consequently, locally treated fresh water had to be supplemented by raw untreated water.

In 1999, a German project helped install water meters in the Apia urban area. The meters were subsequently used to measure water use in Apia homes that were supplied with both raw and treated water. Prior to the introduction of the water meters, there were no tariffs for water use in Samoa (Wendt 2002). When the meters were introduced, access charges for water were established. The effect was to increase the cost of water to householders, who then had an incentive to minimise water use as much as possible. The Samoa Water Authority has subsequently reported a 'noticeable' fall in the demand for water.

Water and sanitation management in Papua New Guinea

Water control is divided into water management and delivery in Port Moresby and neighbouring areas. The region outside Port Moresby (which covers 14 districts) is serviced by a private supplier. The private supplier is managed by a board that comprises representatives from agencies effecting water management – including the Water Board, the Department of Works and Implementation, the Department of Health, the Institute of Engineers, the Institute of Accountants, the Institute of Management and the Chamber of Commerce and Industry.

Corporatisation of water management and delivery in the region resulted in the introduction of water charges. The charging system enables the water suppliers to meet bills and ensure delivery of the water. Private sector management was considered to have resulted in efficiency benefits.

User fees on Ebeye Island in the Marshall Islands

Unpaid power bills on Ebeye meant many consumers were using power but not paying for it. Power use was consequently very high. To reduce the level of power use, debit meters were introduced. These meters ensured consumers were obliged to pay in advance for all the power that they used, avoiding unpaid bills for power use. When debit accounts were used up, the supply of power ended. The introduction of the debit meters meant people paid the full cost of their power use (at least from a company perspective) and thus had an incentive to use that power as efficiently as possible.

Access fees for Marovo Lagoon, Solomon Islands

The Marovo Lagoon in the Solomon Islands is a valuable destination for tourists. It contains high levels of biodiversity, clear warm water and attractive reefs that attract divers. The lagoon traditionally falls under the ownership of the local communities, which hold customary rights over the resources. Permission to dive in the lagoon is granted by the customary owners on the payment of access fees. In 1996, access fees were A$20–30 per diver. Fees are paid by the resort to the local community to ensure guests can use the lagoon.

Sources: Adapted from Hunt 1998; Perelini 2002; Wendt 2002, and Crennan and Berry 2002.

In Fiji, the Rivers Fiji Co. established in 1997 runs adventure tours to rural highlands and coastal areas of Navua. The three villages involved work with the tour company and set up the Upper Navua conservation area. They also introduced user fees, with part of the payments being paid directly to the land owners. In addition, the annual payment for the 50-year lease on the 17 kilometre corridor of conservation area is paid directly to the Native Land Trust Board, which represents the interests of the traditional land owners.

Subsidies

Conservation activities may not be undertaken if people cannot appropriate sufficient (external) benefits to make it worth their while. To provide an incentive to people to undertake desirable activities, such as conserving biodiversity, governments or non-government bodies may provide subsidies to increase the benefits of the activity to resource users.

From a conventional economics perspective, the use of subsidies to encourage changes in user behaviour and action represents a payment from those who believe that specific goods or services are beneficial to the nation to those who supply them. Subsidies thus could be considered to reflect the application of the beneficiary pays principle, provided these subsidies are not a form of pork barreling for political gain.

Examples of subsidies to improve environmental quality are those that purchase environmentally friendly technology. A government may identify companies that pollute the environment and offer them subsidies to buy cleaner equipment or to introduce waste treatment processes. Essentially, the government 'bribes' users into changing to a less polluting production process. At times, external donors are interested in setting up a 'win–win' situation by subsidising alternative income-generating activity in return for the declaration of a conservation area and the control of extractive uses.

An example is the Uafato honey project, for which the SPREP under the South Pacific Biodiversity Conservation Programme supplied beehives and protective gear to the residents of Uafato in return for the declaration of the Uafato conservation area and restrictions on the harvest of *ifilele* timber.

Royalty taxes may be used to ensure those who benefit from using environmental goods and services compensate the state or the resource owners for the privilege. Traditionally, most countries have used a system of royalty payments in mainly the mining and forestry sectors. This payment extracts 'resource rent' or any above-normal profits that companies may derive from exploiting a nation's natural resources. In the Solomon Islands, a royalty fee of 10% of gross value product is charged on logging companies, together with an export tax of at least 25%. Papua New Guinea has a flat royalty fee of K14 per cubic metre, plus an export tax of about 24% (Duncan 1994).

Likewise, a number of Pacific island nations charge mining companies royalties for the exploitation of minerals owned by the nation (Clark 2001). Although minerals and petroleum are treated as state-owned resources in many nations, some return to the traditional land owners is often recognised. In some nations, a proportion of the mineral and petroleum royalties are thus returned to the land owners. This payment sometimes involves substantial sums. In Papua New Guinea, each land owner group could expect to get anywhere from K100 000 to as much as K2 million (Koyama 2002, p. 2)

From an economic perspective, royalty taxes can achieve two outcomes. First, they ensure the owners of an environmental good or service (such as mineral resources) appropriate more of the benefits of having conserved their stocks. In the process, the royalty taxes provide a way for resource-rich (but frequently capital-poor) nations to achieve greater equity in the distribution of wealth.

Box 19 contains examples of methods used in the Pacific to create incentives for the sustainable use of goods and services. Table 9 summarises examples of different charging measures applied in the Pacific.

Impactor pays or beneficiary pays?

Managers may be faced with the dilemma as to when to use 'impactor pays' or 'beneficiary pays' charges. Broadly, leaving aside moral and ethical issues as to who should pay, the impactor pays principle is generally the more effective for encouraging people to limit practices that impose external costs. This is because the principle forces impactors to bear more fully the cost of their actions, thus increasing awareness of, and accountability for, the consequences of those actions. In the long term, the use of the impactor pays principle may also create incentives to develop practices that are more environmentally friendly.

These attributes give the principle a distinct moral and technological advantage over the beneficiary pays principle. First, some people view the impactor pays principle as the most 'fair' approach because it penalises only users who benefit from the harmful activity. By comparison, the beneficiary pays principle applied in the case of pollution situation would penalise those who suffer the effects of environmental harm, effectively forcing them to 'bribe' impactors to stop. For this reason, Siebert (1992) referred to the beneficiary pays principle as the 'victim pays principle'.

Further, the provision of payments to encourage people to cease activities that create external costs may create incentives for those people to 'threaten' to continue those activities if the funds end. This incentive for rent seeking means the costs of implementing the instrument can escalate even though the external costs may be limited. A weakness of the impactor pays principle, therefore, is that it relies on the identification of polluters, monitoring and enforcement.

Second, by raising the costs of using environmental goods and services unsustainably, the impactor pays approach to external costs creates incentives for people to identify and invest in innovative or alternative ways of meeting their needs. When the impactor is made to pay for environmental damage from fishing with dynamite, for example, he or she has an incentive to invest in a technology alternative to dynamite.

On the other hand, the beneficiary pays principle is more relevant in certain circumstances, such as when communities seek to create incentives for people to provide public goods. The beneficiary pays principle is also preferred when people use public goods as 'free' goods and thus tend to over use these resources. If users are made to pay for the privilege of using a public good, they will have an incentive to use only that level of public good for which the marginal benefit just equals marginal costs.

When neither is preferred

Imposing a charge on people is not always the solution in practice. Where the transaction cost of identifying and/or charging impactors or beneficiaries is high, it may not make economic sense to introduce a fee. Similarly, if the monitoring and enforcement costs are likely to be greater than the fees recovered, imposing a charge may be more costly than not charging at all. In this case, other solutions are needed to minimise negative environmental impacts. Box 20 summarises the merits of charging and not charging.

Box 20. Merits of a charging system

Charges have the advantage of being relatively straightforward to understand and explain. They need to be set after discussion with stakeholders and a consideration of likely impacts. A charge set too low may increase funds for mitigation works but will not remove externalities or deter unsustainable resource use. On the other hand, a charge set too high may deter even sustainable resource use and unfairly penalise a community.

Experiences in both developing and developed countries suggest impactor or beneficiary charges are often set too low and usually do not reflect the cost of environmental harm (the marginal environmental costs) of the activity. Nevertheless, charges have been instrumental in making companies change their behaviour (Cansier and Krumm1997; Panayantou 1998).

That said, charging systems may not always be suitable. The success of any charging system depends on the ability of enforcers to identify impactors and their level of impact, and then implementing a charge that will discourage (but not unduly penalise) those impactors from excessively harming the environment.

In Samoa, for example, the introduction of water meters in Apia meant the water authority could observe how much water people used and thus work out charge rates. Similarly, it is relatively easy to impose a departure tax on tourists in the Cook Islands, or a dive fee in Palau. On the other hand, the introduction of a user charge may have an impact on the financial welfare of poorer groups. Poor groups who use water may have difficulty paying charges (although most water charge systems assist poorer users with a 'free' initial allowance, for example).

The effectiveness of the charging system also depends on the ability to enforce charges. The effectiveness of Malaysia's pollution tax, for example, was improved by increased monitoring and enforcement. The Government also took non-compliant polluters to court. The level of pollution from palm oil mills decreased substantially in one year; after 10 years, it fell to less than 1% of the level of pollution that existed when the time management system was introduced.

Under the beneficiary pays principle, users of environmental goods and services also need to be identified, and payment has to be enforced to remove externalities. Yet, the ability of communities to identify external beneficiaries may not be high. Identifying users of an outer reef fishery, for example, may be difficult compared with, say, identifying users of the local river. Charging thus works best where identification is straightforward and the costs of monitoring and enforcement low.

The costs of monitoring and enforcing charges can be high. Communities may need to employ and pay locals as wardens to enforce penalties. These implementation costs need to be considered before a charging scheme is introduced. A charging system is only a sensible solution to addressing externalities if the value of fines/revenue generated exceeds the costs of running the system (such as the wages to wardens). That is, the transaction costs (including the costs of collecting fees and monitoring and enforcing the charging system) have to be less than the revenue generated.

10.3 Creating property rights

An alternative to command and control or incentive-based instruments is to conduct a wholesale revision of the property rights governing the resource of concern. This is sometimes called 'rights creation', or the strengthening of existing rights. Property rights for goods and services may be 'created' where the revision of rights is extensive. Such creation usually occurs where the property rights over resources are exceptionally weak, such as where no-one appears to own the resources and the resources are subject to the 'tragedy of the commons', as discussed in Chapter 7. If well-defined rights for environmental goods and services can be established, then users will incur/appropriate more (or all) of the costs and benefits of their use, because either:

- users have an incentive to reduce practices that impose external costs because they face higher costs from those practices; or
- users have an incentive to undertake conservation practices because they can appropriate more benefits.

Given that people personally bear more of the true impact of their decisions, they will have an incentive to negotiate the level and type of resource use. They will do this via either:

- a negotiation process in which only few parties are involved; or
- the formation of a market in which many parties are involved.

The creation of well-defined rights to use environmental goods and services involves a wholesale redefinition of what can be done with environmental goods or services, when and how. Clearly-defined rights principally increase the appropriability of benefits and costs from use, and avoid or constrain the external benefits and costs (as discussed in Chapter 7). This may also mean establishing (or reinforcing) rules to ensure appropriability.

The creation of rights can work in two ways. First, where few parties are involved, communities or governments can define property rights so it is clear who owns what, who has the right to do what with which resources; and who has the rights to release what outputs. With these rules explicit, stakeholders should be able to negotiate an outcome for the quality of the environment. This negotiation approach is suitable when dealing with pollution, for example. Communities or the government can decide who has over-riding rights: the polluter (the right to dump waste) or the victims (the right to a clean environment).

Once rights are clearly specified, the polluters and the victims should be able to arrive at an efficient environmental quality if the cost of negotiation is small. Fiji's fisheries sector illustrates refined property rights and subsequent negotiated solutions. The Colonial Government had formally acknowledged the existence of customary fishing rights, but these rights had not been regarded as 'compensatory rights'. Consequently, *qoliqoli* owners were for a long time unable to demand compensation for the loss of any fishing rights due to the loss or degradation of coastal habitat. In the mid-1980s, the government temporarily reinterpreted customary fishing rights as rights that should be compensated if local fisheries were lost. Although these rights were not clearly defined or registered, the government set up an arbitration system under which compensation levels for lost fisheries could be determined. At that point, traditional Fijian fishery owners could claim compensation amounts that reflected the value of the loss in fisheries output due to activities such as mangrove reclamation (Lal 1990).

The negotiation process can work only if the number of parties involved is small and the transaction cost of negotiation is low; however, if there are many players involved, negotiation is likely to be drawn out costly and is highly unlikely to produce an efficient outcome; unless a robust analytical based negotiation support system is available (see Lal 2008 for an example).

The second way in which the creation of rights can work is through the development of a market for the good or service. Generally, this can occur only where many stakeholders seek access to the good or service. An example of this 'solution' to environmental management is the creation of a market for fishing rights in Australia's southern blue fin tuna fishery (Box 21).

In this case, the Government of Australia redefined the rights to harvest fish. Instead of a right to enter the fishery and chase fish with no guarantee of catch, the rights were defined in terms of individual quotas that each licensee could catch. Licensees thus knew their quota of fish throughout the year and could target catches at the most convenient times and when the prices were favourable. The quotas allocated were made 'transferable', so licensees could sell their quotas or lease them to other users. The licensees would transfer their fishing quota only if it was in their interest – that is, if they could cover the loss in fishing income from the transfer of rights and the saving of fishing costs.

Given the quotas were transferable, a market to allocate rights across users developed, enabling negotiations between those who wished to fish and those who wished to make money out of transferring rights. In response, the government had to decide on a total allowable catch for the fishery (instead of restricting individual fishers) and allow individuals to make their own decisions about fishing effort.

At the international level, with the ratification of the Law of the Sea, some Pacific island countries have declared their rights over 200 nautical miles of coastal waters (or Exclusive Economic Zone (EEZ)) and created property rights over the fisheries (and other resources) contained therein. Once the rights are created, countries may then manage the tuna and other resources using other types of instruments, such as licences, access fees, quota control, etc. A similar principle is being used in the creation of the emission trading scheme to address the global climate change imperatives (see, for example, Stern 2007).

Box 21. The creation of resource use rights in Australia

The southern blue fin tuna fishery is a highly valuable fishery located in the Pacific. The tuna is targeted by a number of fishing nations, the most significant of which are Australia, New Zealand and Japan. The stock is managed using an international quota system. Under this system, Australia, New Zealand and Japan are assigned a right – an annual quota of fish – that each can harvest. Each nation can select how and when they fish, provided they do not exceed their overall national quota.

In Australia, the allocation of the national quota is managed using an individual transferable quota (ITQ) system. The ITQ system was introduced as a response to perceived low efficiency in the harvesting sector in the 1980s. Although catches were not decreasing, fishing costs were increasing and 'races for fish' were common. There was also some evidence that continued fishing styles (racing for fish, high grading) were not sustainable.

In response to these concerns, the Australian ITQ system was introduced in 1984. Under the system, holders can trade rights. Those who value the catch more have an incentive to try to buy the rights from those who value it less. The ITQ system operated in Australia is generally regarded as having contributed to the efficiency of the southern blue fin tuna sector in the 1990s. There is also some evidence that the system contributed to the sustainability of the stock by increasing the average size of fish caught.

Sources: ABARE 1993; Holland 1997.

The wholesale redefinition of rights does not always lead to a market solution, because the approach has difficulties. First, the excludable and/or rival nature of some environmental goods and services, such as waste assimilation by the sea, means incentives to over use those goods and services may continue, regardless of attempts to refine rights. In these cases, a command and control style of resource management may be the only option for preventing degradation.

In any case, the creation of well-defined rights requires access to good information about the nature of the environmental good or service. The total amount of the good to be used in and across the area needs to be identified, and information to underpin this calculation is frequently missing. The amount of fish that can be sustainably caught from one area, for example, may not be known (and may even vary from one area/season to the next).

Additionally, within a country, there may be cultural or social obstacles to the creation of well-defined rights. It may be possible to identify individual quotas for a fish stock that is under pressure, but communal rights to the stock are more conventional in the Pacific, where stating that one person has a legal fishing right over another may be unacceptable. On the other hand, it may be acceptable for outsiders to access communal resources, with the revenue going to customary owners.

The creation of new rights can lead to friction among user communities. Competition to secure rights can create incentives for individuals to rent seek to secure a higher share of rights than others secure. Consequently, the initial allocation of individual quotas for tuna stocks in Australia (and demersal fish stocks in northern Europe) created disputes among fishers who believed their allocation of the rights was insufficient and unfair. Similarly, in Fiji, 384 *qoliqoli* were initially declared. In response, some clans claimed areas of their own, leading to a subdivision of the original number of *qoliqoli*; about 410 *qoliqoli* are recognised in 2004.

As with all management measures, the monitoring and enforcement of rights are critical. In practice, it can be difficult to monitor who observes rules (that is, who exceeds quotas or who pollutes or uses destructive methods when not scrutinised) and to ensure they are punished/reprimanded sufficiently to deter them from cheating in the future. Where the costs of monitoring and enforcement are high, the creation of rights is not worth the cost; other measures (charges or top-down approaches) would be more effective in reducing externalities (ABARE 1993).

In practice, the creation of property rights requires national legislation and thus is most often used to address external costs at the national level (such as the right to fish yellowfin or big eye in the Pacific) or regional level (such as the right to emit carbon). Property rights usually take the form of top-down management. On the other hand, the fact that rights holders share a resource can encourage users to 'self police'; that is, they have an incentive to ensure that the next person does not break the rules because that would affect the level/quality of the good and service remaining.

In Fiji, the public recognition of *qoliqoli* (although they are not recognised by an Act of Parliament) encouraged the *qoliqoli* owners to take greater interest in the management of their coastal resources. As an example, they set up many no-take reserves and fishery reserves under the local-level managed area (LLMA) network facilitated by the University of the South Pacific and some NGOs.

Alternative forms of property rights creation

The creation of new rights has been used particularly in protected area management. Governments have tended to declare state or Crown land as protected areas by legislative or executive order. This approach worked well where a government owns areas valued for their biodiversity or unique qualities. New rights may also be created where a non-government organisation acquired privately-owned land and converted it into a protected area. Such an approach has been used in Costa Rica, Mexico, Guyana and other developing countries.

In the Pacific, where much of the land is under customary ownership and is inalienable land, the outright purchase of land and its conversion into 'private' property is frequently not an option. Where attempts were made to 'create such rights, such as in Papua New Guinea, massive riots broke out which led to the death of four university students. (Finglteon 2005 quoted in Pacific Islands Forum Secretariat 2008).

More recently, Pacific island countries have acknowledged the need to strengthen property rights over use while the communal ownership of customary resources remains intact. Greater emphasis is now placed on setting the terms and conditions of the leases, including their duration and resource rent (Box 22). On the island of Savai'i, a group of US academics, with the help of the Swedish Society for Nature Conservation and some pharmaceutical companies, negotiated a 50-year lease using a covenant. The new right allowed the villagers continued access to their forest resources for subsistence uses (Cox and Elmquist 1991). In Fiji, agricultural leases are issued for 30-year periods, with fixed annual rent reassessed every five years.

Box 22: Land acquisition for conservation in developing countries

Samoa: A group of conservation-oriented academics from the University of Utah and the Swedish Society of Nature Conservancy, with the assistance of some pharmaceutical companies, used a covenant as a contract in which the Savai'i Village commits not to log or harm its forest for the next 50 years. The signed covenant thus protects the forest (Cox and Elmquist 1991).

Costa Rica: Under the Forest Conservation and Management Through Local Institutions (BOSCOSA) Project, a forest conservation and management incentive fund (PROINFOR) gives land owners a small sum of funds as incentive for putting land under conservation easement, with the balance deposited into an interest-bearing trust fund. The easement was initially for five years and extendable three more years. Funds were paid into interest generating accounts or bonds (Donovan 1992 and Hitz 1994).

Philippines: The Philippines Reef and Rainforest Conservation Foundation Inc. purchased an island off the coast of western Negros in 1997, with the help of a loan from the World Land Trust.

Tanzania: A non-government organisation, the Land Conservation Trust, recently acquired the title to the Manyara Ranch (adjacent to Lake Manyara National Park). The trust would manage the area in a way that provided for use and benefits to the community while maintaining critical wildlife corridors.

Kenya: The Wildlife Trust and the Friends of Nairobi National Park are using wildlife conservation leases negotiated with local Maasai land owners to maintain vital wildlife migration corridors south of the park. For the going rate of $4 per acre (an average family has 100 – 200 acres), the land owners agree not to fence, cultivate or sell the land for the period of the lease (currently on a year-to-year basis).

South Africa: South Africa National Parks makes contractual arrangements with private, communal and municipal land owners to incorporate land into national parks. Examples include the Richtersveld National Park (a 100% contractual park), the Cape Peninsula National Park and the Agulhas National Park.

Guyana: The Global Conservation Fund (Conservation International) leased rights to 200 000 acres (about 78 000 hectares) and established an endowment fund to cover royalties, management fees and economic development activities for local communities (such as education, job training) (Kiss 2004).

10.4 Moral suasion and other instruments

Persuasion can be used to encourage people to limit activities that create external costs or to adopt practices that create external benefits. Moral suasion, for example, can be used to persuade people to 'do the right thing' on the grounds that it is ethical and in the interest of the society.

While moral suasion could contribute to a change in behaviour, it relies on people's value system which, in the Pacific, has been going through rapid transformation because of the influence of globalisation and monetisation of society. There is a growing emphasis on individualisation and individual wealth creation compared to the traditional egalitarian communal lifestyle. Moral suasion could thus be most effective if linked to financial and cultural incentives; that is, people are more likely to respond to moral pressure when they think they will make some gain. In Fiji, a scheme was introduced to encourage villagers to refrain from unsustainable practices, including the fishing of turtles (Box 23). Such an approach can work reasonably well in particularly small societies where social standing is an important consideration for many villagers in their day-to-day life.

Box 23. Moral suasion – shaming in the Cuvu District, Fiji

The Coral Gardens Initiative is a development program in the Cuvu District of Fiji's main island, Viti Levu. The program was intended to support community-based marine resource management by empowering local communities to take responsibility for the sustainable management of their resources. At the same time, the program was intended to involve all other relevant stakeholders, including government departments, non-governmental organisations and the tourism sector.

Under the initiative, marine protected areas were established in the Cuvu District. Bans (or *tabu*) prevented villagers from harvesting certain species in these areas. There were only a few breaches of the *tabu*, and shaming in these cases was an important component of punishing the offenders and deterring future breaches. In one case, three individuals from a village killed three turtles during the village *tabu*. The individuals were caught and reprimanded by the village head, left to stay in the community hall for a long while, and subsequently assigned community service (weeding and cleaning the village). The shame that the individuals experienced served as a deterrent to poaching during the *tabu* period.

Source: Adapted from Robinson, 2002 and Floyd Robinson, FSP-Fiji, pers. comm., July 2003.

Suasive approaches can take one of two forms. They may, like the Fiji scheme described in Box 23, use the prospect of public shame to encourage people to reduce activities that create external costs. Alternatively, they may use public disclosure to congratulate and encourage people to adopt practices that confer external benefits. The International Standards Organisation (which sets ISO standards), for example, includes a new system of environmental management standards. It audits companies, which can take advantage of this certification when marketing of their products.

Another example of this 'positive' moral suasion is independent organisations' certification of environmental products. The Marine Aquarium Council in the Pacific, for example, has begun to certify and label aquarium products sourced from sustainably-managed fisheries. Similarly, the Forest Stewardship Council certifies forest products sourced from sustainably-managed forests. The Solomon Islands have already taken advantage of forest certification for their timber products sourced from Kolambagarra Island (Pesce and Lal 2004).

Certification benefits producers by securing sales to people who value sustainable management. Often, these people are willing to pay a higher price for products sourced sustainably. This demand also puts moral pressure on others to stop harvesting unsustainably where suppliers using less sustainable practices fear customers may refuse to deal with them. Consumers, too, face moral pressure to buy certified products.

10.5 Concluding remarks

Traditionally, governments have used command and control approaches to control the externality effects of using environmental goods and services. Common instruments include bans, input restrictions, output restrictions, standards and process controls. These approaches are valuable but may not work where national management plans have not been developed or implemented, or where the costs of monitoring and enforcement are high. In any event, such an approach can require considerable capital and administrative and enforcement capabilities to establish and enforce. Consequently, breaches of control often occur, resulting in the degradation and over exploitation of resources.

An alternative (or useful adjunct to these approaches) are incentive-based approaches that encourage the 'internalisation' of externality effects. Internalising externality benefits and costs improves the sustainability of resource use (Table 10). Generally, people have more of an incentive to permanently switch to sustainable uses of environmental goods and services if they face penalties for causing environmental harm.

Internalisation of externalities can involve a number of instruments, depending on whether communities seek to internalise externality costs or externality benefits (Table 8). In the Pacific, no one instrument is likely to suffice because necessary information may not be available to accurately specify and implement the instrument. This information issue is particularly critical when small activities are involved. Nonetheless, the principles discussed in this chapter can:

- help identify the types of instruments that could be used; and
- depending on the relative costs and benefits (or the cost-effectiveness) of implementing and enforcing each instrument singly or in combination, help identify the strategy most suitable for the local situation. Chapters 11 and 12 discuss financial and economic analyses of alternative activities, strategies and polices. The same analytical methods can be used to assess the relevance of alternative management instruments.

Table 10. Checklist for instruments to reduce externalities

	Environmental problem		
Instrument type	**Waste accumulation**	**Habitat destruction**	**Over harvesting**
User charges	Objective: To reduce dumping of waste	Objective: To reduce the extent of harmful practices	Objective: To reduce harvesting levels (fish, water)
	Conditions for efficient use: Identification of all users and the extent to which they dump waste Idea of the cost of pollution (environment and human health) from waste disposal Cost-effective identification of waste discharge and enforcement of charges	Conditions for efficient use: Identification of all users and the extent to which they destroy habitat Idea of the economic value of impact of habitat loss on uses Cost-effective identification of users, collection of charges and enforcement of charges	Conditions for efficient use: Identification of all harvesters and the extent to which they harvest Idea of the loss in the value (resource rent) of harvested resource Cost-effective identification of users, collection of charges and enforcement of charges
Emissions charges	Objective: To reduce the emission of pollutants into the air or sea/river	Objective: To reduce the release of pesticides into a river	Not applicable
	Conditions for efficient use: Identification of the human health and other environmental costs (marginal) Cost-effective monitoring and enforcement of pollution levels and pollution impacts	Conditions for efficient use: The identification of all users and the extent to which they release pesticides Idea of the value of damage to rivers/drinking water Cost-effective identification of emitters, collection of charges and enforcement of charges	

	Environmental problem		
Instrument type	**Waste accumulation**	**Habitat destruction**	**Over harvesting**
Performance bonds	Objective: To minimise wastes	Objective: To recover the costs of destruction	Not applicable
	Condition for use: Realistic idea of the expected costs of clean-up after an activity has ceased	Condition for efficient use: Realistic idea of the likely scale of damage and cost of repair	
Non-transferable rights creation (such as non-transferable catch quotas)	Not applicable	Not applicable	Objective: To ensure sustainable use of fish, timber or fresh water
			Conditions for efficient use: Information on sustainable extraction rates Identification of all users Rivalry and excludability of fish, timber or water units Durable and enforceable rights Cost-effective identification of emitters and enforcement
Transferable rights creation (such as quotas)	Objective: To create a market for a good that can be traded to achieve efficiency in resource allocation or waste minimisation	Not applicable	Objective: To ensure efficient and sustainable use of fish, timber or fresh water
	Condition for efficient use: Identification of who has rights to the good, clean environment, the polluted environment etc.		Conditions for efficient use: Information on sustainable extraction rates or total allowable catch/harvest Identification of all users Rivalry and excludability of fish, timber or water units Durable, transferable and enforceable rights Cost-effective identification of users and enforcement
Moral suasion	Objective: To discourage the dumping of waste at non-assigned sites or action that goes against the cultural norm	Not applicable	Objective: To shame people into sustainable approaches instead of using the environment for dumping or over harvesting
	Conditions for efficient use: Identification of all who dump Identification of all who harvest/use the environmental resources The need for individuals to value their public/social/ communal image Identification of dumping not publicly known or acknowledged (threat)		Conditions for efficient use: Agreed limits/rules for harvesting Identification of all who breach limits/break rules The need for individuals to value their public image Identification of over harvesting not currently publicly known or acknowledged (threat)
Certification system e.g. ISO 14001 (Forest certification) and MAC certification		Objective: To encourage consumers or to purchase products sourced from sustainable forests, fisheries and environmentally-sound production process	Objective: To encourage consumers to purchase products sourced from sustainable forests, fisheries and environmentally sound production process
		Conditions for efficient use: Internationally recognised validated and trusted certification system Sufficient price differentials between the certified products and uncertified products to make it worthwhile for companies to change their production practices and obtain certification	Conditions for efficient use: Internationally recognised, validated and trusted certification system Sufficient price differentials between the certified products and uncertified products to make it worthwhile for companies to change their production practices and obtain certification

	Environmental problem		
Instrument type	**Waste accumulation**	**Habitat destruction**	**Over harvesting**
Rebate schemes	Objective: To encourage consumers to return specific containers or used equipment to collection points for disposal	Not applicable	Not applicable
	Conditions for efficient use: The need for the rebates to be high enough to act as an inducement Sufficient ongoing funds to finance rebates		
Subsidies	Objective: To reduce the cost of waste collection by providing subsidies	Objective: To reduce the cost of habitat destruction by subsidising a change in technology	Objective: To reduce the cost of waste collection by providing subsidies
	Condition for efficient use: Understanding that subsidies are one-off support to encourage change in technology, otherwise subsidy use can have a distortionary effect	Condition for efficient use: Understanding that subsidies are one-off support to encourage change in technology, otherwise subsidy use can have a distortionary effect	Condition for efficient use: Understanding that subsidies are one-off support to encourage change in technology, otherwise subsidy use can have a distortionary effect

Section IV

Making choices: Financial and Economic Assessments

Aggregate mining in Kiribati and other Pacific atoll countries is commercially beneficial but can also lead to costly coastal erosion.

Picture reproduced with the kind permission of Arthur Webb, SOPAC.

It is relatively easy in the Pacific to find community projects that were started with great enthusiasm and then abandoned after a short period. A key reason for unsuccessful projects is often inadequate consideration of the financial and operational feasibility of activities. Whether a community project concerns the provision of commercial ecotourism enterprises or free local amenities, whether it concerns waste recycling or forestry/fishery, it will involve financial and/or in-kind costs and returns that have an impact on individuals, families, clans and/or the nation as a whole. To avoid wasting resources and effort, all costs and benefits (or, in financial terms, 'returns') should be considered if a project is to be both financially viable and economically sustainable over time. Without an assessment of the financial viability and economic sustainability of projects, individuals or communities risk losing scarce development funds. In the process, they are also likely to lose their faith in community development projects.

Two types of analysis are relevant when determining the desirability of a project or an activity: financial and economic:

- Financial analysis, discussed in Chapter 11, focuses on the financial interests of individuals, families and/or the community directly involved in a project or activity. It addresses the question of whether an activity is commercially practical and financially profitable. Financial viability is crucial for all projects because each project has only limited resources from which to fund activities and achieve outcomes. Most people understand the general need for a financial analysis to determine how much an activity will cost and, where commercial activity is concerned, how much revenue it will generate.
- Economic (cost-benefit) analysis, covered in Chapter 12, focuses on the interests of society as a whole in a project or activity; that is, it assesses from a national perspective whether an activity will increase social well being. Compared to financial analysis, which addresses the monetary (commercial) feasibility of activities, economic analysis also considers the non-monetary, non-market benefits and costs of an activity, along with that activity's economic, environmental and social impact on people not directly involved with the project.

The significant differences between the two types of analysis are discussed in the Chapter 12, followed by a set of case studies in Chapter 13 highlighting some practical examples in the Pacific where financial and economic analysis have been used for different purposes. Chapter 14 considers how, in light of financial and economic assessments, managers might select between management options.

Chapter 11

FINANCIAL ASSESSMENT

Where projects involve commercially available inputs and outputs; individuals, communities, companies, countries and/or donors need to assess the financial viability of the project before deciding whether to proceed with it. The perspectives of these stakeholders are not necessarily the same, particularly when different stakeholders may focus on different cost components of an activity. Communities often do not have to cover the full cost of a project, particularly when development partners have provided the initial project costs. When donors provide initial establishment funds, for example, a community would be interested in the project as long as the variable costs are covered. By comparison, other stakeholders (such as international donors or even governments) may wish to ensure their scarce funds are used for activities that are at least cost-effective and at best profitable. Otherwise, they could have used their scarce funds to support other projects that would have generated more benefits. In other words, financial feasibility for one set of stakeholders may differ to that for other stakeholders. It is thus critical at the outset to identify whose perspective is the focus of analysis.

Whichever perspective is chosen, an activity makes commercial sense only if it generates more revenue than costs. That is, it is commercially viable only if it produces a net income. A single project may comprise many smaller activities. Financial assessments for individual components may be desirable when those components:

- are singularly expensive or particularly focal to the project to determine whether the expense is worthwhile (justified); or
- involve commercial or income-generation activities determine whether the activities are financially feasible and sustainable.

Project managers may thus need to undertake financial assessments of individual activities, as well as assessments of whole projects from the perspective of communities, donors and/or governments. The degree of detail involved in individual financial assessments depends on the size and importance of the activity. No rule exists for what detail is required, except that the scale of the assessment should be ‘reasonable’ – that is, small simple assessments are likely to be cost-effective for assessing small activities, while more detailed assessments can be justified for larger activities.

11.1 Decision criteria

Generally, those activities that produce higher net income or profits are preferable to those producing lower profits; although some stakeholders may be prepared to accept any activities that improve their general well being and/or the quality of their environment. Several different criteria can be used to determine whether a project is commercially viable. The most commonly understood criterion is ‘net revenue’ (profit) (Table 11). When costs are less than revenue, a project generates a positive return or profit. Where profits exist a project is financially viable. An alternative criterion is the financial return that an activity generates for every dollar invested (Table 11). This is measured using a financial benefit (revenue) – cost ratio.

In some cases, communities and project managers may wish to select between two possible activities to improve their environment. A community that wishes to conserve its forests, for example, has strategic options A and B. Both strategies are aimed at achieving the same conservation level, but they have different cost structures. Once the community has decided on the outcome it desires, the project manager can use financial analysis to choose the cheaper of the two options; that is, the more cost effective.

Table 11. Financial decision making criteria.

Criteria	Decisions
Revenue minus cost is greater than 0	Proceed
Revenue minus cost, net revenue is less than 0	Reject
Revenue/cost ratio is greater than 1	Proceed
Revenue/cost ratio is less than 1	Reject
Net revenue for option A is greater than the net revenue for option B	Select A over B
Cost of option A is less than the cost of option B, but both options produce the same revenue	Select A over B

11.2 Steps in financial assessment

Before attempting financial analysis, it is essential to clearly identify the nature of the project so as to provide the technical foundation for the financial analysis. The analyst can then systematically:

- identify (1) all inputs required to conduct the activity; (2) unit costs associated with each input; (3) when the different inputs (costs) will be required; and (4) estimate total costs.
- Identify (1) all outputs likely to result from the activity; (2), the price of each output; 3) when the different outputs will occur; and (4) and estimate total revenue.
- Determine the net revenue (profit) and/or revenue to cost ratio.

Inputs and outputs

The identification of all inputs and outputs is key to a financial analysis. It can be framed in terms of the terminology and issues introduced in Chapter 4. Recall that a production process is described in terms of the inputs used and the outputs produced. A financial analysis of an activity thus involves identifying the production process, the factors of production and the outputs (products) of an activity (good or service).

Also recall from Chapter 4 that factors of production are the inputs required over time to produce goods and services. These inputs include:

- all material goods bought or sourced from the environment;
- financial and physical capital;
- labour (hired or family) and technical expertise; and
- non-material services, such as the pollution assimilative capacity of the coastal water or air.

Production outputs, or products, may be goods and services that society values as well as those that are also pollutants or waste outputs.

It is vital to systematically identify all the inputs (factors of production) and outputs (products) associated with an activity because these are needed to identify that activity's cost and revenue. Inputs and outputs may be most easily envisaged using a materials input-output table. Consider the honey production initiated as part of the Uafato Conservation Area Project, which was supported financially by the South Pacific Biodiversity Conservation Programme and executed by the Secretariat of the Pacific Regional Environment Programme. Honey production is a natural process whereby bees produce honey from the nectar that they collect from flowers. Honey is extracted by humans after smoking the bees out of the honeycombs. The Uafato families were given beehives and trained how to produce honey for sale as an income-generating activity to substitute for logging. In return, logging was banned from the conservation area.

Honey production involves a number of inputs, as discussed in Chapter 4: hive boxes, queen and worker bees, special protective clothing (boots, gloves, suits), tools and brushes, and honey 'extractor' frames. Honey is the single output (the final product), which is subsequently sold at the local markets and supermarkets. In some countries, honeycomb (and bees wax) may also be sold and that will involve joint products. Table 12 summarises the list of inputs and outputs for the Uafato money project.

Table 12. Materials input-output table for the Uafato honey project.

Inputs	Output
• Bee hive • Queen bee • Worker bees • Hive boxes • Special clothing – boots, gloves, suits • Tools and brushes • Harvest 'extractor' frames. • Nectar from flowering trees and plants in nearby forests or home gardens	• Honey

The construction of such an input-output table may require more thought, as with an ecotourism project. Table 13 lists the inputs and outputs associated with ecotourism activities in the Utwe-Walung marine protected area in Kosrae of the Federated States of Micronesia.

Table 13. Materials input-output table for the Utwe-Walung project.

Inputs	Output
• Foreign tourists • Material for constructing a visitor centre for information display • Conference and meeting rooms • Storage space for canoes • Caretaker's house • Ranger's office and snack bar • Material for a mangrove board walk and interpretive signage • Floating dock • Canoe launch ramp • Parking area • Kayaks and outboard boats • Food and beverage for tourists	• Overall tourist experiences (environmental and social package experiences) • Specialised tourist experiences, including guided environmental tours • Specialised water-based tourist experiences, including snorkelling on the coral reef and boardwalking in mangrove areas

Source: Caraker 1994.

Estimating revenue and costs

Having identified all the inputs and outputs of an activity, it is then important to assess the value of these items; that is, the cost of inputs and the revenue from outputs estimated.

Costs

Financial analysis directly considers only those inputs that are purchased from others (those that incur actual costs). There may be some inputs obtained 'for free'. Otherwise, costs include, for example, wages, rent, interest on loans and insurance on property. As discussed in Chapter 4, project managers will need to categorise costs into fixed costs and variable costs.

To recap, fixed costs are those that do not vary with the level of output produced. In the case of coral extraction in Fiji, for example, fixed costs would include one-off establishment costs, such as the purchase of a chisel and hammer, and a small raft for extracting coral. In the case of the South Pacific Biodiversity Conservation Programme's honey project in Uafato, one-off establishment costs included the cost of hives boxes, cover for the hives (roofing iron), and the queen and worker bees. In addition, there were fixed costs associated with the equipment needed to extract honey and to maintain hives. Other fixed costs were the initial training costs for the villagers.

The fixed costs associated with initial investments can be substantial, such as where boats and outboard engines are bought for community-based fishing activities, or where large capital outlays are required to construct tourist accommodation for ecotourism.

By comparison, variable costs, as discussed earlier, vary with the amount of output produced. They include labour, fuel and electricity. In the case of ecotourism, variable costs also include the cost of providing refreshments to tourists. In the case of the South Pacific Biodiversity Conservation Programme's honey project in Uafato, the variable costs include the time that people spend tending to the hives (labour), the jars and labels for packing honey, the replacement of bees, and the periodic maintenance of hives.

The fixed and variable costs for Uafato's honey production may appear as in Table 14.

Table 14. Fixed and variable costs for Uafato's honey production.

Input	Number/costs
Number of hives	31
Cost per hive	$410
Fixed cost of 31 hives	$12 710
One-off equipment cost	$4 500
Total fixed costs ($410 per hive multiplied by 31 hives) plus one-off equipment costs	$17 210
Variable costs (labour, jars and labels, fuel and electricity)	$3 850

Source: SPREP 1999.

Complete financial analysis, including fixed cost considerations

The costs collected so far contribute to a crude financial analysis of an activity; however, a complete picture of the financial state of an activity should reflect the deterioration in any assets involved. Capital items deteriorate over time and eventually need to be replaced. Until the time of replacement, the older an asset, the more servicing and maintenance it requires (and the more expensive it becomes to the project).

The value of deterioration in capital assets is termed 'depreciation'. The depreciated value of an asset can be estimated using one of two methods: straight-line depreciation or a diminishing value approach. Straight-line depreciation is used if it is assumed that the capital item will be replaced at the end of its life and that the owner will put aside an equal amount each year towards the replacement cost. On the other hand, the diminishing value approach 'writes off' a larger amount at the beginning of the life of the capital, reducing the write-off over time. The former approach is simpler to use and is also the most commonly used.

In the case of Uafato's honey project, the flow of costs and returns would show an annual value of initial capital costs. Say the hives and gear last for five years. Most simply done, the annual depreciation value could be estimated by dividing $17 210 by 5 ($3 442); so total accounting costs will be $7 292 annually (that is, variable costs of $3 850 plus a depreciation cost of $3 442).

Timing of costs

The costs associated with an activity may vary over time. Generally, they are high in the early stages of the project due to the establishment costs. By comparison, costs tend to be lower later into the project, when variable costs (which are often lower) dominate. In the case of Uafato's honey project, the fixed costs were incurred at the beginning of the project. In subsequent years, the variable costs associated with beehives and honey extraction were incurred. Table 15 summarises the timing of these costs, showing the spread of total costs over the life of the project.

Table 15. Flow of costs over time for Uafato's honey project.

	Year 0	Year 1	Year 2	Year 3	Year 4
Fixed costs	17 210				
Variable costs	3 850	3 850	3 850	3 850	3 850
Total costs	21 060	3 850	3 850	3 850	3 850

Revenue

As with costs, only those outputs that are produced by an activity and sold (and consumed by the family) should be considered in a financial analysis. In community-based environment projects, outputs that are sold include goods (for example, the Uafato honey) and services (for example, tourism where visitors can access community resources such as beaches).

Outputs from activities may be sold on the domestic or international market. For example:

- Uafato families produce honey for sale in Samoa (domestic).
- Fiji aquarium trade fishers produce live coral, aquarium fishes and/or coral rubble for sale overseas (international).
- The Utwe-Walung marine protected area project produces ecotourism services (recreational and aesthetic benefits) for international tourists.

The price needs to be determined for all products of an activity. In the case of Uafato's honey projects, experts were brought in to examine the feasibility of beekeeping. Based on a trial of three hives, the experts estimated that each hive would produce 30 kilograms of honey annually. Another expert assessed the market for honey in Samoa, estimating that the honey could be sold for a market price of $10 per kilogram. Subsequently, 31 hives were established. They were expected to generate honey worth $9 300 per year for all the households involved in the project. In reality, revenue will build up slowly as the households learn to produce and extract honey, and achieve the market share. Experts have argued that 31 kilograms per hive is a conservative output, suggesting that as much as 60 kilograms per hive could be achieved. Further, they also suggested the price of honey could be higher.

Timing of revenue

The revenue associated with an activity may vary over time. Generally, revenue is higher in the latter stages of the project, because it takes time to make and produce final products to capacity and to establish relationships with buyers. In the case of Uafato's honey project, because the households were trained at the beginning and honey production is a low technology activity, it was reasonable to assume maximum honey production from the beginning (Table 16).

Table 16. Flow of output and revenue for Uafato honey project.

	Year 0	Year 1	Year 2	Year 3	Year 4
Honey output	310	310	310	310	310
Total revenue @ $10/kg	9 300	9 300	9 300	9 300	9 300

Net revenue (profit) flows

Projected net returns are estimated by deducting the expected costs of an activity from the expected revenue. In the case of Uafato's honey project, total revenue for each year is estimated as the price of honey multiplied by honey output. Annual total cost is calculated as the sum of the fixed and variable costs. Given the costs and revenue estimated above, Table 17 shows expected profits from honey production.

Table 17. Flow of costs and returns for Uafato honey project.

	Year 0	Year 1	Year 2	Year 3	Year 4
Fixed costs	17 210				
Variable costs	3 850	3 850	3 850	3 850	3 850
Total costs	21 060	3 850	3 850	3 850	3 850
Total revenue @ $10/kg	9 300	9 300	9 300	9 300	9 300
Net revenue	–11 760	5 450	5 450	5 450	5 450

For the Uafato's honey project, the expected net revenue (or profit) for the start-up year (year 0) was negative (– $11 760) because the initial fixed costs occurred at the start of the activity. Positive net returns (profits) were expected to occur only in later years, after covering the cost of establishing the activity.

If the Uafato families had established the beekeeping activity without the assistance of the South Pacific Biodiversity Conservation Programme, they would have had to cover all costs themselves; however, because the programme covered the bulk of the fixed costs, the families involved did not incur the losses predicted for year 0. Instead, they were mostly required to meet only variable costs. Consequently, the expected net return to the families in year 0 was $5450, so the activity remained financially feasible from the perspective of those families.

This difference in the financial feasibility for the Uafato families highlights the different perspectives that different stakeholders may have of an activity. What is feasible for one stakeholder may not be feasible for another. In the case of Uafato's honey project, the South Pacific Biodiversity Conservation Programme donors and any families/villagers who wished to establish beekeeping enterprises independently would have experienced a loss from honey production in year 0, while Uafato families would have experienced a profit. Where people do not have to cover the fixed costs of an activity, financial feasibility is easier to achieve. By comparison, where people have to cover all the costs of an activity, financial feasibility is harder to achieve.

Similarly, if this were to be run as a business venture, and one had to consider depreciation value of capital, instead of considering the fixed cost in year 1, a manager might consider the depreciation each year. In such a situation the 'net financial return will be $10 040 over a five year period, or an annual return of $2 008.

Net returns versus gross margins

The Uafato example shows that the flow of profits over time varies according to when costs and revenues occur. This concept is important for the financial viability of an activity in the short term and the long term. From a commercial perspective, the short term is the period in which no additional new fixed costs occur; that is, no new equipment, buildings or establishment costs are incurred. By comparison, the purchase of new equipment and buildings, or the incidence of fixed costs marks the commencement of the long term.

Where items bought for an activity (equipment, buildings or gear, for example) last a long time, the financial viability of the activity in the short term rests on variable costs only. It is assessed in terms of gross margin (which is total revenue minus variable costs). Consider that the equipment for the Uafato project (hives, clothing and so on) was expensive to buy. Once that equipment was bought, the only costs continuing to affect the project in the short term are variable costs such as monitoring and the replacement of the occasional dead bee. Provided total revenue exceeds the total variable costs, families still find it profitable to continue to produce honey. The gross margin is $5450 for the Uafato project, so it was worthwhile for the Uafato families to continue honey production in the short term.

People eventually need to replace fixed-cost items such as equipment or buildings, to continue their commercial enterprises; that is, activities eventually enter a long-term period. At this stage, people need to earn sufficient revenue to cover fixed costs as well as variable costs to maintain production. For the Uafato project to remain viable, the replacement of hives, bee colonies and protective gear eventually has to be covered either from honey earnings or from donor funds.

Similarly, where villagers independently engage in income-generating activities, they have to cover all fixed and variable costs from their revenue to remain viable over time. To do so, they also need to provide for the depreciation of assets and the eventual replacement of those assets.

Taxes, subsidies and family labour in community-based environment and development projects

Financial analysis becomes a little more involved when communities have to pay taxes on their activities, when governments provide subsidies to assist producers, or when family labour is involved.

Subsides and taxes

Subsidies benefit producers. They lower the cost of production (say, by enabling them to buy equipment or inputs more cheaply), thereby raising profits to the producer. Where producers use subsidies, the value of these subsidies should be added back to their incomes during a financial feasibility assessment.

Often, governments or donors provide subsidies to support production, as occurred with Uafato's honey project. In this case, the SPBCP's funding of fixed-cost items increased the financial viability of the project (as noted in the gross margin analysis). Compared to subsidies, taxes create disincentives for producers. They lower revenue, thereby lowering profits to the producer. Where producers incur taxes, the value of these taxes should be treated as a cost in a financial feasibility assessment; that is, they should be deducted from profits.

Family labour

Normally, family labour is provided for free in community-based environment and development projects. Where labour is free, it should be excluded from financial analysis because no expense is incurred.

Occasionally, family labour may involve some cost, such as when a professional person provides advice at a minimal cost. If costs are incurred for family labour, the financial feasibility assessment must include these costs. (The treatment of family labour is also explored in Chapter 12 on economic analysis.)

11.3 Uncertainty and financial analysis

In many cases, the value of some inputs or outputs in an activity may not be known, at least not with accuracy. If there is uncertainty about the value of some inputs or outputs, the financial analysis must include sensitivity analysis using a range of values for each such item.

Sensitivity analysis

A sensitivity analysis involves varying the value of one or more item at a time to perceive the effect on net revenue estimates. This 'sensitivity analysis' enables project managers and communities to understand the risk of their activities.

In the case of Uafato's honey project, the original financial feasibility assessment assumed a constant price of $10 per kilogram of honey sold and a production level of 30 kilogram per hive. Using these values, it determined that honey production would be financially feasible for Uafato families and could produce a positive cash flow from the first year (although families who chose to duplicate the activity independently would not be able to cover the fixed costs until much later). If the price for honey or the production level had not been certain, it would have been critical to identify the financial feasibility of the activity for a range of possible values before deciding whether to proceed.

Varying price

If the price per kilogram of honey were lower, then honey production would be expected to be less financially feasible. Similarly, the activity would be more financially feasible if the price received is higher. Table 18 indicates the gross margin (the feasibility to Uafato families) of honey production when the South Pacific Biodiversity Conservation Programme continued to cover establishment costs, and the price of honey varied from $6 per kilogram to $14 per kilogram.

Table 18. Price sensitivity analysis of Uafato honey project.

	P=$6/kg	P=$8/kg	P=$10/kg	P=$12/kg	P=$14/kg
Number of hives	31	31	31	31	31
Cost per hive ($)	410	410	410	410	410
One-off equipment cost ($)	4 500	4 500	4 500	4 500	4 500
Annual Variable costs ($)	3 850	3 850	3 850	3 850	3 850
Honey output per hive (kg)	30	30	30	30	30
Price of honey ($/kg)	6	8	10	12	14
Total fixed costs ($)	17 210	17 210	17 210	17 210	17 210
Total revenue ($)	5 580	7 440	9 300	11 160	13 020
Gross margin ($)	1 730	3 590	5 450	7 310	9 170

If the price secured is $14 per kilogram, then the community could expect to almost double its gross margin; however, if the price for honey drops, the gross margin for honey production would continue to be positive for Uafato families but greatly reduced. Even if the price for honey falls to $6 per kilogram, participating families would continue to make a profit, but the net returns per family would be less than $100 (a total of $1700 for 19 families). Providing production levels are maintained, the enterprise could succeed, but barely, and without 'saving' for the day when the hives and other fixed items may need to be replaced.

Varying production levels

The financial feasibility of an activity also hinges on the production levels. If production levels are different from 30 kilograms per hive, the financial feasibility of the activity would change because more or less honey would mean higher or lower revenue.

Some experts suggested that the Uafato hives could produce as much as 60 kilograms of honey per year. If this output level were possible, the gross margin for the 31 Uafato hives would be about $14 750, assuming the original price of $10 per kilogram. Even if the price falls to $6 per kilogram, Uafato families would continue to earn profits with a gross margin of $7310 per year.

Table 19 summarises the expected gross margin for Uafato honey, assuming production levels of 40, 50 and 60 kilograms per hive.

Table 19. Gross margin estimates.

Yield (kg/hive)	60	50	40
Gross margin ($)	14 750	11 650	8 550

When a number of inputs and outputs are not known with certainty, sensitivity analysis can be conducted by trying different combinations of values. For Uafato's honey project, the feasibility of honey production for families may appear as in Table 20. It is apparent that the venture is likely to be financially feasible.

Table 20. Price and yield sensitivity analyses.

Yield (kg/hive)	Prices ($/kg)			
	6	8	10	12
30	1 730	3 590	5 450	7 310
40	3 590	6 070	8 550	11 030
50	5 450	8 550	11 650	14 750
60	7 310	11 030	14 750	18 470

Break-even analysis

In some cases, large amounts of information may be unavailable and the values of inputs and outputs may be unknown. In such cases, sensitivity analyses may offer little insight into the likely financial feasibility of an activity. Examples of where financial feasibility and sensitivity analyses are not possible are where there is no information on the number of buyers for a product.

Where little information exists, a break-even analysis may indicate the financial feasibility of an activity. This type of analysis is used to identify sales levels where total revenue can be expected to just cover total costs for a given production level. It estimates the total production costs for a given production level, then estimates the minimum sales needed to cover those costs. People subsequently need to judge how realistic it would be to achieve those sales.

As an example, 30 kilograms of honey may be expected to cost $4 per kilogram to produce per hive, or $120 per hive in total. If honey can be sold for $10 per kilogram, a family would have to sell at least 12 kilograms of honey to break-even. On the advice of the project manager, the family would need to decide whether to pursue the activity. Break-even analysis is thus a two step activity: (1) estimating break-even levels; and (2) making a subjective decision about whether the break-even level is feasible.

Cost-effectiveness analysis

In some cases, it may not be possible to estimate the value of all factors affecting profits. There may even be insufficient information to conduct a sensitivity analysis. A cost-effectiveness analysis can then be used to identify the least-cost means of achieving a desired goal of conservation or environmental improvement. This type of analysis compares the cost of alternative activities to achieve the goal. The activity that produces the goal at the minimum cost is chosen because it will generate the highest return for the same price.

Cost-effectiveness is commonly used in conservation projects where the benefits are not fully known but the desirability of the action has been confirmed. Communities may come up with alternative project options, from which they need to choose. A cost-effectiveness study can identity the option that would produce the same outcome at the least cost.

A cost-effectiveness analyst identifies all the inputs required to produce the desired outcome. Using the same steps as followed for a financial analysis, the analyst estimates and totals the fixed costs and variable costs of a project. A project with a lower cost would be chosen over a project with a higher cost, so long as they both produce the same outcome and their risks are similar.

11.4 Choice between options

The financial feasibility analysis activities discussed so far (profit assessment, sensitivity analysis, break-even analysis and cost-effectiveness analysis) indicates whether an activity is likely to be financial feasible; however, the information generated is insufficient to determine whether an activity is a wise use of finances. From a financial perspective, wise investments are those that generate the highest total profits over time. An activity that is financially feasible will not be the most financially desirable option if an alternative activity would generate more profits.

For individual communities, a wise use of investments may be any financially activity that improves their well being by improving the quality of the environment. However, donors, national governments and/or individual investors often have an interest in determining which activities are more profitable than others, because they will wish to ensure their scarce funds generate the largest financial impact.

To determine whether an activity is financially a wise investment, project managers need to compare the financial feasibility of the proposed activity with the profits that would be generated by investing the money elsewhere. Where several competing activities exist – say, starting up a private waste removal service or establishing a waste composter – the project manager needs to analyse and compare the financial feasibility of each option. The project manager would then need to consider the option that generates the highest profits. In some cases, there may be only one activity (say, starting up the removal service) that is financially feasible.

In any event, the profits that could be gained from the most profitable option need to be compared with the profits that could be gained by investing the money elsewhere. A community may wish to consider this comparison if, for example, it were to receive a lump sum payment from a donor. The simplest approach is to compare the activity’s expected profits with the interest that the same investment could earn in a bank.

Calculating interest plus principle

Banks usually offer interest to people to invest their money with them. The purpose of the interest is to attract investors to surrender their money (which they could otherwise spend and enjoy now) in exchange for more money later. Consequently, $100 invested in a bank now at 10% per year will be worth $110 in one year, representing the original investment plus $10 interest earned.

Money usually earns what is known as compound interest. That is, if the $100 yields $110 in the first year, the interest will be calculated on $110 in the second year and thus equal $11.

The formula to calculate the future value of money invested now is:

Future value of money = $V \times (1+r)^t$

where:

V = the sum of money invested today

r = the rate of bank interest

^{t} = the number of years during which the money is invested.

As an example, $100 may be invested today at 10% interest for five years. In five years, the investment will be worth $161, as shown in the following calculation:

Future value = $V \times (1+r)^t$

= $100 \times (1+0.1)^5$

= $100 \times (1.1)^5$

= 100×1.61

= 161.

This same approach can be used to compare (1) the profitability of investing the costs estimated for the activity with (2) the profits that the same investment could make if deposited in an interest bearing account. A compounding table such as the one summarised in Table 21 could be used. Note that the higher the interest rate, greater is the return over time.

Table 21. Compound interest.

Interest rate	Time over which the compound interest is earned (years)									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0.05	1.05	1.10	1.160	1.22	1.28	1.34	1.41	1.48	1.55	1.63
0.10	1.10	1.21	1.331	1.46	1.61	1.77	1.95	2.14	2.36	2.59
0.20	1.20	1.44	1.728	2.07	2.49	2.99	3.58	4.30	5.16	6.19

All that is needed to calculate the interest is the cost of conducting the activity (previously calculated as the cost of inputs) and the local rate of bank interest.

Operational feasibility

Often, a project is technically feasible as well as financially viable. Nevertheless, it may face operational difficulties that prevent financial benefits from being realised. In the Pacific, examples of projects that fail as a result of operational problems are common (see, for example, Baines, et al 2002; Sesega 2000; Veitayaki 2000).

In the case of Uafato's honey project, a critical issue was the difficulty of getting the product out of Uafato and into the Apia market (SPREP 1999). The road linking Uafato to the villages along the coast is very poor. In addition, the village did not have transport services other than a bus service on Monday, Wednesday, Friday and Saturday. As a result, villagers were initially challenged to get the product to the market on a regular basis. Until the transport situation was resolved (by the pastor making his vehicle available), the viability of the enterprise was threatened despite being financially feasible.

Similar operational problems are widespread in the Pacific. Lee and Awaya (2003) conducted a review of aquaculture projects in the US territories. They noted that aquaculture of giant clams, sponges and other species in the US territories in the Pacific has not been successful despite them being technically feasible and there was high export demand. Among the key reasons cited for these failures are a lack of:

- motivation;
- entrepreneurship; and
- reliable transportation and shipping routes.

Similar feasibility factors dogged the Utwe-Walung marine protected area project (Lal and Keen 2002). It was reported that the project suffered from:

- inadequate consideration of (1) the social boundaries of the two municipalities involved and (2) competing claims over the area assigned for marine protection;
- a lack of easy road access into Walung village from Utwe; and
- a lack of cooperation between the two communities.

The project is not regarded as having been a success, although some members of the Utwe municipality have a successful ecotourism project based on the marine protected area (Roostun, I, Fisheries Officer, Marine Resources Division, pers. comm., May 2003).

Factors such as a lack of technical know-how, climatic variability and/or lack of regular transport inevitably affect the viability of activities. Such information should be uncovered during the situation analysis. In the Pacific, cultural expectations and '*kerekere*' or borrowing without payback, are also common factors that affect the viability of commercial ventures by indigenous people.

Difficulties generated by such issues may be so significant that even financially wise activities may become unviable. Box 24 provides an example of the types of operational factors to be considered, in relation to a sponge farming business plan.

Box 24. Operational factors for sponge aquaculture in Pohnpei.

Sponges develop well in the nutrient-rich lagoon waters of the tropics. Many Pacific islands are thus perfect for raising sponges commercially. Sponge aquaculture requires no specialised expertise, has minimum maintenance and is based on an operation that requires low technology.

The U Visioning Marine Coop (Marine Coop) is a for-profit affiliate of the Conservation Society of Pohnpei, based in the municipal capital Nahn U. Before establishing its own sponge culture operation, the Marine Coop carefully developed a business plan in which it considered:

- potential niche markets in the United States, Europe, South East Asia and Oceania;
- the nature of products required in key export markets for medical, industrial household and cosmetic uses; and
- the range of product prices, sizes and volume demanded.

Bearing in mind these issues, the Marine Coop undertook a financial feasibility assessment of commercial sponge farming. It estimated an expected income of $10 000 to $12 000 per farmer for a successful operation. In its assessment, it focused on issues relating to:

- maintaining a regular supply of products;
- maintaining quality control by establishing standards for cultivation, harvesting, culturing and package design of products, as well as establishing zero-defect standards for quality assurance;
- ensuring training programmes for the local producers and marketing staff;
- ensuring training on sustainable harvesting and optimal production;
- establishing quantitative standards to identify the size of sponges demanded by the export markets; and
- determining packaging that projects a pure, natural and environmentally safe product.

Source: Izabaliza et al 2003, ICD Business Plan for Sponge Farming (Raynor, Bill, The Nature Conservancy, Pohnpei, pers. comm., June 2003).

Financial feasibility versus operational viability

Generally, a project with a high net revenue is desirable over a project with lower expected returns net of costs. Similarly, a project with high feasibility is desirable over one that has low chances of being realised. This concept is illustrated in Figure 45, in which activities that are high in both financial viability and operational feasibility are more desirable than those with low feasibility and viability.

On the other hand, different/competing activities vary in their financial viability (profitability) and operational feasibility. There is no clear rule on whether to select an activity with high net returns but lower viability or one with low net returns and higher viability. For such a decision, the attitude of the community to risk is relevant.

If the community prefers a more secure return, it will probably prefer to invest its funds in an activity that generates lower net returns; communities that are less risk averse may prefer to 'gamble' to gain higher profits.

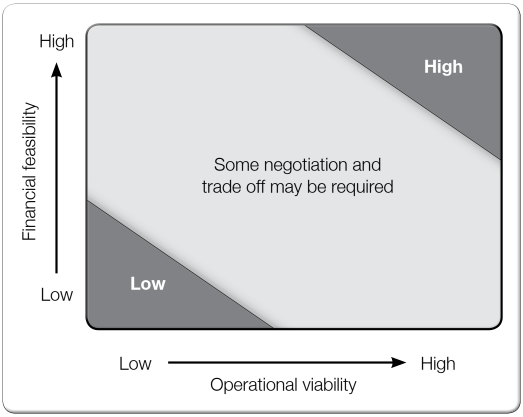


Figure 45. Financial viability versus operational feasibility.

11.5 Concluding remarks

Financial analysis is one of the most critical aspects of a project cycle. Yet it is often a forgotten step, particularly in community projects. People continue to be interested in a project only if their returns are greater than their costs. The financial viability and operational feasibility of a project determines that project's sustainability.

The key variables for a financial analysis are summarised in Table 22.

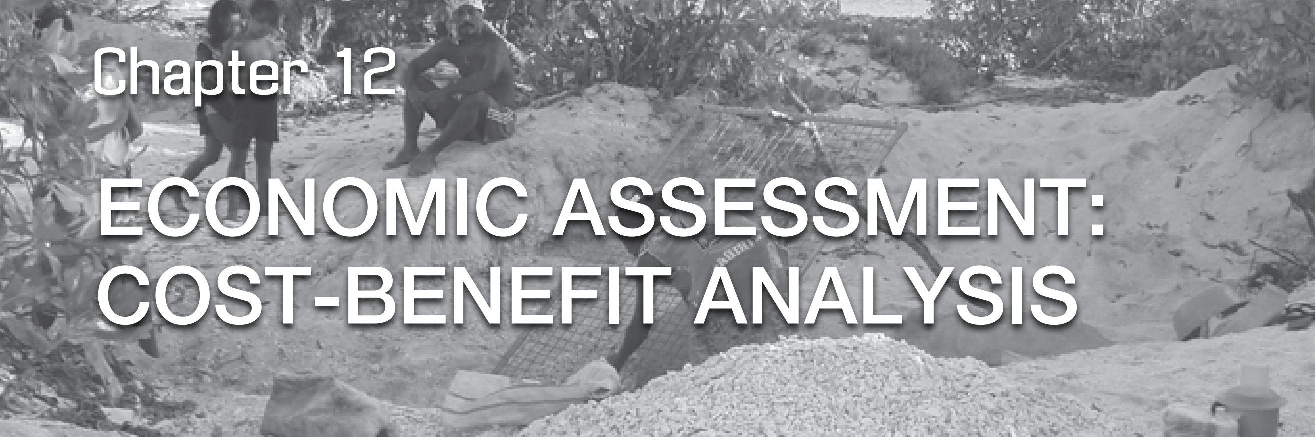
Table 22. Treatment of key variables in financial analysis.

Item	Treatment in financial analysis
Purpose of analysis and whose perspective is relevant	Indicate the profit to the individual, company, household or community.
The notes below relate to a community perspective but apply to other perspectives too	
Overall goal	Increase financial welfare to the community
Concept of improvement	Determine the net financial benefit to the community
Changes in benefit	Include those benefits that accrue to the sum of individuals in the community
Changes in cost	Include those costs that accrue to private individuals in the community
Capital (credit) costs	Include interest and principle as a cost, or use the depreciation value
Taxes	Include taxes as a cost
Subsidies on production cost	Generally include subsidies as a benefit
Government or donor costs	Exclude these costs unless financial analysis is for the government or a donor
Family labour	Include labour only if paid for

Source: Adapted from Sinden and Thampapillai 1995, p. 61.

Operational issues are vital for the sustainability of a project. The success of any income-generating project depends on its operational feasibility which often reflects the proponent's business acumen, as well as commercial reality of the project context. Such factors in the Pacific include:

- secure market demand and supply;
- regular and assured quality and quantity;
- individual producer characteristics;
- motivation and entrepreneurship;
- cultural norms and expectations;
- equitable returns on effort and benefit sharing; and
- infrastructure, including roads, air and shipping transport.



Chapter 12

ECONOMIC ASSESSMENT: COST-BENEFIT ANALYSIS

Chapter 11 showed that a financial analysis reveals the expected profit to an investor from investing funds in an activity; however, such analysis does not indicate the impact (or value of externality costs) of that activity on other persons or on the quality of the environment. Further, it does not establish whether an activity generates a worthwhile return from the perspective of the nation. To do this, an assessment of the activity's economic feasibility is needed. Economic feasibility is most commonly assessed using cost-benefit analysis.

The objective of cost-benefit analysis is to determine the net benefit to society from an activity. Cost-benefit analysis involves comparing an activity's total value of costs with the total value of the benefits generated. Costs and benefits include both the monetary values to the person conducting the activity, externality costs and benefits, and non-market/non-monetary benefits and costs and generally excludes subsidies and taxes. Net benefits can thus be used to decide whether proceeding with an activity is in the interest of the broader community.

12.1 Why use cost and benefit information?

Compared with other decision making tools, cost-benefit analysis provides an objective method to assess: (1) whether an activity should proceed; and (2) which activity to select from several options. Other decision making tools that have been commonly used to select project activities of national importance include democracy/voting systems and consensus driven subjective rankings. Democratic voting draws on individuals' views about the pros and cons of conducting an activity. The activity with the highest votes 'wins' the right to proceed (Table 23). Consensus-based decision making focuses on different stakeholders reaching agreement on which activity to pursue.

Both systems are used as a means of making decisions about environment and development projects in the Pacific; however, both have definite limitations:

- Individual votes may bear little relation to the effect of the activity on human well being (as measured by benefits and costs). Such a system is subject to political and emotive arguments.
- Consensus-based decision making can be an inefficient way to make decisions when many people are involved in the process. The transaction costs of consensus building can be immense in terms of the time and energy required before people agree. That is, consensus decision making has high 'transaction' costs.

Table 23. Vote based decisions versus economic cost-benefit analysis.

Individual	Returns ($)	Costs ($)	Net benefit ($)	Vote (#)	Year 4
1	10	15	–5	–1	
2	15	10	5	1	3 850
3	12	5	–7	–1	3 850
4	20	40	–20	1	
5	15	10	–5	1	
Total social	**72**	**–80**	**–8**	**1**	

Note: With democratic vote-based decision making, the project will be chosen for implementation. As shown later, on the basis of net economic benefits, the project may not be selected.

Compared with the voting and consensus approaches, cost-benefit analysis is based on a systematic comparison of the social (measured in terms of the true economic values) benefits and costs of alternative actions. Activities are selected where they contribute most to economic well being – that is, where the expected economic benefits of the activity exceed the expected economic costs. (The valuation of social benefits and costs is considered later.)

Note the use of the term 'social' benefits and costs, as distinct from private or financial benefits and costs (benefits and costs to private individuals). As noted in Chapter 11, financial assessment uses financial benefits (revenue) and costs to estimate the net cash return from an activity for the person or unit carrying out the project. It does not include the project's non-monetary environmental impacts or externality costs or benefits on third parties.

By comparison, economic feasibility assessments determine the net economic benefits from the perspective of society as a whole. Economic cost-benefit analysis covers all monetary and non-monetary costs and benefits, including market and non-market externality benefits and costs to others and the environment. An activity is economically feasible if it generates positive net benefits, after accounting for all benefits and costs, including environmental effects.

Suppose Muavasa Village is interested in undertaking a forestry project, for example. This project would affect two other communities: Naduri and Sasa, which are downstream. Table 24 lists the hypothetical net benefits of the activity for the three villages.

Table 24. Net benefits of the hypothetical Muavasa forestry project.

Communities	Net benefit of forestry project ($'000)
Muavasa	20
Naduri	–15
Sasa	–10
Total net benefit flow	**–5**

From a financial (private) cost-benefit analysis, Muavasa could generate $20 000 from the forestry project; however, in the process, it would generate environmental costs (due to soil erosion and the siltation of the river downstream) of $25 000 for the other two villages: $15 000 worth of costs to Naduri and $10 000 worth of costs to Sasa. In this case, the project would be undesirable because the total costs of the project would exceed the benefits, even though those costs would not accrue to Muavasa. In other words, the net economic benefit of the project is negative from a social perspective. Box 25 contains a further example of the difference between financial and economic net benefits.

Box 25. Difference between financial and economic benefits.

Suppose the harvest of live coral by villagers for Fiji's aquarium trade generates $1000 per year in cash. Villagers spend about $200 to buy chisels and hammers to chip coral from the reef. In addition, they use rafts to transport coral from the reef to the road, where the exporters collect the coral products. Suppose every cubic metre of coral extracted harms the coastal habitat such that $500 worth of subsistence and commercial fishing is lost per year.

In this case, the financial net benefit of coral harvesting to villagers is $800 ($1000 minus $200). This is different from the net economic benefit of the project, which accounts for the externality costs of coral harvest. The net economic benefit of coral reef extraction is thus only $300 ($1000 - $200 - $500).

Source: Lal and Cerelala 2005.

12.2 Economic viability criteria and decision making

The net economic benefits of an activity are important criteria for assessing the viability of that activity. When communities consider undertaking a major activity during their project, they should do so only if the net economic benefits are positive. When they are considering several activities, they should look to the activity with the highest net economic benefit because it represents the greatest social return on the inputs invested. Table 25 summarises the rule for using net economic benefits to choose activities. When benefits and costs are realised at different points in time, this chapter later considers the conversion of net benefit to present value terms – or a 'net present value' and the rule for choosing activities.

Table 25. Net benefit as a decision criterion.

Benefits are greater than costs	Accept
Benefits are less than costs	Reject
(Benefits minus costs)$_{activity\ 1}$ is greater than (Benefits minus costs)$_{activity\ 2}$	Accept activity 1
(Benefits minus costs)$_{activity\ 1}$ is less than (Benefits minus costs)$_{activity\ 2}$	Accept activity 2

Note: Where benefits and costs occur over time, the present value estimates are the relevant measures to use (see below).

While net benefit is an important guide for selecting activities, it is not the sole criterion that can be developed from benefit and cost information. Another criterion is the benefit-cost ratio. This ratio expresses the benefit gained per unit of costs invested. It is calculated by dividing the total economic benefits of an activity by the total economic costs:

Benefit-cost ratio = Benefits/Costs

Where economic benefits are greater than economic costs, the benefit-cost ratio is greater than 1 – that is, the activity is economically viable. Where economic benefits are lower than costs, the ratio is less than 1. When comparing two competing activities, the most economically feasible project will be that with the highest ratio over 1; however, if the alternative projects had different initial investments, a project that gives a higher return for the dollar invested (that is a project with higher benefit cost ratio) may be preferred over one that gives a lower net value. Table 26 summarises the rule for using benefit-cost ratios to choose activities.

Table 26. Benefit–cost ratios as a decision criterion.

Benefit-cost ratio is greater than 1	Project is economically viable so accept
Benefit-cost ratio is less than 1	Project is not economically viable so reject
Benefit-cost ratio$_{project\ A}$ is less than benefit-cost ratio$_{project\ B}$	Project B is desirable
Benefit-cost ratio$_{project\ A}$ is greater than benefit-cost ratio$_{project\ B}$	Project A is desirable

12.3 Conducting cost-benefit analyses

Simply stated, a cost-benefit analysis involves comparing an activity's total economic costs to the total value of economic benefits generated. Compared with financial analysis, which considers only the monetary expenses incurred and the revenue gained from an activity, cost-benefit analysis includes the non-monetary impacts of an activity – for example, the value of any changes in environmental quality that are brought about by the activity. The objective of cost-benefit analysis is to determine the net economic benefit of a project, an activity or a set of activities. For this objective to be achieved, a 'with and without' project analysis must be conducted.

'With' and 'without' analysis

Cost-benefit analysis involves comparing the state of a situation 'without' an activity (that is, what would happen in any event) and 'with' the activity (which would cause some change).

The 'with' situation

In addressing environmental problems, managers may consider either one or several activities. For each alternative activity, a 'with' scenario needs to be identified – that is, the expected outcome of the 'with' project/activity. If complementary activities are to be carried out at the same time, then the combined outcome of activities would be treated as the 'with' scenario. This type of decision is often based on technical solutions and provided by technical consultants.

The 'without' situation

The 'without' scenario defines what the situation would be if nothing was done to address the problem or concern. It is particularly relevant in situations where some ongoing change occurs and some preventative or ameliorative measures are needed to address an environmental or resource problem. The 'without' situation is not necessarily the 'status quo'. That is, it is not the same as a 'before' a project scenario, because many situations contain dynamic conditions that change over time, even without outside intervention.

Imagine a community is concerned about clearing-induced soil erosion in its area. It may consider introducing hedgerow planting or terracing to reduce the soil erosion. A 'with' situation for the area would represent a reduction in soil erosion and thus an improvement in soil quality (depth). Without the conservation effort, the state of soil quality would not be maintained at its current state; it would continue to decline because people would continue to clear forests or practice their farming techniques. A 'without' situation in this case might show, therefore, a continued decline in the soil condition over time. Ultimately, the soil condition would be lower than when the project was being considered. Figure 46 illustrates the concept of dynamic change in the context of 'with' and 'without' analysis.

An example of this dynamism can be seen in the case of sea-level rise in the Marshall Islands expected due to climate change. Holthus et al. (1992) noted that the shoreline around the Marshall Islands is expected to continue to retreat in the future, regardless of rises in sea level. This expected retreat is due to ongoing coastal erosion. A vulnerability assessment of the Marshall Islands suggested that shoreline retreat associated with a sea level rise of 1 – 3.3 feet is about 10 – 33 feet. On the other hand, shoreline retreat associated with coastal erosion over 30 years was estimated to be in excess of this in many places, depending on the biophysical characteristics of an area (such as shore elevation and protection from the ocean waves).

In the case of the South Pacific Biodiversity Conservation Programme Uafato honey making venture, the 'without' situation will include what the locals continue to do when they have no income-generating activities other than the harvesting and sale of *ifilele* as timber for crafts and building. Further, there were few or no prospects of such projects emerging in the near future. Consequently, the 'without' situation for Uafato would have been continued logging and the decreasing biodiversity values. The extent of these decreases and their values would have needed to be estimated (qualitatively or quantitatively).

Similarly, in Fiji where a waste management project was introduced in the village of Wai Bulabula to reduce pollution and thereby improve the quality of the environment, the 'without' situation represented the continued dumping of waste by people (locals and outsiders) on the beaches and road. Without the project, this practice would have been likely to continue and even increase over time as the population increases. In addition it is also possible that the lifestyle of the local communities could change as they become more affluent. This in turn would mean that the amount of waste generated could increase. Given that the effect of the waste dumping was harming fisheries and local health, the 'without' situation would have been decreasing health and fishery values. Again, the extent of these decreases and their values would have needed to be estimated (qualitatively or quantitatively).

It is thus important to identify the 'without' situation carefully before undertaking a 'with and without' economic cost-benefit analysis.

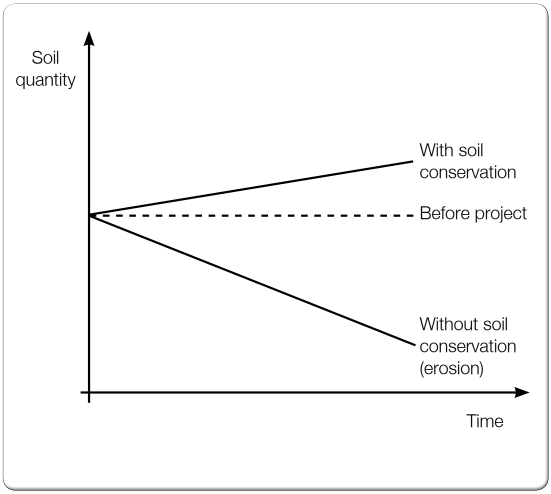


Figure 46. Dynamic change and 'with' and 'without' analysis.

Steps in cost-benefit analysis

The steps involved in conducting cost-benefit analysis using 'with' and 'without' analysis are listed below and illustrated in Figure 47:

- Determine status of the current activities in the 'do nothing' or 'without' situation.
  - Identify the current and expected level of inputs and outputs (including externalities) in physical quantities over time and over the area in the 'do nothing' scenario.
  - Quantify the value of economic benefits and costs.
  - Identify the total net economic benefits to consumers and producers in the 'do nothing' scenario.
- Determine status of the current activities in 'with' situation.
  - Identify the level of inputs and outputs (including externalities) in physical quantities over time and over the area.
  - Quantify the value of economic benefits and costs.
  - Identify the total net economic benefits to consumers and producers.
- Compare the net economic benefits of the 'with' and 'without' scenarios to determine the net economic effect of the proposed activity.

The net economic effects of the activity can be expressed using a variety of measures, which are discussed later in this chapter.

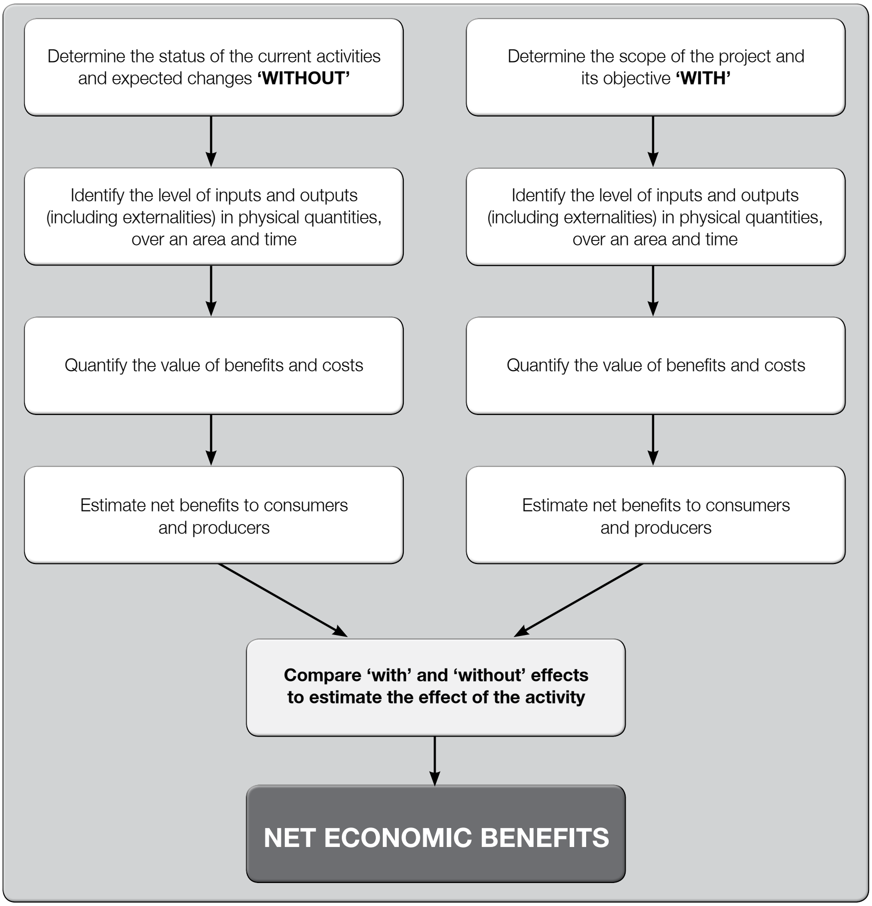


Figure 47. Cost-benefit analysis – 'with' and 'without' analysis.

12.4 Estimating benefits and costs for cost-benefit analysis

For each proposed activity, the economic benefits and costs of that activity need to be assessed, and the costs then need to be subtracted from the benefits to estimate the net benefit. For both the 'with' and 'without' scenarios, the relevant economic benefits and costs need to be estimated.

The types of benefits and costs vary with projects. Recall that Chapter 4 explained how each activity could be treated as a production process, involving inputs and outputs. Outputs can be categorised according to use and non-use benefits and costs, and direct and indirect benefits and costs. These depend on the nature of the activity being considered and the 'without' situation. In the case of Uafato's honey project, the output of the activity is the production of honey for sale. An expected direct benefit of honey production would be an increase in biodiversity. Another known direct output (cost) of the honey production would have been the reduced amount of *ifilele* trees logged for timber.

The outputs of the Utwe–Walung ecotourism project in Kosrae (Chapter 11) included:

- tourist experiences;
- an increased level of marine life;
- the improvement and conservation of biodiversity values;
- the protection of non-use values associated with the mangrove and coral reef systems; and
- a reduction in fishery and forestry harvests (losses).

The expected outputs of the Wai Bulabula waste project would have included reduced waste and thus an improved coastal amenity and improved human health.

For the purpose of cost-benefit analysis, project managers need to work with communities and experts to determine:

- the likely users and non-users affected by the activities;
- those users and non-users' expected activities;
- input requirements in the respective activities, outputs and their prices; and
- non-monetary benefits and costs, if any.

Such information would be collected during the initial stages of the project development and during discussion with community members, government and non-government experts. Inputs and outputs then need to be translated in terms of costs and benefits for analysis.

What economic benefits to consider

Depending on the nature of the project, these may take a variety of forms. The Australian Department of Finance (2006) indicated that benefits may include any or all of the following items:

- The value of new output or revenue generated from direct or indirect use of the resource. Examples are the increase in household income from producing honey in Uafato and sponge farming in Pohnpei.
- Avoided costs. These are the costs that would have been incurred in the 'without' scenario. The benefit of a soil conservation project may be considered as the value of the avoided costs of soil erosion, for example. Where a seawall is constructed in response to expected sea-level rises from climate change, benefits would include the losses avoided by protecting land, human and infrastructure from flooding and damage.
- Productivity savings from a reduction in expenditure arising as a result of the activity. A government activity that leads to an improvement in road infrastructure may reduce the costs of transporting produce to the markets. Similarly, ice making facilities constructed in Fiji increase the quality or reduce the loss of fish, thereby reducing the unit cost of production and/or increasing returns per unit cost.
- Health and environmental benefits. Management projects (such as the Wai Bulabula waste project or the use of composting toilets in Tuvalu) may help improve sanitation, thereby improving community health and the environment.

Chapter 8 also discussed the different types of benefits, monetary and non-monetary, that may be generated from an environmental project. The benefits and costs to be included in cost-benefit analysis include financial, that is 'out-of-pocket' costs and returns (revenue), from an activity. It will also include non-financial and non-monetary, or as discussed in Chapter 6, non-market use and non-use values associated with, for example, improvements in human health, prevention of losses of environmental quality and biodiversity values, and protection of ecological process.

Which economic costs to consider

Chapters 4 and 8 discussed different types of costs normally included in cost-benefit analysis that include:

- fixed costs such as capital expenditures, including initial investment and subsequent capital replacement costs;
- other fixed costs such as research and training costs;
- variable costs such labour costs, including a value for family labour (even it is offered for free), and other operating costs of other inputs;
- other variable costs such as maintenance costs for the entire project life;
- externality costs of air and water pollution, and noise, and habitat destruction; and
- other externality costs such as the value of the environmental costs of loss of biodiversity, and option and existence values.

In economic analysis, the economic value or 'opportunity cost' (Box 26) of all inputs invested in an activity is the relevant measure to use. Often, the 'true' cost of inputs such as labour is not necessarily the same as the 'out-of-pocket' wage rate, because the use of labour generates some benefits, if there is high unemployment. Also, where people are not employed in the workforce, the 'out-of-pocket' cost may be zero but they may still be gainfully doing other things. This means the opportunity cost of free family labour (Box 26) should also be factored into the equation because that labour, although financially free, is still needed as an input for the activity to achieve its output.

Notably, cost-benefit analysis excludes those values that reflect transfers of wealth within an economic sense, such as subsidies and taxes important in financial analysis discussed in Chapter 11.

Box 26. Opportunity cost.

The opportunity cost of an input is defined as the value of that input in the next best alternative activity. The opportunity cost of family labour, for example, is the benefit that the labour could have generated in its highest value alternative use. Family members who are brought into a project would otherwise be engaged in alternative activities such as subsistence fishing and family cooking. The value of these activities is the opportunity cost of labour.

In many Pacific nations, the cost of family labour is often treated as nil, on the grounds that the value of the labour in other activities (subsistence activities and so on) is worth little. Tacconi and Tisdell (1992) assumed that giant clam farming by villagers in the Pacific would mainly involve the purchase of clam seeds and the placement of clams in cages for protection. They assumed both the labour costs and the cost of using the household boat to be close to zero, arguing:

... while use of boat is required for cultivation purposes, most coastal village households already have a boat and there would be no or little extra cost involved in occasionally using it in the husbandry of clams. … Although labour costs are unlikely to be zero, labour is most likely to be used to tend the clam cages when labour is not much needed for other tasks. (Tacconi and Tisdell 1992, p.237).

Similarly, Greer (2007) valued unskilled family labour on Tarawa, Kiribati (in this case, labour used to collect sand and gravel from the shorelines) at 75% of paid unskilled labour.

This low valuation of family labour is not always appropriate. When a family member is asked to engage in an income-generating or conservation project, that person may have to forgo other activities, such as working on a village project that could strengthen social cohesion. The opportunity cost of family labour in this case may be high.

There is no hard and fast rule about the economic cost of family labour. In developing countries, usually one third to half of the local wage rate is used as the opportunity cost of labour. For a more in-depth treatment of opportunity costs, see for example, Department of Finance (2006).

While the opportunity cost of labour may require special attention, the value of most benefits and costs can be estimated using market prices. As noted in Chapters 2 and 5, the market price of goods and services in a competitive market reflects what consumers are willing to pay for the last unit of the good or service. In such cases, market prices can generally be used to measure the economic value of inputs and outputs.

The market price of some inputs to an activity may need to be adjusted so they do reflect the social value of costs and benefits and not just the private costs and benefits. That is, the market price may need to be adjusted to reflect the 'gains and losses to the economy as a whole, rather than to individual persons or groups' (Department of Finance 1991). An example is where a benefit from an activity is an increase in the amount of fish caught for subsistence purposes. Although subsistence fish are not sold, the market price of the same fish caught for commercial purposes indicates the economic value of the subsistence catch.

Where market prices need to be adjusted to reflect social values, the values generated are termed 'shadow values'. Sinden and Thampapillai (1995) defined the shadow value of a good or service as 'the true willingness of society to pay for it' and the shadow value of an input as 'the true opportunity cost to society of producing it'.

As discussed in Chapter 6, not all goods and services are marketed, but their values are nonetheless important from a society's perspective and for carrying out a cost-benefit analysis. Valuation techniques for estimating such benefits and costs are discussed below.

Table 27 summarises a checklist of how to treat different costs and benefits to arrive at shadow values for use in cost-benefit analysis.

Benefits and costs that occur over time

The costs and revenue associated with an activity may vary over time. Many activities incur most costs in their early days because establishment and many fixed costs occur at this point; revenue tends to occur later in the activity, when processes are established. In the same way, the economic benefits and costs of an activity may also vary over time. In the case of environment and development projects, implementation costs generally occur early in a project, but the environmental benefits of an activity – cleaner water, larger fish stocks or better quality habitats, for example – often take several years.

Table 27. Treatment of key variables in cost-benefit analysis.

Item	Treatment in analysis
Purpose of analysis	Indicate economic worth to the well being of the society
Overall goal	Increase economic well being (welfare) of society as a whole
Concept of improvement	Net benefit to society
Benefit	Include all benefits in the year they occur
Costs	Include all costs in each year they occur (capital, labour, operating, maintenance, training and all other input costs)
Environmental and other externality costs	Include
Capital (Credit) Costs	Include when capital is invested
Depreciation	Exclude (because these are accounting charges)
Taxes	Generally exclude
Subsidies on production cost	Generally exclude
Government or donor costs	Include
Family labour	Include as opportunity cost
Un-priced benefits and costs	Include
Environmental and health costs	Include

Sources: Adapted from Department of Finance 2006; Sinden and Thampapillai 1995, p. 61.

This distribution of benefits and costs over time is important because the value of benefits or costs that accrue in the future differ from the value of benefits or costs that accrue today. A benefit experienced today has more relevance to people than the same benefit in the distant future. If someone has the choice of $100 today or $100 in 10 years, a rational person would be expected to take the $100 now. Economists observe that people generally prefer to enjoy things now than in the future – that is, people have a positive time preference (or time preference).

In the same way, a cost incurred today has more relevance to people than the same cost in the distant future. Communities that are threatened with soil erosion in five years, for example, often continue to clear their land because it enables them to increase their income from farming now, even though they know such activity may damage their farming opportunities down the track. Again, this community has a high positive time preference, awarding the future less importance than the present.

In the Pacific, many countries have a high positive time preference because subsistence economies rely on production methods that offer short-term rewards, thus enabling them to feed their families and meet immediate needs. Consequently, activities that do not generate benefits until a long way into the future may have little immediate significance to Pacific communities.

To determine whether the net benefits from a proposed activity are economically feasible from a time perspective, the stream of benefits and costs over time needs to be valued in terms of when they occur. This can be done by applying a 'discount rate'. The discount value measures the rate of time preference that people have. From an individual perspective, the individual rate of time preference is used to calculate the present value of future benefits and costs (Box 27).

Generally, individuals have higher discount rates than those of communities as a whole. That is, people who act in their own interest are usually less prepared to wait to experience benefits, compared with communities, which usually act in the collective interest. The discount rate that represents the time preference of a broad community or economy is called the 'social discount rate', which is the rate that should be used for a cost-benefit analysis (Box 27).

Box 27. Present values and discounting.

The present value of an activity is the value today of a benefit or cost that occurs in the future. It is measured using the discount rate. In mathematic terms, the discount factor is represented by the following formula: $1 / (1+r)^t$.

The present value (PV) of income R that is earned in time t is calculated as:

PV = R x discount factor

R x [1/(1+r)^t]

The discount factor varies over time and the discount rate, as illustrated in the following table.

Examples of the discount factor for rate of time discount values of 5%, 10% and 20%.

Year	5% discount rate	10% discount rate	20% discount rate
0	1.0000	1.000000	1.000000
1	0.9524	0.909091	0.833333
2	0.9070	0.826446	0.694444
3	0.8638	0.751315	0.578704
4	0.8227	0.683013	0.482253
5	0.7835	0.620921	0.401878

$100 earned in one year is worth only $95 today when the discount rate is 5%. In five years, it would be worth only $78 today. If the discount rate is 20%, the same $100 earned in one year would be worth only $83 today. Received after five years, it would be worth only $40 today. The more distant the income, the smaller is its present value at the same discount rate. The higher the discount rate, the smaller is the value of a benefit at some future time.

Net present value

The net present value is the present day value of benefits net of (less) costs, where the benefits and costs accrue over time. The present value of benefits and costs are estimated using the discount rate discussed above. Consider a community that expects to conduct an activity that will earn it an income stream of $100 in each year for five years, at a cost of around $50 per year. The discount rate for the community is 10%.

PV of benefits

The prevent value of future benefits (see table below) can be calculated as:

PV ($100 in year 1) = $90.91
PV ($100 in year 2) = $82.64
PV ($100 in year 3) = $75.13
PV ($100 in year 4) = $68.30
PV ($100 in year 5) = $62.09

The present value of all benefits is the sum of all values:

$PV[_{Revenue}] = PV[R_1] + PV[R_2] + PV[R_3] + PV[R_4] + PV[R_5]$

$PV[_{Revenue}] = \$90.91 + 82.64 + 75.13 + 68.3 + 62.09$

$= \$379.08$

PV of costs

The prevent value of future costs can be calculated as the cost multiplied by the discount factor:

PV ($50 in year 1) = 50 x 0.909 = $45.45
PV ($50 in year 2) = 50 x 0.82644 = $41.32
PV ($50 in year 3) = 50 x 0.7513 = $37.57
PV ($50 in year 4) = 50 x 0.68301 = $34.15

The present value of costs is the sum of all values:

$PV[_{Costs}] = PV[C_1] + PV[C_2] + PV[C_3] + PV[C_4] + PV[C_5]$

$PV[_{Costs}] = \$45.45 + 41.32 + 37.57 + 34.15 + 31.05$

$= \$184.54$

Net present value

The net present value is thus calculated by subtracting the present value of cost from the present value of benefits:

$NPV = PV[_{Revenue}] – PV[_{Costs}]$

$NPV = \$379.08 – \$184.54$

$NPV = \$184.54.$

Social discount rates are often unknown and there is no agreement on what rate should be used. A proxy is a real rate of interest (the bank interest rate adjusted for inflation). It measures how much people must be offered now to delay enjoying their money now. In a sense, discounting (decreasing) future values to the present is the reverse of compounding (increasing) present day values into the future.

Box 28. Social discount rates.

There is no agreement on what the social discount rate should be. Some experts suggest the real interest rate (the commercial interest rate adjusted for inflation) is the appropriate measure for discounting. Other experts suggest the future should not be discounted at all, particularly where natural resources are involved. Sen (1967) suggested that discounting is immoral because it values lives and people living in different times differently. He also argued that discounting disadvantages long-term environmental projects by reducing the value of long-term investments in the environment. This occurs because high discount rates can render projects with small but long-term impacts economically infeasible, compared with low discount rates, which can encourage long-term projects (Hanley and Splash 1993).

A general consensus is slowly emerging that the social discount rate should be lower than the private discount rates, and that low discount rates should be used when environmental impacts are expected over longer periods, or when irreversible outcomes may be expected (see for example Stern 2007).

There is no set rule for selecting a discount rate to use when assessing the economic feasibility of environment and development projects. The social discount rate becomes a personal choice, depending on the project's nature, expected impacts and length of time, and levels of uncertainties and risk. (For further reading, see Hanley and Splash 1993; Perman et al. 1999; Stern 2007).

The range of discount rates used in the Pacific in recent years is summarised below.

Discount rate	Study	Topic	Country
3	Cesar et al. 2004	Benefits of marine managed areas	Hawaii
3	Jacobs 2004	Benefits of coral reefs	American Samoa
3, 5 and 9	Hajkowicz et al. 2005	Costs of watershed degradation	Cook islands
3, 7, 10	Woodruff 2008	Benefits of flood intervention	Samoa
3, 7, 10	Holland 2008	Benefits of flood warning	Fiji
3, 7, 10	Ambroz 2009	Benefits of coastal protection	Tuvalu
4 and 10	Mohd-Shahwahid 2001	Valuation of the terrestrial and marine resources	Samoa
5	Campbell 2006	Benefits of domestic tuna processing	Papua New Guinea
5	Lal and Cerelala 2005	Costs of coral reef extraction	Fiji
7	Woodruff 2007	Investments in renewable energy	Various
10	Greer consulting Services 2007	Prevention of coastal erosion	Kiribati
10	McKenzie et al. 2006	Costs of coastal erosion from coastal mining	Republic of the Marshall Islands
10	Lal et al. 2006	Investments in liquid waste management	Tuvalu
10	Lal and Fakau 2005	Costs of poor waste management	Tonga
10	Pesce and Lal 2004	Investments in sustainable forestry (certification)	Solomon Islands
11	McKenzie 2004	Investments in the black pearl industry	Cook Islands
12	Greer Consulting Services 2005	Investment in a bridge for rural development	Papua New Guinea
15	Zieroth et al. 2007	Biofuel from coconut resources	Fiji

The estimation of benefits and costs

The approach used to estimate the net economic value of an activity depends on the type of activity and the nature of changes to be valued. Recall that Chapter 4 showed the economic value of an activity is the sum of the change in the net economic benefit of the consumer surplus and the producer surplus – that is, net economic benefit equals producer surplus plus consumer surplus. Valuation methods used to estimate the producer surplus and the consumer surplus can thus be categorised as market or non-market, depending on whether the goods and services (or their close substitutes) are marketed.

Market-based valuation

In cost-benefit analysis, the economic net benefit of an activity that affects marketed goods and services is ideally measured through the change in net benefit accruing to consumers and producers as a result of the activity. For existing projects, this means determining the change in consumer and producer surpluses associated with ongoing activities (Chapter 5 and Box 29). For new projects, the net economic benefit is the sum of the newly created consumer and producer surpluses. However, in practice, it is often not possible (or perhaps necessary) to conduct a detailed estimation of the net economic benefit. Instead, a number of crude estimations may suffice. The type of approximation conducted depends on the type of activity and the nature of the impact. The following chapter sections outline three simplified approaches to estimating the net benefit of different types of activities that affect marketed goods and services. Such approaches will provide only orders of magnitude estimates of marginal or incremental net benefits.

Box 29. Estimating economic surplus – forestry in the Solomon Islands.

In 1993, the Solomon Islands exported 590 000 cubic metres of logs. The reported free on board (fob) price for these logs was S$375 per cubic metre. The logging costs, including normal profits, were estimated at around S$150 per cubic metre.

The logging firm paid:

- a royalty of 10% on the gross value product of the logs sold; and
- an export tax of 25% on sales at $75 per cubic metre and 30% on any higher price.

Calculations

The total economic surplus produced from timber in the Solomon Islands can be calculated as follows:

Economic surplus = Total Revenue – Total Cost
= [590 000 x 375] – [590 000 x 150]
= $133 million

The government extracts part of the producer surplus (the royalty tax plus the export tax), calculated as follows:

Royalty tax = 10% x Price x Volume
= 10% x $375 x 590 000
= $22 million

Export tax = [25% x $75 x 590 000] + [30% x $300 x 590 000]
= 11 million + 53 million
= $64 million

The total amount recovered by the government is thus $86 million ($22 million plus $64 million).

The amount of producer surplus retained by the logging companies can be calculated as follows:

Producer surplus retained = Total producer surplus – Taxes recovered
= $133 million – 86 million
= $47 million

Source: Adapted from Duncan 1994, pp. 21–2.

Valuing activities that increase the market price of products

Many development projects aim to either increase the quality of product supplied or value add by processing the good in some way. Such projects result in an increase in the prices that communities can command for a good and service. Usually, such price increases can be achieved at little or no additional cost. That is, the supply of the goods and services does not change; however, the demand is different for the higher quality products, with consumers willing to pay more for each quantity supplied. Recall from Chapter 3, this was considered in terms of an upward (or rightward) shift in the demand curve. This is summarised in Figure 48 as an upward shift in the demand curve from D_0 to D_1, resulting in a higher price (up from P_0 to P_1).

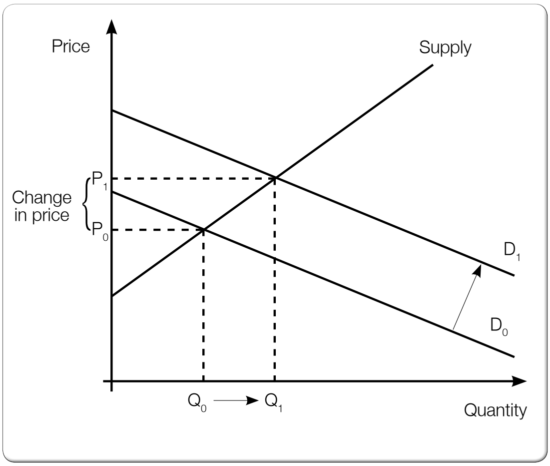


Figure 48: Increases in the market price of outputs.

An accurate estimation of the increase in value depends on the availability of information about supply, supply elasticity, market price information, demand and demand elasticity. Nevertheless, a crude estimation of the net benefit generated from an activity that changes the market price of outputs can be estimated using the formula below. This equation shows the average cost of producing a good, because often only the average cost data are available. It is an approximation only; ideally, marginal cost would be used to determine the net benefit.

Net benefit = Q_0 x [ΔP – ΔC]

where:

Q_0 = Original quantity of the item sold

ΔP = Change in price

ΔC = Change in the average cost of supplying the good

For example, many communities in the Pacific export smoked and dried beche-de-mer, for which the export price is about $10 per kilogram on average; however, this price covers beche-de-mer of varying quality. Higher grade products fetch a higher price – say, $15 per kilogram – while lower grade products may be sold for $7 per kilogram. The same production process is involved in the production of the different qualities, though there is a slight difference in the costs. The average cost of producing higher quality beche-de-mer is $2 per kilogram more than that for the lower quality product.

Imagine a donor decides to help nations increase the quality of their produce. Suppose 1000 kilograms of higher quality beche-de-mer are then produced. Without the project, the community would have produced 1000 kilograms of low grade beche-de-mer.

Estimating the economic net benefit requires an analysis of:

- the present value of increased exports of higher quality product
- the value of lower quality products
- the costs of training provided by the donor.

Without perfect information, the net economic benefit of this activity to the community, excluding the cost of training, could be estimated as follows:

Net benefit = Q_0 x [P – ΔC]

= 1000 x [(15 – 7) – 2] = $6000

Valuing activities that decrease the cost of production

Many community-based projects aim to encourage the use of better technologies or production methods to decrease the average cost of production and increase the profitability of production. Examples of projects that encourage the use of improved technologies are those aimed at introducing fish aggregation devices, use of ice in fisheries, or the use of more efficient fishing gear in the fisheries sector.

At times, a decrease in production costs may also result from improved management of a resource. Improved fisheries management regimes may encourage the build-up of fish stocks, for example. Although this may not necessarily result in an increase in the quantity of fish captured, the effect may be interpreted as a reduction in the production costs. This is because the same quantity of fish is easier to catch when more are available. In Chapter 4 this was discussed in terms of a downward (or a rightward) shift in the supply curve. This is illustrated in Figure 49 as an downward shift in the supply curve from S_0 to S_1, resulting in a lower cost (down from P_0 to P_1).

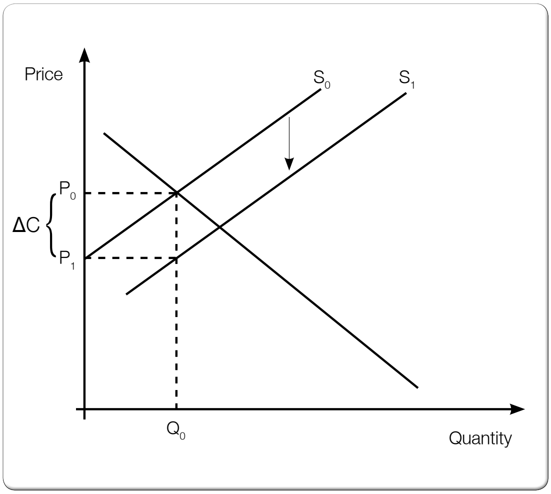


Figure 49. Decreases in the cost of production.

Again, an accurate estimation of the increase in value depends on the availability of information about supply, demand, demand elasticity and market price. Nevertheless, a crude estimation of the net benefits generated from an activity that reduces the costs of production can be estimated using the following formula:

Net benefit = Q_0 x ΔC

where:

Q_0 = Original quantity of the item sold

ΔC = Change in cost

Development of a new income-generating activity

Income generation is a common goal of community-based projects in the Pacific. Such activities result in the production of goods and/or services that are desired by locals, domestic and/or international tourists. The development of income-generation activities presumes the existence of demand for the product. A new income-generating project can be interpreted as a creation of a new supply (shown as a new supply curve in Figure 50).

To estimate the net benefit of a new activity, the quantity of outputs produced and their expected market prices, together with the quantity of inputs required and their input prices, can be used. As an approximation, the market prices of outputs and inputs can be based on average prices in the market place for existing (or similar) products. A crude estimation of the net benefit generated from an activity that reduces the costs of production can be estimated using the following formula:

Net benefit = Q_1 [P_1 – AC_1]

where:

Q_1 = Quantity of product provided

P_1 = Expected price of the product

AC_1 = Average price of supplying the product

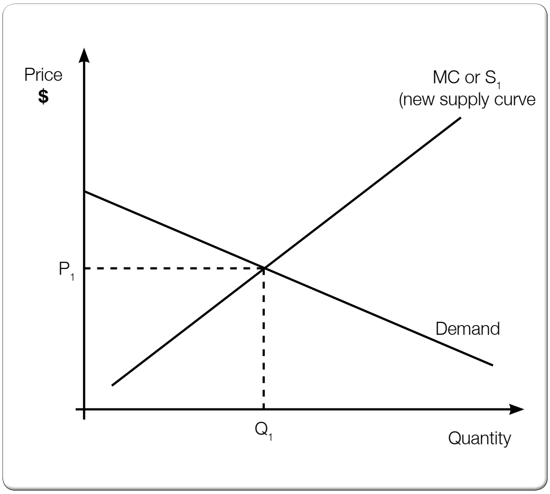


Figure 50: New income-generating activity.

This approach to valuation does not include a value for any changes in environmental quality brought about by the activity (such as pollution or improved habitat).

An example of this type of activity is Uafato's honey project, which was promoted as an alternative source of income for Uafato Village. Because the project is a 'new' income-generating activity for the village, the economic benefit of the activity is the total revenue, net of economic cost.

In Chapter 11, detailed input and output information for the Uafato honey project was given. If the opportunity costs of labour are assumed to be nil, the net present value of honey production would be around $7565 at the discount rate of 5%. However, assuming:

- opportunity cost of labour of $5 per person;
- 20 days of labour from each family per year; and
- participation of 31 families

the shadow value of the annual labour cost would equal the opportunity cost of labour, multiplied by the number of people per day, multiplied by the number of days in a year – that is, $3100. The net present value of the Uafato honey project would then be negative at around -$6525. Honey production would thus be economically non-viable; however, the honey making enterprise was developed as part of a conservation area for Uafato. Honey production was intended to compensate families for the loss of earnings arising from reduced logging and, consequently, a reduction in earnings arising from the reduced sale of wooden crafts. To estimate the full economic feasibility of the honey enterprise, this assessment should include the loss of craft earnings due to the reduction in logging and the economic benefits of the increase in the biodiversity value and the existence value of *ifilele* trees.

Economic feasibility assessments are conducted from a social perspective, rather than a private one such as in a standard financial feasibility assessment. In this case, the honey project appears to be as attractive from a social perspective as from the perspective of the community (Table 28), only because donors paid the initial capital costs and the opportunity cost of labour was assumed to be zero.

Table 28. Cost-benefit analysis of the Uafato honey project.

For a price of $10/kg and 31 bee hives

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Fixed costs	17 210					
Variable costs	3 850	3 850	3 850	3 850	3 850	3 850
Labour cost	3 100	3 100	3 100	3 100	3 100	3 100
Total revenue	9 300	9 300	9 300	9 300	9 300	9 300
Net benefit	–14 860	2 350	2 350	2 350	2 350	2 350
Present value of dollar earned in different years at a social rate of time preference (discount rate) of 5%)	1.0000	0.9524	0.9070	0.8638	0.8227	0.783526
Present net value	–14 860	2 238	2 132	2 030	1 933	1 841
Total net economic benefit	–6 527					
Partial economic net benefit (excluding fixed costs)	10 683					

Non-market valuations

Direct market-based valuations cannot always be used to assess the economic feasibility of some activities because for some outcomes market values do not exist. Many nature-based development and/or conservation projects, for example, generate outputs (goods or services) that cannot be valued using market information. As discussed in Chapter 6, markets and market values do not exist for goods and services that exhibit public good characteristics. For instance, in such cases estimation of non-market values can be attempted using non-market valuation techniques.

The two categories of non-market valuation that exist are 'revealed preference methods' and 'expressed preferences methods'. A brief overview of the general approaches that can be used to value activities that involve non-market values is provided next. (For more details on non-market valuation, see Freeman 1993; Sinden and Thampapillai 1995).

Revealed preference methods

Revealed preferences occur when individuals make choices in the market place that reveal their preferences for non-market goods and services. Revealed preference methods, therefore, are approaches to economic valuation whereby individuals' decisions in the market place are used to derive the market values generated by an activity.

Production method

Some goods and services conferred by the environment are purchased in the market place, for example, fish for eating and timber for building. The prices at which they are exchanged can be used to estimate the economic value of similar non-market benefits of an associated activity or resource. To adequately use this technique, the analyst needs to trace how the proposed activity will induce the physical changes in the environmental characteristics of the marketed good.

Suppose a development activity is expected to decrease the area of mangroves along a coast by reclaiming the land. To estimate the net economic value of the loss in mangrove habitat, a researcher estimates the economic value of the goods and services dependent on the mangroves using the production method. To do this, the researcher first determines the quantity of different species of fish caught that depend on mangroves. The researcher then estimates the quantity of different species of fish caught that may be affected by reclamation. The price at which these fish are sold commercially can be determined, together with the costs of fishing. The net impact of the reclamation on commercial fisheries can thus be estimated.

This method was used to determine the net economic value of mangrove resources in Fiji in the late 1980s (see Lal 1990). For forestry and fishery uses, the researcher obtained survey-based information on the quantities, output prices and input values. The data were used to determine the net economic values of commercial fisheries and forest products (Table 29).

Table 29: Economic values of mangrove uses in Fiji.

	Quantity per ha	NPV ($/unit /ha)	NPV per unit of good/ha
Commercial fisheries	147 kg	17.7	2606
Subsistence fisheries	184 kg	15.6	2862
Forestry – dogo (commercial)	201 m^3	1.1	225
Forestry – tiri (subsistence)	92 m^3	2.3	210
Total forestry value, assuming tiri is 57% of the area whereas dogo represents 43% of the area			216
Total fisheries and forestry values			5684

Source: Lal 1990.

Substitute or proxy method

Some activities may affect the quantity or quality of non-marketed products such as plants used for traditional dyes and medicines. If similar products (or close substitutes for these items) are sold in the market place, the net economic feasibility of the activity can be estimated using the price of the substitutes as a surrogate market price. The value of a subsistence fish harvest, for example, can be determined using the market price of closely related commercial species. This method was used to determine the value of subsistence fisheries associated with mangroves in Fiji (Lal 1990).

If there are no apparent marketed substitutes, then other methods may be used. These include estimating the indirect opportunity cost of producing products as proxies – for example, the cost of time spent collecting and preparing dyes or medicines (Box 30). Alternatively, the gross amount that domestic/international conservation bodies are willing to pay for a lease or purchase of a valuable resource could be used as a proxy for the economic net value of non-market goods and services generated by activities (Box 30). In some cases, users of resources may be willing to pay a goodwill or 'resource rent' for accessing private or communal resources. Dive operators and commercial fishers may pay to access coastal areas owned by local communities, as in Fiji. Such measures can be used to reflect the net economic value of an activity that protects those resources.

These values are indicative of only the value of an activity, because the net economic benefit of the activity is generally greater than what was paid. This is because users may not necessarily pay the full (resource rent) value of the resource. It is also possible the full market value of the public goods were not revealed because not everyone who benefits is made to pay. It is also possible that protected resources may have other ecological or cultural values that are not reflected in payments.

Box 30: Proxy valuation of Savai'i forest – a convenant.

The island of Savai'i is covered by largely undisturbed lowland rainforest of about 5000 hectares. The families in Falealupo Village were desperate to raise $65 000 to establish a school but lacked money. At the same time, they had been under pressure from logging companies to permit them to harvest their forests. The villagers did not want to permit logging but, needing the money, they agreed to allow logging in return for a payment for each tree extracted. They hoped to stop logging once they secured $65 000.

However, international philanthropists and pharmaceutical companies offered alternative funding to build the school in return for an assurance that the forest would be protected. The villagers signed a covenant allowing them use of the forest for medicinal plants, *kava* bowl timber and cultural purposes, but forbidding any logging or activities that would significantly damage the forests.

In this case, the net economic value of conservation activity could be assumed to be at least $65 000 (plus the value of other timber and non-timber forest products) because the international philanthropists and pharmaceutical companies were willing to pay that amount to maintain the forest.

Source: Adapted from Cox and Elmquist 1991.

Preventative and replacement expenditures

Some activities aim to prevent negative environmental occurrences, such as sea wall construction which aims to prevent coastal erosion. In such cases, preventative expenditures can be used to estimate economic value by determining how much people are prepared to pay to prevent the loss from occurring. Similarly, where the negative event occurs, the amount that people have to pay to replace an amenity (good or service) or correct the situation can be used to indicate economic value.

When mangroves are reclaimed, for example, seawalls may be needed to prevent the erosion of the coastal areas. The economic value of an activity that removed the mangroves would thus ideally include the cost of building a seawall to cover the economic cost of losing the coastal protection provided by the mangrove forests. A similar approach can be used to determine the nutrient filtering services valued by people, where the cost of establishing a solid waste filtering device is used as a proxy. The value of the latter was estimated to be $6000 per hectare for Fiji mangroves (Lal 1990).

Similarly, the cost of preventative measures taken to avoid harm from pollution can be used as a proxy for the cost of pollution. Where groundwater pollution occurs, for example, local communities may be forced to drink bottled water purchased from supermarkets, install home water treatment plants or obtain water from alternative sources. In cases such as this, replacement or preventative expenditure could be used to estimate the economic value of the pollution. For example, Hajkowicz and Okotai. (2005) estimated that people of Rarotonga, Cook Islands spent around NZ$ 1.5-2.2 million per year on bottled water in an attempt to avoid drinking poor tasting polluted tap water.

A word of caution is warranted though when using this valuation method. The values generated reflect only the gross costs of environmental degradation. That is to say, they do not also reflect the benefits that the community gains from using the resources to meet their needs. As only the gross costs of degradation are estimated, this valuation method tends to overestimate the value of changes that an activity induces, because expenditure information reflects only costs. The appropriate measure is the opportunity cost of using the resources.

Change in human earnings

Where human health is affected by air or water pollution, the economic cost of activities that cause pollution can be estimated using losses in earnings, together with the cost of medical expenses; however, this approach does not capture the economic impact of chronic health problems that do not result in losses in earnings. Further, it does not reflect the true cost of pollution to society. If human life is lost, the value of that life may be estimated using the life insurance values.

Suppose a new gold mine has been established near a village of 1000 households. In the processing of gold, mines discharge toxic substances that can affect health. Before the mine, people seldom went to see medical staff; since the mine has been established, each household has at least one person visiting the doctor at least 50 times per year for reasons related to the effects of pollution. Usually, these visits take all day, and the head of the household has to take time off from work. The economic cost of the effects of pollution is thus the opportunity cost of visiting the doctor (the foregone daily earning of $50, plus the cost of medicine of $10). With 50 visits per household per year, the total cost of pollution per household can be estimated at $3000: $50 plus $10 per household, multiplied by 50 visits. The total cost of pollution can thus be estimated as $3 million: $3000 multiplied by 1000 households.

Hedonic pricing

This valuation method aims to estimate the amount that people are willing to pay for a non-marketed good and depends on peoples' preferences, and thus willingness to pay for goods of varying quality. The price paid for a house, for example, depends on the size and location of the house, including whether it is in a highly polluted area or near an industrial site where there is excessive air pollution. Consequently, the changes in price that people pay to achieve different quality can be used to identify the value of different levels of environmental quality (see hypothetical example in Box 31).

Box 31. Hypothetical hedonic pricing.

The garbage dump for the capital of Fiji, Suva, was until recently located in the suburb of Lami. Its location there led to a significant change in the house prices around the area because the smell from the dump was apparent for most of the year. Suppose there were 1000 houses within the vicinity of the air pollution from the dump. Suppose also, there were 500 houses upwind away from the dump site, around the Chinese cemetery. Before the dump was constructed, the houses in these two areas would have had similar market prices; Table 30 shows the value of houses afterwards.

Table 30. Hypothetical house values around a dump.

Two-bedroom house site	Values (before dump)	Smell level (with dump)	Values (with dump)	No. of houses
Chinese cemetery area	60 000	Only Occasionally	100 000	500
Lami	60 000	Almost always	70 000	1000

The hedonic method suggests that a comparison of the total value of houses in the two areas would indicate the economic cost of air pollution from the garbage dump. Accordingly:

Total economic value of houses in Lami (with dump) = (FJ$70 000 x 1000)

Total economic value of houses in Chinese cemetery area (with dump) = (FJ$K100 000 x 500)

Without the foul smell, the houses in the Lami would have experienced price changes similar to those in the Chinese cemetery area. That is, the Lami residents would have had their house prices increase to FJ$100 000 if the dump were not located nearby. The economic cost of the foul smell due to the dump, therefore, must be reflected in the marginal change in house price multiplied by the number of houses concerned:

Net economic cost of foul smell = (100 000 – 70 000) x 1000
= $30 000 x 1000
= $3 000 000

In this case, the economic cost of the dump site (air pollution) would be around FJ$3 million! This estimate assumes there are no other environmental costs associated with leachate, water pollution and so on.

Travel cost method

Where activities affect the recreational and aesthetic value of an area, the economic value of the amenity could be estimated using the amount that people are willing to pay to visit the area. This method relies on the availability of actual expenses that the recreational user incurs, to (1) derive a market demand for the area and (2) estimate the economic value of the recreational experience. Regression analyses are used to derive the net economic value of the recreational experiences. A word of caution – the actual expenditure is not equal to the economic value of recreational experience, but it is used to derive the non-market value associated with the recreational use of the resource.

Expressed preference methods

The expressed preference method of valuation uses what people say (as compared with what they do in the revealed preference approach) to derive their willingness to pay, or the demand for a good or service. Accordingly, where an activity improves (or diminishes) the environmental quality of an area, expressed preference methods can be used to estimate the net economic value of the change generated.

These valuation methods are often referred to as 'hypothetical valuation' methods because respondents are given hypothetical scenarios and asked to indicate how much they would be willing to pay to either avoid the harm or to gain some improvement in the environment. The most well known of these methods is the 'contingent valuation method'. This method is commonly used to estimate how much tourists are willing to pay to visit a site, such as a national park, a dive site or a marine park (Box 32). Naylor and Drew (1998) used the contingent valuation method to elicit the value that Kosraens place on protecting mangrove resources. Tacconi and Bennett (1997) also used the method, to determine the economic value that international tourists place on forest conservation in Vanuatu.

Box 32: Contingent valuation and the value of Bonaire Marine Park.

In 1991, a survey on willingness to pay was conducted for Bonaire Marine Park, using the contingent valuation method. Visitors were willing to pay, on average, $27.50 per dive per year, with 92% of the visitors willing to pay $10 per dive. These findings suggest the economic value of the marine park is at least $10 per person per year.

Source: Morris 2003.

An alternative to asking people to directly express how much they would be willing to pay for a single product or change in environmental quality. In Tonga, for example, residents of Tongatapu were asked to express how much they would be willing to pay (WTP) for regular collection and proper disposal of their household solid waste. This estimate was comparable to the direct and indirect cost estimates determined using preventative and expenditure method. The direct and indirect economic costs of solid waste alone was about $3.10, with a 95% confidence limit of WTP per household of $2.80 to $6.50 per household per week, depending on the assumptions made about the marginal impact of solid waste on human health. It also reflects the economic value of 'litter free clean environment,' since a decline in aesthetic value of the environment caused by litter lying around was expressed as the main concern about the solid waste problem in Tonga (Lal and Fakau 2006).

The 'choice modelling approach' (also known as the contingent ranking method) has been used in developed countries (see, for example, Bennett and Blamey 2002). Respondents are asked to consider and rank different bundles of goods and services (which the researcher describes using a set of attributes), plus a charge associated with each scenario. Linked to with the different scenarios, the researcher also gives an indication of the monetary value of the associated bundle of goods and services. Using the responses, the researcher can estimate the value of a specific marginal change (improvement or loss) in environmental quality.

Expressed or hypothetical valuation techniques are generally used to determine the value of intangible goods and services, such as bequest or existence value, changes in biodiversity value and changes in the ecological health of an ecosystem.

Benefits transfer method

When all else fails, benefit transfer estimates may offer the potential to estimate economic values. Benefit transfer involves using values estimated in economic studies conducted elsewhere and applying them to the current site. The reliability of this method depends on the similarity between the characteristics of the two sites, in the following respects:

- the physical characteristics;
- the institutional setting;
- the policy environments;
- their stages of economic development; and
- supply and demand conditions.

Listing of non-market values

Often, non-market economic analysis of projects is beyond the capacity of project managers of small community based projects. In such cases, project managers may need to resort to simply listing important non-market values and using break-even estimates (Chapter 11) to subjectively assess whether the non-market benefits justify the effort.

12.5 Practicalities of cost-benefit analysis

Cost-benefit analysis is a simple tool to use when perfect information is available, the expected impacts of projects are small, all benefits and costs can readily be estimated, and decisions are reversible. Further, the human capacity and local infrastructure to implement development and conservation projects are often assumed to be available; however, when any of these conditions is not met (which is often the case), cost-benefit analysis as an assessment tool needs to be modified.

Uncertainty

Often, the impacts of a project may not be fully known, or information about key items may be incomplete or non-existent. Depending on the nature of uncertainty, one of several different approaches may be relevant to modifying the cost-benefit analysis tool.

Sensitivity analysis

As in the case of financial analysis, cost-benefit analysis should be accompanied by a sensitivity analysis of key items with an uncertain value. In sensitivity analysis, the value of each uncertain item is used to determine a range for the net economic value of an activity and provide decision makers with additional information about, for example, the likely range of benefits and costs associated with that activity. Decision makers thus have a richer set of information on which to base their assessment.

Lal et al. (2007) used sensitivity analysis to provide a range of estimates for the economic costs associated with liquid waste in Tuvalu. The most likely human health costs of key water-borne diseases directly attributable to poor liquid management was estimated to be about $400 000. Given the uncertainty about the likely decline in these water borne diseases directly attributable to liquid wastes, using different assumption, human costs were found to have a low estimate of $285 000 and a high estimate of $450 000.

Cost-effectiveness analysis

It is not always possible to estimate the value of all or key benefits for use in cost-benefit analysis. There may even be insufficient information to conduct a sensitivity analysis. Chapters 6 and 7 noted that some items are public good in nature, and the economic values of such goods are often not known. In other cases, as noted earlier many use and non-use values are not readily quantifiable (given the time and budget involved in estimation) so it is not possible to undertake cost-benefit analysis. Instead, cost-effectiveness analysis, which is a variation of cost-benefit analysis, may be more appropriate.

Cost-effectiveness analysis is used to identify the least-cost means of achieving a desired goal of conservation or environmental improvement. It does not measure benefits in monetary terms, but instead uses a biophysical standard as a goal. The costs of alternative activities that can achieve that goal are compared. The activity that produces the goal at the minimum cost is chosen because it will generate the highest return for the same price.

When costs occur over time, the basis of comparison should be the present value of costs. Again, the activity that involves the lowest present value of cost should be chosen.

Woodruff (2007) uses cost-effectiveness analysis to estimate the most economically efficient way of delivering energy to rural and remote communities in the Pacific. To do this, she assessed the cheapest options to deliver basic electrical services (for lighting etc.) to households. Referring to trials of renewable power at work in the Pacific, she found that solar power was more efficient than diesel in providing power services to the remote Tongan island of 'O'ua (part of the Ha'apai group), that hydroelectric power was a more efficient option than diesel generators to deliver power to Bulelavata Village in the Western Province of the Solomon Islands and that diesel-based power was a better option than a hybrid wind turbine/ grid system in servicing the island of Mangaia in the Cook Islands.

The precautionary principle

Some activities may risk causing a seriously negative environmental impact, although the risk may be small. The government may be interested in establishing a small nuclear-based electricity plant, for example, in the vicinity of a local community. Although the infrastructure would provide a cheap source of electricity, there is a minute chance that the nuclear plant could develop a leak. If a leak occurs, the costs to the environment would be exorbitant.

If the risk probability is known, a risk analysis can be used to determine the expected economic cost of the activity compared with the expected economic benefits of the activity. Using economic feasibility criteria, the decision about whether to proceed with the activity depends on the expected net values of proceeding and not proceeding.

If the probability of the plant leak is known, a risk analysis can be used to determine the expected (mathematical) economic cost of the leak. The expected cost can be calculated by multiplying the probability of a leak by the environmental cost of a leak. This cost can be compared to the net present value of a new electricity plant. The decision about whether to proceed with the activity (building the plant) depends on the expected net values of each (whether the net present value of electricity is greater than the expected environmental cost) (Box 33).

Box 33. Expected value assessment.

Suppose there are two activities A and B. Activity A has an 80% probability of producing a net present value of $2 million and a 20% probability of producing a net present value of $400 000. Its expected net present value (ENPV) is $1.68 million:

ENPV(A) = (0.8 x $2 million) + (0.2 x $0.4 million) = $1.68 million

Activity B has a 90% probability of producing a net present value of $2 million and a 10% probability of producing a net present value of –$500 000. The average expected net present value for the two projects is:

ENPV(B) = (0.9 x $2 million) + (0.1 x –$0.5 million)
= $1.8 million – $0.05 million
= $1.75 million

A risk neutral person would choose project B; however, a society that is averse to risks might choose A, because there is a small chance that project B may actually result in a net loss.

Risk analysis relies on the probability of the negative event (such as the leak) being known with some certainty. It also requires a realistic estimate of the environmental damages from the negative event, which may not be possible.

Probability estimates could be derived from technical information collected in the situation analyses or based on past experiences extrapolated to a future state of the environment. The World Bank recently used this approach to estimate the cost associated with increased incidences of cyclone events in Vanuatu due to climate change (see Shorten and Goosby 2003).

Nevertheless, much of risk analysis is often based on subjective assessments. In risk analysis, different forms of subjectivity need to be brought to bear on deciding:

- the degree of uncertainty or probability of an occurrence;
- whether the uncertainty constitutes a significant risk;
- whether the risk is acceptable; and
- whether the impacts are reversible.

A decision about whether to proceed with an activity may thus need to be made subjectively, without such detailed information.

In conclusion, cost-benefit analysis is applicable only when changes associated with a project are small (marginal) and perfect information is available. It also assumes that the decisions are reversible. Box 34 summarises the key steps in such analysis that can be undertaken in collaboration with local communities, and projects or activities selected using chosen cost-benefit analysis criteria (Table 31).

Box 34. Steps in cost-benefit analysis.

- Clearly define the current situation and the current uses and users of a resource and expected changes in the situation without any intervention – that is, the 'without' project scenario.
- Identify alternative activities – that is, the 'with' project scenarios.
- For 'with' project scenarios, identify each input required (including environmental goods and services) and expected outputs (including any pollutants) over time.
- For each alternative, assess the economic value of benefits and costs (to producers and consumers) of each activity and to each user group over time, including any relevant taxes and subsidies.
- Choose an appropriate social rate of time discount in discussion with the community.
- Assess the present value of economic benefits net of costs (to producers and consumers) of the 'without' project scenario.
- Estimate the net economic benefit, benefit-cost ratio and net present value for each 'with' project alternative and tabulate the results.
- Undertake a sensitivity analysis of data assumptions and uncertainty.
- Compare benefits and costs, the present value of benefits and costs, estimates derived from a sensitivity analysis, and other qualitative information about each alternative.

Table 31 summarises the BCA based criteria used in decision making.

Table 31. Economic criteria used for decision making

$PV_{Revenue}$ is greater than PV_{Costs}	Accept
$PV_{Revenue}$ is less than PV_{Costs}	Reject
$PV_{Revenue}/PV_{Costs}$ is greater than 1	Accept
$PV_{Revenue}/PV_{Costs}$ is less than 1	Reject
NPV is greater than 0	Accept
NPV is less than 0	Reject
NPV_A is greater than NPV_B	Accept project A
NPV_A is less than NPV_B	Accept project B

Where there are uncertainties, sensitivity analysis, as seen above, can help provide additional information. If the probabilities associated with certain events occurring are known then expected cost-benefit analysis could be used; however, where the environmental costs of an activity are expected to be large and irreversible, cost-benefit analysis criteria should not be used to make decisions. Instead, a precautionary approach may be needed – that is, it may be necessary to err on the side of caution and reject the activity.

12.6 Concluding remarks

This chapter has suggested that an activity should proceed if the net economic benefit is greater than zero, the net present value is greater than zero and/or the benefit-cost ratio is greater than 1. Nevertheless, as in the case of financial analysis, the economic viability of a project alone is not sufficient for a community to realise the net benefits of an activity. Again, operational feasibility determines whether net benefits are experienced. These feasibility factors are the same as those highlighted in Chapter 11 that determine financial viability. As for financial viability assessments, project managers need to consider not only the (economic) viability of an activity, but also the activity's viability in terms of whether net economic benefits can be realised.

If probability estimates of an event are known, then the expected net benefits (probability multiplied by the value) of an activity can be used in cost-benefit analysis; however, probability estimates are often difficult to determine. In such a case, qualitative information about viability, together with the quantitative estimate of the net benefit, may be used to determine whether an activity should proceed.

As in the case of financial analysis, a project that has a high net economic benefit and high viability is desirable over one with a low net economic benefit and low feasibility. The choice between high feasibility and low viability, and low feasibility and high viability is not straightforward. In the Pacific, where resources are limited and communities are highly vulnerable to natural forces, a society is likely to be risk averse and choose an activity with low economic feasibility and high operational viability over an activity with high economic feasibility but low operational viability.

At times, not all benefits and costs can be readily estimated, either due to the public nature of benefits and costs or because the process of estimation is too costly. As a result, economic feasibility assessments may not be possible using cost-benefit analysis, and the standard cost-benefit analysis criteria cannot be used directly to compare alternatives and make decisions.

Nevertheless, cost-benefit analysis can still be used as a framework to guide the assessment and comparison of activities. Such a framework can help systematically:

- identify the ‘without’ scenario;
- list options;
- identify uses and users, and the inputs and outputs associated with activities; and
- list and compile qualitative or quantitative information about all the benefits and costs of the alternatives.

The cost-benefit framework can be used in both financial or economic analysis.

Chapter 13

FINANCIAL AND ECONOMIC ASSESSMENTS:

RECENT CASE STUDIES FROM THE PACIFIC ISLANDS

In recent years, economic and financial analyses have been used in the Pacific for many different purposes. Following are examples of projects where economic analysis was used to:

- to raise awareness of and advocate to address environmental problems (improved watershed management in the Cook Islands);
- to assess the feasibility of a policy option (mining aggregate in Kiribati);
- to choose between environmental management options (human waste management in Tuvalu);
- to determine policy implications from disasters (flooding in Fiji); and
- to determine mangrove use options (in Fiji).

13.1 Economic benefits of watershed management

This case study summarises work reported in Hajkowicz and Okotai (2005). The Cook Islands are heavily dependent upon clean water for its leading economic sector, international tourism, as well as for fishing and pearl production. While the UNDP (1999) reports that 95% of the Cook Islands' population have access to 'safe' drinking water, Raea (2005) noted that freshwater in the Cook Islands had been nevertheless a challenge to the Government with:

- water testing in 2005 highlighting that the quality of tap water was falling below international safety standards with faecal coliform exceeding acceptable levels at most intakes around Rarotonga; and
- there being no chemical water treatment in Rarotonga at that time.

Accordingly, the Government of Cook Islands conducted a number of activities to protect water quality. During consultations to assess the water situation, community representatives expressed that they felt uninformed about their role in the degradation of watersheds (how their practices impacted water quality and therefore how or why they should change their practices). Other representatives felt that the priority given by the government to water management was not high compared to other national issues. (See Raea 2005.)

To partially address these issues, an economic valuation of the costs of watershed degradation on Rarotonga was undertaken. The key objective in the valuation was to provide information for the Cook Islands to highlight the importance of addressing watershed management through the IWP or other current or future initiatives – in other words, advocacy at both the community and national level to assist behaviour change.

The economic valuation conducted principally used preventative or replacement expenditures to estimate costs faced by consumers of poor water quality. These cost estimates include:

- the costs of bottled water or water tanks purchased to avoid using local tap water; and
- the costs to government from low water quality such as increased maintenance and water pipe replacement cost.

The approach taken did not put a value on the loss of biodiversity, habitats, scenic amenity, cultural heritage or other more abstract values associated with the degradation of watersheds. This is a potentially important issue as these values can be significant. Any estimates generated using the cost saving/cost avoidance approach are therefore an underestimate of the economic value of protecting watersheds. In other words, they represent a minimum loss.

On the basis of the study conducted it was estimated that the Cook Islands economy was most likely losing approximately NZ$7.4 million per year from the degradation of the watersheds on Rarotonga alone (Table 32). The greatest losses were incurred by the highly valuable tourist sector. Costs were attributed to the issues below:

- The number of tourist visits estimated to be lost to other locations because of watershed pollution. A small number of high-profile pollution incidents had occurred which had led to some negative health impacts that subsequently generated bad publicity for the Cook Islands. A number of affected hoteliers were consulted about the incidents and about water pollution generally. Most hoteliers consulted believed that the health impacts resulting from the high-profile incidents had had a negative impact on tourism numbers and they believed a repeat occurrence (considered a likelihood within the next 10 years by health officials) would lead to future tourist cancellations. Assumptions were then made on the likely change in tourist numbers that could occur if the incidents were repeated and these Figures were multiplied by average expenditure per tourist to generate estimates of tourism losses.

- Purchase of bottled water to avoid the use of poor quality freshwater. A face-to-face survey was conducted at selected spots around the island to ask consumers whether they consumed bottled water, how much they consumed and why. Average consumption of bottled water was estimated from the findings and a proportion assigned to purchases resulting from poor water quality alone (since some people drink bottled water for other purposes, such as image and branding). This quantity of water was then multiplied by a weighted average price of purchased water to estimate losses.

- Health problems arising from poor water quality. These included diarrhoea and gastroenteritis arising from the consumption of polluted water, fish poisoning (ciguatera) arising from the contamination of fisheries by polluted land run off and dengue fever arising from the stagnation of water and creation of mosquito breeding grounds. Health officials provided information on the number of cases of these illnesses and experts were asked to identify the proportion of cases likely to be attributed to poor freshwater management. The costs of seeking medical help (doctor and hospital visits), medicines and average loss of time off work were then used to estimate likely health costs.

- Purchase of upstream public water filters. Managers in the Public Works Department suggested that new infrastructure upgrades are necessary due to reasons like the age of existing infrastructure as well as to watershed pollution which necessitates, among other things, upgraded infrastructure to remove total and faecal coliform from the water supply. Experts were consulted to identify what proportion of the new upgrades could have been avoided if the watersheds had not been polluted. This information was multiplied by the costs of purchasing the upstream filter costs arising from watershed degradation.

- Loss of fish stocks in lagoon. The degradation of watersheds can theoretically result in pollution in coastal waters due to run off. Where this is high enough, fish could theoretically be contaminated resulting in a loss in the usable quantity of fish stock. In fact, a causal link between land-sourced pollutants and fish poisoning has long been suspected but never proven. On the basis of a review of literature and discussions with experts, it was assumed that land-based pollutants could be responsible for up to 50% of fish poisoning (ciguatera). Estimates of the quantity of ciguatoxic fish species were taken from a recent fisheries study conducted on Rarotonga. The loss in fish stocks attributable to watershed degradation was then estimated by multiplying the volume of ciguatoxic fish by the local market prices for the types of fish.

- Downstream water filtration. Concerns about the quality of freshwater supplies on Rarotonga have led to the widespread purchase of household water filtration devices. Consultations were held with two major suppliers of water filter systems on Rarotonga to assess the proportion of households and businesses using a water filter. In addition, a small survey of shoppers was conducted as part of the valuation to see how many householders used filters. Subsequently, it was estimated that two thirds of households used some form of water filter while the majority (90%) of growers used one to protect irrigation pipes. The cost of downstream filtration was then estimated by multiplying these values by the cost of filters.

Table 32: Potentially avoidable costs from improved watersheds on Rarotonga (NZ$ 000s per year).

Cost categories	Best Estimate
Lost tourism income	3 440
Bottled water	1 500
Healthcare and illness costs (diarrhoea, gastro-enteritis, dengue fever & fish poisoning)	1 003
Upstream public water filters	730
Loss of fish stocks in lagoon	534
Downstream household water filters	116
Water pipe upgrades	104
Household rainwater tanks	10
Mosquito control	1
Total annual cost	7 439
Total annual cost per household	2.9
As percentage of 2003 GDP	3.12%

Source: Hajkowicz and Okotai 2005.

The valuation had some positive impacts on watershed management. First, the findings increased stakeholder incentives to address watershed management, including incentives to make the government raise the priority of watershed degradation. The IWP-Cook Islands team reported that:

> … the findings of the [economic valuation] report were used as a way to convince the public and government that if things aren't done to protect our fragile water catchments (and ultimately watersheds) then it will be costing us millions – thru loss on tourism, people buying more water, spending more on health bills, loss of fish in our lagoons, etc. (IWP Cook Islands, personal communication, 13 February 2006).

At the national level, the communication of study findings led to further discussions among private sector stakeholders (particularly from the tourist sector) on how to minimise the economic impact of watershed pollution on tourism. Discussions generated by the study directly contributed to the subsequent establishment of a private sector committee on Rarotonga aimed at targeting improved environmental management (Holland and Parakoti 2006).

13.2 Feasibility of aggregate mining

For Kiribati, a small, developing atoll country in the central Pacific, a combination of growing populations, inward migration from rural areas/islands and development investment has resulted in the rapid growth of its capital, located on the small atoll of Tarawa. Growth has been typified by an increase in small-scale domestic developments (eg., houses) as well as sporadic large-scale investments (eg., public facilities such as hospitals, schools and/or government buildings). The construction to underpin these developments demands access to 'aggregate' – sand, gravel, rip rap or rocks used for construction.

Conventionally, demand for aggregate for construction around Tarawa has been met by digging up the beaches and coastal flats. Although this mining is a cheap way to supply aggregate on Tarawa, the supply is often insufficient to meet local demand. Moreover, the removal of too much aggregate on Pacific atolls has been demonstrated to increase coastal erosion. (See Webb, 2005a, 2005b, 2006.) On Tarawa, increased flooding of key amenities such as the hospital, and saltwater intrusion to groundwater have thus been linked to the coastal mining (see Greer Consulting Services 2007). Flooding is becoming an increasing concern in the face of rising sea levels from climate change. At a time when Tarawa residents most need aggregate to build seawalls to protect them from the sea, removing aggregate from their coastlines to build those walls ironically puts them at greater risk of flooding.

An alternative to coastal mining is to import aggregate from overseas (with Fiji being a common source for the Pacific); however, importation of aggregate is usually extremely expensive, out of the reach of most commercial or domestic users and therefore only practical for donor-led developments. Further, importation risks the introduction of plant, insect or other pests. Previous imports to Pacific atolls countries had seen the discovery of a (dead) frog in cargo to Kiribati (see Greer Consulting Services 2007) and the introduction of some 19 invasive weed species to Tuvalu (see Ambroz 2009).

Given the risks to the environment of importing aggregate and the threats to well being from coastal mining, the Government of Kiribati seeks to replace aggregate sourced from the beaches with aggregate located on the sea bed of Tarawa Lagoon. Work conducted under previous development projects confirmed the existence of large reserves of aggregate there and assessed their suitability for low-scale construction or infilling (Smith and Biribo 1995). Theoretically, these aggregate could be extracted from the lagoon bed by using a suction dredge (effectively sucking aggregate from the seabed using a pipe) or clamshell dredge (scraping them up from the seafloor) attached to a barge. The aggregate could then be transferred to shore for sorting and use. If dredged aggregate could continually replace coastal mining, coastal protection could be increased and livelihoods improved. That said, the Government of Kiribati is keen that any activity to access aggregate in an ongoing manner would be financial and socially sustainable. An economic analysis of dredging was therefore conducted to assess this.

Two analyses were conducted (Greer Consulting Services 2007):

1) A financial feasibility assessment was conducted to see if a commercial operation could be sustained to replace locally-extracted coastal aggregate with aggregate dredged from Tarawa Lagoon. A minimum requirement would be that the company at least sufficiently covered costs to remain in operation.
2) An economic (cost-benefit) analysis of the suitability of lagoon dredging.

Based on a provisional design for a suction dredge in Tarawa Lagoon, preliminary financial analysis indicated that lagoon dredging could be commercially feasible in a ‘quiet’ year when no major developments were underway and only demand as usual applied. Costs for establishment and operation of the dredge were based on those developed for a proposal to establish dredging with donor assistance. Other operational costs were sourced from local establishments (fuel, power, labour) or overseas. Under ‘normal’ conditions, the financial feasibility assessment indicated that a small profit (around A$60 000) might be expected. In years when large-scale developments were also underway, it was estimated that profitability might be expected to improve. The economic feasibility assessment drew on resource rather than financial costs for operation. These included using resource costs for fuel (removing tariff costs) and labour (using a lower cost due to high unemployment of low-skilled labour.

From an economic perspective, lagoon dredging was estimated to generate potential economic returns of 16%. This high rate of return does not include the positive benefits of protecting infrastructure and property, public utilities (water and sewerage, electricity and phone lines), agriculture and public health. These benefits were not quantified because of lack of data on the impact of coastal mining (as distinct from natural processes) on coastal processes; however, they could be significant. The economic return from diverting aggregate mining from the coasts to the lagoon is therefore likely to be higher than 16% in real terms.

Although the financial and economic benefits of lagoon dredging looked promising, there were a number of issues that threaten its sustainability. Critically, a household survey had indicated that around 1200 local families conducted coastal mining and at least 150 relied on the sale of those aggregate as their primary source of income (Pelesikoti 2007). Commercial dredging would compete for business against these households as well as against commercial miners to sell its sand and gravel. The risk is that – especially where families rely on the sale of coastal aggregate for income – businesses and households could undercut the sale price of lagoon-sourced aggregate. The results would be continuing coastal mining, continued coastal erosion and the waste of resources involved in establishing a dredge operation that would not survive.

Theoretically, the government could (and wishes to) establish a full ban on mining the beaches and coastal flats to protect the coastlines. Several areas along the coast are already officially out of bounds; however, many families continue to mine them regardless, since the desire to supplement income for food, education and health fees is too good to ignore.

In light of these drivers, economic analysis indicates a number of policy implications to prevent coastal erosion as follows:

- A total ban on coastal mining is impractical. If current restrictions are not observed, it is unlikely that the government could enforce a wider ban. It would be more sensible to rework the current designated/non-designated area scheme and police that more effectively, accompanied by an awareness campaign.
- A strategic communications campaign is needed before embarking upon operations to ensure that the community understands the benefits of controlling costal mining and the benefits of using lagoon-sourced aggregate instead.
- A sensitive and sensible scheme is required to assist disenfranchised families to cope with the loss of income generation from coastal mining. The government will need to embark on community consultations to identify options.

Other critical issues affecting the feasibility were the need to consider dual pricing policies (to encourage purchases from the company rather than from local coastal miners) and the need for an appropriate environmental impact assessment and ongoing environmental monitoring.

Together with other research, the findings of the analysis were incorporated to design an aggregate dredge project for Kiribati. The project commenced in 2009.

13.3 Economic benefits of human waste management

For decades water-sealed flush toilets and septic tank systems were promoted in Tuvalu as the most hygienic and safe way to dispose of human waste. Little did proponents realise that such systems were highly unsuitable for Funafuti's coral atoll environment where groundwater is relatively close to the ground level, and where groundwater level rises during high tides and heavy rains. Adding the fact that there has conventionally been little or no monitoring of septic tank design, the combined effect of the use of these systems in Funafuti has been septic flooding of Funafuti town during heavy rains and/or high tides, plus the contamination of scarce water resources with human waste, leading to incidents of water-borne disease and other pollution problems.

To inform water management, an economic analysis of alternative water management options was conducted using a 'with' and 'without' approach (Lal et al. 2007). To determine the economic costs of the situation without alternative waste management, several different methods were used.

Preventative values were used to estimate some of the costs of the current pollution problems, with the cost of buying bottled water, cost of using desalinated water and the cost of installing rainwater tanks used as proxies for costs incurred as a result of pollution. Additionally, market measures were used as proxies for some costs. For example, medical records of the incidences of different diseases and local cost of treating each of the water- and insect-borne diseases caused by poor sanitation were used to estimate the total human health costs from poor sanitation. Similarly, the loss in fisheries output due to pollution of coastal water was estimated by the production method, using expert opinion as the base and market price of fish in Funafuti. Estimates were made on a best case, worst case or most likely case scenarios. The resulting economic costs associated of poor sanitation were estimated to most likely be about $476 000 a year (Table 33).

Table 33: Economic cost of current human waste management (AUD).

Component	Worst case	Most likely case	Best case
Human health	452 630	395 807	284 749
Desalination water	49 961	37 470	12 490
Rainwater	44 584	27 020	
Bottled water	14 676	9 784	4 892
Fisheries	14 190	5 676	2 838
Total economic cost	**576 040**	**475 758**	**304 969**

Choice of human waste management option

The government has considered a range of different sanitation options, including in particular a highly sophisticated reticulation system and a basic composting toilet accompanied by improved awareness of sanitation issues. The benefits and costs with each of these options were estimated. Likely impacts of each option was estimated on the basis of experience elsewhere and/or using discussions with stakeholders. The estimated net present values of alternative sanitation options are presented in Table 34. Economic analysis suggested that the compost toilet with improved awareness option was financially and environmentally most likely to be suitable.

Nevertheless, social acceptance of compost toilets was problematic. Trials with compost toilets in Tuvalu and elsewhere in the Pacific, such as Kiribati, have demonstrated that, although such a system is technologically feasible, locals are reluctant to embrace them for social reasons. The main obstacles include the "newness" of the technology, personal attitudes and preferences. Some have argued that the flush toilet system took almost 20 years to be accepted. The rate of adoption of flush toilets no doubt increased once they took on a prestige value and were found to offer convenience, comfort and privacy when the toilets became incorporated in the house. The use of compost toilets is seen as a step backwards, particularly because the early designs placed the toilets outside the house. Although later compost toilet designs an integrated it with the home, they are likely to be slow to gain acceptance, even if they were to offer health as well as economic benefits. Tuvalu's dilemma continues.

Table 34: Economic net benefits of alternative waste management options (AUD).

Sanitation options	Initial capital establishment investment	Annualised cost	Water savings	Compost soil benefits	Annualised option's net benefit (loss)	Preventative Health and environmental benefits (costs)	Total net economic benefit (loss)
Do nothing option						(475,758)	**(590 ,136)**
New septic tank	2,683,800	590,136			(590,136)	475,758	**(590,136)**
Fix septic tank	2,556,000	569,337			(569,337)	475,758	**(569,337)**
Plastic septic tanks	2,300,400	527,740			(527,740)	475,758	**(527,740)**
Compost (add on)			1814363	52,467	1,310,084	475,758	**1,310,084**
Compost (new)				52,467	1,310,084	475,758	**1,310,084**
Hybrid + septic	5,239,800	1,038,063	27215		(1,010,848)	475,758	**(1,010,848)**
Mini-treatment	23,962,500	11,514,105			(11,514,105)		**(11,514,105)**

13.4 Economic losses to the sugar industry from flooding

Since its establishment in the late 19th century, the Fiji sugar industry has significantly influenced the natural landscape on the two main islands of Fiji. It has also been the largest contributor to Fiji's economy, that is, until recently when the tourism industry took over in the early 21st century. Even today, although the industry's dominance in the economy has been overtaken, it still accounts for about 5% of Gross Domestic Product (GDP) and generated about 20% of exports in 2006 (www.adb.org/statistics). The 2006 export value associated with the sugar industry was FJ$234 million. It also provides around 12% of total employment in the country. The sugar industry is the single most important employer in the rural areas.

In January 2009, intense rainfall over a 24-hour period in Fiji led to severe flash floods. With continuous torrential rains over two weeks, most of the low-lying areas of Fiji were under water for days. As well as damage to infrastructure, housing and health, the sugar sector was impacted. The net impact of the floods on the sugar sector – including non-market costs – was estimated using the 'with' and 'without' analysis, based on the United Nation's Economic Commission for Latin America and the Caribbean (ECLAC) disaster assessment framework (see ECLAC 2003).

The direct and indirect costs of the effects of the Fiji floods were defined as damage caused directly to growers (farms and households), millers and damage to infrastructure due to the inundation. Additionally, there were other 'indirect' effects arising from flood inundation of farms, houses and access roads etc, such as loss in wages, decrease in national economy, humanitarian costs (Table 35).

Table 35: Economic costs of floods: with and without cost estimation methodology.

Value of Activities	With Floods Scenario	'With' and 'Without' Flood Damage Analysis	
Farm			
Sugarcane production (plant and ratoon)	Cane output following flooding	$GVP_{Without\ floods}$	$GVP_{With\ floods}$
Non-cane crops and livestock	Non-cane crop and livestock output following flooding (assuming farmers lost only a 6-month equivalent of their annual non-cane crops revenue)	$GVP_{Without\ floods}$	$GVP_{With\ floods}$
Clean-up of farm land of debris	Total clean up following floods	$TC_{Cleanup\ due\ to\ floods}$	$TC_{Cleanup\ without\ floods}$
Farming materials	Replacement (lost) or damaged	$TC_{Farming\ materials\ replacement/repair}$	
Cane access road (private maintenance)	Repair costs following flood	$TC_{Cane\ access\ road\ repair}$	

House and household			
House and household possessions	Replacement (Lost) or Damaged	$TC_{\text{House replacement/repair}}$	$TC_{\text{Household possessions replacement/repair}}$
Normal off-farm income	Gross income earned following floods	$TC_{\text{Off-farm income without floods}}$	$TC_{\text{Off-farm income with floods}}$
Normal home clean-up	Total clean-up following floods	$TC_{\text{Cleanup due to floods}}$	$TC_{\text{Cleanup without floods}}$
Human health	Increased disease incidence and injury following floods	$TC_{\text{Health costs with floods}}$	$TC_{\text{Health costs without floods}}$
Mill			
Mill infrastructure maintenance	Regular maintenance costs plus additional cost of damage	$TC_{\text{Maintenance with floods}}$	$TC_{\text{Maintenance without floods}}$
Miller share of sugar revenue	Reduced level of cane throughout	Miller $\text{Revenue}_{\text{Without floods}}$	Miller $\text{Revenue}_{\text{With floods}}$
Infrastructure			
Cane access road (Regular maintenance)	Regular maintenance costs plus additional cost of damage to the cane access road due to floods	$TC_{\text{Maintenance with floods}}$	$TC_{\text{Maintenance without floods}}$
Tramline (normal maintenance)	Normal maintenance costs plus additional cost of damage to the tramlines due to floods	$TC_{\text{Maintenance with floods}}$	$TC_{\text{Maintenance without floods}}$
Drainage scheme canals and drains	Normal maintenance costs plus additional cost of damage to the drainage schemes due to floods	$TC_{\text{Maintenance with floods}}$	$TC_{\text{Maintenance without floods}}$
Humanitarian			
Humanitarian assistance	Humanitarian disaster response	Monetary equivalent of disaster packs, medical kits, food rations, education support	

Estimates of losses to the sugar sector were based on a stratified sample of flood-affected farms selected using the SUGAR_GIS[4]. Cost estimates were developed using:

- the production method (gross value of loss in sugarcane production, gross value of loss in non-cane crops and livestock, gross loss in wages due to lost work time etc.);
- replacement method (cost to replace household possessions and structural damage; 'clean up' costs, cost to repair sugar infrastructure such as cane access roads, tramlines, drainage, etc.); and
- opportunity cost (for costs of treatment of diseases (Human health)) and value of humanitarian assistance.

Each category of cost information was estimated at the sector level. The sector total was then aggregated across sectors to arrive at an estimate for each mill area. Mill area estimates were further aggregated to obtain the industry total. Ideally, economic costs must be estimated over time, since some of the effects of floods, such as saltwater flooding, would also be felt in subsequent years. Nevertheless, because of data problems, the cost estimates provided here include costs associated with the impacts in the flood year only.

On the basis of the analysis, the total economic cost of the January floods in the sugar belt through direct and indirect damage to infrastructure and losses to growers and millers is estimated to be about $24 million (Figure 51). The 2009 floods caused an economic loss of about $13.4 million to the sugarcane farmers specifically. This was a little over half (56%) of the total industry economic cost of $24 million. The direct and indirect impact of the floods is about to 2.3% of the 4-year average (2004-2008) industry gross value product of $F523 million (ECLAC 2003).

[4] SUGAR_GIS is a geographic information system for the Fiji sugar industry capturing layers of information, including geospatial characteristics of the sugar belt, census information on each individual farms, lease types, production and land ownership, land tenure (see Lal 2008).

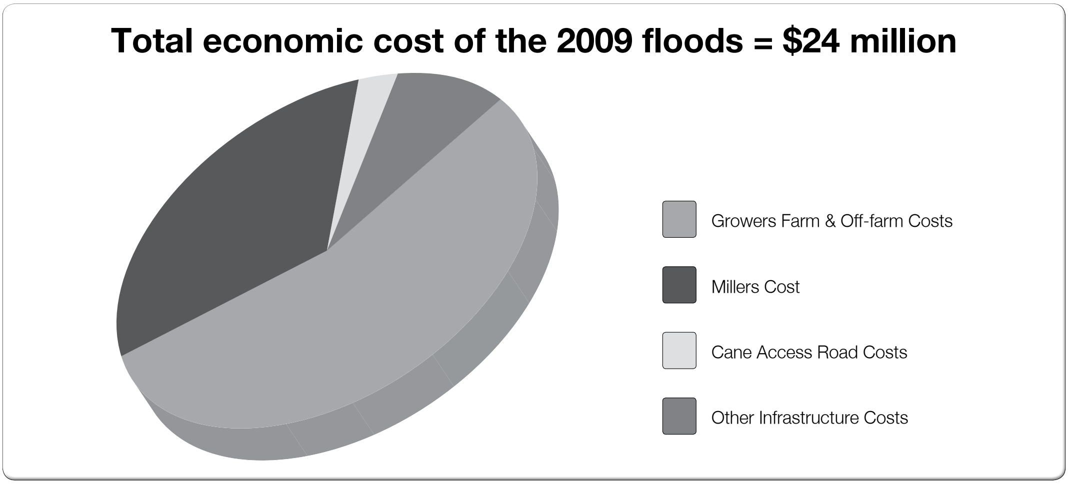


Figure 51: Total economic cost of the 2009 floods on the sugar belt, excluding the humanitarian assistance.

Source: Lal et al. 2009.

While Fiji has had similar, if not higher, disaster-related economic costs on the sugarcane farming sector, the flow-on 2009 effects are likely to be much more serious, particularly given the recent downturn in the economy, following the December 2006 political events. The flood outcomes will be further aggravated by the decline in the national economy, which has retracted by 6.4% since 2006 (Reserve Bank of Fiji 2009) and the loss, due to the lack of a democratically elected government, of the full €120 million allocated by the European Union to Fiji under the National Adaptation Strateg. In October 2009, Fiji also lost its last set of price 'subsidies' from the European Union, and thus its cash flow is expected to further decrease considerably. Such economic woes will have flow-on effects throughout the country, and many of the regional towns in the Western and Northern divisions, where cane is the lifeline, are likely to become ghost towns.

The 'with' and 'without' flood analysis suggests the 2009 floods increased the level of poverty in the sugar belt. An increase in about 25% of flood-affected families are expected to fall below the basic needs poverty line as a result of floods (i.e. 'with' flood situation) than had the floods not occurred (i.e. under the 'without' scenario) (Table 36). It is important to note that this analysis took into account loss in income due to the direct effect of the floods. It excluded flood-related farm costs such as lost farming materials and clean up, and household-related flood costs such as health costs, housing and possessions, clean up and evacuation. This analysis did not include considerations of any debt which almost all the farmers have. Had such costs been included, almost all the farmers would have fallen into poverty.

Table 36: Percent of 2009 flood-affected sugarcane families expected to fall into poverty.

	% of farms below the Fiji food poverty line (=$4 054)	% of farms below the Fiji basic needs poverty line (=$8 361)
Post-devaluation of Fiji currency		
'Without' floods	19	54
'With' Floods	42	77
Pre-devaluation of Fiji currency		
'Without' floods	55	98
'With' Floods	71	91

Source: Lal et al. 2009.

The vulnerability of the sugarcane farmers is also heightened because of the final decline in the EU sugar prices when many sugarcane farmers are expected to struggle to make ends meet. Without floods and pre-devaluation of the Fijian dollar, when the forecast price was $41.24 per tonne, almost 60% of farms were expected to have had negative gross margin (estimated using Lal and Rita (2008) survey data of 2003 and the 2008 FSC production data). It was thus not surprising that many sugarcane farmers, and others in the flood-affected areas, were forced to make some difficult choices immediately following the floods. Many families were reported having to choose between sending children to school or to meeting their basic food requirements. Had it not been for the humanitarian assistance provided by many national and international organisations, it was likely that many children would have dropped out of school in 2010.

13.5 Economic losses from mangrove destruction

Since 1896, the Fiji Government has either directly reclaimed or approved reclamation by the private sector of almost 4 300 ha of mangrove area, or approximately 10% of total mangrove areas. Of these over 25% was directly reclaimed by the government between 1960-1986 to create 'new land'. Access to land has been an ongoing issue in Fiji, particularly because 90% of land is 'owned' by indigenous Fijians, and access to land has not always been easy. Mangrove foreshore areas are generally regarded as being state land, and thus seen to be easily accessible by the government. Of the mangrove areas reclaimed by the government, almost 50% was undertaken primarily for agricultural development, mainly sugarcane and rice; however, almost all of this reclaimed mangrove areas remained unproductive within the projected 5-10 years. A large proportion of the reclaimed mangrove areas remained idle even after 15-20 years, including the Raviravi reclamation area.

Reclamation of mangrove areas for alternative uses would mean that the community loses out on their in situ values. In Fiji the predominant use of mangrove wetlands include commercial and subsistence harvest of fisheries and forestry products, such as timber for housing and firewood and fish, crabs and prawns. Small uses are also made of mangrove dyes in indigenous handicraft, as well as for filtering of nutrients. Other ecological services valued also include protection against storms and cyclones. There are also the existence and bequest values.

The Fiji Government undertook the Sugarcane Drainage Improvement Project as part of the World Bank-funded Sugarcane Extension Development Program. The 'Raviravi Scheme', which commenced in 1971, involved reclamation of 365 hectares of mangroves for sugarcane (282 ha) and shrimp farming (67 ha). It involved clearing of mangroves and construction of bund walls and seawall. Rainwater was used to flood the cleared land and leach salt from the soils. Reclaimed Raviravi land was expected to support 60 farmers, and to come under production within 3-4 years with a projected yield of 70 t/ha.

A cost-benefit framework was used to compare net economic benefits of the conservation of mangroves as compared with the net benefits of conversion for agricultural development (Lal 1990). As a rule, where perfect information is available and all costs and benefits have been adequately considered a society may be better off converting mangrove areas to alternative uses provided the net benefits from the alternative use is greater than in situ net benefits derived from mangrove ecosystems.

Estimation of the economic values of forestry and fisheries products was undertaken using a variety of methods. For instance, the production method was used to estimate the economic values of forestry and fisheries products harvested, with market costs and prices established through a survey of the commercial users of mangrove forest products and fisheries. This together with government records of volumes of fisheries and timber products produced was used to determine average per hectare value estimates for the Western Division. In addition, the nutrient filtration value associated with the mangrove ecosystem was estimated using the alternative cost approach, comparing the economic costs of conventional sewage treatment plants and the use of mangroves for oxidation ponds for the comparable volume of sewage (see Lal 1990 for details).

The value of agricultural benefits was estimated using the initial cost of Raviravi reclamation work (based on Government records and original project documents) and predictions of production based on farming trials by the Fiji Sugar Corporation. The economic net value of sugarcane farming and shrimp farming was estimated using projected cane output and shrimp production, under the projected salt leaching profile of the technical experts. 'Typical' farm, harvest and transport costs on saline soils and the price of sugarcane under the Lome Agreement information was used to determine the net benefits of sugarcane farming on 282 ha. Similarly the net benefits of shrimp farming was estimated using key estimates based on experiences elsewhere in the world, and adjusted for local conditions by the technical experts, and local shrimp market prices (see details in Lal 1990). The Raviravi net benefits was thus estimated assuming an annual harvest of 56 t/ha of sugarcane was achievable within 30 years of the completion of the 282 ha for sugarcane farming and a projected shrimp yield of 1.8 t/ha within 5 years from the 24 ha of actual pond area.

In light of the economic analysis conducted, it would appear that the conversion of mangroves for agriculture does not make economic sense in Fiji. Fiji had an estimated net economic loss of $1 million from the loss of the valuable fisheries habitat as well (Table 37).

Table 37. Loss in economic value due to Raviravi mangrove reclamation project.

	Total Net Value (NPV)	Annual Opportunity Cost $/year)
In situ fisheries and forestry values lost due to reclamation of 350 ha	1 014 000	53 000
Sugarcane and shrimp farming benefits	-3 295 000	-181 000
Net Economic Benefits of the Raviravi project (excluding the nutrient filtration services	-4 310 000	-236 000

Furthermore, the conversion of mangrove areas for agriculture is a waste of resources as ecologically these systems are found the world over to be unsuitable for most agricultural and aquaculture crops. Sensitivity analysis using double the leaching rate, and thus reducing the period taken to reach optimal cane and shrimp yields generates net economic benefits for the Raviravi project of still over -$3 million (losses). This is not unusual as, even in countries where productive use of reclaimed areas may have been experienced immediately following reclamation, a reversal of the desalination process and regeneration of acid sulphate conditions have been experienced over time, with subsequent decrease in crop yields and even subsequent abandonment of farms (Moorman and Pons 1975; FAO 1982; Bandopadhyay 1985). This experience emphasised that economic sustainability of use of natural resources is also dependent on the underlying dynamics of the ecosystem and ecological services it supports.

Chapter 14 CHOOSING BETWEEN INSTRUMENTS AND POLICIES

The choice of policy, activity or instrument to improve resource management activities should be selected according to:

- the extent to which it creates incentives to improve environmental quality (the effectiveness in generating real benefits);
- the net financial benefits and/or the net economic benefits of implementation (net benefits) – this includes recognition of operational and/or viability issues; and
- its impact on the social structure of the community.

14.1 Effectiveness

Not all instruments are equally effective in all situations. The nature and root cause of the environmental problem would, to some extent, dictate which instrument can be used. As discussed, a fee can be introduced when the intention is to encourage the impactors to internalise their externality costs; however, a fixed fee is unlikely to provide the right type of incentive for the impactors to reduce their level of waste; for this purpose, a unit fee is more appropriate.

Some instruments can be expected to have a more significant or immediate impact on environmental quality. Bans on the capture of certain fish or the dumping of household waste, for example, may have an immediate impact on the quality of a fishery. By comparison, charging systems may take longer to affect environmental quality because some level of environmental use continues. Suasion, too, may take a while to affect environmental quality, as families learn that persistent environmental harm can damage their own well being.

At the village level, predicting the likely impact of using one instrument over another is likely to be an intuitive exercise involving the qualitative estimate of effects. For large-scale projects, it may be possible to make a quantitative estimate of impact – for example, feasibility studies of watering or ecotourism enterprises, where data exist and the information generated may indicate the change in behaviour that would result from a charging mechanism.

14.2 Net benefits

No instrument should be selected if the costs of implementation are likely to exceed the benefits. If the monitoring and enforcement costs of bans are likely to be high, yet the effectiveness is expected to be relatively low, the net benefit of using bans to address environmental quality would be low. It is unwise to proceed with an instrument that is not cost-effective. By comparison, instruments that are expected to have a large impact on the problem relative to their costs would confer a net benefit and thus would be a financially wise investment. Chapters 11, 12 and 13 have a;ready provided detailed guidance on how to assess the financial and economic net benefits of a policy, instrument or action.

14.3 Social impacts

People generally make decisions that are in their own interest. From a personal perspective, even environmentally harmful practices benefit the private individual; otherwise, that individual would have made a different decision. Accordingly, any change in property rights to encourage a change in behaviour to improve the environment is likely to reduce the level of personal wealth or welfare of an individual. A solution to environmental degradation that may reduce personal welfare could be where people make decisions that harm environmental quality because they lack information. By comparison, any solution that involves a change in rules of property – for example, the introduction of new command and control institutions or alternative management responses – will make some individuals involved worse off. There again, this cost to the individuals occurs in the interest of the broader community. For this reason, while unsustainable resource use may occur because the actions of individuals are not in the interests of the group, environmental improvement may occur because the interests of the collective may occur at the expense of individuals.

14.4 Other social costs

Getting people to limit their environmentally unsustainable behaviour may result in welfare problems. Bans to protect fisheries, for example, may mean fishing families have less food to eat and/or less income (from selling fish). As a result, the management instrument may result in social costs, such as reduced health or a reduced ability to pay school, church and other fees. Such a reduction in welfare can lead to problems in rule enforcement and a lack of compliance. This raises the issue of the equity implications of an activity.

Equity

As some people make the necessary sacrifices for the environment, others may benefit. This can lead to tension between stakeholder groups. Chapter 10 noted that the Utwe–Walung Conservation Area Project (CAP) resulted in tension between the two key villages: Utwe and Walung. To encourage conservation in the Utwe–Walung area, the CAP supported ecotourism activities that would provide income to families who no longer exploited the area. Consequently, a tourist centre was established in Utwe. Conservation benefits from tourism tended towards the Utwe Village as a result, but the costs of conservation were borne by Walung residents, who received little benefits from the ecotourism project (SPREP 2001). The Walung residents, who had to restrict their use of the conservation area, soon became disillusioned in the CAP and withdrew their participation, and tension developed between the two villages.

It is thus important to consider the likely distribution of costs and benefits from resource and environmental projects across the stakeholder groups. Where some stakeholder groups bear the greater cost of the project, problems with compliance and/or social breakdown may arise.

It is in the interest of communities to implement instruments that are likely to confer the highest net benefit to the community (improvements in environmental quality that can be financially/ economically justified) and that produces equitable distribution of benefits and costs. It may not always be possible to address these objectives jointly, and institutions may need to be created to ensure that benefits are equitably distributed, and thus minimise the scope for tension and conflicts from emerging. This is particularly the case where customary resources are involved. It is important to take into account at the project design stage considerations of not only the generation of net benefit but also equity in order to maintain the social fabric of the community. Figure 52 illustrates the desirability of instruments.

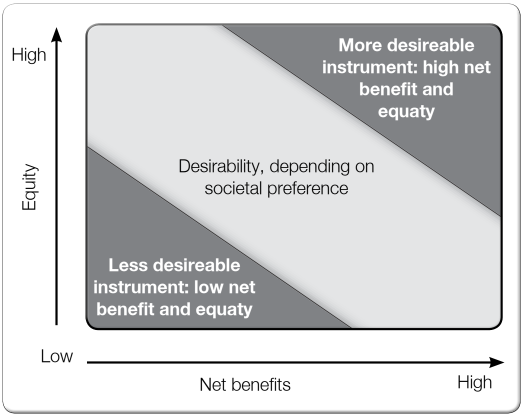


Figure 52: Equity and net benefits for different options.

14.5 Concluding remarks

Selection of a project, policy or instrument to improve resource management will need to take into account other issues aside from its effectiveness in addressing the problem. Project managers will need to consider the financial feasibility of any commercial aspects, and the net economic benefits that the project makes in the broader community. Operational issues (including those indicated in Chapter 11) and social impacts will also need to be considered.

Section V

Monitoring and evaluation of projects

Sustainable environmental management in the Pacific protects not only our food and homes, but creates opportunities for ecotourism like these lodges in Vanuatu.

Picture reproduced with the kind permission of Nigel Dowdeswell.

The project cycle provided in Chapter 1 indicated that a key stage in project management is design and implementation followed by monitoring, evaluation and adaptation. While design is a subject covered by technical specialists, and implementation is an administrative decision, economists can play an important role in the monitoring and evaluation of projects.

Monitoring and evaluation of individual components or entire projects involve two distinct but highly-related activities. Evaluation concerns the detailed assessment of the success of components or projects, undertaken prior to (ex ante evaluation), following (ex post evaluation) or sometimes during projects (such as mid-term evaluations). By comparison, monitoring of components or projects concerns an ongoing broad assessment of the progress of activities.

Monitoring and evaluation activities can be used to indicate changes in the importance of an activity to the local economy, the environment and/or the local communities. They can provide a basis for determining changes in the community or national natural resource capital – a function on which people have tended to focus from an environment conservation perspective. Additionally, they provide the opportunity for stakeholders to gauge the progress of an activity against expected or hoped for outcomes of the project; however, most importantly, monitoring and evaluation are principally conducted to inform stakeholders of the success of environment and development actions with a view to improving actions in the future. In other words, they are aimed at achieving adaptive management. Chapter 15 applies some of the key economic concepts covered so far in the book and highlights their relevance when undertaking monitoring and evaluation of projects.

Chapter 15

MONITORING AND EVALUATION

Evaluation and monitoring are intended to generate information on the progress or success of environment and development activities, and economic information can help in this process.

Project evaluations may be carried out at different stages of the project:

- Ex ante evaluation of projects, particularly in relation to assessments of operational viability, can generate information on how to improve the design of activities before they commence.
- Mid-term evaluations of projects generate information on the progress of projects achieved to date, indicating where outcomes are failing and where they are succeeding. The information can be used to redirect ongoing projects to improve the chances of their success down the track.
- Ex post evaluations generate information on how well or how poorly projects achieved their goals, providing lessons for future projects so that they can benefit from the experience of the past.

In comparison to project evaluations, monitoring reflects the ongoing assessment of specific components of projects or activities, rather than an assessment of an entire project. Monitoring of specific components of a project is intended to enable revision of the project as it progresses, enabling adaptation to changes in information and situation. In a sense, mid-term evaluations of projects offer the strongest alignment to monitoring in that they permit in-project revisions to occur. The key difference is that monitoring is focused on the assessment of only selected parameters, whereas mid-term evaluations seek a more detailed assessment of the entire project.

15.1 Cost-benefit analysis and project evaluation

Using the process outlined in Chapter 12, the framework of a cost-benefit analysis can be used to evaluate projects at any stage of the project cycle. The outputs of a cost-benefit analysis – estimates of net benefits generated, assessments of operational viability and risk etc. – can provide critical information to determine the success or failure of projects and thereby could be used to inform the identification and design of other projects.

Details of how to conduct a cost-benefit analysis of entire projects or specific components were provided in Chapter 12. The rest of this chapter will therefore focus on economic monitoring of environment and development projects.

15.2 Economic and financial monitoring

Financial and economic monitoring of environment and development projects involves the identification of specific components of a project/activity to monitor in order to assess their financial and economic performance and inform project management. Usually, for income-generating activities, financial performance (profitability) is monitored. In other cases it is the economic performance that is of relevance, particularly where the environmental costs are involved.

Financial and economic indicators can play a role in monitoring the changes at the national, local and/or project level; however, no one measure can be used for all possible types of projects. The type of financial and economic indicator relevant for a particular project depends on the nature of the project and its initial objectives. Where projects are intended to generate income for local communities, for example, financial indicators, such as the level of profits generated at the household level, or total profits generated across all households, are relevant. The distribution of opportunities and profits is also important to monitor.

On the other hand, where the net social effects of, say, an infrastructure project is under consideration, economic indicators, such as net economic benefit, is relevant. Net economic benefit estimates will reflect not only the economic benefits but also the externality costs imposed on third parties as well.

It should be noted that not all economic costs and benefits are readily measurable. It may, for example, be straightforward to identify profits in an ecotourism venture and assess its financial success. On the other hand, the value of ecotourism-associated environmental change is difficult to estimate because these changes are not 'traded' in a market place. (See Chapter 6 for examples of how to approach the estimation of these values.) In such a case proxy indicators of environmental quality may be needed, such as water quality or changes in the way people use the environment.

When setting up a financial/economic monitoring and evaluation system, a number of key issues need to be considered. These will vary from project to project. Some guiding questions for identifying economic indicators are listed in Box 35.

Box 35. Guiding questions for economic indicators to monitor projects.

- What is to be monitored? Why?
- What is the scale at which the activity is to be monitored?
    - If monitoring needs to be done at the industry level, then what is the appropriate indicator to use?
    - If monitoring is to be done at the local resource level, then what is the unit of resource to be monitored?
    - If monitoring is to be done at the project level, then what are the key indicators of relevance?
- Does the project boundary closely reflect the ecological boundary of the local habitat/ecosystem?
    - Is the project boundary part of one or more recognised administrative boundaries?
- What economic or financial information is readily available or regularly collected and can form the basis of monitoring?
    - What local level indicator can be used to monitor the project's success?
- At the industry level, does the country record gross value of the industry?
    - If not, does it report volume harvested/produced and prices of the products?
    - If so, is the local project large enough to influence the national gross value product?
- Is information regularly collected at the *qoliqoli* level/or the management unit of the resource?
    - If so, what is the gross value of product at the local management unit/*qoliqoli* level?
    - If not, can a data collection/recording system be set up for the most appropriate level of resource unit?
- If the project is not large enough to have any significant impact on the national gross domestic product, then what indicators can be used to monitor the performance of the project at the local level?
    - What key economic indicators (or their proxies) are relevant to the local situation, such as income-generated, the number of people employed, the volume of harvest, prices and the gross value of product?
    - What measure can assess equity of opportunity?
- For a community project, this may mean identifying whether everyone has equal opportunity to participate; the level of opportunity available for community members to participate; who decides on the participation in an income generating activity; and how the resource is shared among the community members.
    - What other indicators can be used to monitor the success of a project? In the case of community-based projects, such indicators could include the level of tension in the community and the level of cooperation among participants in the communal project. Was this tension/cooperation initially anticipated? If not, then why?
    - Closely monitor key indicators and, if significant changes are observed, decide how to address the changes and who needs to act.

15.3 Economic monitoring indicators

Not all economic indicators can be used for monitoring financial performance. Indicators to monitor the economic performance of a project (or the individual activities within it) may also reflect the effect of a project on:

- addressing the economic root causes of the problem, which are founded in property rights and the incentives they create for the unsustainable use of natural resources (Chapters 7 and 8) including weaknesses in rights, enforceability and rights transferability; and
- the social sustainability of the project.

Depending on the issues selected for monitoring, these items may be measured from the perspective of a village, nation or region. Generally, it is optimistic to expect to be able to collect the ideal economic indicators for an activity. Often, much information may not be recorded or available, or it may be impractical to collect. In some cases, information may be impossible to collect due to the time lags between the project start and the generation (or not) of environmental and/or social improvement.

The information collected for the assessment of financial feasibility, should be accompanied by other measures to provide a more rounded picture. Otherwise, it will provide only estimates, possibly crude ones. Assessments made on the basis of economic indicators thus need to be treated with care.

Indicators of the economic root causes of a problem

Chapter 7 described the economic root cause of environmental concerns as the existence of incentives to use resources unsustainably. Incentives for resource use arise from the physical or social attributes of resource use, or from the property rights that govern that use. If the causes of environmental concerns are property rights-driven incentives for unsustainable use, then it makes sense to monitor the key attributes of property rights discussed in Chapter 7. The attributes of property rights that are most easily monitored, and also relatively more easily acted on, are changes in enforceability and transferability.

Enforceability

Most environmental conservation project activities are likely to include a change in the social institutions affecting resource use. That is, they are likely to include the introduction of new rules. These rules may concern, for example, what waste can be thrown where, how many fish can be caught using what technology, when clearing may occur or the penalties that people must pay if they break a rule.

Accordingly, the difficulty of ensuring compliance should be monitored, which can be done by monitoring:

- the number of breaches of rules per season or year;
- if penalties are used, the value of fines raised; and
- the effort (number of people or hours) or cost required to monitor and police the system.

The higher the numbers, the greater is the weakness with enforceability and, presumably, the greater is the incentive to breach the rules. Infringements may be higher in the early days of a project when people are adjusting to new rules (when they forget or simply 'test' the system). Nevertheless, persistently high levels of breaches indicate that the incentives created under the project are weak; the penalties for breaching rules may be too low; there may be no-one to monitor behaviour (no wardens in conservation areas, for example); or the benefits of breaching the system (by selling protected fish, for example) may be high. In these cases, stakeholders (villagers or government bodies) need to consider how they can address compliance issues in a more effective (yet also cost-effective) manner. They may need to increase the level of fines or policing, for example.

In some cases, while breaches of rules are monitored, penalties or punishments are not enforced. Such a situation is indicated by a high number of breaches found but a low level of fines raised. In these cases, stakeholders need to consider their commitment to the project and why fines are not enforced.

Transferability

Some projects include the development of new markets – say, enabling new users to secure access to resources. This market may be the provision of services, such as charges to access an area. The level of transferability could be monitored via the number of transactions made (number of visits per year or season). Broadly, the lower the number of transactions, the less effective the provision of services may be; but some transactions may not occur for other reasons. Access to a site may be damaged during storms, or tour boat guides may fall sick and be unable to operate. The number of transactions for an activity thus needs to be considered in the context of broader events while making efforts to increase access to the amenity and improve transferability.

Indicators of the sustainability of an activity

Financial sustainability

Activities need to be financially sustainable to continue after projects end. Chapter 11 noted that activities are only financially sustainable where:

- they are financially feasible – that is, profits occur (revenue exceeds costs); and
- they are operationally viable.

Accordingly, the financial feasibility of commercial activities must be monitored.

Net profits

Profitability of an activity is the key financial indicator of a commercial project. Where the profit from an enterprise is positive, the activity is feasible and vice versa. Usually, most countries require commercial enterprises to lodge tax returns to the government at least once per year. Even for small enterprises where tax returns may not be required, regular financial reviews is important to keep an eye on how the business is performing. To do so, an operations manager needs to regularly calculate the costs and revenue associated with an activity. This information (or at least a summarised form) should be used to monitor the financial feasibility of commercial activities. Declines in profit need to monitored and raised with stakeholders to identify:

- why they are occurring (for example, due to lack of custom, increasing costs, staffing problems and/or difficulties with transport); and
- strategies to cope with the problems (for example, by advertising campaigns, making special offers and/or increased efficiency).

The operational viability of activities is likely to be raised at these points, and basic commercial infrastructure (access to the site, access to capable staff, inputs and so on) should also be monitored. These broad issues that explain (where possible) changes in the financial sustainability of an enterprise should be described and explained.

Gross value of product

In some cases, financial statements on an activity may not be prepared (or available). As a proxy, the gross value of output for an activity can be used as a second-best indicator. The volume of output for an activity should be observable from annual reports, enterprise managers, community groups or other relevant stakeholders. Similarly, an average price for produce should be available from either key stakeholders or basic observation.

For the aquarium trade in Fiji, Malomalo Village produced a total of 1260–2520 megatonnes of coral in seven years (M. Sovaki, Senior Environment Officer, Fiji pers comm. 2001). This coral was sold at $0.65 per kilogram. The total gross value of coral supplied per year would have ranged from about $100 000 to about $200 000.

Increases in the gross value of an activity generally suggest improvements in its financial sustainability. Nevertheless, gross value indicators should be used with caution. Because they do not reflect the costs involved in an activity, they do not indicate whether an activity is profitable or whether there is scope for improvements.

The gross value of coral used in the aquarium trade, for example, could increase due to increases in the demand for coral or due to the scarcity of the resource. The increase in demand for Fiji products could result from an overall increase in the quality demanded. Alternatively, it could result from other exporting nations being unable to compete. The increase in international demand could increase prices and thus the value of Fiji's exports. The gross value of the product may increase; but so may the costs. Thus the gross value may increase because of higher prices, even though they represent lower profits due to higher costs.

Other indicators

Where gross value information is not available, indicators of the financial health of an activity are:

- changes in the volume of goods and services produced; and
- changes in the number of people employed.

Information on the volume of output (such as harvest of a product) is a crude indicator of the health of an activity. It is not accompanied by cost information or price information, so it is only a crude measure of financial sustainability. In this case, assessments of the financial sustainability of the activity must be accompanied by other indicators before embarking upon adaptive management measures.

In some cases, government agencies may monitor activities or sectors at the aggregated level to measure the value of those activities/sectors to the economy. They take the value of an activity/sector and multiply it by a 'multiplier' value to determine the total value of the industry across the national economy. The values generated indicate the dollar contributions that the activity generates in other sectors. An ecotourism venture, for example, may create jobs locally, from which locals spend their wages locally to generate more wealth. In such cases, an increase in the value conferred in other sectors can be a crude indicator of financial health.

Where multiplier indicators exist, they can be useful for raising the profile of an activity/project for political or advocacy purposes; however, the values generated do not reflect the net contribution of a project to society. Nor do they reflect the effects of the activity on the environment (pollution generated and so on). These latter factors need to be monitored as ecological sustainability.

Household wealth

Where income generation is the goal of a community project, it is important to monitor changes in household income as a result of the project. Clearly, where income levels are rising, as intended, projects can be considered to be 'on track'. Where income levels are either not rising as predicted or are falling, project activities – particularly any income-generating activities – need to be scrutinised and refined. In practice, it can be difficult to monitor household wealth easily because surveys of wealth are time consuming to conduct, and many householders are likely to feel uncomfortable talking about their income.

A proxy in this case is the use of gross value measures of the activity (discussed above), but at the household level. As noted, increases in the gross value of an activity broadly suggest improvements in the financial sustainability of an activity; however, because they do not reflect the costs involved in an activity, they do not indicate whether a family is better or worse off. This could be ultimately revealed only by surveys of household income or, more crudely, by the level of participation in a project. Accordingly, participation in a project (the number of people directly involved in the project, attending meetings, sharing information and so on) might be monitored. If these numbers are falling, project managers need to hold consultations with stakeholders to determine the lack of project support and work to improve that.

Economic sustainability

Ideally, economists would use economic rent as the ultimate indicator of the economic status of a natural resource. Economic rent reflects the market value of a resource generated from the consumption of goods and services. It captures the value of any producer surplus and consumer surplus associated with resource use as well as the ecological sustainability of the resource, thus capturing the effects of both the stock changes and changes in market supply and demand conditions.

In practice, economic rent is unlikely to be straightforward to estimate in Pacific island community-based environment projects. The generation of values relies on detailed cost and price information, together with information on the physical status of resources. This information is not always available. Accordingly, even highly-resourced government agencies in developed countries are challenged to estimate the rent associated with their natural resources. The Government of Australia, for example, has only attempted to estimate the economic rent associated with its fisheries resources in the last 10 to 15 years.

In some cases, non-market valuation methods may be used to estimate rent levels; however, such estimation methods are time consuming and resource intensive. Pacific island nations are likely to find that it is more practical to use crude proxy values for economic rent. One proxy is a royalty or access charge – that is, the income that resource owners can obtain in payment for access to their resource. In Fiji, goodwill payments are made to *qoliqoli* owners in exchange for access to fisheries resources (Lal 1990). Annualised goodwill payments plus the annual rental values could be used as a proxy for the level of resource rent expected from that activity. Nevertheless, such payments do not always reflect the true economic rent in an industry, unless there is perfect information about profitability of the activity and users' willingness to pay – there are many players and there is competition between them. Nonetheless, the presence of goodwill payment would suggest that there are resource rents in the industry, and the activity is economically sustainable. Clearly, where goodwill payments are on the decline, project managers can take this information as a warning of the need to reassess management and project effectiveness.

Another proxy is the price of a good harvested from the environment and/or service. An increase in price of the good or service may reflect an increase in the quality of natural resources in the environment – say, an increase in the quality of fish or forest products provided by the environment as a result of the project. On the other hand, an increase in price of a good may also be due to an increase in scarcity or a shift on the supply and demand of the good. Recall from Chapter 3 that a shift in demand may be due to changes in consumer preferences, whereas a shift in supply arise because of a decline in the natural stock, causing an increase in the market price. Price information should thus be interpreted with care because changes may be due to a change in quality, quantity, demand and/or supply.

Where goods are exported, price may be a poor indicator because export prices are a function of international demand and supply. Fiji is one of the many international suppliers on the international coral market, for example. In economic jargon, Fiji is said to be a 'price taker', which means it is a producer whose output is not large enough to affect the market price. The export price that Fiji receives for its local coral, therefore, is not a good indicator of the status of the local resources or activity for the following reasons:

- Export prices are determined by changes in the international demand and supply.
- Prices may vary as a result of temporary changes (due to climatic factors or weather perhaps) affecting short-term supply.

Commercial profitability cannot be used in isolation to infer the ecological health of a resource because the profitability of some resource uses may increase when a resource in being degraded – for example, where high prices for rare timber increase the profitability of logging and thereby results in the decimation of forests. Accordingly, the gross value of products as an economic indicator of success for a development or environmental project has limitations. Likewise, the volume of activity/output as an economic indicator of success of such activities is limited.

Data for monitoring of an activity can be obtained from many different sources, depending on the activity. Information on the commercial profitability and gross value of sectors may be obtained from trade statistics (which are recorded routinely by government departments that deal with exports and imports). At times, trade figures may be available by product (see Table 3 in Lovell and Timuri 1999, p. 40).

Similarly, production information can be obtained for commercial and subsistence fish harvests, and for diving operations associated with coral reefs. For such information to be used to monitor changes in the value of local resources, it needs to be disaggregated down to the local level. In the case of the coral trade, ideally such information would need to be disaggregated to the *qoliqoli* or village level.

Economic indicators for monitoring the status of a resource are limited in the information that they can provide. For environmental purposes, the volume of harvests or waste generated is likely to be a better measure of the changes in resource sustainability. Volume can be a useful measure, particularly if scientific information is already available to provide the benchmark (the safe minimum harvest, for example) against which the industry performance can be monitored.

In the case of fisheries, catch per unit effort may be a useful indicator of sustainability. Declines in fish stock make it harder to catch fish, resulting in decreases in the catch per unit effort (such as fish caught per day) and, subsequently, increases in fishing costs. Indicators of declining stocks can thus include catch per unit effort and the supply costs for fish. These indicators are useful for revealing the status of the resource, assuming that there have been no major shifts in the type of technology used in the industry.

Social sustainability

Projects often have different impacts on different strata of a community. The different impacts are usually a concern to project managers, the government and the donors. Such variation is also an issue when a resource is communally owned and different members of the community have different levels of influence over the resource use. Accordingly, stakeholders are likely to be interested in the social impact of an activity from an economic perspective. Governments and locals may wish to know, for example, the effects of one activity on other people (externalities), or the distribution of economic benefits of a project.

The social impact of an activity is also important from an economic perspective, because it affects the popularity of a project and the rule institutions that it creates. Where social impacts are benign or positive, people are more likely to comply with new arrangements that address environmental quality. Conversely, activities that harm the social fabric of an area perhaps generating resentment (because one group gains or loses more than another or dissatisfaction because the new rules cause poverty) are likely to result in compliance problems. Non-compliance usually either increases the costs of the project, thereby reducing net social benefits, or results in project failure. Measures of the social impact of a project often thus come down to the issue of equity.

Equity

Environment and development projects involve changing resource use practices that people previously adopted for being the easiest, cheapest or most profitable. Accordingly, project activities that change these practices are likely to result in increases in effort, costs or losses in profits to some stakeholders. Accordingly, an activity's net benefits to householders should be measured, although such measurement is likely to be difficult in practice. For this reason, where breaches of compliance occur, they should be monitored to identify which stakeholders most commonly break rules and thus identify which groups are most affected by an activity. Alternatively, the level of participation in a project should be monitored. From this information, project managers can work with stakeholders to identify why a particular level occurs, especially when there is a decline in participation.

Where income-generating activities occur, profits may be distributed differently to different stakeholder groups within a community. Where profits are unevenly distributed, groups who perceive that they receive lower returns may become disenfranchised and may cease to participate in a project and/or fall into dispute with other stakeholders (as occurred in the Utwe–Walung Conservation Area Project discussed in earlier chapters). Alternatively, the distribution of profits from an activity may be even, but people may become dissatisfied if they put in more effort than others to make a venture work. (For a discussion of free riding, see Chapter 6.) Accordingly, the distribution of family labour input or distribution of profits could be useful proxy social economic indicators. This distribution is most easily monitored through village meetings or where profits are managed through a trust.

15.4 Concluding remarks

Economic evaluation involves assessing the effectiveness of key activities or entire projects in relation to their objectives. Evaluation can be conducted using principles of identifying, assessing and comparing costs and benefits as outlined in Chapter 12. Evaluations can be conducted ex ante, mid-term or ex post. All the information can be used to inform and improve on project delivery by either informing project design in advance or providing lessons for improving project delivery now or in the future.

Project monitoring also contributes to project management by providing indications of how well projects are performing against key parameters. From an economic perspective, monitoring involves observing changes in (1) the incentives for resource use (property rights); (2) the financial, economic and ecological sustainability of activities; and (3) the social impact of activities. In all issues, as minimum information about net values is important to collect. Where this information does not exist, proxy values for the first two issues (such as gross value of product) can be used with caution.

Economic indicators of the ecological sustainability of resources are difficult to collect with confidence, although a number of readily available proxies exist (price, royalties, goodwill, etc.), so long as they are treated with caution. Financial indicators are usually more readily available. As a minimum, price and quantity information can be used.

Rather than relying on economic indicators to monitor the status of the natural capital, project managers can also monitor changes in biological or ecological parameters (as a proxy: flora and fauna composition, abundance of fish and non-fish species harvested etc). Economic monitoring needs to be supplemented by regular scientific monitoring in cases where the local resource use is significantly large to warrant such a study. Economic indicators of the social sustainability of a project are limited to equity, as measured by income distribution and wealth. Box 36 summarises economic indicators to consider.

Box 36. Potential economic indicators for resource and environment projects.

Strength of property rights

- Compliance
- Number of breaches of rules
- Value of fines raised
- Effort (number of people or hours) or cost needed to monitor/police the system

Commercial activities

- Number of transactions made in new markets
- Annual costs, revenue, profit, loss, an explanation of changes in profit
- Gross value of output
- Volume of goods and services produced
- Number of people employed
- Multiplier information (to be treated with caution)
- Economic sustainability
- Net economic benefits, including royalties, goodwill
- Proxy measures (with caution)
- Commercial profitability of sectors
- Gross value of product
- Volume of activity or output
- Catch per unit effort

Social issues

- Level of equitable distribution of profits
- Level of participation
- Degree of tension and/or level of conflict
- Breaches in compliance

Chapter 16

ECONOMICS AND PROJECT MANAGEMENT:

SOME FINAL REMARKS

Sustainable development, as defined by the World Commission on Environment and Development (1987), is an appropriate philosophy to guide the use of and manage resources in a way that accommodates future and current uses while maintaining or enhancing human well being. Sustainable development is about the marrying of ecological, social and economic considerations in the management of natural resource use. Sometimes, this involves finding a solution that meets all three objectives or finding a compromised solution that requires making trade offs between the three objectives. Such solutions can be sustainable as long as they do not undermine the core principles of economic viability, ecological integrity and social harmony.

This book provides an economics framework of consumption, production, environment and institution, CPEI, to understand the complex relationship between what people want, desire and need, the factors that influence their decisions and actions and the outcomes of their actions and decisions. Using this CPEI in a context of a project cycle, the book illustrates the key economic issues that need to be considered, before designing economic development or environmental management projects. These include the following:

- The relevance of property rights – as determined by the physical and institutional attributes of goods and services – and other institutions in influencing whether people have the incentive to use a resource efficiently and sustainably on their own and whether they still have that incentive when others also use that resource.
- The presence of market and non-market values, and the incentives that resource users (consumers, producers, local leaders and even governments) face in using and/or managing resources.

The book highlights how such understanding can be used to address the underlying drivers and root causes of observed resource and environmental problems, and provides many Pacific examples of the types of economic considerations that are needed in – and how to use them for – the successful design, execution or assessment of environmental projects. The book identifies a range of resource management options, including economic instruments, moral suasion, to address resource and environmental degradation and illustrates how these options are (and can be used) in the Pacific to redress resource and environmental problems.

Merely identifying potential ways to manage the problem is not enough. Financial and economic assessments are also needed, if projects are to be sustained. This book demonstrates the difference between financial and economic analysis and shows that price and costs data are essential to assess the financial feasibility of commercial solutions. Financial feasibility alone cannot assure success of a project, without also explicitly considering major operational issues. Likewise, where activities are major, economic analysis – cost-benefit analysis – is important to identify in advance the economic pay off from alternative options, from a social perspective. In the Pacific, the use of economic and financial analysis to inform solutions for environmental problems is still a relatively new concept although it is of increasing interest. Holland (2006, 2008) observed a number of economic analyses recently emerging from the Pacific to inform sustainable natural resource-use policy. Nevertheless, the use of economic tools to assess environmental projects is still not widespread and is a long way from being standard practice in the Pacific.

Finally, economic considerations can be used to assess the performance of resource and environmental projects and to improve and inform their future management. Ex post assessment of a resource and environmental projects – cost-benefit analysis of the type used to assess the economic feasibility of projects – is a standard approach. Where information is limited, cost-benefit analysis can still be used to provide ball-park estimates using simplified analysis. On the other hand where quantitative data in unavailable, cost-benefit analysis can be used as a way to systematically consider all the inputs and outputs and costs and benefits associated with projects, before making informed decisions.

Economics also has a role to play in any ongoing monitoring of a project. Many different types of economic indicators are highlighted that can be used to support project management. This book illustrates that for monitoring of environmental projects, the economic indicators must be linked as closely as possible to the root causes (property rights) of environmental problems that projects seek to combat. They should reflect assessments of the financial and/or economic sustainability of solutions, particularly for economic development projects. Such information can be used by project managers to refine project execution in light of changing conditions and performance, closing the project cycle road map.

Because past Pacific-based resource and environmental projects have tended to be developed in the absence of economic consideration, the chances of their success, let alone sustainable development, have been reduced. Accordingly, this book is intended to focus on just the economic considerations needed to improve the chances of success in the Pacific. In many instances, economic assessment of resource and environmental projects can only be conducted on the back of solid scientific and technical knowledge, and social understanding.

"There can be no peace without equitable development and there can be no development without sustainable management of the environment in a democratic and peaceful space".

(Professor Wangari Maathai, 2004 Nobel Prize Winner)

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