ST/ESCAP/2273

Economic and Social Commission for
Asia and the Pacific

INTEGRATING ECONOMIC AND ENVIRONMENTAL POLICIES: THE CASE OF PACIFIC ISLAND COUNTRIES

UNITED NATIONS

DEVELOPMENT PAPERS
NO. 25

ESCAP WORKS TOWARDS REDUCING POVERTY AND MANAGING GLOBALIZATION

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New York, 2004

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UNITED NATIONS PUBLICATION

Sales No. E.03.II.F.55

ISBN: 92-1-120329-5 ISSN: 0255-9250

PREFACE

The present volume of the *Development Papers* series addresses the subject of the integration of environmental issues into mainstream development policies in the Pacific island countries.

The remarkable economic growth seen in the developing countries in the Asia-Pacific region in the past decades has masked the ecological and social costs associated with it. Countries have increasingly recognized that integration of economic and environmental considerations is an imminent challenge in formulating effective sustainable development policies. In this regard, the challenges facing countries are common – for instance, policy options to adopt environmental concerns in development policies, institutional arrangements to support such policy formulation, and timely and comprehensive information to support appropriate policy decisions. For Pacific island countries, the unique and fragile environment requires an even more delicate balance between environmental and economic policies owning to the effects of climate change, land degradation and deforestation. In the spirit of the United Nations Millennium Declaration, this volume addresses these challenges for the Pacific island countries and provides important insights into government planning not only for Pacific island countries but also for other developing countries.

The present volume has been prepared by Dr. John Asafu-Adjaye, who was involved in the various activities associated with ESCAP's initiative to promote the integration of environmental concerns into economic policy-making. He is currently a senior lecturer in economics at the University of Queensland, Brisbane, Australia.

Raj Kumar
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ABBREVIATIONS

ADB	Asian Development Bank
AusAID	Australian Agency for International Development
BT	Benefit Transfer
CAC	Command-and-Control mechanism
CBA	Cost-Benefit Analysis
CEA	Cost Effectiveness Analysis
CFC	Chlorofluorocarbon
CGE	Computable General Equilibrium
CM	Choice Modelling
CMT	Customary Marine Tenure
CSD	Commission on Sustainable Development
CSIRO	Council for Scientific and Industrial Research Organisation
CVM	Contingent Valuation Method
DCF	Discounted cash flows
ECBA	Environmental Cost-Benefit Analysis
EDP	Environmentally Adjusted net Domestic Product
ENI	Environmentally Adjusted National Income
ENSO	El Nino Southern Oscillation
ESCAP	Economic and Social Commission for Asia and the Pacific
ESD	Environmentally Sustainable Development
EU	European Union
FFA	Forum Fisheries Agency
FSM	Federated States of Micronesia
GDP	Gross Domestic Product
GIS	Geographic Information System
GNP	Gross National Product
GPI	Genuine Progress Indicator
GS	Genuine (or Extended) Saving
GSP	Gross State Product
HDI	Human Development Index
HPM	Hedonic Pricing Method
IIT	Information Integration Theory
IPCC	Intergovernmental Panel on Climate Change
ISEW	Index of Sustainable Economic Welfare
ISO	International Organization for Standardization
ITQ	Individual Transferable Quota
IUCN	International Union for the Conservation of Nature

MBI	Market-Based Instrument
MCA	Multicriteria Analysis
MCP	Marginal Private Cost
MEC	Marginal External Cost
MSC	Marginal Social Cost
NDP	Net Domestic Product
NFCAP	National Forestry and Conservation Action Programme
NGO	Non-Government Organization
NOAA	National Oceanic and Atmospheric Administration
NPP	Net Primary Productivity
NPV	Net Present Value
ODA	Overseas Development Assistance
PACE-SD	Pacific Centre for Environment and Sustainable Development
PIC	Pacific Island country
PNG	Papua New Guinea
RP	Revealed Preference
SD	Sustainable Development
SEEA	System of Environmental and Economic Accounts
SEM	Strategic Environmental Management
SIDS	Small Island Developing States
SNA	System of National Accounts
SOPAC	South Pacific Applied Geoscience Commission
SP	Stated (or Expressed) Preference
SPC	Secretariat for the Pacific Community
SPREP	South Pacific Environmental Programme
TCM	Travel Cost Method
TEV	Total economic value
UNDP	United Nations Development Programme
UNSO	United Nations Statistical Office
USP	University of the South Pacific
VANRIS	Vanuatu Resource Information System
WCED	World Commission on Environment and Development
WEHAB	Water and sanitation, energy, health, agriculture, and biodiversity protection and ecosystem management
WSSD	World Summit on Sustainable Development
WTA	Willingness to accept compensation
WTP	Willingness to pay

INTEGRATING ECONOMIC AND ENVIRONMENTAL POLICIES: THE CASE OF PACIFIC ISLAND COUNTRIES

by John Asafu-Adjaye*

I. INTRODUCTION

A. Introduction

This study explores ways in which environmental considerations can be integrated into economic decisions in order to facilitate planning for sustainable development (SD), with particular emphasis on Pacific Island Countries (PICs).[1] Ever since the 'Earth Summit' was held in June 1992 in Rio de Janeiro, Brazil, sustainable development has been embraced worldwide as a desirable development goal. At the Earth Summit, world leaders adopted Agenda 21, an agreement consisting of various action programmes covering nearly every aspect of all human activities that impact on the natural environment. Chapter 8 of Agenda 21 deals with integrating environment and development in decision making. Section 8.5, 'Improving planning and management system', states,

"Countries will develop their own priorities in accordance with their national plans, policies and programmes for the following activities:

(a) Improving the use of data and information at all stages in planning and management making systematic and simultaneous use of social, economic, developmental, ecological and environmental data; analysis should stress interactions and synergisms; a broad range of analytical methods should be encouraged so as to provide various points of view; and

(b) Adopting comprehensive analytical procedures for prior and simultaneous assessment of the impacts of decisions, including impacts within and among the economic, social and environmental spheres. These procedures should extend beyond the project level to policies and programmes; analysis should also include assessment of costs, benefits and risks".

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[1] The term "Pacific Island Countries" as used in this study refers to the developing countries and territories in the Pacific Islands region and excludes the two OECD countries, Australia and New Zealand.

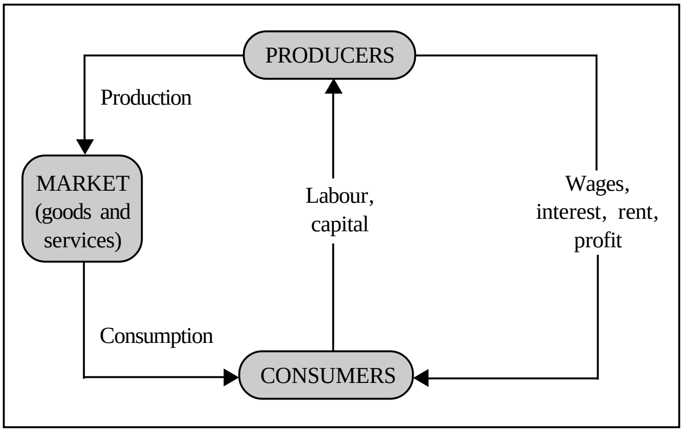
Since countries in different parts of the world have different social, economic cultural and environmental circumstances, recommendations made for one region may not be appropriate for another. Pacific Island countries belong to the group of countries referred to as Small Island Developing States (SIDS). This is a group of 43 developing countries/states in the Pacific, Caribbean, Atlantic, Indian Ocean, Mediterranean and African island nations who attended the Global Conference on the Sustainable Development of Small Island Developing States in Barbados in 1994 and were signatories to the Barbados Action Plan. This study focuses on PICs in the ESCAP region which have unique characteristics and face a different set of environmental and socioeconomic challenges.

As a background for the discussion that follows later, the next section briefly describes the links between the environment and the economy. This is followed by an overview of PICs and the unique socioeconomic and environmental problems that they face. The chapter concludes with an introduction to the remaining chapters in this volume.

B. The relationship between the environment and the economy

Traditional economic models have depicted the economic system as comprising producers, consumers and markets. In this system, firms purchase inputs from input markets and intermediate goods from product markets, which are then used to produce goods in the product markets (Figure I.1). Consumers purchase final goods from the product markets and sell their labour in the factor and product markets in return for wages.

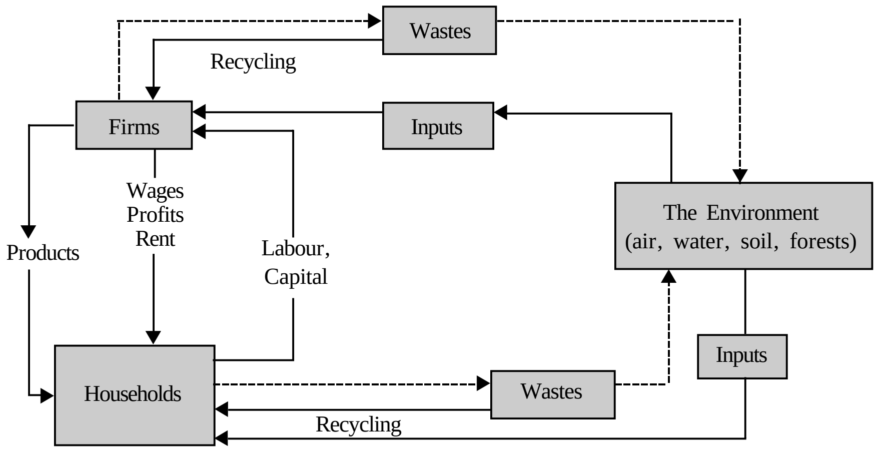
Figure I.1. A Traditional Economic System



The environment is largely ignored here as environmental inputs such as air and water are regarded as 'free' goods. The recent concerns about the environment have caused a change in thinking about the economic system. An alternative view is that described in Figure I.2 where the economic system interacts with a distinct environmental system. Firms use raw materials such as minerals, agricultural products, timber, fuels, water and oxygen that are extracted from the environment. These goods are sold in the market as either consumer goods or as intermediate goods for the production process. Nearly all the material inputs to the production and consumption processes are returned to the environment as waste. The waste products are mainly in the form of gases (e.g., carbon monoxide, carbon dioxide, nitrogen dioxide, sulphur dioxide), dry solids (e.g., rubbish and scrap), or wet solids (e.g., wastewater). Both solid and liquid waste products from the household and production sectors may go through a further processing stage before being returned to the environment as waste.

Unless recycled, all materials eventually return to the environment. This process whereby all waste and energy are returned to the environment is a consequence of the First Law of Thermodynamics which states that matter and energy cannot be created or destroyed. Processing can only change the form and ultimate destination of the residual flows. However, in the final analysis, the total amount of materials returned to the environment remains unchanged. At present, we can recycle materials but not energy. Therefore, it follows that achieving 100 per cent recycling is not possible. This is because economic activity has high 'entropy'. That is, it uses materials and energy that are converted into diffuse components that are difficult and expensive to recycle.

Figure I.2. An Economy-Environment System



The above approach to viewing economy-environment interactions is based on the principle of ‘materials balance’. The environment in the above system can be seen as playing four important roles:

- As a provider of raw materials inputs to producers and consumers;
- As a receptacle for the waste products of producers and consumers;
- As a provider of amenities to consumers (e.g., recreation); and
- As a basic life support system (e.g., climate and ecosystem regulation).

Two important points are worth noting about the economy-environment system shown above. First, there is a strong interrelationship between the four types of support provided by the environment. For example, there is a limit to the extent of the environment’s capacity to assimilate waste. Pollution and environmental degradation begin to occur when this assimilative capacity is exceeded. Second, once this limit is exceeded, the ability of the environment to provide other services (e.g., provide inputs) is compromised.

Three policy implications flow from the foregoing discussion. First, it is clear that continuous extraction of resources with fixed supply is not sustainable. This suggests a switch from non-renewable to renewable resources. In Chapter II, we describe conditions in which resource use can be sustained. Second, resource use can be maximized by increasing the level of recycling provided that the recycling cost is not prohibitively high. Third, effort must be made to ensure that waste products emitted from different economic activities are within the carrying capacities of the various receiving environments.

C. Overview of Pacific Island countries

The countries in the Pacific islands region are diverse with regard to land area, population, resource endowment and economic attainment. The largest country in the region in terms of population and land area is Papua New Guinea (PNG) with a population of over four million and a land area of 461,690 sq km (Table I.1).

At the other extreme, Tuvalu is a small atoll country with a population of 10,900 and a land area of just 26 sq km. In terms of resource endowments, land type and population size, the PICs can be classified into three main groups: the relatively large countries of Melanesia; the middle level countries of Polynesia; and the small predominantly atoll states. The Melanesian countries consist of PNG, Fiji, Solomon Islands, New Caledonia, and Vanuatu. These countries are among the richest in terms of resource endowments with over 90 per cent of the land and about 85 per cent of the total population. The majority (more than 80 per cent) of the population in these countries lives in the rural areas and is engaged in agriculture for their livelihood. The middle level countries are Tonga and Samoa with populations of 97,800 and 170,700, respectively. These countries have modest land resources and are agricultural-based. The small atoll states include Cook Islands, Kiribati, Tuvalu, Federated States of Micronesia (FSM), Marshall Islands, Niue, and Tokelau. Although small in size, some of these countries are scattered over vast expanses of ocean. For example, Kiribati covers and area roughly equivalent to main land of the United States of America.

Table I.1. A List of Pacific Island Countries and Territories

Country/Territory	*Political status*	*Land area (sq km)*	*Population (mid-1997 estimate)*	*Geographic Type*
American Samoa	US Territory	240	61,100	High islands and atolls
Cook Islands	Independent, New Zealand-affiliated	180	19,000	High islands and atolls
Federated States of Micronesia	Independent, US-affiliated	702	111,800	High islands and atolls
Fiji	Independent	18,376	779,200	High islands and a few minor atolls
French Polynesia	French Territory	3,521	222,300	High islands and atolls
Guam	US Territory	549	145,400	High islands
Kiribati	Independent	726	83,400	Predominantly atolls
Marshall Islands	Independent, US-affiliated	720	60,000	Atolls
Nauru	Independent	21	11,200	Raised coral island
Niue	Independent, New Zealand-affiliated	258	2,100	Raised coral island
Palau	Independent, US-affiliated	475	18,100	High islands and atolls
Papua New Guinea	Independent	461,690	4,311,500	High islands and a few minor atolls
Solomon Islands	Independent	29,785	401,100	High islands and a few minor atolls
Tokelau	New Zealand Territory	12	1,500	Atolls
Tonga	Independent kingdom	696	97,800	High islands
Tuvalu	Independent	26	10,900	Atolls
Vanuatu	Independent	12,189	177,200	High islands and a few atolls
Samoa	Independent	2,934	170,700	High islands

Source: McGregor (1998).

Economic and social development among the PICs has been uneven. The richest country in the region in terms of resource endowments is PNG. However, PNG's development performance in relation to her resource endowments has been disappointing. The PNG economy declined by 2.8 per cent in 1998 as a result of the drought combined with the Asian financial crisis of 1997 (Table I.2). Asian countries are among PNG's largest trading partners and therefore the crisis affected PNG's exports. The economy rebounded in 1999 as a result of increased petroleum exports. However, declines of 0.8 per cent and 3.3 per cent were recorded in 2000 and 2001, respectively. Fiji, the next largest economy fared better between 1998 and 1999. Sugar is the main export economy, although in recent years sugar's contribution to gross domestic product (GDP) and exports is on the decline, having now been overtaken by tourism and textiles. The attempted coup of 2000 caused a dramatic drop in tourist arrivals, resulting in a slump in a real GDP growth of –2.8 per cent. Economic growth has been patchy since then due to low investor confidence. Timber is the major export in the Solomon Islands, followed by tuna and agricultural commodities. Within the last five years the Solomon Islands economy has been decimated by the on-going civil unrest. For example, in 2000 and 2001 the economy declined by 14.5 and 7.0 per cent in real terms, respectively.

In comparison to the large Melanesian countries, the economies of the middle level countries of Polynesia have been more stable. Despite having population sizes of only a few hundred thousands and fewer natural resources, Samoa and Tonga have established themselves as successful trading nations. Following the cyclones of the early 1990s and the destruction of the taro industry by taro blight in 1994, the Samoan economy has rebounded with real GDP growth of 7.3 per cent and 6.5 per cent in 2000 and 2001, respectively.

Much of this growth can be attributed to increase in exports of coconut products and tourism. Tonga has enjoyed strong agricultural export-led growth in the last few years. Squash is the major agricultural crop that is exported to Japan. The Tongan economy grew at rates of 6.1 and 3.0 per cent, respectively in 2000 and 2001. In Tonga and Samoa, as well as in other Polynesian countries, remittances from nationals residing overseas are a major source of income, which helps to stabilize the current account.

Most of the small atoll states such as Kiribati and the Marshall Islands have limited land resources. Copra is the main export in these countries but this has been declining in recent years. An exception to this is the Cook Islands where tourism and papaya are strong export industries. The Cook Island economy grew at a rate of 3.2 per cent in 2000 and 2001. Tuvalu also experienced strong growth in 2000 and 2001 with real GDP growth of 3.0 per
.

Table I.2. Selected Pacific Island Economies: Real GDP Growth Rates, 1998-2001

	1998	*1999*	*2000*	*2001*
Cook Islands	–2.3	2.7	3.2	3.2
Fiji	1.4	9.7	–2.8	1.5
Kiribati	7.3	–1.0	–1.6	n.a.
PNG	–2.8	7.6	–0.8	–3.3
Samoa	2.6	3.1	7.3	6.5
Solomon Islands	1.3	–1.4	–14.5	–7.0
Tonga	2.5	5.0	6.1	3.0
Tuvalu	14.9	3.0	3.0	5.0
Vanuatu	2.2	–2.5	4.0	2.0

Source: United Nations (2003), Table II.8, p. 72.

cent and 5.0 per cent, respectively. Most of these countries run huge current account deficits with some of the short fall being made up from remittances, licenses fees for fishing access and overseas development assistance (ODA).

Table I.3 presents socioeconomic indicators for selected PICs. Life expectancy at birth in the region ranges from a low of 57.0 years for PNG to 70.4 years for the Cook Islands. The second column shows figures for gross primary school enrolment ratios in percentages. They range from 114 for Vanuatu to 30 for the Solomon Islands. The third column of Table I.3 presents figures for per capita Gross National Product (GNP). These range from US$ 700 for PNG to US$ 4,355 for the Cook Islands. The last two columns show the Human Development Index (HDI) and HDI rank for the first five countries listed. Of the five PICs included in UNDP's HDI, Samoa has the highest rank of 70, followed by Fiji with a rank of 81, with PNG having the lowest rank of 132.[2] The small atoll states are not included in the human development index. However, in terms of socioeconomic indicators such as primary school enrolment ratio and per capita GNP, countries/territories such as Cook Islands, FSM, Tonga, and Tuvalu outperform the western Melanesian countries of PNG, the Solomon Islands and Vanuatu.

[2] The HDI measures a country's achievements in three aspects of human development: longevity, knowledge, and a decent standard of living. Longevity is measured by life expectancy at birth; knowledge is measured by a combination of the adult literacy rate and the combined gross primary, secondary, and tertiary enrolment ratio; and standard of living is measured by GDP per capita (PPP US$).

Table I.3. Socioeconomic Indicators for Selected PICs

Country/Territory	*Life expectancy at birth (years) 2001*[a]	*Gross primary school enrolment ratio (%)*[a]	*Gross national product (US$) 2000*[a]	*Human development index (HDI)*[b]	*HDI rank*[b]
Samoa	70	102	1,450	0.775	70
Fiji	69	112	1,820	0.754	81
Solomon Islands	69	39	620	0.632	123
Vanuatu	66	114	1,150	0.568	128
Papua New Guinea	56	85	700	0.548	132
Cook Islands	70	100	4,355	n.a.	n.a.
Kiribati	62	77	950	n.a.	n.a.
Marshall Islands	65	79	1,970	n.a.	n.a.
Federated States of Micronesia	66	83	2,110	n.a.	n.a.
Nauru	63	96	n.a.	n.a.	n.a.
Tonga	70	91	1,660	n.a.	n.a.
Tuvalu	66	88	1,296	n.a.	n.a.

Notes: [a] Average of male and female life expectancy taken from ADB (2003).

[b] Average of male and female gross primary school enrolment ratio taken from UNDP (2003).

D. Environmental issues in PICs

Environmental problems in PICs may be classified into two categories: externally induced and internally induced problems. The major externally induced problem is sea level rise, which is caused by climate change. The countries most at risk are the small atoll states, which are generally only a few metres above sea level. For example, the highest point in the whole of the Marshall Islands is 10 m above sea level, while the islands of Tokelau are all below 5 metres (Douglas, 1993). An Intergovernmental Panel on Climate Change (IPCC) report estimates a central value for sea level rise by the year 2100 of about 46 centimetres (IPCC, 1996). The worst-case scenarios include disappearance of small island states such as Tokelau, the Marshall Islands, Tuvalu, and Kiribati. Severe impacts resulting in major population displacement will be felt by FSM, Palau, Nauru, French Polynesia, the Cook Islands, Niue and Tonga. The sea level rise will also affect agricultural activity, pushing it inland from coastal areas onto less suitable soils, thus increasing soil erosion. Other effects of climate change include increased frequency of tropical cyclones in areas not normally affected by them (Pernetta, 1992).

The major internally induced environmental problem in the PICs is land degradation. In broad terms, land degradation[3] associated with agricultural intensification, inappropriate farming practices, deforestation and other land uses contributes to environmental problems such as biodiversity loss, fresh water quality and availability, and to a limited extent, climate change. In Fiji, for example, the main form of land degradation is soil degradation, which occurs from widespread and indiscriminate burning, particularly, but not exclusively in the sugar cane growing areas. Other causes of soil degradation include overgrazing and farming on steep slopes, and cultivation of marginal sugar lands. A recent review of a variety of catchments in both the wet and dry zones estimated soil loss to be 24-79 tons per hectare per annum, which is equivalent to a topsoil loss of 1.6-5.3 millimetres per annum (IUCN, 1992). Other forms of land degradation include excessive pesticide and fertilizer use in taro and vegetable farming. It is conservatively estimated that the cost of land degradation in Fiji, in terms of lost sugar production and increased fertilizer input, is about 16 million Fiji dollars per annum (Nisha, 1994:15).

Deforestation in the PICs is another issue of major concern. With some 80 per cent of the PIC population living in the rural areas their forest resources supply most of their basic needs including food, medicinal, building and household products. The forests also provide non-use values such as recreation, watershed regulation, biodiversity values, and supply of agroforestry products. Logging in PNG and the Solomon Islands, which have the bulk of tropical hardwood resources as well as biodiversity resources, is proceeding at unsustainable rates. In the case of the Solomon Islands, the overexploitation of forestry resources has been fueled by a desire to find means of paying public debts.

Pacific Island countries have vast marine resources. While exploitation of some offshore fisheries such as tuna is currently within maximum sustainable yields, subsistence fisheries such as reef and inshore pelagic fish are coming under pressure. In some of the heavily populated atolls such as Kiribati, Tuvalu and Marshall Islands, over exploitation and pollution of lagoons has become a serious environmental problem. Pollution from mining has been a problem in PNG and Fiji, to some extent. Minerals and petroleum in PNG generate over three-quarters of export income and are the main source of revenue for the government. However, the environmental costs of mining in PNG have been high. For example, discharge of mine tailings by the Ok Tedi gold/copper mine in PNG into the Ok Tedi River has had adverse impacts on people on the floodplain downstream. A similar situation has occurred in Fiji where, until recently, gold was the third largest foreign exchange earner.

[3] Land degradation consists of soil, biological, physical and chemical degradation.

Even though, as indicated earlier, the majority of the region's population lives in the rural areas, the rate of urbanization is increasing in the larger countries and in some of the smaller atoll states. The latest statistics indicate high urban population growth rates of 8.2 per cent, 7.3 per cent and 6.2 per cent for the Marshall Islands, Vanuatu, and Solomon Islands, respectively (Table I.4). At this rate of urbanization, it is estimated that the urban population will double in about nine years in the Marshall Islands and in 10 years in Vanuatu.

Table I.4. Urban Population Growth Rates in Selected PICs

Country/Territory	*Annual urban population growth (%)*	*Urban population doubling time (years)*
Fiji	2.6	28
Papua New Guinea	4.1	27
Solomon Islands	6.2	14
Vanuatu	7.3	10
Federated States of Micronesia	1.3	55
Kiribati	2.2	33
Marshall Islands	8.2	9
Palau	3.2	23
Cook Islands	0.5	144
Samoa	1.2	60
Tonga	0.7	103
Tuvalu	4.8	15

Source: SPC (1998).

The rapid population growth in the urban centres is generating a host of environmental problems including loss of coastal resources, air and water pollution, noise pollution, solid waste disposal, littering, and land degradation. Chapter V presents a case study of littering and air pollution in Suva where it is shown that the current policies to deal with pollution are not effective.

In addition to the above list of environmental problems, many of the PICs are vulnerable to physical and biological disasters. The most serious physical disasters include cyclones, floods and drought, which are expected to intensify with climate change. Cyclones are the most prominent and widespread natural disaster in the region. In recent years, vulnerability to cyclones has been exacerbated by factors such as unsustainable agricultural and logging practices, and increase in human settlements along the coasts. The Melanesian region forms part of the "Pacific Rim of Fire" which stretches north to the Philippines. Consequently, that region is susceptible to volcanic eruptions, earthquakes, landslides, and *tsunami*. Recent examples include the devastating volcanic eruptions in East New Britain and the *tsunami* in East Sepik, both in PNG. Another type of natural disaster prevalent in the region is drought. Available evidence indicates a correlation between the El Nino Southern Oscillation (ENSO) and severe drought in the region. For example, drought episodes in 1987, 1992 and 1997 were ENSO induced. These natural disasters have had an immense impact on embattled economies in the region. For example, the growth rate of –2.8 per cent in PNG in 1998 was mostly a result of the "50 year" drought which had a devastating effect on agriculture in the highlands.

Pacific Island agriculture has also, at various times, experienced episodes of biological disasters. Examples include the taro leaf blight that wiped out Samoa's major staple and export earner, coffee rust in the highlands of PNG, and the incursion of the melon fly into the Solomon Islands. It has been suggested that there is a link between physical and biological disasters. For example, a cyclone could upset the ecological balance in a region, making crops vulnerable to pests and diseases. It is believed that the taro leaf blight in Samoa in 1995 was related to cyclones Ofa and Val that struck in 1992 and 1993.

E. Unique socioeconomic problems of PICs

Pacific Island countries face several disadvantages arising from their smallness in terms of size. These problems are exacerbated by the fact that many of these countries are not only small but are themselves made up of a number of small islands. These disadvantages include a narrow range of resources, which leads to undue specialization; excessive dependence on international trade and hence vulnerability to global developments; high population density, which increases the pressure on already limited resources; excessive exploitation of natural resources, causing premature depletion; relatively small watersheds and threatened supplies of fresh water; costly public administration and infrastructure, including transportation and communication; and limited institutional capacities and domestic markets, which are too small to provide significant scale economies, while their limited export volumes, sometimes from remote locations, lead to high freight costs and reduced competitiveness. These issues are discussed further in this book.

Small islands also tend to have high degrees of endemism and levels of biodiversity, but the relatively small numbers of the various species impose high risks of extinction and create a need for protection. Due to the small size, isolation and fragility of island ecosystems, biodiversity in these countries is among the most threatened in the world today. The smallness of size also implies that development and environment are more closely interrelated and interdependent than in other parts of the world. In particular, their almost exclusive dependence on coastal and marine resources emphasizes the need for the development of appropriate and effective management policies.

Given their narrow resource base and limited opportunities for achieving economies of scale, production in PICs is limited to a narrow range of crops, minerals and industries. This situation makes them particularly vulnerable to external shocks such as adverse movements in commodity prices. Partly because of their small size and partly because of their vulnerability to natural and environmental disasters, most PICs are classified as high-risk entities, which has led to insurance and reinsurance being either unavailable or exorbitantly expensive, with adverse consequences for investment, production costs, government finances and infrastructure.

Per capita incomes in some PICs tend to be higher than that of developing countries as a group, which means that they sometimes cannot get access to concessionary finance. However, closer examination of these economies shows that in many cases, current incomes are often facilitated by migrant remittances, preferential market access for some major exports and assistance from the international community, sources which are neither endogenous nor secure. Furthermore, those incomes have generally been unstable over time as a result of natural and man-made disasters, as well as difficulties in the international market for particular commodities. Furthermore, recession in some developed economies often reduce incomes in small island developing states dramatically, sometimes by as much as 20 to 30 per cent of GDP in a single year.

The limited land area and resources available for disposal of waste materials in PICs, combined with rapid urbanization and a high level of imports, imply that pollution and waste management are critical issues. There is also growing concern about the transboundary movement of toxic and hazardous waste. The isolation and oceanic location of PICs, as well as their dependence on a marine and limited terrestrial resource base make them highly vulnerable to contamination by toxic and hazardous wastes and chemicals, and radioactive materials. The passage of ships carrying toxic and hazardous wastes, chemicals and radioactive materials is of international concern and a matter of serious concern to PICs. The issue of waste disposal could be a major constraint to the sustainable development prospects of PICs. As such, there is an urgent need to seek ways of minimizing waste and/or recycling waste material.

F. Overview of this Study

At the Millennium Summit held at the United Nations in September 2000, the world's leaders committed their countries to achieving a number of goals including environmental sustainability and poverty eradication. At that Summit, the UN General Assembly requested that a road map for achieving the commitments be prepared, resulting in the Millennium Development Goals. These goals consist of eight goals, 18 targets and 48 indicators, and are summarized in Table I.5. To the extent that human development and environmental objectives feature prominently in these goals, achieving the targets can be considered as a measure of progress towards sustainable development. This book highlights the use of environmental economics concepts and tools to assist sustainable development policy making in Pacific island countries. The next chapter discusses the subject of sustainable development. Definitions from different perspectives are canvassed, following which the conditions for achieving SD are defined. This is followed by a discussion of how to measure progress towards SD, including alternative measures of welfare. The chapter concludes with a discussion of constraints to achieving SD with particular emphasis on the PIC context.

Measuring the non-market values of environmental goods and services is crucial to enabling decision-makers to make informed decisions when confronted with trade-offs between environmental conservation and economic development. Chapter III discusses various valuation techniques including their strengths and weaknesses. Issues relating to implementation of these techniques in the PIC context are discussed. The chapter includes a case study of an environmental valuation study conducted in Samoa. In Chapter II, the deficiencies of the current system of national accounting are highlighted. This includes a reliance on welfare measures such as GDP and GNP that overlook natural resource depreciation and environmental degradation. Chapter IV presents a discussion of alternative 'greener' measures such as Green Accounting and Genuine Saving. The chapter concludes with a case study of green accounting applied to Papua New Guinea.

Chapter V discusses policies for integrating economic and environmental concerns into decision-making processes. It begins by explaining why the market system fails to protect the environment and states the case for government intervention. This is followed by a discussion of Command-and-Control mechanisms (CACs) and Market-Based Instruments (MBIs). The chapter concludes with cases studies of CACs and MBIs from the Pacific Island region. Chapter VI introduces some of the tools for assessing the effectiveness of economic and environmental policies. These include environmental cost-benefit analysis, cost-effectiveness analysis, multi-criteria analysis, and computable general equilibrium analysis. The penultimate chapter presents the institutional and capacity building issues that need to be addressed in the PICs in order to implement the tools and techniques discussed earlier. The discussion touches on institutional issues such as governance, the political and legal environment, the human resource constraints, as well as data and infrastructure requirements. Chapter VIII concludes by assessing the economic and environmental challenges facing the region in light of globalization and other external changes, and reviewing the agenda for action.

Table I.5. Millennium Development Goals and Targets

Goals	*Targets*
1. Eradicate extreme poverty and hunger	Target 1: Halve between 1990 and 2015, the proportion of people whose income is less than $ 1/day
	Target 2: Halve between 1990 and 2015, the proportion of people who suffer from hunger
2. Achieve universal primary education	Target 3: Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling
3. Promote gender equality and empower women	Target 4: Eliminate gender disparity in primary and secondary education, preferably by 2003, and to all levels no later than 2015
4. Reduce child mortality	Target 5: Reduce levels by two thirds, between 1990 and 2015, the under-5 mortality rate
5. Improve maternal health	Target 6: Reduce by three quarters, between 1990 and 2015, the maternal mortality rate
6. Combat HIV/AIDS, malaria and other diseases	Target 7: Have halted by 2015 and begun to reverse spread of HIV/AIDS
	Target 8: Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases
7. Ensure environmental sustainability	Target 9: Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources
	Target 10: Halve by 2015 the proportion of people without sustainable access to safe drinking water
	Target 11: Have achieved a significant improvement in the lives of at least 100 million slum dwellers by 2020

Table I.5. *(Continued)*

Goals	*Targets*
8. Develop a global partnership for development	Target 12: Develop further, an open, rule-based predictable, non-discriminatory trading and financial system
	Target 13: Address the special needs of the least developed countries
	Target 14: Address the special needs of landlocked countries and small island developing states
	Target 15: Deal comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term
	Target 16: In cooperation with develop and implement strategies for decent and productive work for youth
	Target 17: In cooperation with pharmaceutical companies, provide access to affordable essential drugs in developing countries
	Target 18: In cooperation with the private sector, make available the benefits of new technologies, especially information and communications

Source: Annan, K.A. (2000).

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II. WHAT IS SUSTAINABLE DEVELOPMENT?

"Then I say the earth belongs to each… generation during its course, fully and in its own right, no generation can contract debts greater than may be paid during the course of its own existence."

Thomas Jefferson, September 6, 1789.

A. Introduction

The publication that many would agree has set the environmental agenda for the past decade and the future is the report, *Our Common Future* (WCED, 1987), which served as the background for the historic Earth Summit. The Earth Summit raised hopes and expectations about achieving sustainable development. Through Agenda 21 (see Box II.1) and other important documents such as the Rio Declaration on Environment and Development and the Statement of Principles for the Sustainable Management of Forests, a comprehensive environment and development agenda was drawn up for the 21st century. Unfortunately, within the past decade, progress in these areas has not matched the expectations. In many countries around the world, poverty has increased and environmental degradation has continued at an alarming pace. The World Summit on Sustainable Development (WSSD), which was held in Johannesburg, South Africa in August/September 2002, sought to overcome the obstacles to achieving SD. The WSSD, among other things, affirmed commitment to Agenda 21 and resolved to strengthen the concept of SD and the important linkages between poverty, the environment and the use of natural resources. Several priority areas were identified under the acronym WEHAB – water and sanitation, energy, health, agriculture, and biodiversity protection and ecosystem management.

It is often said that 'Beauty lies in the eyes of the beholder', and the same can be said of 'sustainable development'. Sustainable development (or sustainability) has been defined in several different ways. In order to make progress towards SD, it is important to clarify what the term means. This chapter canvasses a number of the definitions of SD from various perspectives and then goes on to discuss the conditions for sustainable development by introducing the concepts of 'weak' and 'strong' sustainability and their implications for SD. This is followed by an outline of various indicators for assessing progress towards SD. The chapter concludes with a brief discussion of how to operationalize SD.

Box II.1. Agenda 21

Agenda 21 is an 800-page agreement consisting of 120 action programmes covering nearly every aspect of all human activities that impact on the natural environment. Agenda 21 urges nations to:

> "harmonize the various sectoral economic, social and environmental policies and plans that are operating in the country… to ensure socially responsible economic development while protecting the resource base and environment for the benefit of future generations… [National strategies] should be developed through the widest possible participation" (United Nations, 1992:67).

The cost of the package is estimated at US$ 600 billion per annum for developing countries. The advanced countries are supposed to provide an extra US$ 125 billion in funding by the year 2000.

Agenda 21 comprises four basic dimensions, namely:

- Social and economic dimensions;
- Conservation and management of natural resources for development;
- Strengthening the role of major groups; and
- Means of implementation.

It can be seen from the above that the diversity of the dimensions covered reflects the complexity of sustainable development.

Agenda 21 is a broad statement of principles and is not legally binding. Although it is a morally compelling document, it is not mandatory and the signatories can opt out if they choose to. Perhaps, the greatest constraint facing the implementation of Agenda 21 is lack of financial resources. There is the danger that some countries will be selective about which aspects they implement depending on their budgetary positions. It is conceivable that the countries that are in urgent need of sustainable development may be the least able to afford it.

Source: United Nations (1992).

B. Definitions of sustainable development

According to Mustafa Tolba, sustainable development has become an article of faith, a 'shibboleth', often used but little explained (Tolba, 1987). Does it amount to a strategy? Does it apply only to renewable resources? What does the term actually mean? In the paragraphs that follow, we consider briefly the meaning of SD from various perspectives including 'neoclassical' economics, ecology, intergenerational equity and materials balance. In a review of sustainable development, the environmental economist John Pezzey counted over sixty different definitions (Pezzey, 1989a).

1. The neoclassical economics definition

Traditional 'neoclassical' economics supposes that economic growth is maximized when all opportunities to increase the efficiency of resource use have been exhausted. In this approach, SD can be defined as the maintenance of a constant per capita consumption across all generations (Solow, 1956) or the maintenance of non-declining per capita income over the indefinite future (Pezzey, 1989b). In this approach, no distinction is made between natural capital and man-made capital. It is assumed that natural, physical and human capital can be substituted for each other to a high degree. Furthermore, this definition ignores changes in natural capital stocks and environmental quality. This definition, in effect, equates SD with sustainable economic growth. However, increase in economic growth does not necessarily imply that well-being is increasing over time.

2. The ecological perspective

From the ecological perspective, the quality of life depends on environmental quality. Therefore, retaining ecological integrity and the assimilative capacity of the natural environment is crucial for the functioning of the economic system.

There have been a number of ecological definitions of SD. These include the following:

> "Ecologically sustainable development is a condition in which society's use of renewable resources takes place without destruction of the resources or the environmental context which they require" (Solomon, 1990).

> "Ecologically sustainable development means using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased" (Government of Australia, 1992).

> "A system that is healthy and free from 'distress syndrome' if it is stable and sustainable, that is, if it is active and maintains its structure (organization) function (vigor) and autonomy over time and is resilient to stress" (Costanza, 1994).

A common thread of the ecologists' definition is that a decline in environmental quality has an adverse impact on the welfare of the society. Therefore development can only be sustained by maintaining (or increasing) net wealth, environmental quality, and the stock of renewable resources.

3. The sociologists' perspective

From the sociologists' viewpoint, the key actors on the economic-environmental system are human beings. Human beings' patterns of organization are important for developing viable solutions to SD. From this perspective, failure to devote attention to social factors in the development process will seriously hamper the progress of programmes and policies aimed at achieving SD.

4. The intergenerational and intra-generational equity perspectives

The intergenerational equity perspective is more restrictive than the previous definitions. It suggests that the rate at which natural resources are being exploited is too fast and works against the interests of the unborn. As such, sustainable development is defined as the maintenance of non-declining per capita income over the indefinite future (the neoclassical definition) and maintenance of the stock of renewable resources (ecological definition) with the added proviso that the net value of the stock of non-renewable resources must also be non-declining. According to this view, if the above conditions are met, our quality of life will not only be maintained but also future generations will have an undiminished or even enhanced stock of natural resources and other assets. It is also consistent with intra-generational equity since it is argued that non-declining natural capital implies that per capita utility or well-being is also being maintained.

5. The materials balance approach

The materials balance approach to SD is derived from the First and Second Laws of Thermodynamics, which recognize physical and ecological constraints to economic activity. The First Law of Thermodynamics (also referred to as the law of conservation of mass and energy) states that energy cannot be created or destroyed. This implies that, although the form of energy may change, the total amount of energy in the system remains constant. The Second Law of Thermodynamics (also known as the Entropy Law) states that entropy always increases. A major implication of the First Law for SD is that any raw material inputs used in the production and consumption process must eventually be returned to the environment as high-entropy waste products or pollutants. Recycling can help to reduce the amount of waste, to some extent, although recycling cannot be 100 per cent effective.

The Second Law implies that economic processes (i.e., production and consumption) are time irreversible in the sense that waste material cannot be fully converted to useful energy. This has led some economists such as Daly (1991) to propose a transition to a 'steady state' economy. A steady state economy is one in which there are constant stocks of people and physical wealth that are kept at a desired level. Maintenance of a steady state implies:

- Use of (conditionally) renewable resources should, within a specific area and time span, not exceed the formation of new stocks. Thus, for instance, yearly extraction of groundwater should not exceed the yearly addition to groundwater reserves coming from rain and surface water; and
- Use of relatively rare non-renewable resources, such as fossil carbon or rare metals, should be close to zero, unless future generations are compensated for current use by making available for future use an equivalent amount of renewable resources.

The materials balance approach basically raises doubt about human kind's ability to indefinitely extract more energy and materials from the world's ecosystem. The materials balance approach therefore disputes the neoclassical assumption that income growth leads to increase in human satisfaction. In this respect, the concept of the materials balance approach is similar to the ecologists' concept of SD.

6. The biogeophysical perspective

Sustainable development has also been defined on a biophysical dimension. According to Mohan Munasinghe and Walter Shearer, biogeophysical sustainability is the maintenance and/or improvement of the integrity of the life-support system on Earth. Sustaining the biosphere with adequate provisions for maximizing future options includes providing for human economic and social improvement for current and future human generations within a framework of cultural diversity while: (a) making adequate provisions for the maintenance of biological diversity and (b) maintaining the biogeochemical integrity of the biosphere by conservation and proper use of its air, water and land resources (Munasinghe and Shearer, 1995).

7. The IUCN – World Conservation Union Definition

The IUCN – World Conservation Union defines SD as the maintenance of essential ecological processes and life support systems, the preservation of genetic diversity, and the sustainable utilization of species and ecosystems (IUCN, 1980). Their approach has an anthropocentric focus because it places emphasis on achieving a quality of life (or standard of living) that can be maintained for many generations. Sustainability is described in terms of fulfilling people's cultural, material, and spiritual needs in equitable ways.

8. The World Commission on Environment and Development's definition

It appears that in defining sustainable development, the World Commission on Environment and Development (WCED) took into consideration all the above perspectives, in recognition of the fact that SD is a multifaceted concept. The WCED (or the Brundtland Commission) defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987:43).

9. Other definitions

Various writers on the subject have put forth variants of the WCED definition. Pearce et al. (1989) have offered the following interpretation of SD:

> "Sustainable development involves a substantially increased emphasis on the value of natural, built and cultural environments… sustainable development places emphasis on providing the needs of the least advantaged in society ('intragenerational equity'), and on the fair treatment of future generations ('intergenerational equity')" (Pearce et al., 1989).

R. Kerry Turner also defined SD as follows:

> "Sustainable development involves maximizing the net benefits of economic development subject to maintaining the services and quality of natural resources over time" (Turner, 1988).

Robert Solow has defined 'sustainability' in terms of the 'duty' of humanity to future generations. According to him:

> "The duty imposed by sustainability is to bequeath to posterity not any particular thing… but rather to endow them with whatever it takes to achieve a standard of living at least as good as our own and to look after the next generation similarly" (Solow, 1992).

Maurice Strong defined SD as:

> "Sustainable development involves a process of deep and profound change in the political, social, economic, institutional, and technological order, including redefinition of relations between developing and more developed countries" (Strong, 1992).

C. Conditions for sustainable development

From the foregoing discussion, it is important, for purposes of implementing strategies towards SD, to further investigates the conditions that are necessary to promote SD. Pearce et al. (1996) have proposed two conditions for sustainable development: "weak sustainability" and "strong sustainability". Weak sustainability assumes that there can be perfect substitution between physical, natural and human capital. For example, the depletion of natural capital in the current period can be offset by increases in physical or human capital (the neoclassical economics definition). Sustainable development can be achieved as long as the stocks of capital available to future generations are at least equal to the stocks available to the current generation. That is, so long as there is a constant aggregate capital stock. Strong sustainability, on the other hand, is much more restrictive. It assumes that not all natural capital stock can be substituted for man-made capital stock. For example, some ecosystem functions that are essential for the maintenance of living creatures cannot be replicated by human beings and the ozone layer cannot be recreated. Strong sustainability also implies that we have to preserve environmental assets for the future because of our limited understanding of their life-supporting functions.

The concept of strong sustainability is implicit in both the Brundtland Report and the *World Conservation Strategy*. According to the Brundtland Report, "if needs are to be met on a sustainable basis the Earth's natural resource base must be conserved and enhanced" (WCED, 1987:57). The *World Conservation Strategy* makes references to maintaining "essential ecological processes and life support systems" and "sustainable utilization of species and ecosystems" (IUCN, 1980:1).

Georgescu-Roegen (1971, 1979) has proposed the concept of resilience as a condition for SD. This requires the maintenance of a system within its thresholds of healthy and productive operation. The resilience perspective is based on an interdisciplinary understanding of the operation of ecological, environmental and social systems.

1. A working definition for sustainable development

From the foregoing discussion, it can be seen that the pure neoclassical definition of SD can be rejected because 'development' does not necessarily equate to 'economic growth (i.e., increases in per capita income). However, the role of economic growth in achieving SD must not be discounted. It has been estimated that the rate of economic growth necessary to keep the numbers of the poor from increasing is between 3-5 per cent per annum. That is, in order to arrest increase in poverty, the economy must grow at rates in excess of population growth rates. Economic growth is required to generate income to pay for the development process. A recurring theme in the above definitions is that SD involves improving the quality of life and maintaining environmentally responsible policies and practices. Improving the quality of life involves reducing poverty (which indirectly relieves pressures on the environment), improving health and nutritional status, improving education, and improving equity. To improve equity, policies must be developed to improve access to resources and achieve a 'fairer' distribution of income. To conserve environmental resources, there is a need to manage our natural resources wisely and to lower the intensity of resource use in order to leave future generations an unlimited (or even enhanced) stock of natural resources and other assets. A crucial element in the drive to improve the quality of life and the management of our natural resources is the reform of our institutions.[4] The role of institutions in achieving SD is discussed further below.

D. Measuring sustainable development

How do we measure progress towards SD and, more importantly, how do we translate the SD concepts into practical measures? In this section, we consider the issue of measuring SD and then take up the issue of implementing SD in the next section.

1. Traditional measures of welfare

For many years economists have used GDP and GNP as measures of welfare or well-being. GDP is the value of final goods and services produced in the domestic economy, whereas GNP is the value of goods and services produced in the domestic economy plus overseas income other than for exports. For aid purposes, the World Bank has divided countries into low, middle and upper income using income cut-offs based on these measures.[5] Measures such as GDP and GNP may provide a biased or overstated view of human welfare because they do not consider depreciation of the natural capital stock as a result of economic exploitation and environmental degradation. GDP is calculated on the basis of the value of goods and services produced in the economy, and thus it will indicate an increase (i.e., an improvement in 'welfare') even when our stock of natural capital is being depleted and we have to expend more effort to extract lower grade resources. One anomalous property of GDP (or GNP) is that it will increase even when the quality of

[4] The 2003 World Development Report defines institutions as the rules and organizations, including informal norms that coordinate human behaviour.

[5] The per capita GNP cut-offs are: high income (US$ 9,266), middle income (US$ 756-9,265), and low income (US$ 755 or less).

the environment is reduced by pollution. This is because it ignores degradation of environmental quality and effects on human health and welfare. Thus, for example, increase in the consumption of potentially health-threatening goods such as alcohol, cigarettes and fatty foods will appear as an increase in GDP, although they may even decrease individuals' welfare and impose a heavy burden on the national health budget. GNP increases when expenditures are made on pollution abatement. This is another distortion because environmental protection expenditures may actually be social costs of maintaining environmental quality (i.e., defensive expenditures). Other objections to the use of GDP/GNP as a measure of welfare include:

- They are average measures that do not consider how income or wealth is distributed within the population. A country may have a high GDP per capita and be classified as 'rich' and yet there may be a high proportion of people who are deprived;
- It ignores changes in population and the productivity of human capital;
- It is a 'flow' concept (measures the flows of goods and services) and does not say anything about the stocks of natural resources. Thus it does not provide an adequate guide about how resources are being managed;
- It only accounts for transactions that occur in the market place and does not adequately consider subsistence production of peasants, housework (e.g., home cooking and gardening) and the work of voluntary or charitable organizations; and
- It does not discriminate between different types of goods. In resource dependent economies, GDP/GNP can provide an erroneous picture of welfare and economic progress (see Box II.2). Therefore, any long term development plans based on such statistics may not be environmentally sound or sustainable.

2. Alternative measures of welfare

Within the last decade alternative measures of welfare have been developed to rectify the deficiencies of GDP/GNP measures in order to provide a better guide of progress towards SD. From the definitions given in the previous section, it can be seen that it would be almost impossible to provide a single indicator that will capture the concept of SD. In this section, we will consider SD indicators under the broad categories of economic, ecological and sociopolitical. The economic indicators include environmentally adjusted domestic product (green accounting); and genuine saving. The sociopolitical indicators include the Index of Sustainable Economic Welfare, the Genuine Progress Indicator, and the Human Development Index. The ecological measures include Net Primary Productivity and Carrying Capacity, Ecological Footprints, and Environmental Space. We begin the discussion with the economic indicators.

Box II.2. The Indonesian Case Study

David Repetto and others at the World Resources Institute in Washington, D.C., undertook a study to adjust the national accounts of Indonesia for environmental effects in 1990 (Repetto et al., 1989). Indonesia's natural resources consist of: oil, gas, minerals, timber and forest products. Together, these resources account for 44 per cent of GDP, 84 per cent of exports, and 55 per cent of total employment.

Economic progress over the period of the study, 1970 to 1990, has been considered very good. For example, GDP per capita grew at 4.6 per cent per annum between 1965 and 1986. This is quite high in relation to that of low-income and middle-income countries. Repetto et al. (1989) adjusted Indonesia's national accounts for the period 1971-1983 by subtracting from GDP estimates of net national resource depreciation for only three sectors: petroleum, timber and soils, to arrive at an estimate of net domestic product (NDP).

The results clearly indicated that official GDP estimates overstated net income and growth of net income. The actual overstatement was higher since only three natural resources (petroleum, timber and soils) were considered. Items not included were: (i) exhaustible resources – natural gas, coal, tin, nickel; and (ii) depreciation of renewable resources (e.g., fisheries and non-timber forest products).

Source: Repetto et al., 1989.

(a) Economic indicators: environmentally adjusted product and income (green accounting)

The environmentally adjusted net domestic product (EDP), referred to as 'Eco Domestic Product' and environmentally adjusted national income (ENI) are results of the United Nations Statistical Office (UNSO) effort's to develop a new framework for integrated environmental and economic accounting, referred to as the integrated System of Environmental and Economic Accounts (SEEA) (Bartelmus et al., 1992). Details of the SEEA are given in Chapter IV. The EDP is obtained by adjusting the national accounts for changes in the quality of the natural environment and the depletion of natural resources.

Measures of EDP can be used to assess progress towards SD in the following ways:

- It can be used to indicate whether economic growth is sustainable and whether there are structural distortions in the economy by following environmentally unsound production and consumption patterns;

- For example, let C = total consumption expenditure; then C/EDP computed from the SEEA could be used as an indicator to indicate non-sustainable growth patterns. If C/EDP > 1, then it can be implied that the country is running down its natural capital base and therefore growth is not sustainable. On the other hand, C/EDP < 1 implies that the capital stock is being left intact or enhanced; and
- A high rate of depletion of natural resources would appear in the accounts as a low rate of capital accumulation, indicating environmentally unsound production and consumption patterns.

(b) Economic indicators: genuine (extended) saving

The concept of genuine (or extended) saving (GS) is a new measure of sustainability. A country's wealth can be defined in terms of the value of a whole range of assets including the value of physical, natural and human capital. Genuine saving measures the change in the total value of the three components of resources in the economy over a given period of time, usually a year. GS helps to track the sustainability of the economy by incorporating the effects of natural capital depletion into the standard flow of savings and income. For example, GS falls when the extraction or depletion of natural resources is not balanced by an offsetting re-investment in natural, physical or human capital. Further discussion of GS can be found in the Chapter IV.

(c) Socio-political indicators: index of sustainable economic welfare

The index of sustainable economic welfare (ISEW) was proposed by Daly and Cobb (1989) as an alternative measure of welfare changes and a better indication of economic progress than GDP/GNP. The computation of ISEW normally begins with compuation of personal consumption expenditures which are weighted with an index of income inequality. Then, certain welfare-relevant contributions such as services of hosuehold labour and the services of streets and highways are added. On the other hand, ceratin welfare-relevant losses such as 'defensive expenditures', costs of environmental pollution, costs of depeletion of non-renewable resources, and long-term environmental damage are subtracted from the estimates. The ISEW can be expressed in equation form as

$$ISEW = C + P + G + W - D - E - N \qquad (2.1)$$

where: C = weighted consumer expenditure; P = non-defensive public expenditures; G = growth in capital and net change in international position; W = estimate of non-monetarised contributions to welfare; D = defensive expenditures; E = costs of environmental degradation; and N = depreciation of natural capital.

The ISEW is expressed in monetary units and a rising value would imply that the economy is becoming more sustainable. On the other jand, a falling value would indicate an unsustainable path.

(d) Socio-political indicators: genuine progress indicator

The Genuine Progress Indicator (GPI) was proposed by Cobb et al. (1995). The GPI is an extension of the ISEW and aims to provide an indicator that more accurately reflects the health of the economy. The difference between the GPI and the ISEW is that the GPI excludes both public and private defensive expenditures on health and education, includes deductions of cost estimates for loss of leisure time, unemployment, but excludes loss of forests. As with the ISEW, a rising GPI indicates that an economy is heading towards a sustainable path, while a falling GPI indicates the opposite.

The major criticism of both the GPI and ISEW is that they involve a series of ad hoc adjustments. Also, like the EDP, they are based on current flows rather than stocks and thus they do not really address the maintenance of capacity, which, it has been argued, is at the heart of the concept of sustainability.

(e) Socio-political indicators: human development index

Human development is about much more than the rise or fall of national incomes. Thus, relying on GDP/GNP will give a narrow view of economic development because it focuses only on income. The UN has developed an alternative measure, the HDI, which measures a country's achievements in three aspects of human development: longevity, knowledge, and a decent standard of living. Longevity is measured by life expectancy at birth; knowledge is measured by a combination of the adult literacy rate and the combined gross primary, secondary, and tertiary enrolment ratio; and standard of living is measured by GDP per capita (PPP US$). As a rough index of development, non-declining HDI over time would indicate a sustainable human development path. However, because the HDI considers only the educational and health status of the population, it too provides a limited view of development.

(f) Ecological indicators: net primary productivity and carrying capacity

Net Primary Productivity (NPP) [Vitousek et al., 1986] is a measure of the total available food resource for a system. NPP is derived from the ecological notion of carrying capacity (K), which is defined as the maximum population size that a given area can support without diminishing its ability to support the species in future periods. Vitousek et al. (1986) have linked NPP to K at the global level and have concluded that world NPP would not be able to support predicted increases in world per capita consumption rates. The NPP/K ratio for any given country can thus be interpreted as indicating how close or how far from its carrying capacity that country is. Thus, for example, NPP/K = 1 indicates a sustainable population level, given current food requirements or food consumption.

The main criticism of the NPP/K indicator of SD is that it only considers the relationship between consumption and biological production. However, at a sub-global level, consumption can exceed natural productivity through imports. It also ignores the fact that natural productivity can be enhanced through the use of man-made capital and non-renewable natural resource inputs.

(g) Ecological indicators: ecological footprints

The concept of ecological footprints was developed by Wackernagel and Rees (Rees and Wackernagel, 1994; Wackernagel and Rees, 1996). It is a land-based measure of SD, which compares human demands in a given country, in terms of consumption, with the extent to which those demands can be met from the land area in that country. Energy, food and timber consumption per capita are expressed in terms of the land areas needed to produce these amounts. This is similar to the NPP/K indicator discussed above. A given country's 'footprint' is then calculated in relation to the available land area (excluding unproductive land). In this approach, a positive footprint (also referred to as an 'ecological deficit') could mean that the country's natural capital is being depleted, or alternatively, it could mean that it is imposing part of its footprint on other countries via imports. The ecological footprint concept assumes that the only sustainable form of energy is that derived from renewable resources.

The main criticism of the ecological footprints measure is that it is not a predictive measure. That is, given the value of this year's measure, we are not able to predict whether next year's measure will be higher or lower. However, this deficiency is also true of other measures such as EDP, Genuine Saving, ISEW and GPI.

(h) Ecological indicators: environmental space

The concept of Environmental Space is concerned with the fairness of resource use in any given country relative to world average use of that resource. The environmental space approach involves comparing global average use of a given resource (in per capita terms) with national consumption (also in per capita terms). Selected resources often include non-renewable resources, arable land, forestry, and water resources. Pollutants are included in the measure by specifying an upper limit on assimilative capacity. For example, in a study involving CO_2, Friends of the Earth Europe (1995) found average per capita emissions in Europe to be 7.3 tonnes compared to a predicted per capita maximum of 1.7 tonnes per annum, allowing for an estimated world population growth of about 7.19 billion people by 2010.

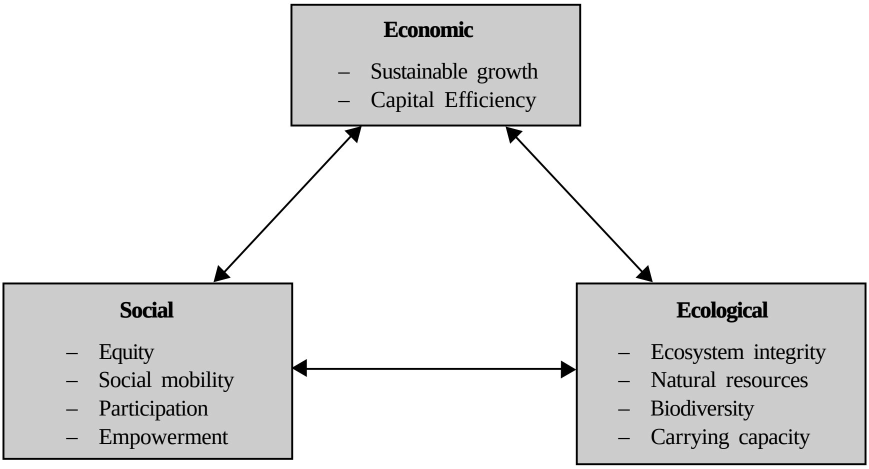
There are a number of problems with the environmental space approach. First, there are difficulties for specifying what permissible maximum and minimum use rates are. Second, the selection of resources to be included appears to be arbitrary. It has been suggested that the method is susceptible to double counting of resource use.

E. Operationalizing the concept of sustainable development

While there has been no shortage of conceptual definitions of SD, practical measures to translate them into specific plans are few and far between. One approach is to establish a framework which will enable plans and policies to be tested to see whether they are economically, ecologically and socially sustainable before they are implemented. This approach is referred to as the environmentally sustainable development (ESD) triangular framework (Serageldin and Steer, 1994). The triangular approach may be explained with the aid of Figure II.1. The figure shows the links between the environment, the economy and the society and draws attention to the need to strike a balance between the three components in order to achieve SD. Thus, for example, a proposal first has to be economically and financially sustainable in terms of enhancing growth and making efficient use of scarce resources. Secondly, it must be ecologically sustainable. This can be determined in terms of its impacts in terms of ecosystem integrity, carrying capacity and conservation of natural resources including biodiversity. Finally, it must be sustainable in terms of certain social criteria. These include equity, social mobility, social cohesion, participation, empowerment, cultural identity, and institutional development. As has been shown, the social dimension is important for achieving SD. Neglect of the social dimension will lead to a collapse of institutions, increase social disorder and negatively impact on the environment.

How can we ensure that the triple objectives of economic, ecological and social integrity of plans, programmes and policies are met? This could be done in a number of steps. The first step would be to develop a system of environmental and social indicators that could be used in decision-making processes. This issue has been briefly discussed above and is dealt with in more detail in Chapter IV (Green National Accounting and the Measurement of Genuine Saving). The next step would be to develop new ways, or modify existing approaches, for incorporating this information into economic decision-making process. This step is considered in Chapter VI (Methods for Assessing the Effectiveness of Economic and Environmental Policies). The third step would be to restructure institutions to provide the correct signals for sustainable resource use and to achieve distributional goals. This is discussed in Chapter V (Policies for Integrating Economic and Environmental Concerns). The remainder of this chapter discusses the constraints to implementing SD policies.

Figure II.1. The ESD Triangle

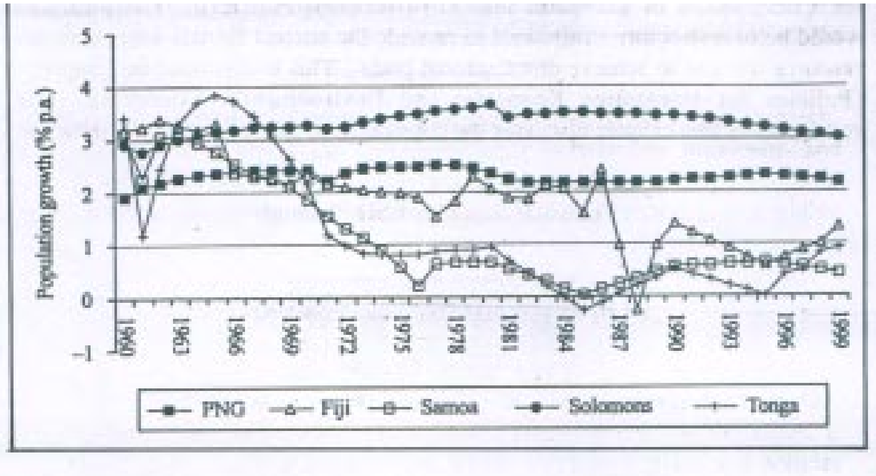


Source: Adapted from Serageldin and Steer (1994:2).

F. Constraints to sustainable development in PICs

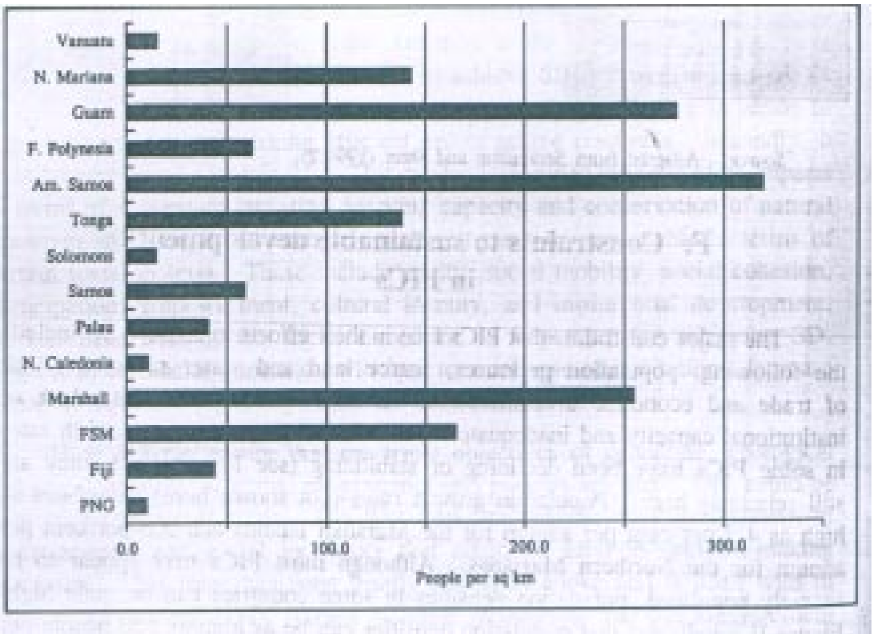
The major constraints that PICs face in their efforts to achieve SD include the following: population pressures, scarce land and water resources, lack of trade and economic diversification; human resource constraints, lack of institutional capacity and inadequate funds. Although population growth rates in some PICs have been declining or stabilizing (see Figure II.2), they are still relatively high. Population growth rates (not shown here) have been as high as 4.2 per cent per annum for the Marshall Islands and 5.6 per cent per annum for the Northern Marianas. Although most PICs may appear to be sparsely populated, population densities in some countries can be quite high. Figure II.3 indicates that population densities can be as high as 320 people per

Figure II.2. Population Growth in Selected PICs



Source: World Bank (2001).

Figure II.3. Population Density in Selected PICs in 1999



Source: World Bank (2001).

sq km in American Samoa and 255 people per sq km in the Marshall Islands. A particular feature of many PICs is that a high percentage of the land is not habitable because it is too rugged, too steep, arid, too small or lacks water. Therefore, computing population densities on the basis of arable (or habitable) land would produce figures even higher than those shown in Figure II.3.

The relatively high population densities tend to put pressure on freshwater, coastal and marine resources. In some countries, the pressure on land resources has caused young people to migrate to the urban areas in search of non-existent jobs. As a result, growth in the urban areas has outstripped overall population growth. In many of the PICs, this trend has given rise to additional economic, social and environmental problems, posing challenges to cash strapped governments. In addition to the population problem, PICs are hindered by a host of other human resource issues including poor health and social services, poor nutrition and housing, and low levels of female participation in the development process.

The capacity to implement government development programmes is also constrained by lack of skilled personnel. In some countries, this problem has been exacerbated by migration of skilled and qualified workers to Australia, New Zealand and the United States. Pacific Island countries are also constrained by lack of trade and economic diversification. This is a result of their small size, their narrow resource base and the limited opportunities to achieve economies of scale. The lack of diversification makes them particularly vulnerable to external factors such as natural disasters and adverse external economic conditions (e.g., a fall in commodity prices) which can easily lead to rapid falls in output, foreign-exchange earnings and employment.

Other constraints to the implementation of SD include lack of institutional capacity and inadequate financial resources. The Earth Summit in Rio de Janeiro adopted Agenda 21 (United Nations, 1992), a 300-page plan for achieving sustainable development in the 21st century. A Commission on Sustainable Development (CSD) was created in 1992 to oversee the implementation of Agenda 21, and to monitor and report on implementation of the Earth Summit agreements at the local, national, regional and international levels. At a five-year review of Earth Summit progress in 1997, the CSD reported that about 150 countries had either established new or modified institutional structures to assist in the implementation of Agenda 21. However, in some PICs, these structures are not well-developed. In cases where there have been established (e.g., National Council for Sustainable Development), their effectiveness has been compromised by problems such as lack of authority to enforce policies, insufficient representation, lack of qualified personnel and lack of financial resources. Some countries have instituted legislation to protect the environment. However, some of these regulations literally have no teeth due to lack of trained personnel to monitor and enforce them.

The Asian Development Bank (ADB) estimates that the cost of implementing some of the Agenda 21 initiatives in the Asia-Pacific region will amount to about US$ 13 billion by the year 2000, rising to US$ 70 billion by 2010 (United Nations, 1995). It is quite clear from this that sustainable development does not come cheap. Governments in the region already face severe budget constraints that compromise their ability to implement SD programmes. The major sources of funds for the majority PICs are ODA and remittances. The PICs receive more ODA per capita than any other group of countries. For example, in 1993, PICs received about $ 650 million in ODA, with Australia providing about half of this amount. Aid dependence as a percentage of GDP ranges from 4 per cent (Fiji) to 18-22 per cent (Solomon islands) to 32-80 per cent (Samoa and Federated States of Micronesia). Recent trends suggest that ODA as a proportion of GDP has declined. The challenge to governments in the region is to generate more private sector participation in transferring environmentally friendly technologies.

Notwithstanding the above constraints, there are good prospects for PICs for planning towards SD by implementing certain policies. These include introducing environmental concepts such as environmental valuation and green national accounting, as well as establishing the appropriate institutional framework which enable environmental policies (e.g., market-based instruments) to be implemented. The issue of environmental valuation is dealt with in the next chapter, while green national accounting and implementation of environmental policies are dealt with in Chapters III and IV.

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III. ENVIRONMENTAL VALUATION

A. Introduction

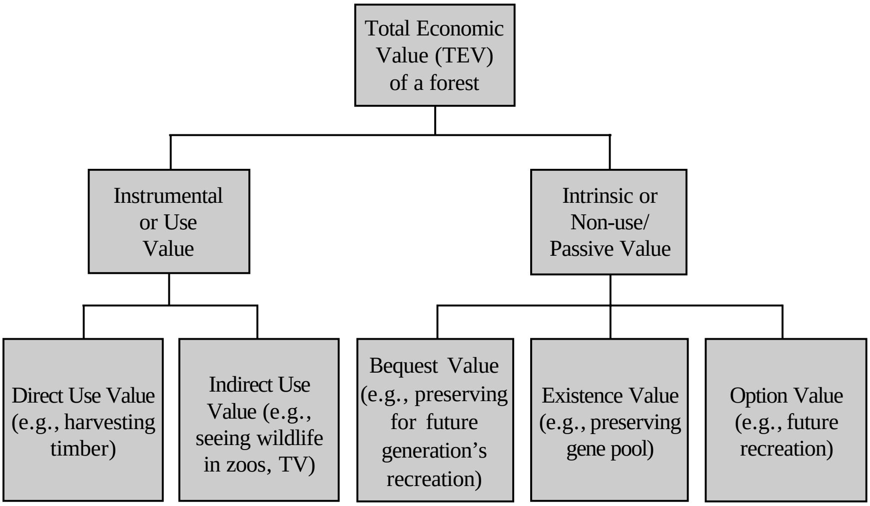
Efforts to value the environmental effects of economic activities lie at the heart of planning for sustainable development. In the past some environmental goods and services have been assigned zero or low values. This was due to difficulties involved in assigning economic values to such commodities or to the attitude that they are ‘free goods’. It is important to integrate environmental values into economic decision making processes because failure to do so can have adverse implications not only for current generations but also future generations. This chapter discusses various techniques that have been developed to value environmental goods and services in monetary terms. The chapter begins with a description of the types of non-market values associated with a given environmental resource. We then proceed to describe a range of techniques for valuing non-market environmental commodities, highlighting their strengths and limitations. This is followed by a discussion of the constraints to the implementation of valuation techniques in PICs. The chapter concludes with a case study of environmental valuation conducted in Samoa.

B. Types of economic value

There are many types of values associated with a given environmental resource. Taking the example of forest resources in some PICs, these can take the form of cultural, spiritual, social as well as economic values. Because economic decisions are based on a common denominator – money, this section focuses on economic values. This is not to lessen the importance of the other types of values. In fact significant non-economic values must be listed along with economic ones in the decision making process.

Figure III.1 shows that the total economic value (TEV) of a natural resource can be divided into two broad categories: instrumental (or use values), and intrinsic or non-use (also referred to as passive use) values. Use values, the most commonly known of the two, refer to the capacity of a good or service to satisfy human needs or preferences. Use values can be direct or indirect. Direct use values can also be consumptive or non-consumptive in nature. Examples of consumptive uses include logging and harvesting of non-timber forest products. Examples of non-consumptive uses include camping, hiking and bird watching. Indirect use values of the forest are derived from environmental services such as maintenance of the hydrological system, climatic stabilization (e.g., carbon fixing) and soil stabilization. Intrinsic or non-use values, as the name suggests, are inherent in the good. That is, the satisfaction we derive from the good is not related to its consumption, *per se*. Non-use or passive use values consist of existence value, bequest value and option value. Existence value arises from the benefit an individual derives from knowing that a resource exists or will continue to exist, regardless of the fact that he or she has never seen or used the resource, or intends to see or use it in the future. A good example of the significance of non-use value is the international outcry over the whaling issue. There are many people who have never seen a whale or plan to see one, but are nevertheless willing to pay significant sums of money to ensure that whales are not hunted to extinction.

Figure III.1. A Taxonomy of Economic Values



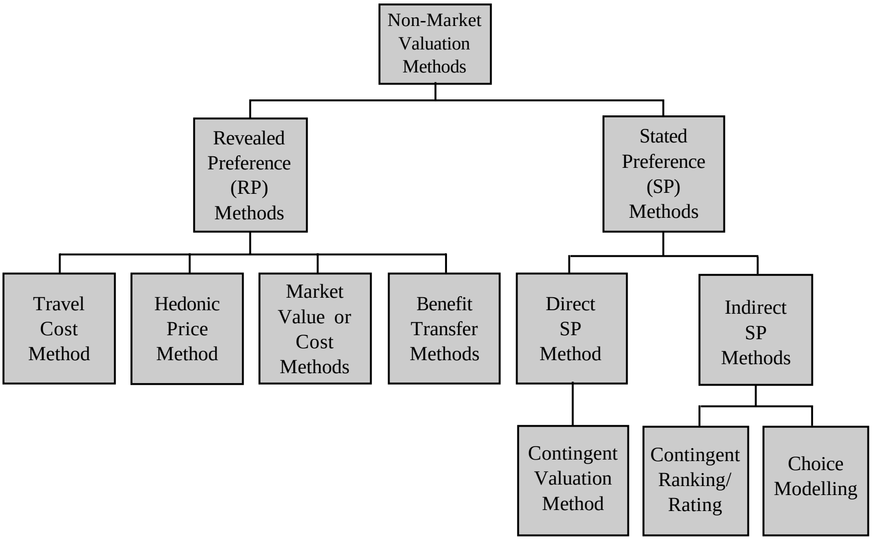
Source: Asafu-Adjaye (2000).

Bequest value, as the name suggests, is derived from the benefits that individuals obtain from knowing that a resource will be available for future generations. The third type of non-use value, option value, is a little more complex. Option value may be defined as the amount of money an individual is willing to pay, at the current time, to ensure the future availability of the resource. To the extent that option value is the expected value of future use of the resource, it may also be classified as a use value. Another type of option value, which is not shown in Figure III.1, is "Quasi-option" value (Arrow and Fisher, 1974; Fisher and Hanemann, 1987). Suppose there is a choice between conservation and development. However, the development option will result in an irreversible change. In this case, quasi-option value is the value of information that results after a decision has been made to develop or conserve at the present time. For example, if a cure for a fatal disease were to be found after the conservation decision has been made, then quasi-option value would clearly be positive. It must be noted that quasi-option value cannot be summed with option value because it involves a different concept of economic value.

C. Non-market valuation methods

Non-market valuation methods can be divided into two main categories: revealed preference (RP) (or indirect) approaches and stated (or expressed) preference (SP) (or direct) approaches (see Figure III.2). The revealed preference (i.e., indirect) approach infers value indirectly by observing individuals' behaviour in actual or simulated markets. For example, the value of a wilderness area may be inferred by expenditures that recreationists incur to travel to the area. The value of, say, noise pollution may be inferred by analyzing the value of residential property near an airport. On the other hand, stated preference methods attempt to elicit environmental values directly from respondents by asking them about their preferences for a given environmental good or service. At the present time, only SP methods can be used to estimate total economic value (i.e., use and non-use values), whereas RP methods are only restricted to estimating use values.

Figure III.2. Classification of Non-Market Valuation Methods



1. Revealed Preference Methods

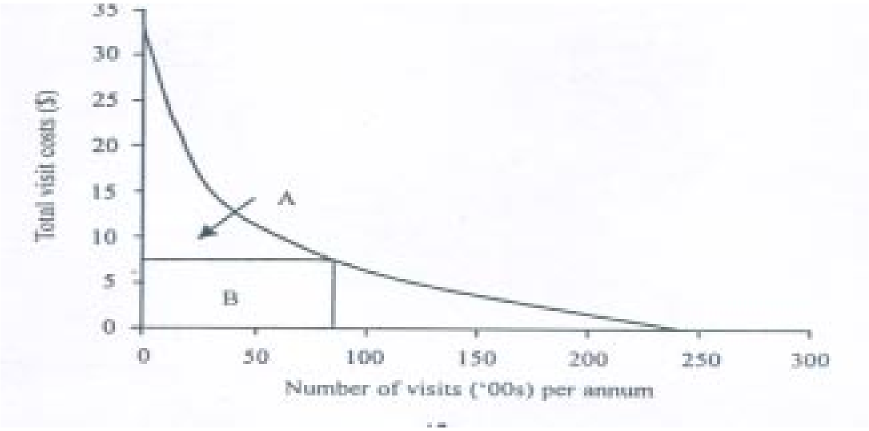
Revealed Preference methods include the Travel Cost Method (TCM), Hedonic Pricing Method (HPM), Cost (or Expenditure) Methods, and Benefit Transfer (BT) Methods. We briefly discuss each of these methods.

(a) The Travel Cost Method

The TCM assumes that the costs that an individual incurs in visiting a recreational site are a measure of his or her valuation of that site. The approach involves asking visitors questions about where they have traveled from and the costs they have incurred. This information is then related to the number of visits per annum, to generate a demand curve for the recreational site under question. Since we expect people living near the site to make more visits per annum compared to those living far away, the demand curve will be downward sloping. That is, travel cost will be inversely related to number of visits (see Figure III.3).

The information requested in a travel cost survey includes the following: travel costs (petrol, food, and other travel-related expenses), income, alternative sites and personal motivations. Entrance fees to recreation sites are often non-existent or nominal. The demand curve drawn from the relationship between travel costs (a proxy for the price of recreation) and number of visits can be used to estimate the total recreation value of the given site. In the example of demand curve given in Figure III.3, if, for instance, 8,000 visitors spent an average of $ 6 per visit per annum, the total annual recreational value of the site would be $ 48,000 (Area B). The net benefits to the community (also referred to as consumer's surplus) will be given by Area A, which is approximately $ 104,000 per annum.

Figure III.3. Demand Curve for the Travel Cost Method



Limitations of the TCM

The main assumption of the TCM is that the value of a recreational site can be proxied by the costs that the recreationist incurs in undertaking the recreational experience. The strength of the approach is that it is based on real rather than hypothetical data and as such can provide true values. However, the assumption that the recreational value of a place is directly related to travel costs incurred in getting there could be an oversimplification of reality. For example, people who live near the site may incur zero or minimal travel costs but may nevertheless have high values for the site. Other limitations include the following:

(1) The TCM is suited to estimating the value of particular sites or locations and is unsuited for measuring other kinds of goods or services. For example, TCM cannot be used to value non-use or passive use values;

(2) Multiple destinations: a problem arises about the appropriate allocation of costs among multipurpose journeys. The allocation of such costs could be arbitrary. The issue of how to treat visitors from overseas is also problematic;

(3) Visits to certain sites could be seasonal and therefore the survey results could be biased unless it is conducted over a long period;

(4) Substitute sites: the current state-of-the-art methodology does not enable the TCM to account for substitute sites. In other words, travel costs of, say, two recreationists are given the same utility rating if they incur the same travel costs. However, it may be the case that one has a lower value for the site but has been compelled to go there due to lack of a nearby substitute site;

(5) Time and other factors: the TCM assumes that travel costs (e.g., fuel costs) are the major determinants of the value of a recreational site. However, other factors could affect the demand for recreation. For example, travel time is an opportunity cost because the time spent travelling is not available for other pursuits. Time should therefore be considered as a cost.[6] However, there is no consensus as to how time should be accounted for in TCM. In some studies, a certain proportion of the wage rate is multiplied by travel time to provide an estimate of the opportunity cost of time. However, the choice of the weight is quite arbitrary and open to question; and

(6) It cannot be used to estimate non-use (or passive) values.

[6] If a person enjoys, say, views of the countryside while travelling, or simply enjoys travelling then, of course, this should be considered a benefit.

(b) The Hedonic Price Method

The HPM derives values for an environmental good or service by using information from the market price of close substitutes. Suppose the government wishes to value the disutility generated by aircraft noise in a given location. It could do this by analyzing variations in house prices with distance from the flight path of aircraft. Take the example of two houses with the same facilities (e.g., number of bedrooms, bathrooms, and swimming pool), with one directly under the flight path and the other quite a distance away. It is expected that the house under the flight path will be cheaper and the price difference may be attributable to the value of the noise pollution.

In practice, the analyst specifies a mathematical function where the price of a house is determined by various attributes. For example,

$$\text{Price of house} = f\,(\text{number of rooms, access to amenities, income of tenant, environmental quality})$$

where environmental quality is proxied by aircraft noise measured in decibels.

Data are collected on each of the five variables and the equation is estimated using multiple regression techniques. We would expect the dependent variable (price of a house) to be positively related to the number of rooms, the degree of access to amenities (e.g., shops, schools, entertainment) and income of tenant and negatively related to environmental quality (aircraft noise in decibels). The monetary value for a one-unit change in noise level is given by the size of the coefficient of the environmental quality variable. The monetary value of noise reduction is given by the coefficient multiplied by the average house price in the area. Figure III.4 shows a demand curve for noise reduction generated by estimating house prices for varying noise levels. The study was conducted in Washington, D.C., urban and suburban areas. A sample size of 456 was used and the mean property value (in 1978 prices) was US$ 28,000 (Nelson, 1978). The explanatory variables in the hedonic price model included number of rooms, age of house, lot area, location near riverside, racial mix and various indices of air pollution.

Limitations of the HPM

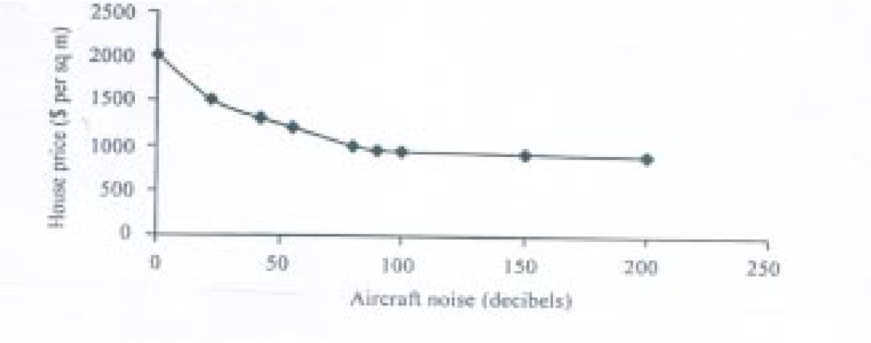
The HPM is applicable to all environmental attributes that are likely to affect property prices. Examples of such attributes are water supply, noise and air quality. However, it also has some limitations. The main one is that it is only applicable in areas where the property market is well developed and the property owners are aware of the environmental attributes or impacts and take them into consideration in their assessment of property values. Other limitations include:

(1) Statistical skills: a reasonable degree of statistical know-how is required to estimate the hedonic price function. Further skills are required to sort out the relevant variables for a suitable regression;

(2) A major assumption is that, given income constraints, people are free to select the characteristics of houses that satisfy their preferences and that the price they are willing to pay takes account of these factors. However, house prices can also be affected by external factors such as taxes and interest rates, which are not accounted for in the hedonic price equation; and

(3) The method cannot be used to estimate non-use values.

Figure III.4. Impact of Aircraft Noise on House Prices



Source: Asafu-Adjaye (2000).

(c) Market Value/Cost Methods

These methods use market or surrogate market data to estimate the value of an environmental good. Examples include the market value approach, the replacement cost approach and the avertive expenditure method.

Market value approach:

The market value approach is used to value environmental goods and services that have established markets. These are commodities which have:

- Direct uses: e.g., plantation timber, commercial fisheries, tourism;
- Some indirect uses: e.g., the value of water from protected watersheds; and
- Some option values: e.g., gene research, forest conservation.

The market value method attempts to find a link between a proposed environmental change and the market value of the corresponding goods and services. A common approach is to use changes in productivity of the good or service. For example, the direct impacts of an environmental change on human health can be estimated as a change in income. The assumption here is that sickness reduces one's ability to earn income. The limitations of the market value approach are as follows: (i) The types of values that it can capture are limited; (ii) It can be difficult to define the physical flows over time; and (iii) In some cases, the links between the environmental change and the market good or service may not be obvious.

Replacement cost approach

This approach assumes that the value of an environmental good or service is the cost of replacing it or restoring it to its original state. For example, if a storm damages roads, buildings and transmission lines, then an estimate of the damage done is the cost of replacing these structures. However, in this case, the replacement cost must be considered as the minimum value of the benefits derived from these goods. This is because we need to add on the consumer surplus that people derive from utilizing the good or service. A variation of replacement cost is mitigation cost, which is an estimate of the cost of restoring a damaged environmental good to its former condition. This approach could be useful where the damage is minor. Obviously, it is of limited use where the damage is either irreversible or total restoration is impossible.

Avertive expenditure method

This method can be used when households (or governments) spend money to offset adverse environmental impacts. In this case, the measures taken by households are identified and their costs are estimated using market prices. An example of avertive behaviour is a community which does not have potable water. In this case, the benefits of introducing a water treatment plant include the amount of money people spend to boil or treat their water for cooking or drinking purposes. The results obtained from this approach are valid because it is based on actual expenditures but there is the need to ensure that the benefit people receive from the expenditure is only the improvement of environmental quality.

(d) Benefit Transfer (BT) Methods

The BT method, as suggested by the name, involves 'transferring' values that have already been estimated for a similar good or service from area to the current area. At the present time there is some controversy about the validity of BT methods. It has been suggested that the following conditions must hold to ensure the validity of BT estimates.

- The goods (or services) in both sites should have roughly similar characteristics;
- The population in both areas should be similar; and
- The values in the first study should not have been estimated a long time ago because preferences change over time.

Three tests have been suggested to determine the accuracy of benefit transfer. The purpose of these tests is to determine the convergent validity (i.e., statistical validity) of benefit transfer and the extent of any bias. The first test compares the BT values with primary data obtained from the policy site. Validity of the BT estimates can be established if they are not statistically different from the data values obtained from the policy site. The extent of bias can be shown by the deviation between the two estimates. The second test involves determining whether different populations have the same preferences for the same non-market good, after controlling for differences in socioeconomic characteristics such as income and education levels. The third test determines how stable the BT estimates are over time.[7] Many studies have concluded that value estimates remain relatively stable over a few years. Morrison et al. (1998) investigated the suitability of using choice modelling estimates for benefit transfers both across different populations and across different wetlands in northern New South Wales, Australia. In general, the weight of the evidence appeared to be against the convergent validity of both transfers across sites and across populations. However, they found that transfers across sites tended to be less problematic compared to transfers across populations.

2. Stated Preference Methods

Stated Preference Methods can be either direct or indirect (see Figure III.2). The direct form of SP method is referred to as the contingent valuation method (CVM). Indirect SP methods include a variety of approaches including contingent ranking and choice modelling.

(a) Contingent Valuation Method

The CVM directly infers values by using surveys to ask people their maximum willingness to pay to avoid (WTP) and/or minimum willingness

[7] See, for example, studies by Reiling et al. (1990) and Teisl et al. (1994).

to accept compensation (WTA) for changes in environmental goods or services.[8] The term 'contingent' in CVM suggests that it is contingent on simulating a hypothetical market for the good in question. Theoretically, WTP and WTP measures should be equivalent. However, empirical studies have that WTA estimates tend to be higher than WTP estimates. A CV survey has a number of well-defined components. First, the interviewer describes the environmental good or service, including the change in the resource to be valued. The second element is a mechanism for eliciting the respondent's WTP or WTA. There are various formats for eliciting WTP (see Table III.1). The dichotomous choice (or referendum) format (Bishop and Heberlein, 1979) is considered to be the state-of-the-art in CVM methodology. A National Oceanic and Atmospheric Administration (NOAA) panel of economic experts, chaired by Kenneth Arrow and Robert Solow, recommended the referendum format over the open-ended format (Arrow et al., 1993). In all the formats, a payment method such as increased income taxes, increased utility bills or voluntary donations are used.

Table III.1. Formats for Eliciting WTP Values in the Contingent Valuation Method

Format	*Main features*
Bidding games	Respondents are offered progressively higher bids until they reach their maximum WTP
Payment card	A range of values is provided on a card and the respondent is requested to choose one
Open-ended questions	Respondents are asked to report their maximum WTP
Dichotomous choice (referendum)	A single amount is offered and respondents are asked to provide a 'yes' or 'no' answer, also referred to as the 'take it or leave it' or approach
Double-bounded referendum	Respondents who answer 'no' to the first amount are offered a lower amount, and those who answer 'yes' are offered a higher amount
Trichotomous choice	Respondents are offered three choices to the payment: 'yes', 'no' and 'indifferent'

[8] The CVM was first suggested by Ciriacy-Wantrup (1947). Since then it has been widely used. Carson et al. (1995) produced a bibliography showing 1,674 applications of the CVM.

The CVM survey also asks questions about respondents' socioeconomic characteristics, as well as other information about their environmental attitudes and other factors that might affect their WTP. The final part of the CVM study is the statistical analysis. The WTP responses are usually regressed against the socioeconomic and attitudinal characteristics and the estimated equation is used to provide aggregate estimates of mean or median consumer's surplus.

Limitations of the CVM

The method is quite versatile and can be applied to any environmental impact. As indicated earlier, it is the only method which can, so far, be used to estimate non-use values. The approach is fairly simple and relatively straight-forward to apply. However, the CVM has many acknowledged problems. These include hypothetical bias, strategic bias, embedding effects, information bias, and survey techniques bias. These biases are summarized in Table III.2.

Some of these issues were reviewed by the NOAA panel who concluded that "… under [a number of stringent guidelines] CV studies convey helpful information…. There will always be controversy where intangible losses have to be evaluated in monetary terms" (Arrow et al., 1993, pp. 4603-4604).

(b) Indirect SP Methods

Contingent ranking/rating and choice modelling belong to a group of indirect SP methodologies that were initially developed by market researchers in the evaluation of new products and markets (Louviere and Woodworth, 1983). In recent years, these techniques have been adapted to value environmental goods and services. (Table III.3 shows an example from a contingent rating survey.)

Contingent Ranking/Contingent Rating

In this approach, respondents are asked to rank a set of hypothetical alternatives from "most preferred" to "least preferred". Another form of contingent ranking is contingent rating where respondents are required to rate a set of hypothetical alternatives on a numerical scale. The theoretical basis of these methods is information integration theory (IIT) (Anderson, 1982; Lynch, 1985). Under IIT, each respondent is assumed to evaluate separately each piece of information about an option presented to them and assign a value to each piece of information. The information is then integrated to produce an overall evaluation, which is then transformed into a ranking or rating. (Table III.3 shows an example of a contingent rating survey.)

Table III.2. Some of the Biases Associated with the Contingent Valuation Method

Bias	*Description*
Hypothetical bias	It has been suggested that the hypothetical nature of the exercise might induce people to 'free ride', that is, understate their true WTP.
Strategic bias	Occurs when a person deliberately overstates (or understates) his or her true bid in order to influence the outcome. For example, some people who strongly support a proposed development may report a zero WTP for conservation even when they have a positive WTP.
Embedding effect	Occurs when an individual's WTP is lower when it is valued as part of a more inclusive good or service, rather than on its own. It has been suggested that embedding is caused by the existence of substitutes. That is, people will reduce their WTP if they are aware of substitutes.
Information bias	If insufficient information about the environmental good or service being values is given, the individual's WTP many not the same as the actual WTP.
Survey technique bias	Mail surveys generally have fewer respondents than face-to-face interviews, but interviewers could influence the responses. Also bias could result could arise from the use of inappropriate sampling techniques.

Table III.3. Example from a Contingent Rating Survey

Wetland Management Study

Please circle the number that shows your preferences for the following option:

Water quality	fair
Number of waterbirds	20,000
Area of wetland	30,000 ha
Cost to household	$ 20

1 2 3 4 5 6 7 8 9 10

least preferred — most preferred

Choice Modelling

Choice modelling (CM) is an SP technique in which respondents choose their most preferred resource use option from a number of alternatives. Usually, each alternative is defined by a number of attributes. For example, in a CM study of preserving a wilderness area the attributes could be the following: numbers of rare species present; ease of access to the area, size of area and cost to households (Table III.4). These attributes are varied across the various alternatives. The respondents are then required to choose their most preferred alternative. Estimates of respondents' WTP are obtained by estimating a multinomial logit[9] model.

Table III.4. Example from a Choice Modelling Survey

Wilderness Management Study

Please indicate the options you prefer most by ticking one of the boxes below:

	Option 1 (status quo)	*Option 2*	*Option 3*
Number of endangered species	5	15	15
Area to be set aside	1,500	1,800	2,100
Visitor days per annum	2,000	3,000	2,000
Cost to household	$ 0	$ 20	$ 10

Limitations of Indirect SP Methods

Methods such as CM and contingent ranking/rating are perceived as having a number of advantages over CVM. First, respondents are not required to monetize environmental goods and services explicitly. It is felt that people are generally more comfortable with providing qualitative rankings or ratings of attribute bundles, which include prices, rather than monetary valuations of the same attributes without prices. In that sense, these methods could minimize some of the biases of the CVM. Second, indirect SP methods enable a more detailed evaluation of alternatives and are less prone to strategic bias compared to CVM. A weakness of contingent ranking/rating is that respondents are not given the opportunity to express opposition to payment for the environmental

[9] A multinomial logit model is a regression model in which the dependent variable (i.e., left-hand side variable) represents the choice that the respondent makes. For example, in Table III.4, the respondent has to choose one out of three options and therefore the dependent variable will take on values of either 1, 2 or 3.

good unless through providing a low ranking or rating. CM can be used to value multiple sites or multiple use alternatives. However, the main disadvantage of CM is that it requires complex survey designs. The number of choice sets can be large, which tends to lengthen interview times. Thus the "accuracy" of the responses could decline as the survey progresses.

D. Implementing non-market valuation techniques in PICs

There are two major benefits of carrying out non-market valuation exercises in PICs. First, it uncovers the size and value of a country's natural resources. Even though such values tend to be lower bound estimates (because not all aspects of environmental resources can be valued), they nevertheless allow decision makers to make informed judgements when it comes to trade-offs involving natural resources. In the absence of such estimates, environmental resources are likely to be given zero (or low) values that might favour the development option over the conservation option. Second, valuation, when carried out in the context of natural resource (or green) accounting, helps to identify "critical natural capital". Critical natural capital is the part of the natural capital stock that is required to perform vital environmental functions and is a key requirement of environmental sustainability. Such information would be helpful for setting minimum standards for maintaining various types of natural capital and for planning towards SD.

As is shown in the case study below, non-market valuation techniques can be applied in the Pacific Island setting. Although, care needs to be taken to ensure that the particular method chosen is appropriate for a given situation. In particular, any assumptions inherent in the method must be shown to be satisfied. For example, the HPM assumes that there is a well-developed property market and that environmental values are reflected in property prices. Such assumptions may not be realistic in some rural areas where property markets do not exist. The choice of technique also depends on the capacity to generate or provide the relevant data. For example, the HPM involves the collection of house prices over time and in different areas with similar characteristics. In some countries, such data may not exist yet and would have to be collected over a period of time.

In terms of ease of application, the CVM offers the best prospects in PICs (see case study below). The CVM has been applied in many developing country situations including Pakistan (Altaf and Deshazo, 1996), India (Kohlin, 1996), and Kenya (Whittington et al., 1990), to mention just a few. The only assumption inherent in the CVM is that people are willing and able to report a monetary valuation of their preference for a given good or service.

This assumption could be problematic in a mainly subsistence-based economy where people are not used to paying for goods and services in cash. But even in such situations, modifications could be made to the CVM to enable the method to be applied. For example, the payment method could take the form of in-kind payments rather than cash payments, if the respondents are more familiar with them.

Case Study III.1: Economic Valuation of the Terrestrial and Marine Resources of Samoa[10]

Introduction

Agriculture, fishing and tourism are the main contributors to Samoa's economy. The national government has identified the need to incorporate the economic values of Samoa's natural resources into the National Biodiversity Strategy and Action Plan (NBSAP) with the view to incorporate biodiversity conservation with policy planning. It was recognized that the essential role played by these resources in the economy is not explicitly known since many of the services they provide are not transacted through formal markets. In some cases, markets do not exist to permit payments for their utilization. The government therefore commissioned this study to value Samoa's marine and terrestrial resources, in particular, its forest resources.

The report contains several case studies on assessing the economic value of forest and marine resources. Three of these case studies are reported here – the use and non-use values of recreational services provided by the Mount Vaea Forest Reserve Trail and the Palolo Deep Marine Reserve using the CVM, and the economic values of other services using Benefit Transfer Methods. Mount Vaea Scenic Forest Reserve Trail offers interesting outdoor experiences to the recreationist. This national park contains a botanical garden at the foot of Mount Vaea. A trail to the summit of Mount Vaea leads to the tomb of Robert Louis Stevenson, the renowned author. The trail is a steep climb, providing beautiful views of the forest, birdlife and Apia. The trail is maintained by the Division of Environment and Conservation (DEC) and there is currently no entrance fee charged for access.

Palolo Deep Marine Reserve is a fringing reef encompassing a lagoon comprising a total area of 137.5 hectares. It was formalized as a marine reserve in 1974, under the National Parks and Reserve Act and remains the only recognized national marine reserve in Samoa. The best part of the reserve is a

[10] The material in this section is taken from Mohd-Shahwahid (2001).

deep chasm about 100 metres offshore filled with colourful corals and other marine life. Currently the reserve is being managed by a private agent under the supervision of DEC. A fee of 2 Samoan Tala (WS$) per person is currently charged for entry.

The use value of recreational services provided by forest and marine resources obtained from the CVM

In this study a clear and realistic hypothetical market for the recreational services provided by the Mount Vaea Forest Reserve Trail and the Palolo Deep Marine Reserve was established. Respondents were reminded that only the recreational benefits of these resources were being valued. They were told that to maintain the quality of the services, the reserves would have to be managed. This set up a reason for payment for the services where no direct payment is currently demanded at Mount Vaea and an additional payment is being sought for Palolo Deep. Entrance fees were used as the payment vehicle to elicit respondents' WTP. This particular payment vehicle was considered to be appropriate since respondents could easily relate to it and it is currently being used at Palolo Deep.

To ensure the validity of the WTP responses, information on the responses' socioeconomic charateristics (e.g., age, income and education) was collected to be used in a multiple regression equation. The payment card elicitation format was used. Respondents were given a series of values from which to choose their maximum WTP. Prior to implementing the CV survey, the questionnaire was pre-tested on a small sample of respondents at the sites and further adjustments were made to it. During the data analysis, the rate of non-responses, protest responses and zero or extremely high responses was found to be low, not exceeding 10 per cent. Further analysis of the zero WTP responses revealed that they consisted of people with genuine income constraints as well as protest bidders. The latter included a small proportion who indicated that natural resource recreational services should be a free good to be supplied by the government. The mean and median WTP bids were computed from the responses and multiplied by the total number of visitors to obtain an estimate of the total recreational value.

Table III.5 shows that the mean WTP for a visit to Mt Vaea was WS$ 2.61 for international visitors and WS$ 0.67 for domestic visitors. For Palolo Deep, the corresponding figures were WS$ 4.49 for international visitors and WS$ 3.57 for domestic visitors. Multiplying the mean WTPs by the total number of visitors per annum resulted in benefits of WS$ 6,515 and WS$ 22,136 for Mt Vaea and Palolo Deep, respectively, generated by international visitors. Corresponding figures for domestic visitors were WS$ 1,544 and WS$ 2,142 per annum for Mt Vaea and Palolo Deep, respectively.

Table III.5. The Recreational Value of Forest and Marine Resources in Samoa (WS$/year)

Resource	*International Visitors*			*Domestic Visitors*		
	No. of visitors	*Mean WTP*	*Total WTP*	*No. of visitors*	*Mean WTP*	*Total WTP*
Mt Vaea	1,860	2.61	6,515	2,300	0.67	1,544
Palolo Deep	4,928	4.49	22,136	600	3.57	2,142
All forest resources	–	–	346,545	–	–	–
All marine resources	–	–	1,390,329	–	–	–
Total for forest and marine resources	–	–	1,736,874	–	–	–

Source: Based on Mohd-Shahwahid (2001), Table III.19.

It was not possible to estimate the total economic value of recreational services provided by forest and marine resources for domestic visitors as no records of daily visits to all sites in the country were available. For international visitors, the mean WTP for Palolo Deep was used as a proxy for the economic value of a visit to a marine-based resource, while the mean WTP for Mt Vaea was also used as a proxy for the economic value of a visit to a forest-based resource. Multiplying the number of holiday arrivals by the number of sites and the mean WTP provided estimates of the economic value of recreational services of WS$ 346,545 per annum for forest resources and WS$ 1,390,329 per annum for marine resources. Adding these two figures together gave an estimate of WS$ 1,736,874 per annum for the two resources.

The indirect use and option values of the ecological functions of the forest and marine resources obtained from the CVM

This CVM study was conducted specifically to value the preferences of Samoan citizens for the indirect and option values generated by the ecological functions of the Mount Vaea Scenic Forest Reserve and the Palolo Marine Reserve. Hence, the study excluded the value of these resources held by the rest of the world. Special attention was given in the survey to highlight the fact that the resources of interest are limited to tropical rain forests, mangroves and marine reserves. The respondents were specifically requested to consider the list of benefits and services generated by each of these resources. For instance, in the case of the rainforest, respondents were given a brief description of the functions of the tropical rainforest including:

- Regulation of atmospheric gases (e.g., absorption of CO_2 and release of oxygen);
- Provision of climate regulation services including cooler temperatures and rain to adjacent areas;
- Regulation of hydrological flows (e.g., reducing soil erosion; minimizing siltation of dams, lakes and rivers; storing and retaining rainwater); and
- Source of biodiversity and source of gene pools to support future human needs for food and medicine.

Since the study was intended to capture only the indirect and option values of the ecological functions of the forest, the questions focused on the indirect use functions and benefits of the forest. The direct use values (e.g., timber, non-timber and recreational services) were valued using other methods. To ensure that the respondents were clear about this point, they were reminded again of the forest's role as a source of human needs for food, raw materials like timber, herbs and medicine, and also the place to seek opportunities for recreation, spiritual tranquillity, and education.

Following this introduction, the respondents were asked for the maximum WTP per annum which would be placed in a conservation trust fund and used to manage the forest resources, not only for current generations but also for future generations. The survey was conducted at various locations around the town where it was felt that both rural and urban residents would be found. The interviews were conducted in the Samoan language. The sample size was 100 and the total mean annual economic value of the ecological functions of the natural forest and marine resources was estimated to be WS$ 4.75 per person, and the median was WS$ 3.50 per person (see Table III.6). These values were quite evenly distributed among the three resources considered with slightly higher values (WS$ 1.90 per person) being registered for the rainforest and lower values (WS$ 1.22 per person) for mangroves.

Given Samoa's population of 170,000, and assuming that the sample is representative of the population, the economic value of the benefits provided by the natural forest and marine resources was estimated to be WS$ 807,500 per annum. A breakdown of this total by resource provides benefits of WS$ 323,106 per annum for the rainforest, WS$ 277,242 per annum for the marine reserve and WS$ 207,152 for mangroves. A regression analysis was conducted to further investigate the validity of the bids. There was a positive relationship between WTP, on one hand, and age, education, and income on the other. However, income was found not to be a statistically significant variable.

Table III.6. Indirect and Non-Use Values of the Ecological Functions of the Natural Forest and Marine Resources in Samoa

	Rainforest	*Marine Reserve*	*Mangroves*	*Total value*
Mean WTP (WS$/person/year)	1.90	1.63	1.22	4.75
Median WTP (WS$/person/year)	1.45	1.00	0.65	3.50
Population Total value (WS$/year)	323,106	277,106	207,152	807,500

Source: Mohd-Shahwahid (2001), Table III.20.

Assessing economic value of the ecological functions of the natural forest using the Benefit Transfer Method

The BT method was also used to estimate the total economic value of the ecological functions of Samoa's forest resources. A comprehensive review of the literature was conducted on the values of various environmental goods and services that were not originally estimated in this study. The approach adopted here was based on Costanza et al.'s (1997) approach. Costanza and his colleagues computed the value of the world's ecosystem services and natural capital and converted it into 1994 US$ equivalents on a per hectare per annum basis. They did this by adjusting for purchasing power parity differences between the country of origin and the United States. This makes it easier to convert the estimated value into Samoan Tala (WS$) equivalents since it uses a single ratio of purchasing power GNP per capita of the United States of America to that of Samoa. The values were then inflated to the year 2000 by multiplying by the Samoa's consumer price index. This conversion is necessary is necessary to adjust for income effects.

Benefit transfer was used to value the ecological functions of forests for two reasons. The first was to provide an alternative estimate for comparison with that obtained from the CVM. The second was to obtain a breakdown of the separate components of the ecological functions. Table III.7 shows estimates for the value of the ecological functions of Samoan forests. Climate regulation provides benefits of about WS$ 2.3 million per annum, water regulation is valued at WS$ 653,108 per annum, while the value of genetic resources is estimated to be WS$ 835,978 per annum.

Table III.7. Economic Values of the Ecological Functions of Forest Resources in Samoa

Function	*Source of value estimate*	*Economic valuation technique*	*Research site*	*Purchasing Power Parity adjusted*	
				Unit value (WS$/ha/yr)	*Benefit Transfer value (WS$)*
Climate regulation	Adger et al., 1995	Avoided damage cost	Mexico	13.32	2,298,940
Disturbance regulation	Ruteenbeek (1988)	Change in productivity	Cameroon	0.32	52,249
Water regulation	Kumari (1995)	Change in productivity	Malaysia	3.78	653,108
Water supply	Kumari (1995)	Change in productivity	Malaysia	1.67	287,368
Erosion control	Mohd Shawahid et al. (1999)	Change in productivity	Malaysia	1.25	214,874
Genetic resources	Adger et al. (1995)	Option value	Mexico	4.84	835,978
Total ecological function					4,342,517

Source: Based on Mohd-Shahwahid (2001), Table III.24.

The total value of the ecological functions of the forest in Samoa is WS$ 4.3 million per annum. This figure is much higher than the value obtained from the CVM study for two reasons. First, Costanza et al.'s method includes the benefits of climate regulation services enjoyed by all mankind. Second, some of the components in their approach are valued using cost-based approaches that do not necessarily reflect individual's WTP.

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IV. GREEN NATIONAL ACCOUNTING AND THE MEASUREMENT OF GENUINE (EXTENDED) SAVING

"[The] difference in the treatment of natural resources and other tangible assets [in the existing national accounts] reinforces the false dichotomy between the economy and 'the environment' that leads policy makers to ignore or destroy the latter in the name of economic development"

Repetto et al., 1989:3

A. Introduction

The environment plays a number of important roles including, sustaining basic life support systems, providing raw material inputs to producers and consumers, serving as a receptacle for the waste products of producers and consumers, and providing amenities to consumers (e.g., recreation). In the periods when the world's population and the scale of economic activities were relatively small, environmental inputs were often regarded as 'free' goods and the environment was treated as a 'sink' for disposal of waste. However, there is a limit to the extent of the environment's capacity to assimilate waste. Pollution and environmental degradation begin to occur when this assimilative capacity is reached. Furthermore, once this limit is exceeded, the ability of the environment to provide other services (e.g., provide inputs) is compromised. There is a need to view the natural environment not only as a resource but also as an asset similar to traditional assets such as land, labour and capital. The value of this resource must therefore be integrated into the economic system. In Chapter II, the deficiencies in the traditional System of National Accounts (SNA) which places emphasis on GDP/GNP measures were discussed. Measures such as Net Domestic Product (NDP), while better than GDP for measuring sustainability, account only for the depreciation of produced assets and ignore the depreciation of natural resources and degradation of the environment. Alternative 'greener' measures such as Green Accounting and Genuine Saving were briefly introduced in Chapter II. This Chapter discusses the two approaches in a little more detail, noting their limitations. The chapter concludes with case studies reporting applications of the two approaches.

B. Green accounting

The 'greening' of the SNA to reflect environmental concerns followed the initial work of Ahmed et al. (1989), Repetto et al. (1989) and Hartwick (1990). The approach taken by Hartwick is based on neo-classical growth models and attempts to specify 'optimal' adjustments to the SNA. The second approach, that of Ahmed et al. (1989) and Repetto et al. (1989), is a more practical approach that attempts to make piecemeal changes to the widely accepted SNA.[11] As of now, there is no universal agreement among economists as to how these adjustments should be made to reflect environmental damage. In December 1993, the UNSO, in collaboration with international agencies, launched the SEEA, which is based on the framework presented by Ahmed et al. (1989)[12]. The SEEA is implemented in the form of satellite (or supplementary) accounts that are linked with the core accounts of the SNA. In that sense, the SEEA maintains concepts and principles embodied in the SNA. The basic features of the SEEA are as follows:

- **Segregation and elaboration of all environment-related flows and stocks of traditional accounts.** This aspect of the SEEA seeks to identify the part of GDP which reflects the costs necessary to compensate for the negative impacts of economic growth, i.e., defensive expenditures;
- **Linkage of physical resource accounts with monetary environmental accounts and balance sheets.** This component attempts to establish comprehensive physical resource accounts to be linked to the monetary balance sheet and flow accounts of the system of national accounts. The resource accounts will consider the total reserves of natural resources and changes therein even when such resources are not yet affected by the economic system;
- **Assessment of environmental costs and benefits.** This key part of the SEEA seeks to improve on the SNA by accounting for depletion of natural resources and changes in environmental quality due to economic activity;
- **Accounting for the maintenance of tangible wealth.** In this component, natural capital is handled in the same way as physical capital. Natural capital defined here includes renewable resources

[11] Excellent reviews of this literature can be found in Hamilton (1994) and Hanley (1997).

[12] The five agencies are the Commission of the European Communities, IMF, OECD, UN and World Bank.

(e.g., forestry, fisheries,), non-renewable resources (e.g., land, soil, mineral), and air and water resources; and

- **Elaboration and measurement of indicators of environmentally adjusted product and income.** The intention here is to develop modified macroeconomic measures of national income such as environmentally adjusted domestic product (EDP). This measure accounts for the costs of depletion of natural capital and changes in environmental quality.

As indicated earlier, EDP is obtained by subtracting from NDP the costs of environmental degradation and the depreciation of the stock of natural resources. Two alternative measures of EDP have been suggested:

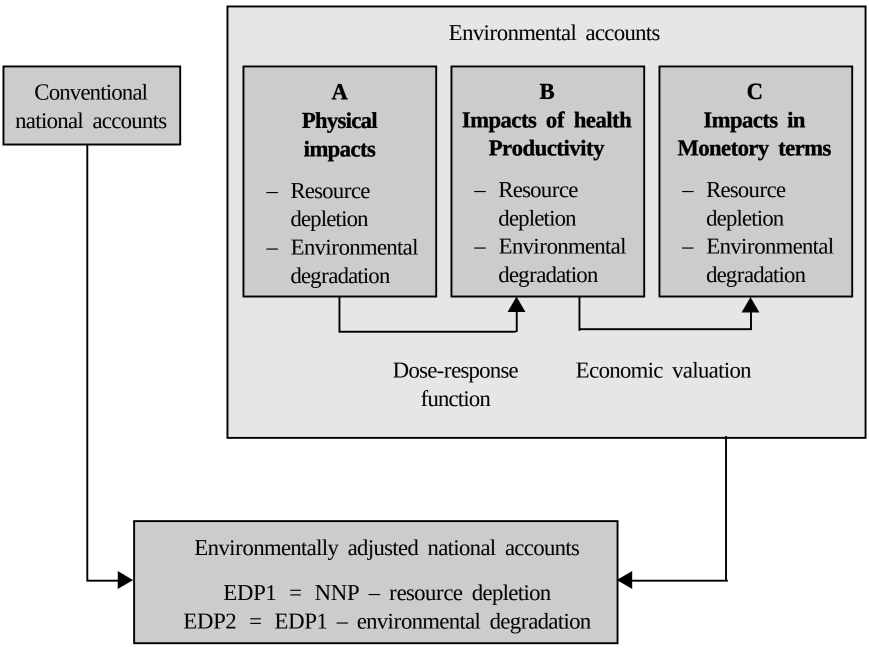
EDP1: NDP minus depreciation of natural resources due to extraction; and

EDP2: EDP1 minus the cost of environmental degradation.

The construction of the SEEA proceeds in four steps (see Figure IV.1). The first step involves compilation of physical accounts. These are non-monetary accounts that measure resource depletion and environmental effects. The second step is to compute the non-monetary impacts. These include impacts on health, agricultural production, global warming, and ozone depletion. The third step is to value these effects in monetary terms. The final step is to adjust the conventional national accounts using the EDP measures. The first measure, EDP1, uses the market value of extracted resources to compute depreciation from NDP, with no allowance for changes in prices. As the majority of environmental costs are non-market in nature, EDP2 is based on willingness-to-pay estimates that are obtained by using the non-market valuation methods discussed in the previous chapter. There are a number of problems with implementing the EDP measures and these are discussed below.

The SEEA (and variants of it) has been implemented on a trial basis in a number of developing countries including Papua New Guinea (a case study is presented below), Mexico and Indonesia. In the Indonesian study, David Repetto and others at the World Resources Institute in Washington, D.C., adjusted Indonesia’s national accounts for environmental effects in 1990 (Repetto et al., 1989). Indonesia’s natural resources consist of oil, gas, minerals, timber and forest products. Together, these resources account for 44 per cent of GDP, 84 per cent of exports, and 55 per cent of total employment. Economic progress over the period of the study, 1970 to 1990, has been considered very good. For example, GDP per capita grew at 4.6 per cent per annum between 1965 and 1986. This is quite high in relation to that of low-income and middle-income countries. Repetto et al. (1989) adjusted Indonesia’s national accounts for the period 1971-1983 by subtracting from GDP estimates of net national resource depreciation for only three sectors: petroleum, timber and soils, to arrive at an estimate of NDP. The results clearly indicated that official GDP estimates overstated net income and growth of net income. The actual overstatement was higher since only three natural resources (petroleum, timber and soils) were considered. Items not included were: (i) exhaustible resources – natural gas, coal, tin, nickel; and (ii) depreciation of renewable resources (e.g., fisheries and non-timber forest products).

Figure IV.1. Framework of the System of Integrated Economic and Environmental Accounting



Source: Adapted from Serageldin and Steer (1994).

1. Issues and Limitations of Green Accounting

Although progress has been made in terms of trying to change the way national accounts are compiled with the view to making them reflect environmental considerations, several practical difficulties and issues remain to be resolved. These issues include: accounting for defensive expenditures and pollution damages, the valuation of environmental damages, the treatment of transboundary pollutants, and the treatment of socio-political development goals and issues.

(a) Defensive expenditures and pollution damages

'Defensive expenditures' can be defined as expenditures incurred by households and governments to reduce the effects of pollution. Examples of defensive expenditures for the household include buying water purification equipment to improve drinking water quality or buying a malaria prophylactic. For the government, this could include expenditures on litter removal or repairing degraded recreational sites. There is no agreement on to how to handle these expenditures. Maler (1991) argues that such expenditures should not be deducted from NDP if the changes in the values of 'environmental services' (e.g., air and water quality) are included, since this would amount to double counting. Dasgupta (1995), on the other hand, states that defensive expenditures should be included in final demand. Bartelmus and van Tongeren (1994) argue that the cost of restoring polluted or damaged natural environments to their original state at the beginning of the accounting period should be deducted from NDP. This is similar to the EDP2 measure mentioned above and is referred to as the 'maintenance cost' approach to accounting for environmental effects. However, this maintenance cost approach has also been criticized on two grounds. First, Aaheim and Nyborg (1995) argue that costs that would have been incurred to prevent an increase in emissions could severely underestimate the cost of actually repairing the damage, especially if the damage is irreversible. Second, the maintenance cost approach is problematic for cumulative pollutants for which any emission adds to the stock because there is no assimilative capacity. Hueting et al. (1992) argue that a better approach would be to value environmental damage at the cost of bringing environmental quality to 'sustainable levels'. However, the problem with this suggestion is that there is likely to be disagreement over how to determine what level is sustainable.

(b) Valuation of environmental damages

Regardless of which measure of environmental damage to use, there are difficulties in placing monetary values on effects that are non-market in nature. As was discussed in Chapter III, techniques such as contingent valuation, choice experiments, hedonic pricing and travel cost methods have been developed to assist environmental valuation. However, there are some environmental effects that are difficult to value even with the state of the art techniques. Even when such effects can be valued, there is the additional issue of whether the society's valuation is equal to the sum of the individual valuations. A practical consideration is that the different techniques often yield different estimates, implying that there could be large differences in the value of environmental depreciation used to compute EDP.

(c) Transboundary pollutants

The transboundary issue concerns the case where some pollutants (e.g., SO_2 and NO_2) are emitted in one country and has adverse effects on other countries. An extreme case is where the effects (e.g., global warming) are worldwide. The practical issue here is how, or whether, we should account for the polluting effects external to the country for which EDP is being computed. The same question applies to the case of imports of transboundary pollutants. Some people (e.g., Maler, 1995) have argued that pollution damages of a country on other countries should be deducted from its NDP, since NDP measures the welfare impacts of projects in that country. However, he suggests that imports of emission into the country should be ignored. His suggestion raises a couple of issues. The first is the practical problem of separating out pollution impacts in the country, which is more difficult if there are also similar emissions from the country. The second point is the counter argument that if NDP is a measure of the welfare of the inhabitants of a given country, then imports of emissions should be counted but exports should not. Whatever the approach adopted, there is the additional problem that all countries should reach a consensus for the SEEA to be meaningful at the global level.

(d) Treatment of socio-political development goals and issues

Development goals such as equity, cultural aspirations or political stability are difficult to quantify and quite impossible to value in monetary terms. Such effects would have to be specified in normative terms as targets or standards. In many developing countries today, there is increasing poverty, income inequality, corruption, and crime. These issues are difficult to measure, even when we use non-economic indicators.

C. Genuine (extended) saving

The concept of genuine (or extended) saving (Pearce and Atkinson, 1993) has been proposed as a broad measure of sustainability that values changes in the natural resource base and environmental quality in addition to man-made (or produced) assets. The traditional measure of a country's rate of wealth accumulation is gross saving which is given by the difference between GNP and private consumption. Gross saving is the total amount that is set aside for the future in terms of either foreign lending or investment of productive assets, and it tells us little about whether or not a particular development path is sustainable. This is because we expect productive assets to depreciate.

The issue then is whether the amount of depreciation is greater than gross saving. Net saving, which is gross saving minus depreciation of produced assets is a slightly better indicator of sustainability, although it focuses only on produced assets.

The World Bank has proposed a methodology for calculating genuine saving (GS) which they have applied to a number of countries. The process begins with the conventional national accounts. First, gross domestic saving is obtained by deducting net foreign borrowing (including net official transfers) from gross domestic investment, which consists of total investments in structures, machinery and equipment, and inventory accumulation. That is,

$$\text{Gross Domestic Saving} = \text{Gross Domestic Investment} - \text{Net Foreign Borrowing} + \text{Net Official Transfers} \qquad (4.1)$$

Next, net saving is obtained by deducting depreciation of produced asset from gross domestic saving. That is,

$$\text{Net Saving} = \text{Gross Domestic Saving} - \text{Depreciation of produced capital} \qquad (4.2)$$

Finally, GS is obtained by subtracting the value of resource depletion and pollution damages from net saving, and adding on the value of investment in human capital. That is,

$$\text{GS} = \text{net saving} + \text{human capital investment} - \text{depletion of natural resources} - \text{pollution damage} \qquad (4.3)$$

Human capital investment:

The inclusion of human capital is based on the rationale that human capital contributes to overall sustainability by assisting in the ongoing creation and maintenance of national wealth. Human capital investment in the current period is assumed to provide the resources for improvements in productivity and income in the future. Although, historically, a number of specific measures of human capital have been developed (e.g., see OECD, 2000), in computing the GS measures, the World Bank uses current educational expenditures as a proxy for the value of human capital.[13] Obviously, this is not the best measure because expenditure by itself is an indicator of financial input into the process of human capital formation. Therefore, it is only an indirect indicator of the economic contribution of education to a nation's growth and productivity.

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[13] Current educational expenditures consist of teachers' salaries and expenditure on textbooks.

Depletion of natural resources:

Depletion of natural resources is measured as the total rents on resources extracted and harvested. For renewable resources (e.g., bauxite, copper, gold, iron ore, and so on) rents are estimated as the difference between the value of production at world prices and the total production costs. For forest resources, the rent is computed as the difference between the rental value of log harvests and the corresponding value of natural growth and plantations less harvesting costs. In the computation of forestry rents, only the commercial value of timber is considered and other environmental services provided by trees such as carbon storage, watershed protection and the value of non-timber forest benefits are excluded. The calculation of resource rents also omits other natural assets such as fisheries resources and the economic costs of soil degradation.

Pollution damages:

Due to problems associated with precisely determining the welfare effects of pollution damage, a very simple approach is adopted in the computation of GS. Pollution damage is calculated only for CO_2, using a global estimate of US$ 20 per metric ton of carbon emitted. It is, however, possible to extend the calculation to include other critical pollutants such as chlorofluorocarbons (CFCs).

1. Policy uses of genuine savings estimates

For PICs that are dependent on natural resources for the bulk of their national income, GS estimates computed over a period of time can be used to answer pertinent questions about the sustainability of natural resource use. Such questions include:

- Are the rents from natural resources invested or consumed?
- What are the types of investments that a country makes?
- Do existing property rights regimes encourage sustainable exploitation of natural resources?
- Are royalties set appropriately to capture resource rents?
- Do policies to promote natural resource exports also contain plans for the investment of the resource royalties?
- What micro and macroeconomic policies such as government expenditures, taxation and interest rates can be devised to create incentives for higher genuine savings?

Some PICs are beginning to experience pollution problems associated with rapid urbanization. Computation of GS estimates would enable planners to answer the following questions:

- Do the current pollution reduction policies target efficient levels of emissions?
- Are sufficient savings being made to offset cumulative effects of pollution?

2. Limitations of genuine saving measures

There are a number of limitations associated with GS as a measure of sustainability. These can be divided into two categories – conceptual and technical. The conceptual issues deal with the way the measure is defined, while the latter deal with how the measure is actually computed. There are at least four conceptual problems with the definition of GS. First, it cannot be assumed that savings necessarily equates to investment. Furthermore, even if all savings are channeled into investment, this does not mean that the level of output will be sustained. The sustainability of output will depend on the quality of the investment in capital and how efficient it is. For example, a developing country investing heavily in primary education may be setting itself up on a more sustainable growth path than one that is consuming the proceeds of natural resource extraction. Second, GS does not address the issue of intra-generational equity. For example, a country may have a high level of savings but these could belong to a small fraction of the population and therefore may not contribute much to the country's development. Third, GS is based on weak sustainability since it does not distinguish between the types of capital that can be substituted for each other. In that sense, it is a narrow concept of sustainability. Fourth, due to the fact that GS is measured in monetary units, changes in resource prices (which is usually beyond the control of individual countries) may cloud changes in physical stocks, and may therefore give a less than clear picture of changes in sustainability.

The main technical limitation of GS measures relates to the fact that it is currently based on the World Bank's methodology that excludes some important aspects of natural capital. For example, the approach restricts pollution damage to only CO_2 emission, which is estimated at a flat rate of US$ 20 per ton for all periods. Other major air pollutants such as SO_x, NO_x, particulates, ozone and CFCs, as well as damage from water pollution, are excluded. The approach also restricts natural resource depletion to only two components – minerals and forestry – and makes no provision for the depletion of other land-based capital due to factors such as soil erosion, salinity and water pollution. Finally, the current approach also ignores the following important components of natural capital: freshwater and marine-based resources; the value of ecosystem services such as carbon sequestration, biodiversity and watershed regulation; the value of native remnant bushland (e.g., dry tropical savannah); the value of air resources; and industrial and household uses of water. Admittedly, mostly these omissions are due to the technical difficulties associated with estimating non-market values such as biodiversity and other ecosystem services. However, research advances should make it possible to at least obtain ball park estimates of some of these effects.

Case Study IV.1: A Calculation of Genuine Savings for Queensland[14]

Introduction

Estimates of GS were computed for the state of Queensland using the World Bank's methodology. Queensland is a natural resource dependent state with mining accounting for 45 per cent of its natural capital, and agriculture and forestry accounting for 38 per cent (see Figure IV.2)

The GS for Queensland was estimated for the period 1989/90 to 1999/2000, at constant (1999/2000) prices. Some modifications were made to the calculation to reflect the State-level equivalent of each component in the World Bank's methodology. GS was defined as follows:

$$\text{GS} = \text{Net State Saving} + \text{Human Capital Investment} - \text{Depletion of Natural Resources} - \text{Pollution Damage} \tag{4.4}$$

where

$$\text{Net Saving} = \text{Gross Domestic Saving} - \text{Consumption of Fixed Capital} \tag{4.5}$$

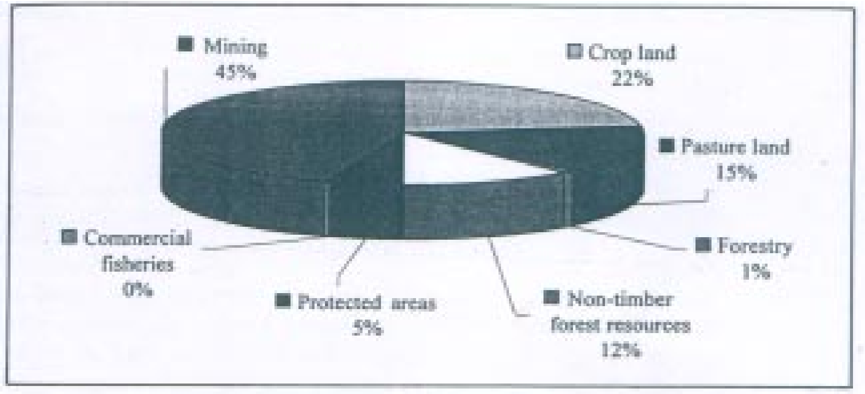
and;

$$\text{Gross Domestic Saving} = \text{Gross Domestic Investment} - \text{Net Foreign Borrowing} + \text{Net Official Transfers} \tag{4.6}$$

Gross Domestic Saving was measured using the State level equivalent of national disposable income, defined as national income plus net unrequited transfers. At the level of a State within a country, this implies adding the current account balance to Gross State Product (GSP). Human capital investment was measured by government expenditure on education. Effectively, this

[14] This section is based on Brown et al. (2003).

Figure IV.2. Components of Natural Capital for the State of Queensland



Source: CEPM (2002).

is a re-classification of government expenditure, as education expenditure is usually treated as an element of government consumption. It ignores other components of human capital such as health, and it measures the value of human capital in terms of the cost of education measured by public expenditure on the education sector.

Following the World Bank's approach, pollution damage was restricted to include carbon dioxide only and water pollution damage was not included. Estimated carbon emissions were based on annual data for the whole of Australia and Queensland data for two years, 1989/90 and 1998/99. The intermediate years' values were estimated by interpolation using Queensland's share of total Australian emissions in the two end years. The calculation also restricted the calculation of natural capital depletion to forest and mineral resources. These two components represent the depletion of the economy's renewable and non-renewable resources, respectively, and make no provision for the depletion of other land-based capital due to factors such as soil erosion, salinization and water pollution. Furthermore, freshwater and marine-based resources are also excluded.

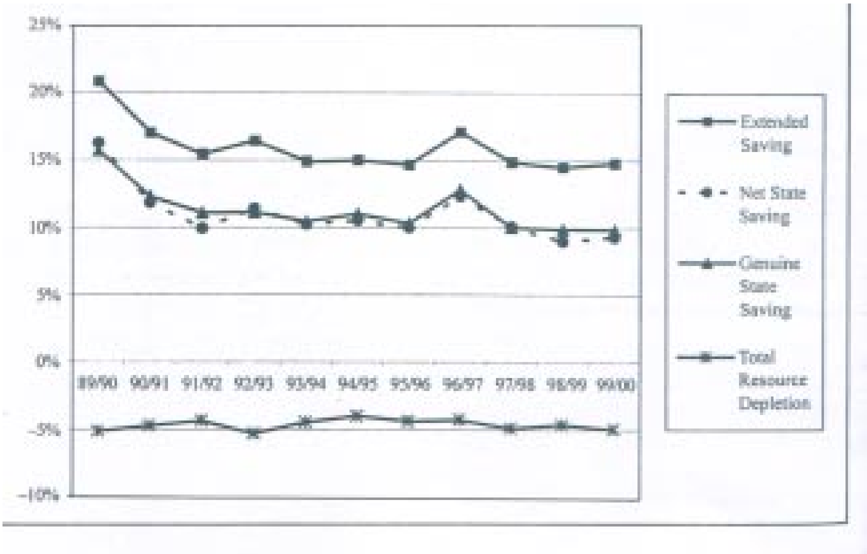
To estimate resource rent for mineral production and forestry, gross surplus was calculated first by adding royalties and company taxes to gross operating surplus. Next, 'normal profit' was calculated as 10 per cent of total costs (including depreciation). This was then subtracted from gross operating surplus to arrive at the estimates of resource rents for mining and forestry.

Results

The results of GS estimates are graphed in Figure IV.3. The main findings are as follows:

- Since 1989, Queensland's GS has fallen from 15.7 per cent to 9.9 per cent, implying that although, following the World Bank interpretation of GS, we are possibly on a sustainable growth path, the decline should be of concern to policy makers;
- Mineral depletion is the leading component of the State's overall depletion of natural resources. It comprises approximately 80 per cent of the total depletion of natural resources; and
- The extent of any divergence between saving as measured by State accounts and the GS is dominated by two components – the effects of mineral depletion and ongoing investments in human capital. These two parts of the GS effectively offset each other implying that Queensland's Net State Saving rate as measured in the State Accounts closely approximates the GS.

Figure IV.3. Genuine Saving Estimates for the State of Queensland



Source: Brown et al. (2003).

Interpretation of Results

The interpretation of these estimated trends in the aggregate levels of Genuine Saving requires a consideration of the following issues:

- First, it needs to be acknowledged that apart from the mobilization of State savings for investment in physical capital, savings are also required for investment in human capital. When human capital investment is added to State saving to obtain extended State saving, the trend is positive in absolute terms, as shown in Figure IV.3. It could be concluded that the proceeds from the exploitation of natural capital are, in effect, supporting a higher level of human capital accumulation than what would be possible otherwise. This hypothesis requires further empirical analysis;
- Second, it would be more meaningful to express the levels of saving in relation to some aggregate such as GSP to gauge saving performance relative to other macroeconomic aggregates. This is done in the next section of this chapter; and
- Third, while data on the levels of natural capital depletion are instructive in providing some indication of the extent to which State income, saving and the accumulation of physical and human capital are dependent on the exploitation of natural capital, they do not provide any indication as to the sustainability of the historical and current levels of depletion and environmental damage.

Case Study IV.2: An Application of Green Accounting to Papua New Guinea[15]

Introduction

The main purpose of this case study was to apply the proposed SEEA in a country at a relatively early stage of development and with as yet moderate environmental problems. One of the challenges of the project was to see to what extent environmental accounting could be applied with limited effort in country with relatively weak institutional capacities and limited data.

Papua New Guinea is country of about four million people, 90 per cent of whom live in rural areas. It has few urban centres and there is a low level of industrialization. A few large copper, gold and silver mines contribute about

[15] The material in the section is based on Bartelmus et al. (1992) and Asafu-Adjaye (1991).

70 per cent of export. Central government expenditures on the environment are low, accounting for less than one per cent of total budgeted expenditure for the period 1986 to 1990, which was the period for this analysis.

The SEEA was implemented in three steps. In the first step, the national accounts framework in PNG was adapted to meet the structure of the SEEA so as to identify environmental expenditures and to incorporate balance sheets of produced and non-produced (natural) tangible assets. However, due to inadequate data, environmental protection expenditures could not be presented separately for any of the economic agents in PNG. Also, the lack of physical resource accounts, with the notable exception of mineral resources, made it difficult to estimate scarcities of other renewable and non-renewable resources.

In the second step, an attempt was made to value the natural resource scarcities in monetary terms. Two approaches were considered for calculating the depletion costs of the use of scarce natural resources – the user cost approach and the net price approach. The user cost approach attempts to convert the stream of revenues from sales of an exhaustible natural resource into a permanent income stream by investing a part of the revenues (referred to as the "user-cost allowance") over the lifetime of the resource. According to El Serafy (1989), only the remaining amount of the revenues should be considered as "true income". The "net price" is applied in this study, which is defined as the market price minus all factor costs including a normal return to capital. The final step was to compute the discounted future stream of income using the net price. This was used to estimate an 'environmental depletion cost' which was deducted from net value added to obtain estimates of environmentally adjusted net value added of the sector and environmentally adjusted net domestic product of the economy.

Results

Table IV.1 shows estimates of the economic costs of environmental quality degradation of four sectors – agriculture, forestry, mining and energy.

The main environmental impacts of agriculture are from the effects of forest clearing for cultivation. Non-economic, ecological, and related social and spiritual values of forests are lost through the conversion of forests for agriculture and other uses. The main consequences of the depletion of PNG's forests include loss of biodiversity, soil loss, impairment of watershed regulation and nutrient cycles, and the increased risk and intensity of flood and landslides. The estimates of the costs of forest depletion are for conversion of forest land to agricultural uses. The estimates are based on the rate of compensation to be paid to landowners deprived of traditional uses of the forests by logging activities and should therefore be regarded as very conservative. The low estimates are 9.4 million (1981-85) kina (K) and K 8.1 million (1986-90) per annum. The high estimate is K 119.0 million per annum for the period 1981-1991.

Table IV.1. Papua New Guinea: Average Annual Costs of Environmental Quality Degradation (millions of kina)

Sector	*1981-85*		*1986-91*	
	Lower Estimate	*Upper Estimate*	*Lower Estimate*	*Upper Estimate*
Agriculture[a]	9.4	119.0	8.1	119.0
Forestry[b]	10.0	45.0	10.0	61.0
Mining[b]	35.7	101.2	35.7	101.2
Energy[a]	0.03	0.03	0.03	0.03
Total	55.1	265.2	53.8	281.2

Source: Bartelmus et al. (1993:125), Table VII.12.

Notes: [a] Based on compensation values.
[b] Based on avoidance costs.

As is the case in the agricultural sector, the major environmental impacts of logging are the losses of ecological and cultural functions of forestry resources. The social costs of logging are estimated at about K 45 million per annum for 1981-85 and K 61 million per annum for 1986-90. In PNG, the main environmental effects of mining are from the discharge of mine tailings that pose a threat to aquatic resources in fresh and marine waters. Estimates of the costs of avoiding environmental damage from mining range from K 35.7 million per annum to K 101.2 million per annum.

Table IV.2 presents estimates for environmentally adjusted net value added and domestic product using only the lower values of the estimated environmental damage. The results indicate that EDP1 reduces NDP by amounts ranging from 1 to 8 per cent and EDP2 by 2 to 10 per cent.

Due to the fact that the period under review is short, no definite conclusions can be reached regarding the trends in environmental depletion and degradation. EDP2 (i.e., the additional accounting for environmental quality degradation) reduces NDP by a further 2.1 per cent on average. A comparison of the ratios of final consumption (C) to EDP2 indicates that consumption exceeded net (environmentally adjusted) domestic product.

Table IV.2. Papua New Guinea: Estimates of Environmentally Adjusted Net Value Added and Domestic Product, 1986-90 (millions of kina)

Adjusted items	*1986*	*1987*	*1988*	*1989*	*1990*
NDP	2,313.6	2,569.2	2,861.6	2,698.1	2,760.2
EDP1	2,186.8	2,359.5	2,755.3	2,672.9	2,579.5
EDP2	2,132.9	2,305.6	2,701.6	2,619.2	2,525.7
[(NDP-EDP1)/NDP]*100	7.8	10.3	5.6	2.9	8.5
[(NDP-EDP2)/NDP]*100	5.5	8.2	3.7	0.9	6.5
(C/EDP2)*100	105.4	105.5	94.5	102.1	109.1

Source: Bartelmus et al. (1993:128), Table VII.13.

Conclusions

The study shows that it is feasible to implement the SEEA in a developing country situation. But at the same time, it highlights the constraints and limitations of the approach. The main contribution of the study is to reveal the many significant data gaps that exist. The following priorities for environmental data collection were identified:

(i) It would be necessary to establish natural resource accounts and balance sheets in the areas of forests, soils, subsoil assets of minerals, gas and oil, and fish stocks;

(ii) There is a need to monitor effluents and loadings of water pollutants from agriculture, mining, industry and municipalities, as well as changes in levels of biodiversity; and

(iii) Statistics should be developed on environmental (protection) expenditures by the government, industries and households.

It is hoped that a strong physical database would enable a more accurate estimate of the environmental costs of economic development to be made. Box IV.1 highlights some of the issues that need to be addressed before the SEEA can be more effectively implemented. These include promotion of awareness and devoting more resources to human resource development and research.

Box IV.1. Environmental Accounting in Papua New Guinea

Papua New Guinea (PNG) is at an early phase of industrial development and, in general, is yet to experience the kinds of serious environmental problems that we have seen in some countries. The use of an approach such as the SEEA could serve as an 'early warning' system for potentially serious environmental problems. The main constraints to implementing the SEEA in PNG include: (i) awareness; (ii) training; and (iii) research.

Awareness

In spite of the high profile given to environmental issues, individual governments are not putting their money 'where their mouths are'. In PNG, for example, environmental protection services account for a meagre 0.2 per cent of total budget expenditure. There is a need for an environmental awareness campaign aimed at government policy makers and analysts, emphasising the need for effective environmental management.

Training

Statisticians and economic planners in government departments such as Finance and Planning, Agriculture, Minerals and Energy, must be given training not only in the concepts of the SEEA but also in relevant aspects of the emerging discipline of environmental economics.

Research

Considerable research effort is required to provide the necessary inputs into the SEEA. The problem of data availability is especially acute in developing countries such as PNG. Areas of research could include: impacts on agriculture, forestry and fisheries, soil erosion and run-off, and non-market valuation techniques. Research funding could be sought from external agencies such as the World Bank.

Source: Asafu-Adjaye (1991).

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V. POLICIES FOR INTEGRATING ECONOMIC AND ENVIRONMENTAL CONCERNS

A. Introduction

The purpose of this chapter is to discuss why environmental degradation occurs and to suggest policies for integrating economic and environmental concerns so as to minimize environmental degradation. It is argued that too much environmental degradation occurs due to the failure of the market system to correctly account for the value of environmental goods and services, as a result of which 'market failure' occurs. Inappropriate government policies, referred to as 'government (or policy) failure', can also have adverse impacts on the environment. Given the vulnerability of PICs to environmental problems, the application of environmental economics tools and concepts in policy formulation is even more relevant than in other parts of the world. In this chapter we present various tools that could be used to integrate environmental concerns into economic policies. These tools include Command-and-Control (CAC) Mechanisms and Market-Based Instruments (MBIs). A community-based resource management approach, which is an alternative to Market-Based Instruments in certain PIC contexts, is also discussed. The chapter concludes with case studies drawn from the region.

B. Market failure and government (or policy) failure

The perfectly competitive market model makes a number of assumptions that are not realistic. It is assumed that economic agents have perfect information about prices and other relevant variables and that sellers in the market have well-defined ownership or property rights to the goods and services offered for sale. It is also assumed that prices reflect all values, that is, opportunity cost. While some of these assumptions may be true for private goods, they break down in the case of environmental goods. Many environmental goods belong to the class of 'public goods'. Public goods are non-exclusive (i.e., those who do not pay cannot be excluded from consumption) and non-rival in consumption (i.e., one person's consumption does not diminish the amount available to others). There are also environmental goods that have a mixture of public and private goods characteristics. For example, there are environmental goods that are: (i) non-exclusive but rival in consumption (e.g., ocean fisheries and migratory wildlife), (ii) exclusive and non-rival in consumption (e.g., closed access to nature reserves), and (iii) rival in consumption and exclusive for a group of people (communal fishing or grazing areas). Due to these characteristics, markets often treat such environmental goods as unpriced (or low priced) goods.

Market failure occurs when firms (or individuals) fail to consider the true price of environmental goods and services in their decisions. As a result, overuse of the resource does not incur an internal (i.e., financial) cost to the firm (or individual), but rather incurs an external cost to society. Policy (or government) failure occurs when the government creates incentives for certain goods and services at prices lower than the actual cost of production per unit. An example of policy failure is a government subsidy on pesticides which provides incentives for farmers to use more pesticide than is socially efficient, resulting in adverse environmental impacts. This type of subsidy is referred to as an input subsidy and other examples include energy, fertilizer and irrigation subsidies. Other types of subsidies include guaranteed prices for agricultural products and subsidies for land clearing which tend to encourage large scale production and loss of forest cover. Sometimes, the subsidies could be put on consumer products. In this case, if the particular product, or the input used in its production, is environmentally damaging, then the net effects on the environment could be negative.

Table V.1 presents rough estimates of subsidies worldwide. Among other things, the figures indicate that subsidies worldwide are substantial, amounting to about four per cent of the world's GNP. This is estimated to be about US$ 25 trillion. The subsidies are about 14 times ODA flows in any given year. It is interesting to note that the highest subsidies are in the OECD countries. In general, subsidies in the developing countries are on the decline as most of them have adopted structural adjustment programmes over the past two decades.

Table V.1. Provisional Estimates of World Subsidies (US$ billion)

Sector	*OECD*	*Non-OECD*
Water:		
Irrigation	3 +	20
Sanitation	?	5
Supply	?	28
Fossil Fuel	34-52	100 +
Nuclear Power	9-14	0?
Agriculture:		
Pesticides	0?	2?
Fertilizers	0?	4
Outputs	336	0?
Transport	79-108	?
Total	**461-513**	**159**

Source: Pearce and Ozdemiroglu (1997).

C. The case for government intervention

Given that pollution is a public good, firms and households have little incentives to factor its costs into their decisions. Therefore, it has been argued that there is a need for government intervention to coerce people to consider the external costs of pollution. Two main approaches have been suggested for integrating environmental concerns into government policies – Command and Control mechanisms and Market Based Instruments (see Figure V.1). Command and Control mechanisms are also known as regulations or standards and comprise ambient standards and emission standards. Market Based Instruments comprise, taxes (or charges), subsidies, marketable pollution permits and other MBIs such as deposit refund systems, ecolabelling, and community-based management systems. Finally, there are other policies such as liability legislation, zoning and bans that could be used to force polluters to account for their actions. The following sections discuss the two main approaches, as well as a community-based resource management system.

D. Command and control mechanisms

Command and control mechanisms are the oldest forms of pollution control policies in existence. As the name implies, the CAC mechanism consists of a 'command', which sets a standard (e.g., the maximum level of pollution allowable), and a 'control', which monitors and enforces the standard. In general, there are three types of standards: ambient standards, emissions standards and technology standards (Figure V.1).

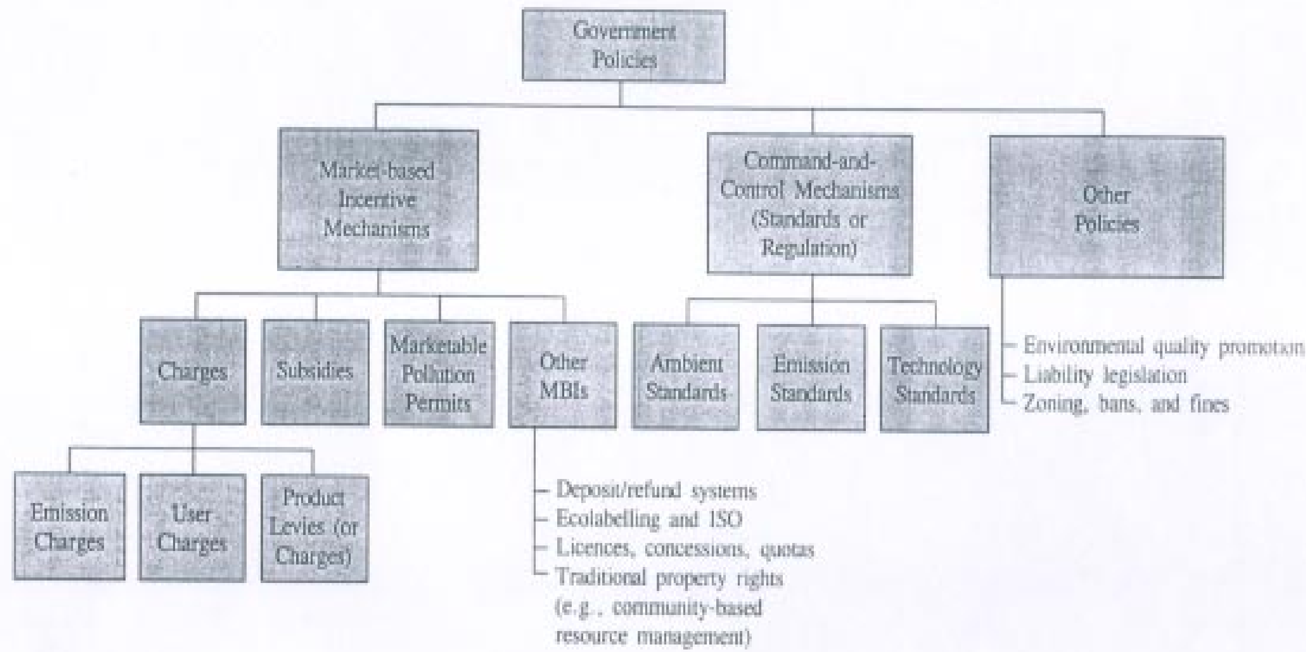
1. Ambient standards

Ambient standards set the minimum desired level of air or water quality, or the maximum level of a pollutant, that must be maintained in the ambient environment. For example, an ambient standard for dissolved oxygen in a certain river may be set at three parts per million, meaning that this is the lowest level of dissolved oxygen allowed. Ambient standards are normally expressed in terms of average concentration levels over some period of time. In general, they cannot be enforced directly. What can be enforced are the emissions from various sources that can lead to ambient quality levels.

2. Emission standards

Emission (or effluent) standards specify the maximum level of permitted emissions. They can be expressed in terms of quantity of material per unit of time (e.g., grams per minute, or tons per week), total quantity of residuals, residuals per unit of output (e.g., SO_2 emissions per kilowatt-hour), or residuals per unit of input (e.g., sulphur content of coal used in power generation). Emissions standards are also referred to as performance standards because they refer to end results to be achieved by the polluter.

Figure V.1. Government Policies for Integrating Environmental Considerations into Economic Decisions



Source: Adapted from Asafu-Adjaye (2000a).

3. Technology standards

Technology-based standards specify the technology, techniques or practices that a firm must adopt. This type of standard could be in the form of 'design standards' or 'engineering standards'. Other related types of standards include product standards that specify characteristics that goods must have, and input standards that specify conditions that inputs used in the production process must meet. Technology-based standards not only specify emissions limits, but also the "best" technology that must be used. The main difference between a performance standard and a technology standard is that the former sets a constraint on some performance criteria and then allows individual firms to choose the best means of achieving it. On the other hand, the latter actually dictates certain decisions and techniques that should be used to achieve the criteria.

Although standards are widely understood they have serious deficiencies in terms of providing incentives to reduce pollution.[16] First, firms have no incentives to reduce pollution beyond the standard. Second, as shown above, penalties for violating standards tend to be too low and enforcement tends to be weak. Third, to be effective, standards need to be revised frequently in response to rapidly changing circumstances. However, in practice legislation tends not to keep up with the pace of change. Fourth, the financial costs of will be high if there are many polluters. These costs include the administrative cost of implementing the system of standards and the monitoring and enforcement costs. Fifth, there could also be political costs if the standards are stringent and businesses are adversely affected. By far the most serious defect of standards is the fact that they are uniformly applied to all firms and regions. This takes flexibility away from polluters. The fact of the matter is that pollution abatement costs differ between firms and regions, and forcing high-cost abaters to reduce pollution as much as low-cost abaters, results in more resources being used to achieve a cleaner environment. The community can achieve cost savings by having more abatement undertaken by firms who can do so at a relatively lower cost.

Standards do have a number of advantages. First, they are a more widely understood form of environmental policy. Second, although standards are considered to be inefficient, they are a pragmatic approach when there is uncertainty about the effects of pollution on the environment. This issue becomes crucial when we are confronted with the possibility of irreversible environmental damage. Finally, the political costs of standards are lower

[16] Although standards are considered to be inefficient, they are a pragmatic approach when there is uncertainty about the effects of pollution on the environment.

compared to market based instruments such as taxes and subsidies as setting standards does not incur direct budgetary implications.

E. Market-based instruments

Instead of enforcing environmental quality by setting standards that must be adhered to, MBIs attempt to use economic incentives to change the behaviour of polluters. There are two main forms of MBIs – charges and subsidies, and marketable pollution permits. Other forms of MBIs include deposit-refund systems and performance bonds. A relatively new type of MBI is offset banking (see Box V.2 below).

1. Charges

Charges (or taxes) attempt to account for pollution externalities by imposing on the polluter a cost proportional to the amount of pollution. There are various forms of charges including emission charges, user charges, product/input charges and administrative charges. Emissions charges are levied on the emissions of pollutants in relation to the quantity and type of the pollutant, as well as the amount of damage to the environment. User charges are fees levied for using an environmental resource. They are often not directly related to the level of pollution or the costs of environmental damage. They tend to have a revenue-raising intent and sometimes are used to recover some portion of the abatement cost. Product/input charges are levied on goods that have a negative impact on the environment when used in production processes, or when consumed or disposed of. An example of a product charge is a carbon (fuel) tax. Finally, administrative charges are service fees levied by a government authority for implementing or monitoring a regulation. Charges are based on the 'Polluter-Pays Principle' that states that polluters themselves should bear the cost of measures taken to reduce pollution levels or maintain an acceptable level of environmental quality (OECD, 1989).

Charges have a number of advantages over standards. First, a charge gives consumers and firms an economic incentive to reduce pollution. Second, unlike standards, which are applied uniformly to all polluters, charges are flexible and enable firms to adopt a cost-effective solution to pollution abatement. Thus, there are savings to compliance costs. Third, compared to standards, there is a stronger incentive for firms to adopt new technology in order to lower the charges they have to pay.

Nevertheless, charges also have some limitations. As already mentioned above, due to uncertainty about the demand curve, the charges can be too low (firms may not reduce pollutants and simply pay penalty) or too high (firms may be simply put out of business). Firms could pass on a portion of the tax or charge to consumers in the form of higher product prices. If the product is a necessity, then low-income households who spend a high proportion of their income on such goods would be adversely affected. Imposing a tax could also lead to job losses as firms minimize their costs in order to increase pollution abatement. Finally, the costs of monitoring compliance may be high if the charges are based on the emissions and the number of pollutants is high.

2. Comparison of charges and subsidies

In theory, both taxes and subsidies should result in the same optimum level of environmental quality. However, there could be the following differences. First, where there is unrestricted entry into the industry, subsidies could attract more firms and therefore aggregate pollution could increase in the long-run. Second, subsidising polluters may be seen as socially unjust because some may see this as taking income away from the society.

F. Marketable (or tradeable) permits

A relatively new addition to MBIs is the marketable (or tradeable) permit system, which originated from the United States of America. Under this system, the government issues a fixed number of permits or "rights to pollute" equal to the permissible total emissions and distributes them among polluting firms in a given area. A market for permits is established and permits are traded among firms. Firms that maintain their emission levels below their allotted level can sell or lease their surplus allotments to other firms or use them to offset emissions in other parts of their own facilities. A variant of marketable permits is the Individual Transferable Quota system that has been used in Australian and New Zealand to manage fisheries (see Box V.1).

Permits have a number of advantages including the following:

- Permits rely on market forces to determine the allocation of permits. This approach is more efficient than relying on the government to determine the distribution and/or price of permits;
- The ability to sell permits is an incentive for firms to invest in pollution abatement;
- Permits make allowance for industrial development. New polluters are able to purchase unwanted permits from established firms. Both new and old firms are encouraged to acquire efficient pollution control capabilities; and
- Permits can generate income for the government, although the cost of enforcing penalties must also be considered. The income generated from the scheme could be considered as a form of compensation to the public.

Box V.1. Individual Transferable Quotas in Fisheries Management

The Case of New Zealand

In an effort to combat the problem of declining fish stocks, the New Zealand government in 1983 introduced an *Individual Transferable Quota* (ITQ) system. The ITQ system is a form of marketable permit system. In the case, the government freely distributed quotas among the industry participants based on historical catch. Each quota allowed the owner to harvest a certain quantity of fish to be harvested. The total tonnage associated with the quotas was made to equal the total allowable catch (TAC) that had been determined by the government to be sustainable. The Fisheries Board was empowered to monitor the fish catch through sales to retailers. Initial assessment indicated that there was an improvement in fish stocks. However, in 1989, it was found that the initial distribution of ITQs was excessive and the government decided to reduce the TAC. Despite some teething problems, the ITQ system has proven to be an effective tool to manage fisheries resources in New Zealand's exclusive economic zone.

Source: Based on Clark (1991).

The disadvantages of permits include the following:

- Permits have a limited applicability when there is more than one pollutant;
- If there are a small number of firms, the market for permits may not be perfectly competitive. In such cases, the bigger firms may be able to influence permit prices;
- The lack of a well developed market system is a major constraint to implementing a system of marketable permits;
- Administrative, monitoring and enforcement costs may be high, although they are likely to be comparable to other schemes such as standards; and
- There have been low levels of trading permits in some of the U.S. systems.

G. Other MBIs

1. Deposit-refund systems

Deposit-refund systems require a deposit to be paid on products that can potentially pollute the environment. A refund is paid on returning the used products or empty containers to a predetermined collection point.

Box V.2. Offset Banking

Offset banking is a new form of MBI that is in a way similar to permit trading which has good prospects for use in urban areas. The basic concept underlying offset banking is that if a developer is proposing a project that will create additional pollution in a given location, it must first ‘offset’ this increase by reducing pollution elsewhere. For example, the developers of a new golf course might be required to fund best management practices in nearby agricultural areas in addition to on-site best management practices. Or a new housing development might only be approved if, as part of the development, septic tanks in an existing development are installed. The basic intent of offset banking is to ensure that development proceeds without any net environmental impacts.

An offset bank can be privately or publicly owned. It is not a bank in the usual sense of the word. Rather, it involves completion of one or more projects in which environmental remediation is carried out. By completing these environmental projects, the offset bank earns “credits” that can then be sold to developers who are creating net-impacts on the environment. Offset banking has been applied in the United States of America. Examples include wetland mitigation banking, mitigation of streambank impacts, and in controlling air quality impacts. The main advantage of offsets is that they can generate substantial cost savings for businesses compared to having to fully mitigate any impacts on-site. Thus, the system has the potential to reduce environmental risk and at the same time encourage investment.

Source: Morrison (2003).

Advantages of deposit-refund systems include the following:

- It is an incentive-based system that rewards appropriate behaviour;
- It encourages sustainable use of natural resources through recycling and more efficient use of raw materials; and
- Monitoring and enforcement costs are minimal because it requires limited supervision.

Disadvantages of deposit-refund systems:

- If refunds are too low, the public may not have an incentive to participate in the scheme; and
- For natural resource sectors such as logging and mining, there can be high set up, distribution and refilling costs for deposit refund systems.

2. Eco-labelling and ISO standards

In the eco-labelling or performance rating approaches, firms are required to provide information on the final end-use product. Firms' performance are rated based on ISO 14000 voluntary guidelines that include the following: zero discharge of pollutants, adoption of pollution abatement technology, submission of mitigation plans. The 'eco-labels' are attached to products that are determined to be 'environmentally friendly'.

3. Performance bonds

The Performance bond system requires a company to deposit a certain amount of money in the form of a bond before commencing a project. The money is returned to the company if it complies with regulations concerning rehabilitation or clean up of the project site after the project is completed. Performance bonds vary in the terms and conditions of the penalty clauses. In some cases, the bond forms part of a permit issued by the relevant government agency, setting out the type of activity allowed and the location of the activity.

4. Traditional property rights

It has been shown that integrating traditional or customary communal rights systems with western systems of natural resource management can assist in the process of sustainable development (see case study below). In the past, resource managers in developing countries have concentrated their management efforts on licenses and quotas in order to prevent overexploitation of natural resources such as fisheries and forests. In many cases, these efforts have been unsuccessful. Customary communal rights systems, whereby local people manage their own resources through the establishment of private or communal ownership over common property resources, have better chances of success. This is because the "owners" of the resource have an interest in its current and future productivity and would be inclined to control exploitation so as to maximize the net benefits. Traditional property rights have been used to manage coastal fisheries in Papua New Guinea (see Case Study V.3 below), trochus fishing in Vanuatu (see Case Study V.4 below) and beche-de-mer and reef fishing in Kiribati.

H. Implementing the policy instruments in PICs

As indicated earlier, one of the causes of environmental degradation is the fact that prices charged for goods and services do not include the external costs of pollution in the production process. Consequently, more pollution than is socially desirable is produced. These 'wrong' prices are either due to market failure or government (policy) failure. The issue of policy failure can be addressed by first evaluating government subsidy programmes and making appropriate recommendations in cases where the subsidies have been shown to contribute to environmental degradation. In the case of market failure, applying appropriate tools (e.g., CACs or MBIs) offers opportunities to correct for market failure in the PICs by encouraging industries to internalize environmental costs in the prices of their products. These policies have been shown to generate “win-win” benefits as they increase economic efficiency while at the same time minimize (or even eliminate) the adverse environmental impacts. However, it is essential that any price distortions caused by government failure be removed before instruments such as MBIs can be effective.

The most common form of environmental management instrument in the PICs is the CAC approach. Regarding MBIs, elementary forms such as deposit-refund schemes are popular while more sophisticated systems such environmental taxes or tradable permits have yet to find their market. Although MBIs have been shown to be more efficient than CACs, they are not always necessarily the best policy response to environmental degradation. For example, in cases where environmental damage is unexpected, direct government intervention in the form of regulatory controls is a more pragmatic response. Also, when there is a small number of polluters, dialogue and negotiation between the government and the polluters may be a desirable approach. Some of the constraints to the implementation of MBIs (e.g., tradable permits) in the PICs include (i) lack of institutional capacity; (ii) lack of political will; (iii) lack of public awareness; and (iv) lack of well-developed markets. We briefly discuss each of these in turn. The section concludes with a discussion on the policy implications for the design of instruments for pollution abatement.

1. Lack of institutional capacity

The first set of issues concerning institutional capacity has to do with whether the necessary laws to implement MBIs exist. If they exist, do they cover the forms of pollution discharge, renewable resource damage and over harvesting of renewable natural resources? Many of the PICs do have comprehensive environmental laws. However, in some cases, these laws are not backed by effective enforcement and the penalties are not high enough to deter violators (see Case Study V.1). Although most PIC governments generally acknowledge environmental problems, the environment is not given priority in terms of allocation of resources. In many countries, the environment ministry/department is not influential in the decision-making process. Environment ministries/departments sometimes do not have the authority to enforce environmental policies. In cases where they have the mandate to implement policies, they often do not have adequate resources (financial and manpower) to enforce and monitor legislation. Implementation of MBIs involves the need for detailed rules and regulations by trained legal personnel. In addition, there is need for skilled technical personnel to monitor ambient environmental conditions. There is a drastic shortage of such skilled personnel, especially in the smaller PICs. In the larger countries where the administrative structures exist for implementing environmental policies, there are additional problems with coordination between different levels and sections of government. In some cases, there is overlapping jurisdiction in environmental functions that leads to gaps and duplication in their coverage.

2. Lack of political will and lack of public awareness

A serious constraint to implementing MBIs in the PICs relates to countries' political will to follow through with measures that may be unpopular. For example, a policy to remove input subsidies in the agriculture and energy sectors may not be in the interests of certain groups in the society who benefit from the distribution and sale of these commodities. Often opposition to such reforms may stem from the public's ignorance about what they are meant achieve. Community support can be garnered through public consultation and education programmes. Similar programmes may also be targeted to industry groups. The public and industry should also be sufficiently warned about changes in economic instruments such as charge rates, allowable quotas (e.g., for fish and forest harvests) and so on. Finally, policy reforms involving, say, removal of input subsidies, are more likely to succeed if they are introduced gradually over time.

3. Lack of well-developed markets and a strong legal structure

For successful implementation of some MBIs, (e.g., marketable permits) there need a well-developed market with a sufficient number of players. Industries that are monopolies may not respond well to economic instruments. Another key ingredient required to make some MBIs work properly is the existence of a strong legal structure. This includes a clear definition of property rights and resource tenure regimes and the ability to transfer these rights. However, actually in most PICs, industries are dominated by a small number of large firms. Thus implementation of such policies may not be feasible.

I. Policy implications

Before an appropriate instrument can be chosen, each country needs to carefully consider the following issues: (i) is the instrument economically efficient? (ii) is it effective (or dependable)? (iii) is it adaptable (i.e., flexible)? (iv) is it equitable?, and (v) is it politically acceptable?

1. Economic efficiency

Efficiency or ‘allocative efficiency’ refers to the use of society’s resources in an optimal way, i.e., without any wastage or additional costs. For a policy to be considered ‘efficient’, the total costs (including costs to the government, individuals and firms) involved in implementing the policy must be outweighed by the total benefits. Thus, improved efficiency is associated with cost savings to firms or net benefits in terms of improvement in environmental quality and natural resource stocks. For natural resources, examples include increases in sustained yields in fisheries and forestry. Policies such as MBIs do have associated costs and these costs must be weighed against any benefits to determine whether they are a worthwhile venture for a specific country. It may be the case that MBIs are too costly for some countries due to additional factors such as the possibility of low compliance and costs of installing monitoring equipment.

2. Effectiveness

‘Effectiveness’ refers to the degree to which the policy or measure achieves the environmental objective of protecting the environment or natural resource. For example, with regard to a pollution abatement policy, the issue is whether the policy actually results in a reduction of pollution. Different instruments will have different levels of effectiveness and should be compared. For example, for controlling highly hazardous chemicals, CACs may be more effective than MBIs since it has more certainty in the level of pollution to be abated, while MBIs may be more effective for other types of environmental damage (e.g., biodegradable waste).

3. Adaptability

A good instrument should continue to be effective in the face of changing circumstances (e.g., changes in prices, environmental conditions and technology). In this respect, a policy instrument such as CAC is not adaptable or flexible since the standards are often not revised frequently. Also it does not give firms the incentive to adapt to changing technology.

4. Equity

An important consideration in assessing policy instruments is the issue of equity or ‘fairness’. This has to do with the distribution of the costs and benefits among different groups in the population. Impacts on low-income groups may be a concern, as well as effects on the profitability and competitiveness of local industry. Before a particular policy is adopted, there is the need for a distributional analysis to identify the various groups (consumers and producers) who will be adversely affected. In some cases, it might be appropriate to use revenues raised from the policy to address inequalities in income distribution resulting from the policy. The OECD has recommended the following checklist for conducting distributional analysis (OECD, 1994).

1. What is the benchmark for comparison of different policy tools? The two options here are to compare the new instrument against the old one, or where there is no existing instrument, to compare the instrument with the "no regulation" case (i.e., the status quo).
2. Will the economic instrument lead to government revenues and to what use will these revenues be put?
3. What are the initial impacts of the instruments?
4. What are the relevant groups for which impacts will be addressed (either quantitatively or qualitatively)?
5. What empirical steps are needed to determine the final impacts (taking into account the shifting of costs and benefits to other groups).

5. Political acceptability

As indicated earlier environmental policy instruments such as taxes tend to be unpopular. Opposition to particular instruments could also stem from lack of knowledge. For example, establishing a system of tradable permits could be misconstrued as giving people a 'license' to pollute. Thus, one of the ways to increase political acceptability is through a programme of public education and consultation. Other ways to promote political acceptability include gradual implementation of the policies and explanation of how any revenues raised would be used.

6. Concluding remarks

Market-based instruments have been shown to achieve the same environmental objectives at a lesser cost than CAC mechanisms (Tietenberg, 1991). They can also generate significant revenues for the government. These revenues could then be used to address any equity issues if that is a political concern.[17] Given their limited resource base, PICs would need to consider

[17] It has been argued that in some cases, the total distributional impact of MBIs can be less than CACs. Evidence from the United States of America suggests that CACs can be regressive. That is, the poor bear a greater burden of the cost relative to their income compared to the rich.

the introduction of MBIs in the long run in order to maintain their external competitiveness. MBIs may be costly in some countries due to technical reasons, while in others the economic and institutional framework needed to support them are either weak or non-existent. In general, MBIs are more likely to be successful in the region if they are introduced gradually and, where appropriate, in combination with CAC instruments. A mix of CAC and MBIs is also important for the overall success of environmental policy if the institutional/legal framework is poor. There is also the need to educate industries and the general public about MBIs. In particular, it is important to stress that MBIs provide incentives for reducing pollution rather than simply a tool to punish polluters.

Case Study V.1: The use of Command and Control Instruments in Fiji

In Fiji, as in other PICs, CACs are by far the most common instrument for implementing environmental policies. The application of CACs has involved the enactment of legislation and its enforcement through government agencies. In this section, we review anti-pollution measures to deal with littering and vehicle exhaust.

Part I: Fiji's Anti-Litter Decree

The problem of solid waste disposal is emerging as a serious environmental issue in many PICs. Public awareness on littering is relatively low in most countries in the region. It is quite common to find litter dumped on foreshore areas, rivers and mangroves. The main types of waste include plastics, glass, metals, oil products, and used tires. In many countries, hazardous waste is not safely disposed, and there have been some cases of toxic materials being dumped together with general waste. Fiji has tackled the litter problem using the CAC approach, which is briefly describe below.

The Anti-Litter Decree was passed in March 1992. Prior to the Decree, offenders were normally dealt with by imposing a fine of 2 Fiji dollars (F$). Under the Decree, an offender may be fined between F$ 500-1,000, or may be sentenced to imprisonment for up to six months. Although there was a marked decline in the amount of litter in public places immediately following passage of the decree, the situation soon returned to 'normal' not long after. One of the early weaknesses of the decree was the problem of enforcing summons brought about because it was difficult to verify offenders' names and addresses. To rectify the deficiencies, the Anti-Litter Decree was amended to the Anti-Litter Act in 1997, with the main body of the Decree retained and modification of the distribution of summons. The main difference in introducing the Act, in comparison with the Decree, was that there was a period of publicity in the month preceding its enactment.

Although the Act brought about a significant improvement in the litter situation in Suva, at present it appears to have lost some steam. A number of lessons from implementation of the Act are relevant to other PICs. They include the following:

(i) Environmental problems such as littering cannot be solved with legislation alone. There is the need for on-going public education to enhance awareness about the problem and to change behaviour patterns. It is felt that the public awareness campaign that preceded the Act should have been more substantial and sustained;

(ii) To be effective, there is a need for laws and administrative arrangements to be flexible and to be regularly updated in response to changing circumstances; and

(iii) There is a need for a long-term programme to change the entrenched negative public attitudes to enforcement. This could be achieved through a combination of significant penalties, consistent enforcement and ongoing education.

Part II: Fiji's Air Pollution Laws

In Fiji's urban areas, exhaust fumes from vehicles are amongst the most common forms of air pollution. While there is no quantitative data due to lack of data, anecdotal evidence suggests that the emissions levels have been increasing. The current anti-pollution laws include the public nuisance provisions of the Public Health Act of 1936 and the provisions for air pollution under the Traffic Regulations 1974. Air pollution can also be included as a condition for the granting of planning permits under the 1946 Town Planning Act. However, these laws are rarely enforced and there are numerous examples of blatant violations. Currently, the only form of pollution control being exercised is through government and local authority licensing, as well as through development compliance requirements for new industries and plants. The reasons for the ineffectiveness of the current laws include the following: outdated, fragmented, and uncoordinated legislation; overlapping jurisdictions and lack of coordination among government agencies; lack of legally enforceable criteria for air and water quality; lack of training and resources; low and ineffective penalties; and insufficient public education and awareness. These issues are briefly discussed below.

(i) Outdated, fragmented, and uncoordinated legislation: the Public Health Act, for example, is 67 years old and is the backbone of Fiji's environmental legislation. Under the Act pollution is classified as a mere public nuisance, rather than as a major public health concern. There are currently 54 pieces of legislation, of which about 25 affect environmental management. The fragmented legislation creates loopholes that make effective prosecution difficult;

(ii) Overlapping jurisdictions and lack of coordination among government agencies: There are a large number of government agencies responsible for enforcement of the various laws. However, there is no single agency charged with the responsibility for monitoring compliance;

(iii) Lack of legally enforceable criteria for air and water quality: Currently, Fiji has no air and water quality criteria or guidelines. For example, WHO guidelines have been adopted for meeting the quality of drinking water. The current regulations do not specify any standards;

(iv) Lack of training and resources: There are insufficient resources allocated to the hiring and training of enforcement officers. The institutional capacity for implementing regulation is weak; and

(v) Low and ineffective penalties: The current fines for violation are low and do not pose a significant deterrent to violators. For example, the 1990 Ports Authority of Fiji Regulations provide for a maximum fine of F$ 400 for pollution offences, while the cost of cleaning up a chemical spill in Suva could run into millions of dollars.

(vi) Insufficient public education and awareness: Although Fiji has a high adult literacy rate (about 85 per cent) and there have been environmental awareness programmes in the past, the public response to environmental pollution has generally been poor. There is the need for more public awareness programmes and increase in environmental awareness programmes in the curricula in the entire school system.

Air and water quality criteria and guidelines have been included in the Sustainable Development Act (yet to be enacted) to rectify the current lack of standards on which control measures could be based. The Sustainable Development Act makes provision for economic incentives in the form of a self-regulation system. The system offers a choice for industries to either self-regulate or be regulated by government. Industries that choose self-regulation will receive some kind of incentive and will be allowed to develop their own industrial Code of Practice. These codes will be based on the International Organization for Standardization ISO 14000 series.[18] The Code and Practice and the implementation plan will have to be approved by the

[18] The ISO 14000 is a series of universally accepted standards for proving compliance with many national environmental laws.

government. The Act makes a requirement for industries to submit regular audit reports, produced by an external accredited environmental auditor, to the regulatory agencies as proof of compliance. But it is not clear who will monitor compliance. The proposed Sustainable Development Act will also address the issue of low penalties. For example, in the area of air pollution, a first offender will be liable for a fine of F$ 10,000 or imprisonment of not more than a year, or both. The penalties are doubled in the case of a second offence.

Case Study V.2: Bottle reuse and drink can recycling in Port Moresby

Refunds for returned bottle paid by PNG Bottle Industry Pty Ltd. is K 1.50 for a 285 ml Coke bottle, K 1.70 for a 285 ml Pepsi bottle and K 1.20 for an SP beer bottle. The use of returnable bottles is cheaper in economic and energy terms than non-returnable bottles or cans. Therefore PNG Bottle Industry Pty Ltd has an incentive to offer refunds. The average returnable rate for bottles is 85 per cent within the country, while in Port Moresby, it can be as high as 90 per cent, that is, the same bottle is reused about 9 times.

Aluminium cans cannot be re-used but the raw material, aluminium, is valuable. The strength of the overseas aluminium market allows the recycling companies to offer reasonable refunds. PNG Recycling exported 13,000 tonnes of cans in 1997. Given a price of US$ 1,050 per tonne for packed cans, the company could have earned over US$ 13 million in foreign exchange. The high level of reuse and recycling means that resources are conserved and the waste stream reduced. Recycling also has social benefits in the form of income redistribution of sections of the population with no formal employment.

Case Study V.3: Customary Marine Tenure Systems in Papua New Guinea[19]

The traditional model used for fisheries management in Papua New Guinea (PNG), as is the case in most countries, is based on the ‘tragedy of the commons’ advanced by Hardin (1968). According to this model, if people weigh their private benefits against private costs, they will overexploit common resources when given free access. In terms of fisheries resources, this model predicts that where access is free, there will be intense competition resulting in overexploitation and extinction of the fish stocks. In line with this model, the focus of fisheries management has been to limit fishing effort by imposing rules. Here, it is argued that a system of customary marine tenure (CMT) is a

[19] This section heavily draws on Asafu-Adjaye (2000a).

more effective management strategy because it is based on community participation in decision-making and is derived from kinship and lineage structures.

The term 'customary marine tenure' was first coined by Hviding (1989) when he used it to refer to particular forms of sea tenure practiced in the Pacific Islands.[20] Hviding uses the term '*customary*' to refer to a system founded on traditional roots and with links to the past; '*marine*' refers to the fact that the system deals with coral reefs, lagoons, coast and open sea, including islands and islets; and '*tenure'* refers to the fact that the system deals with access to marine areas and regulation of exploitation. Although CMT systems are widespread in Pacific Island countries, including Australia, there have been few studies that have attempted to document or research them. In recent years, the governments of PNG, the Solomon Islands, Vanuatu and Fiji have formulated policies, which explicitly recognize 'tradition' and 'custom' in the process of economic development. For example, Section 5 of the Customs Recognition Act of the PNG constitution confers rights over water, reefs, and seabed to traditional owners. The section states:

> The ownership by custom of rights in, over or in connection with the sea or a reef; or in or on the bed of the sea or of a river or lake, including rights of fishing; or the ownership by custom of water, or of rights in, over or to water.

Thus, PNG law acknowledges traditional rights of ownership to coastal water and fisheries resources. However, in reality, the government only recognizes CMT when it is practised within three miles of the coastline. The problem is that such boundaries are often in conflict with those of CMT systems. CMT systems use the estuaries of rivers, seashores and mangrove swamps as landward reference points. From these points, the sea territory extends outwards to include ocean-facing submerged reefs.[21]

Coastal communities have connections with their marine environments that extend beyond three miles of the coastline. These areas are referred to as 'home reefs'. Communities often have folklore that asserts that their ancestors were the original inhabitants and users of these particular areas. Indigenous coastal communities have a holistic connection to the sea and certain marine sites are of special religious and cultural significance. For these and other

[20] See, for example, studies by Hviding (1989), Cordell (1989), Ruddle et al. (1992) and Hviding et al. (1994).

[21] In one Solomon Islands coastal community, the marine boundary is defined as the farthest point one can see from the tallest coconut tree.

reasons, some CMT systems may not have well demarcated boundaries. For example, some species of socio-cultural significance (e.g., dugong and turtle) are migratory and regarded as an inseparable component of the seascape. Therefore, the community's connections to these animals and the marine environment may transcend government-imposed boundaries.

A major issue, which has been the subject of some debate, is whether traditional resource management systems, of which CMT systems are a part, are inherently sustainable. A popular but mistaken view among many resource managers and government policy-makers is that traditional resource management practices today are no longer sustainable because modern economic forces have undermined them. One of the arguments that have been used to support this view is that indigenous societies are no longer in balance with their environment since they now use upgraded technology such as outboard motors and guns rather than canoes and bows and arrows. Such views and misconceptions are based on lack of knowledge or ignorance about how indigenous communities interact with their natural environments. Another common misconception is that poor or marginalized communities do not hold strong environmental values because they are only concerned about survival. However, the fact of the matter is that tradition is not static.

CMT systems, like the societies from which they come, are dynamic and highly adaptive. Over time, CMT systems in the study area have changed to reflect the changing social and economic circumstances. The evidence suggests that CMT systems thrive on an impressive body of local environmental knowledge amassed over a long period of time. This knowledge also includes an awareness of ecological interaction between land and sea. Decisions about resource use are made on the basis of such knowledge and there is little doubt that, in terms of resource management in local areas, CMT systems are capable of sustaining marine resources.

Obviously, as economic conditions worsen, CMT systems are put under pressure. In the study area, there is evidence of increasing commercialization of certain common property resources. Also, the dire economic circumstances of the people have caused some to abandon or overlook certain CMT rules. However, these developments do not necessarily mean that CMT systems have failed and must be abandoned. On the contrary, the government must make efforts to strengthen them. CMT systems are communal, exclusive access collective property systems. They are self-managed and self-regulated systems that change according to local circumstances. The World Conservation Strategy recommended CMT systems as one way of enhancing common property resources (IUCN, 1990:33), and they were also given a prominent role in Agenda 21 and the Rio Declaration (UN, 1992).

CMT systems meet the requirements for social equity since all members of the community are given input in decision-making. In particular, CMT systems support multi-purpose and diversified exploitation strategies. This is in line with the fact that most village households operate mixed production strategies. CMT systems involve not only controlling access to resources, but also policing and monitoring. It may be argued that they constitute a sustainable management tool.

Customary marine tenure systems have a potential role to play in the sustainable management of fisheries and marine resources in Papua New Guinea, as well as in other PICs. In the past, fisheries managers and government policy-makers have wrongly applied the fisheries management model advanced by Hardin's (1968) 'tragedy of the commons'. According to this model, where access to a fishery is free, it is not in the interest of anyone to limit his or her effort. To prevent over-fishing and eventual destruction of fish stocks, fisheries managers have tended to impose rules based on limits on fishing effort. Such methods have not been successful as management tools because they have been imposed on the community by outsiders. CMT systems are more likely to succeed in the management of local fisheries resources because they are community-based and are derived from kinship and lineage structures. It is advocated that government and fisheries resource managers must recognise and strengthen the functioning of CMT systems to enable them play their role in the sustainable management of fisheries resources.

Case Study V.4: The Vanuatu Community Trochus Management Programme[22]

Trochus, also known as peal shell or topshell, are fished for their shells to be used as buttons, ornaments and ground down as a component of paint and lacquer. Trochus are found on intertidal reefs in tropical areas of the western Pacific and eastern Indian Oceans. The Trochus communities in Vanuatu have been successful in controlling their own Trochus harvesting activities through traditional custom and practice for a long period of time. However, the traditional manner is now seen as rather unsustainable according to scientific discoveries today. Therefore, the Fishery Department has decided to step in to slightly modify traditional practices by simply talking to them. In the past, the Fisheries Department used a command and control approach to fisheries management. The new approach involves going out to the people

[22] Based on the ESCAP Virtual Conference on integrating environmental considerations into economic policy making processes, found at http://www.unescap.org/drpad/vc/conference/bg_vu_46_vct.htm

in rural areas and explaining to them in simple language the importance of respecting the minimum size limit of 9.0 cm, as well as the importance of promoting trochus fishing at both economically and biologically sustainable levels. This approach has been successful because, in the eyes of the people, the Fisheries Officer has some concern over their marine resources and thus has lowered himself/herself to their level, willing to eat and sleep with the people and to sit with the people in their Nakamal (meeting house) to discuss sustainable management. In this way, the Fisheries Officer gains the respect of the people, especially the Chief (which is very important) and establishes a working co-operation with them.

A major feature of customary rights approach is that the controls are exerted at the local level, not from outside. Controls exerted at local levels are much more effective than controls exerted from the outside, for example, the Vanuatu Government Fisheries Management Regulations. Controls exerted at local levels are set and implemented by the people directly affected by the controls. This promotes self-confidence amongst members of the community and can create a good working partnership for trochus resource management between the Fisheries Department and the Community.

The Fisheries Research Division therefore relies on the co-operation of the resource users and resource owners for the protection of the trochus juvenile re-seeded sites. This working co-operation can only be achieved through negotiations with the people, which involves talking, listening, and learning from the people. The difficult part of the combined management system is establishing a working relationship between the Fisheries Department and the resource users and resource owners. Precaution is required when discussing and addressing appropriate sustainable management systems and establishing a form of a working partnership with the people. The people get very defensive and apprehensive if their views concerning the management of their resource are over-looked or considered not relevant for modern development needs.

The Fisheries Department and the people need each other to manage the marine resources. The people are made aware that the Fisheries Management Regulation is a supplementary management system to their existing Traditional Management System, to safe-guard their trochus resources. It should not be taken as a threat to overwhelm their custom environmental knowledge and practices. While the Fisheries Department respects their custom environmental knowledge and practices they should in the same way respect the Fisheries Management Regulation.

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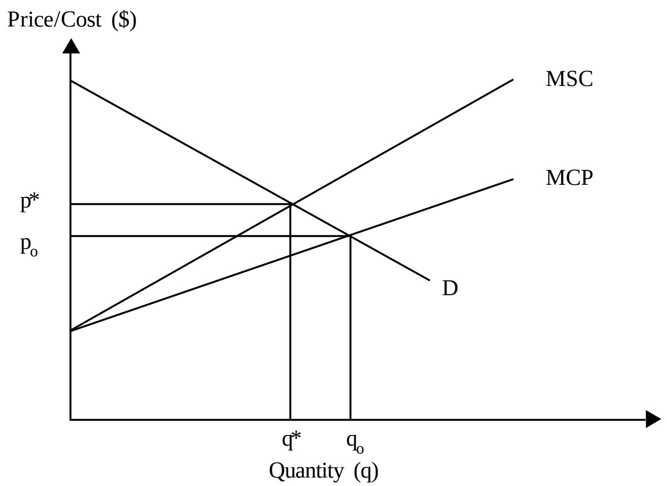
Appendix V.1: Explaining market failure

Let us define the following variables: D = demand curve for gold; MCP = marginal private cost of producing gold (i.e., the firm's supply curve); MSC = marginal social cost (Figure V.2). Marginal social cost is the cost to the entire society while marginal private cost is the cost from the viewpoint of the individual firm. We assume that MSC is greater than MCP at any level of output because society considers both the costs of pollution as well as gold production, but the company considers only its marginal private cost. The marginal social cost of gold production is therefore given by the marginal external cost (MEC), the cost of disutility caused by the externality, plus the marginal private cost. That is:

$$MSC = MCP + MEC \qquad (5.1)$$

Owing to the fact that the firm does not consider the external costs of gold production, it only reacts to price p_0 and produces q_0 units of gold, which is associated with more pollution than is socially desirable. If pollution abatement is enforced, the company will reduce pollution but raise the price per unit of output to p*, resulting in reduced output of gold. However, in this case, the reduced output is the socially efficient level and the higher price is also the efficient price.

Figure V.2. The Socially Efficient Level of Output

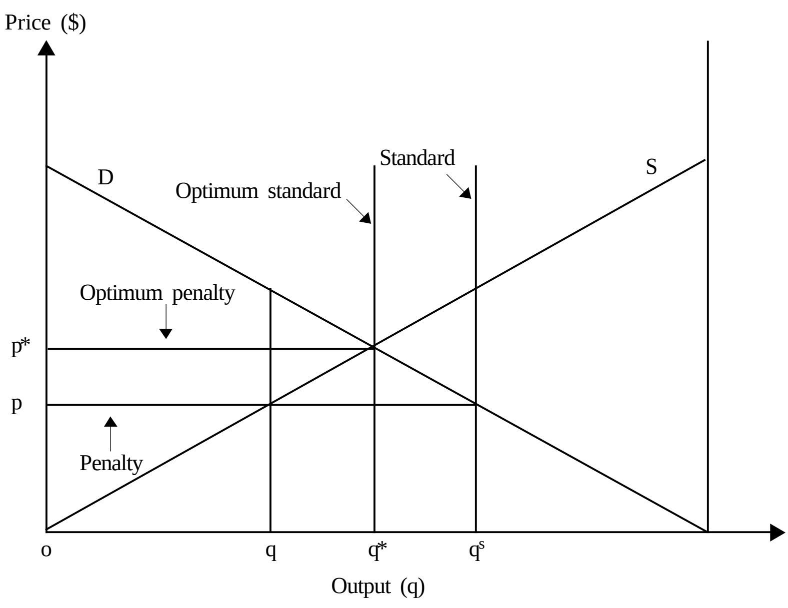


Source: Asafu-Adjaye (2000b).

Appendix V.2: The economics of standards

Figure V.3 shows how an emission standard can be used to achieve a socially efficient level of pollution in theory. Let the demand curve for pollution abatement be D and the supply of pollution abatement be S. In this case, the socially optimum standard and penalty will be q* and p*, respectively. In practice, however, the socially optimum standard is not likely to be known. In the figure, the standard is set at qs, higher than socially optimal emission level q* and the penalty is likely to be lower than optimal at p. Given the penalty, p, the efficient level of pollution abatement for the firm will be q. However, in some situations the firm will find it cheaper to pay the penalty than to abate pollution.

Figure V.3. An Emission Standard

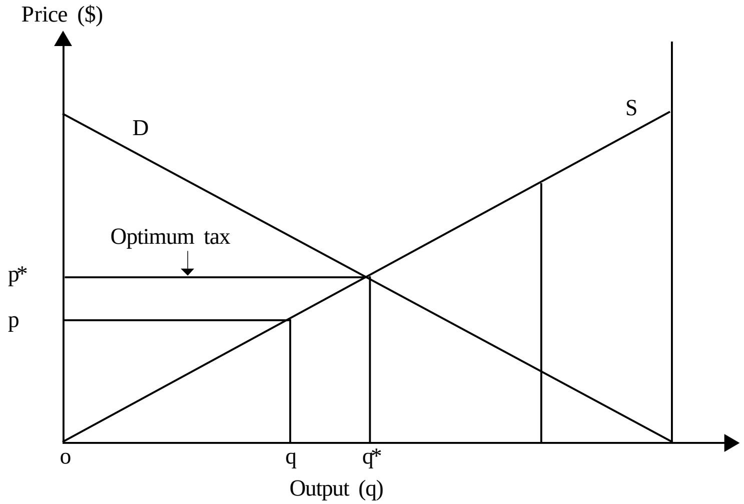


Source: Asafu-Adjaye (2000a).

Appendix V.3: How charges can result in less pollution

Figure V.4 gives an example of how charges could result in an optimal (socially desirable) level of pollution abatement. Let the demand curve for pollution abatement be D and the supply of pollution abatement be S. Suppose the government sets the charge at p*, where demand equals supply. In the case, the optimal level of pollution abatement will be q*. However, as was the case with standards, in practice the charge is likely to be set at a point p < p* at which the level of pollution abatement will be less than optimum. A problem in determining the optimal charge (as with the optimal standard) is that both the demand and supply curves are not known with certainty. The demand curve is referred to as 'latent' demand since the benefits are non-market in nature. While progress has been made in non-market benefit estimation, the techniques are yet to be widely used and accepted. On the supply side, as was indicated above, the government often does not have adequate information on the abatement costs of polluters.

Figure V.4. An Example of a Charge



Source: Asafu-Adjaye (2000a).

VI. METHODS FOR ASSESSING THE EFFECTIVENESS OF ECONOMIC AND ENVIRONMENTAL POLICIES

A. Introduction

In Chapter V, we introduced policies that could enable decision makers and planners to integrate economic and environmental considerations in the decision-making process. The purpose of this chapter is to introduce readers to analytical methods that could be used to assess the effectiveness of some of the policies outlined in the previous chapter. The analyses discussed here could assist decision makers to make choices that would maximize economic benefits, while minimizing environmental cost thus ensuring that the outcomes are environmentally sustainable. The following section introduces the technique of Environmental Cost-Benefit Analysis (ECBA) which is an extension of traditional Cost-Benefit Analysis but with explicit treatment of environmental costs and benefits. This approach relies heavily on the valuation techniques discussed in Chapter III to provide economic estimates of the environmental impacts of policies and programmes. The discussion also includes a qualitative approach in cases where environmental valuation is not feasible. The next two sections briefly outline the techniques of Cost Effectiveness Analysis (CEA) and Multicriteria Analysis (MCA) which are alternatives to ECBA. Both CEA and MCA are useful in cases where the environmental impacts cannot be valued in monetary terms, while MCA can also be used to choose among a set of policy alternatives when there are multiple objectives at stake. The final technique presented is computable general equilibrium (CGE) analysis which is useful for assessing the impacts of policies on different sectors (e.g., domestic producers, households, exporters and government). It can also be extended to include environmental impacts. The chapter ends with case studies of applications of CGE analysis to assess the effects of policies in PNG and Fiji.

B. Environmental cost-benefit analysis

Cost-Benefit Analysis is a decision-making framework that can be used to determine whether the economic costs of implementing a given policy are outweighed by the benefits. For the policy to be beneficial to the society, the net benefits must be positive. One method for carrying out this type of analysis is a social cost-benefit analysis (CBA). A social CBA is normally carried out from a social perspective, in contrast to a financial analysis which is carried out from a particular firm's or individual's perspective. An ECBA introduces additional steps into the CBA process to account for environmental effects. An ECBA can be carried out in the following steps.

1. Define the objective(s) and screen the alternatives for achieving the objective(s);
2. Identify and value the costs and benefits for the alternatives;
3. Calculate discounted cash flows (DCFs) and project performance criteria for each alternative; and
4. Project selection and sensitivity analysis for the preferred alternative(s).

1. Defining the objective and screening the alternatives

Every policy/programme must have an objective (or objectives). Decision-makers in the bureaucracy often specify the objective. However, to facilitate the process of the CBA this objective (or objectives) should be clear and unambiguous. Taking the example of, say, a Command and Control policy with the objective to treat wastewater to at a given minimum standard. This stage includes listing all possible options for achieving the objective(s). This includes the *status quo*, which is the 'do nothing' option. It must be borne in mind that the 'do nothing' option is not without costs. In some cases, doing nothing might entail social and environmental costs. Therefore, the avoidance of these costs must be counted among the benefits of the project. In most cases, the alternatives can be reduced to just two options: 'do nothing' versus a given alternative.

2. Identifying and valuing the costs and benefits

In assessing the policy's contribution to the objective(s), we should only consider additional (i.e., marginal) changes in costs and benefits and not the total costs and benefits. That is, we net out the costs and benefits without the policy from the costs and benefits with the policy. This is referred to as the incremental approach. If the objective is to increase social welfare, as would be the case with many public programmes, a 'benefit' or a 'cost' will be defined as any outcome which results in an increase or decrease in an individual's welfare. Once again, it is necessary to reiterate that this definition of costs and benefits will be different for a private business whose objective is to maximize profits. In this case a cost is any outcome that decreases profits and a benefit is any outcome that increases profits.

Once the costs and benefits of the policy have been identified, the next step is to value them in monetary terms. In valuing the costs and benefits, we assume that prices reflect value or opportunity costs, or can be adjusted to do so. The procedure is to value the costs and benefits according to the opportunity cost principle.[23] This is to respond to the view that the market price of a good may not necessarily reflect its opportunity cost or scarcity value (i.e., the value of that good in its next best use). Thus, in a social CBA the prices of inputs (and outputs) which do not reflect their true value to the society are adjusted. This process is referred to as shadow pricing, and involves adjusting the market prices by given discount factors. In the case of some environmental costs and benefits that do not have market prices, the non-market valuation methods discussed in Chapter III could be used to estimate their values.

3. Calculating discounted cash flows (DCF) and project performance criteria

Following the identification and valuation of the costs and benefits of the policy options, the next step is to compare the costs and benefits in order to make a decision on which alternative(s) to accept or reject. This is done by calculating project performance criteria (or project selection criteria). It provides a means to compare different alternatives that last several years into the future and have different streams of costs and benefits. Calculating these measures involves using the technique of discounting. The rationale for discounting is to 'reduce' future streams of benefits and costs to their 'present values' to enable comparisons to be made between competing alternatives. For example, given an investment stream of:

t (years)	0	1	2
Investment	–$ 100	$ 50	$ 150

The net present value (NPV) at an interest rate of 10 per cent is given by:

$$NPV = -100 + 50/(1 + 0.1)^1 + 150/(1.01)^2 = \$ 96.54 \qquad (6.1)$$

In more general terms, given a stream of benefits, B_0, $B_1 \ldots B_n$, and a stream of costs C_0, $C_1, \ldots C_n$, the net present value (or net present worth) at a discount rate of r per cent could be written as:

$$NPV = B_0 - C_0 + \frac{B_1 - C_1}{1 + r} + \frac{B_2 - C_2}{(1 + r)^2} + \cdots \frac{B_n - C_n}{(1 + r)^n} = \sum_{t=0}^{n} \frac{B_n - C_n}{(1 + r)^n} \qquad (6.2)$$

[23] 'Opportunity cost' is defined here as the value of a resource in its next best alternative use.

For ECBA the above traditional approach to discounting is modified slightly to account for environmental impacts. Let B_t be the total commercial benefits in period t; C_t the total costs in period t; and E_t the net environmental benefits in period t. The modified project selection criterion will be given by

$$NPV = \frac{\sum_{t=1}^{n} (B_t - C_t - E_t)}{(1+r)^t} > 0 \qquad (6.3)$$

The net environmental benefits could be estimated by valuing the total economic value (i.e., use plus non-use values) of the resource by means of the contingent valuation method.

4. Project selection and sensitivity analysis

If there is just one other option in addition to the 'do nothing' option, the decision rule is to accept a project or policy when NPV ≥ 0. If there are several options, they are then ranked according to the size of the NPV. Sensitivity analysis is used to assess the possible impact of uncertainty by posing 'what if' questions. These questions pertain to what would happen to the project's viability if some or all of the key parameter values happen to be different from the original values. A sensitivity analysis highlights the critical factors affecting the project's viability. This allows the decision-makers to pay attention to these factors during the implementation stage. Parameters subjected to sensitivity analysis include: the discount rate; length of the project planning horizon; different timing of the project's operation; changes in the capital outlays; changes in the price of market goods, and changes in social and environmental benefits and costs.

The sensitivity analysis is normally carried out by recalculating the project performance criteria, using a range of values for the uncertain parameter (or parameters). The results of the analysis may be in the form of two-way and three-way tables. A sensitivity analysis helps the analyst to identify the range of parameter values within which a project can remain economically viable. It helps to identify critical variables and, in so doing, provides information that could be used to redesign a particular option. Sensitivity analysis may also point out additional information required to ensure that the assumptions are more realistic.

5. Environmental impact analysis (qualitative, quantitative and checklist approaches)

A CBA can be supplemented by an environmental impact analysis. The environmental impact of a policy or project may be defined as changes in the quality and/or supply of an environmental good or service that results from the policy/project. Impacts can be classified into the following:

- Positive or negative;
- On-site and off-site;
- Physical, social, economic and psychological;
- Near-term and long-term; and
- Internal and external.

(a) Positive or negative impacts

Positive impacts are normally referred to as benefits, while negative impacts are referred to as damages. Damages have the effect of increasing the costs of the project or reducing the net economic benefits, while benefits have the opposite effect.

(b) On-site and off-site impacts

Impacts can occur on the site where the project is operated, or they can occur off-site. An example of on-site impact is noise pollution, while an example of off-site impact is downstream river pollution.

(c) Physical, social, economic and psychological: impacts

Examples of physical impacts of a project include loss of biodiversty and exposure to carcinogenic substances. Social and economic impacts include such effects as lost income, employment generation, displacement of people, destruction of cultural artifacts and buildings. Finally, psychological impacts include increased stress as a result of project activity.

(d) Near-term and long-term impacts

Near-term impacts include impacts that can occur at the onset of or soon after the project commences, while long-term impacts extend several years after the project. It is important to note that some impacts may be irreversible.

(e) Internal and external impacts

Project impacts that are reflected in the prices or costs of goods and services and that only affect the consumers or producers of those goods/services are referred to as internal impacts. On the other hand, impacts which are not reflected in prices or which affect those not compensated or directly involved in the good's production/consumption, are referred to as external.

In general, an impact analysis identifies the winners and losers of a proposed policy or project and aims to quantify the gains and losses so that mitigation measures can be designed as part of the project.

C. Cost-effectiveness analysis

A CBA may not be possible in all situations. Examples are when a policy's major benefits cannot be quantified in dollar terms, or when two policies or programmes have similar economic benefits. In such cases, it would be appropriate to use CEA. For large-scale projects CBA is the preferred approach because it enables to identify and value the major items of costs and benefits and to compute DCF performance criteria. However, in cases where the major benefits cannot be quantified in dollar terms, CEA is the preferred approach. CEA is also appropriate in a case where the choice is between, say, two options with the same outputs or service levels at different locations. Most of the foregoing discussion on CBA applies generally to CEA. Unlike CBA, CEA does not have absolute criteria by which to judge the economic viability of projects. Therefore CEA is not recommended when a decision on the level of output or service to be provided is an issue, or where the social and environmental impacts are significant.

1. Conducting a cost-effectiveness analysis

The steps involved in carrying out a CEA are similar those for a CBA. They are:

1. Define the objective(s) and screen the alternatives for achieving the objective(s);
2. Choose the method of analysis;
3. Identify and value the costs;
4. Calculate discounted cash flows;
5. Calculate measures of effectiveness for each alternative; and
6. Project selection and sensitivity analysis for the preferred alternative(s).

2. Defining the objective and screening the alternatives

The issues here are the same as discussed for a CBA. That is, there is need to outline the project objective or problem to be solved, describe the target population, discount rate, project life and other useful parameters.

3. Choosing the method of analysis

Careful consideration needs to be given to the method of analysis to use in a given situation. As already indicated above, CBA is the preferred approach in large and complex projects with significant social and environmental ramifications. However, in cases where two or more options have similar service levels and the major economic benefits cannot be valued in monetary terms, a CEA is appropriate.

4. Identifying and valuing the costs

All the costs of the project must be identified and valued. It requires caution in dealing with secondary (or indirect) costs. As far as possible, only direct costs should be included in the analysis.

5. Calculating discounted cash flows and project performance criteria for each alternative

The stream of costs must be discounted over the life of the project or policy to arrive at present values as described in the earlier example.

6. Calculating the measures of effectiveness

An appropriate measure of effectiveness must be identified. As a guide, the measure must be as close as possible to the objective of the project activities. For example, for a wastewater project the obvious choice would be ‘cost per Ml’ or ‘cost per Ml per annum’. For a health project the measure could be ‘cost per patient’, and so on.

7. Project selection and sensitivity analysis for the preferred alternative(s)

As in a CBA, a sensitivity analysis will be required in a CEA. To assist the choice between options, it would be necessary to find out how sensitive the cost-effectiveness measures are to changes in project parameters such as discount rate and planning horizon.

D. Multi-criteria analysis

Multi-criteria analysis is also referred to as multi-objective decision making, multi-objective decision support system, or multi-criteria decision aid. It may be described as a framework that can be used to assist decision makers to choose between alternative policies and projects in situations where there are multiple objectives. The approach uses both quantitative and qualitative data and is therefore suited to situations where the environmental impacts cannot be valued in monetary terms. CBA may be considered as a special case of MCA in which the alternatives are evaluated by performance criteria (e.g., NPV) that are measured in dollar terms. Apart from not being based exclusively on money valuations, MCA differs from CBA in other respects. CBA is based on economic efficiency criteria (e.g., NPV ≥ 0), while MCA incorporates other types of criteria such as distributional, equity, ecological and so on.

The steps in MCA are as follows:

1. Identify the problem to be addressed and the alternatives;
2. Identify the criteria to evaluate the alternatives;
3. Score the performance of each alternative in relation to each criterion;
4. Weight the scores according to the weight or rank assigned to the criteria;
5. Evaluate the alternatives and undertake a sensitivity analysis; and
6. Produce a ranking of alternatives on which to make a recommendation.

The data required for an MCA include scientific, social and economic information about the problem to be addressed, as well as information obtained from identified stakeholders. One of the advantages of MCA is that it facilitates a participatory approach to decision-making by involving stakeholders in the process. The steps in conducting an MCA are illustrated in Figure VI.1 and explained below.

1. Identifying the problem and the alternatives

As was the case in CBA and CEA, the first step in the MCA process is the identification of the problem to be addressed. It is likely that this step would initiate data collection to determine the extent and severity of the problem. In the illustrative case presented here, the problem to be addressed is the sustainable use of forest resources. It is important at this stage to solicit the input of the stakeholders in deciding what alternatives should be considered. Taking the hypothetical example of management of a forest resource, there could be four possible alternatives:

1. Ban all forms of logging;
2. Ban logging in only old growth forest, allow logging in plantation forest;
3. Permit logging of any type; and
4. Do nothing.

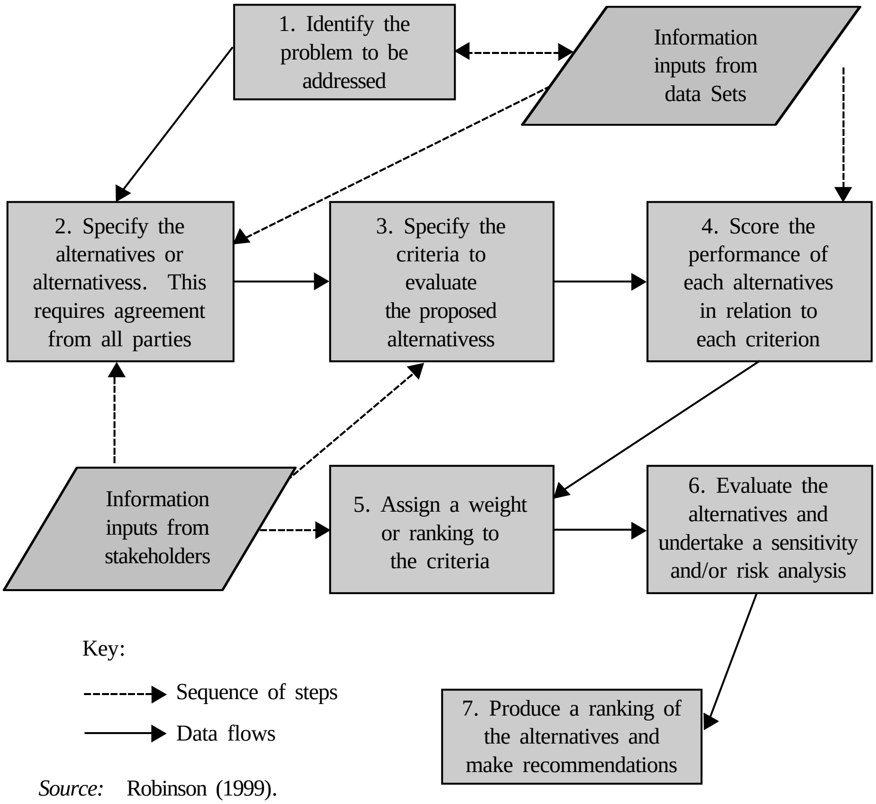
2. Identifying the criteria

In this case, we can identify three main objectives namely:

- Maximize economic growth;
- Maximize environmental quality; and
- Maximize social benefits.

The criteria for the first objective could be the number of jobs created and the amount of revenue from the sale of logs. The criteria for the second objective could include the level of biodiversity, the area of forest conserved, the amount of soil erosion avoided and the level of water quality. Sub-criteria for water quality could include the pH level, amount of suspended particulate matter, and so on. Finally, the criteria for the third objective could be the value of recreation and tourism and the level of poverty.

Figure VI.1. Schematic Representation of the Steps in the MCA Process



Source: Robinson (1999).

3. Scoring the alternatives in relation to the criteria

In order for scores to be assigned to each alternative in relation to each criterion, the 'do nothing' alternative must be identified so that the alternatives can be evaluated as marginal or incremental to the 'do nothing' alternative. The scores are presented in an 'effects table', or matrix, displaying the criteria in the rows and the alternatives in the columns (see Table VI.1). A score is provided for each alternative against each criterion in relation to the 'do nothing' alternative. For example, for the employment creation criterion in the forest management case, the score for Alternative 4 (do nothing) could be no additional jobs, Alternative 1 (ban all logging) could be three jobs and that of Alternative 3 (permit all logging) could be 90 jobs (Table VI.1). For the income generation criterion, the score could be zero dollars per annum for both the 'do nothing' alternative as well as Alternative 1 and $ 35,000 per annum for Alternative 3. Note that some of the criteria are expressed in qualitative, or ordinal, form. For example, the score for the biodoversity is high under Alternative 1 and very low under Alternative 3.

Table VI.1. Effects Table for the Forest Resource Management Example

Criteria	*Alternatives*			
	1. Ban all logging	*2. Ban logging in old growth forest*	*3. Permit all forms of logging*	*4. Do nothing*
Employment creation (number of jobs)	3	30	90	0
Income ($ '000 p.a.)	0	40	35	0
Biodiversity	High	Low	Very low	Low
Forest conserved (ha)	10,000	6,000	1,000	5,000
Water quality (low to high)	High	Medium	Low	Medium
Soil erosion (kg/ha/p.a.)	1	25	70	30
Recreation and tourism ($ '000 p.a.)	500	300	10	250
Poverty level ($ change in per capita income)	–20	+ 5	+ 30	0

Source: Asafu-Adjaye (2000).

4. Weighting the scores

The next step in the MCA process involves 'prioritizing' the criteria by assigning different rankings or weights. The weights can be assigned by the analyst, the decision maker or they can be based on the views of the stakeholders. In some cases, the criteria can be weighted by a panel of experts using techniques such as the Delphi method.[24] The weights can also be generated mathematically.

5. Evaluating the alternatives

A number of approaches can be used to evaluate the alternatives. These include aggregation techniques where the scores are aggregated over the range of criteria, and the lexicographic technique which evaluates the criteria by ranking them from the least important to the most important.

6. Ranking the alternatives and making a recommendation

The final step in MCA is to establish a ranking of the alternatives and to make a recommendation. The outcome from a MCA process is a prioritization of alternative courses of action or projects. Depending on the number of alternatives and criteria, the process can generate a vast amount of information. Graphical methods have been shown to be an effective way of presenting the results for different alternatives. Interactive computer packages are now available which enable the decision maker to view graphical outputs, as well as what happens if any of the key parameters or assumptions change.

7. Advantages and disadvantages of MCA

MCA has a number of advantages compared to techniques such as CBA and CEA. First, compared to CBA, MCA enables a more realistic representation of the decision problem to be made, and in particular for the trade-offs to be made explicit. Second, the interactive nature of MCA enables both the analyst and the decision maker, who could be a number of groups of stakeholders, to learn more about the problem. Third, although MCA is a structured approach, it is flexible enough to allow the use of value judgement. Finally, it is suitable for problems where dollar estimates of the effects are not readily available.

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[24] The Delphi approach involves getting a panel of experts together to come up with weights in their area of expertise. Each person is then given the opportunity to re-evaluate their individual responses. Through successive rounds of re-evaluation, a consensus on the weights is then reached.

There are a number of difficulties and potential problems associated with trying to implement MCA. First, there is a possibility that community preferences is not determined by the community but by a single decision-maker, without consultation with the community. Second, MCA does not necessarily require quantitative or monetary data. Nevertheless considerable information is required to compile the effects table and derive the weights. It is also possible that even though the weights used in the process are explicit weights, the analyst may unintentionally introduce implicit weights during the evaluation process. Finally, if not properly used MCA has the potential to become a 'black box', producing results that cannot be explained.

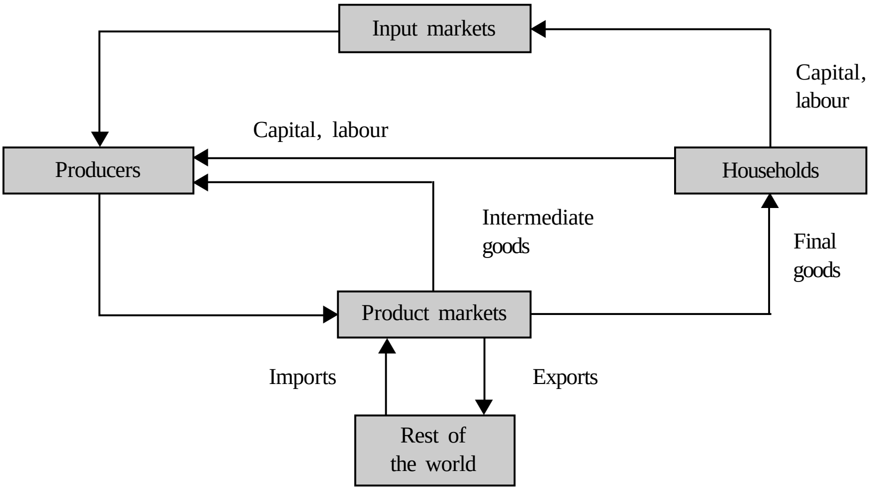
E. Computable general equilibrium analysis

Economic impact assessment evaluates the impact of the project on the region (or state), on local communities and on industry sectors. It can be carried out, at an elementary level, by describing the impacts and providing estimates of how many jobs will be created during the construction and operation phases of the project. A more sophisticated analysis can be carried out using CGE models. These models can be used to give an indication of the 'economy-wide' impacts of a policy or project. For example, if a policy/ project increases output of a good or service, the models can be used to assess the simultaneous impacts on different sectors of the economy, including effects on the government sector and households.

CGE models are based on the assumptions about the optimising behaviour of consumers and producers. That is, consumers maximize their utility or satisfaction, while producers maximize profits (and minimize costs). CGE models attempt to represent the circular flow of goods and services in the economy. A simplified example of this circular flow is shown in Figure VI.2. Firms purchase inputs from input markets and intermediate goods from product markets, which are then used to produce goods in the product markets. Consumers purchase final goods from product markets and sell their labour in the factor and product markets in return for wages. Finally, goods are exported to the rest of the world, and imported goods are also sold in the domestic product market. More sophisticated models would contain the government, banking sectors, and environmental sectors.

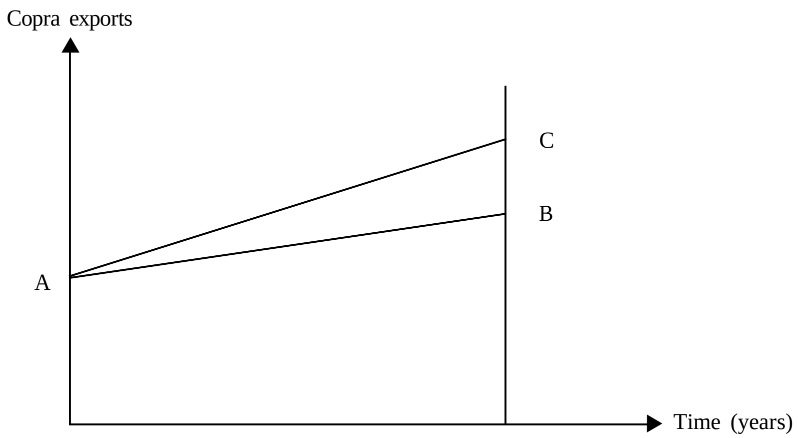
CGE models are designed to enable the analyst to answer 'what if' questions in three types of policy issues. These are: (i) policies at the sector level – industry, commodity, occupation and households; (ii) policies at the macroeconomic level; and (iii) changes in international economic conditions. Examples of policies of type (i) include taxes and subsidies on industry production, households, exports and imports. Examples of type (ii) include changes in the level and composition of government spending, changes in wage rates and changes in the exchange rate. Finally, type (iii) includes changes in the world prices of, say, agricultural commodities, or changes in a country's terms of trade.

Figure VI.2. Economy-Wide Circular Flow of Goods and Services



The term 'computable' in computable general equilibrium model refers to the fact that a CGE model is a quantitative model that is solved using a computer. The term 'general equilibrium' refers to the fact that the model simultaneously considers the production and consumption relationships, prices and the interaction between supply and demand in factor and product markers. Finally, CGE models are termed economy-wide models because they contain a sufficient level of disaggregation that enables the effects of a policy to be traced to different sectors of the economy. CGE models can be comparative static or dynamic. A comparative static model provides projections at only one point in time. It is illustrated in Figure VI.3. Let the path AB represent the underlying time path of a given variable, say exports of copra, as result of current economic conditions. The line AB may be considered the 'control' solution. Now suppose at time t = 0, a shock is imposed, say a 10 per cent increase in the price of copra. After adjustment to the price shock, exports of copra would have increased to point C. Comparative statics is only concerned with gap BC. It does not explain how the economy got to point C. The gap, BC, measures how much exports of copra would increase as a result of the 10 per cent increase in copra prices, compared with the level they would have reached had the price change not taken place. In general, comparative models are solved for a short run (t = 2 years) and a long-run (t = 5-10 years). They are not very specific about the timing of effects or the time taken for an economy to adjust after a policy shock. On the other hand, dynamic models enable the adjustment path of a policy to be traced following the policy shock.

Figure VI.3. Illustration of the Comparative Static Approach



1. Input-output structure of a CGE model

The input-output structure of the CGD model represents links between production, consumption within the economy, as well as links to the external economy. It consists of various matrices that are briefly described below (see Figure VI.4). Matrix A contains the inputs of locally produced commodities into the production processes of local industries. Matrix B shows the inputs of local inputs into the production of capital goods, while Matrix C shows the consumption of locally produced commodities by households.

Matrices D and E are vectors that show the flow of locally produced commodities to exports and government demands, respectively. Matrix F shows inputs of imported commodities for current production, while G shows inputs of imported commodities for the production of capital goods. Matrices H and I are also vectors which show household and government consumption of imported commodities, respectively. Matrix Z contains the negative of the duty on imported commodities. Matrix K shows the use of the different occupations types by industry. Matrix L shows the rental value of each sector's fixed capital, while M shows the rental value of land. Matrix N shows aggregate inputs of labour by each industry. The entries in the database represent estimates of the value of output of each commodity in each industry in the base period for the study. Thus, the column entries indicate the commodity composition of each sector's output. By a similar token, the row entries indicate the proportions of a particular commodity produced in each sector and the row totals show the value of output of each commodity.

The following sections present case studies of applications of CGE models to analyse various policy issues for the Papua New Guinea and Fiji economies. For PNG, the policy simulated is the economic impacts of closing the Ok Tedi gold/copper mine. BHP and the PNG Government jointly own the mine, with the former holding a 52 per cent equity in the mine. As indicated earlier the mine has caused significant environmental damage in downstream areas as a result of dumping untreated mine waste into the Ok Tedi River. The mine is scheduled to close down in 2010. Here we consider the impacts if it were to shut down now. The second case study considers the impacts on the Fijian economy of abolishing EU trade preferences for Fiji's sugar exports.

F. Strategic environmental management

Strategic Environmental Management (SEM) has been defined (see ESCAP, 2003) as an approach by which governments and stakeholders (i) take a long-term view of environmental trends in natural resource use, economic and social development; (ii) identify the changes necessary to bring these trends within sustainable limits, and (iii) establish a management framework. There are a number of characteristics that distinguishes SEM from traditional planning approaches. First, SEM takes a long-term perspective. Second, it takes a more comprehensive approach to planning in the sense that the environmental, economic and social dimensions are integrated into the decision-making processes. The traditional approach tends to focus on just economic (and/or social) aspects. Third, the approach involves setting quantifiable targets and goals (e.g., improvement in air quality), thereby making it easier to assess the extent of progress and to take appropriate remedial action. Fourth, the approach puts emphasis on the involvement of stakeholders. Whereas, the traditional management approach has relied on the enforcement of regulatory instruments (e.g., permits and fines), SEM engages stakeholders and the government in ongoing dialogue in the implementation of agreed programmes and policies.

Figure VI.4. Representation of Input-Output Database for a CGE Model

		Industries (current goods) n	Industries (capital goods) n	Household consumption 1	Exports 1	Government 1	Duty	
Domestic Commodities	n	A	B	C	D	E		Row sums = total usage of local commodities
Imports	n	F	G	H		I	-Z	Row sums = total imports c.i.f.
Labour Occupations	q	K						
Capital Land Labour	1 1 1	L M N						
		Column sums = outputs of local industries	Column sums = capital expenditure by industries	Column sums = total household expenditure	Column sums = total exports	Column sums = total government demand	Column sums = total duty	

The process of SEM is explained with Figure VI.5. The first step is development of a vision. This could be in the form of a political or policy statement that articulates medium and long-term goals. In the second step, this vision is then translated into realistic targets in a strategic framework that aims to achieve sustainable development. Step 3 involves developing action plans in consultation with relevant groups. The action plans are a means of implementing the overall strategy and consist of the goals, timeframe, budget, and organizational aspects. The fourth step involves implementing the strategy with the involvement of industry sectors, local authorities and other relevant parties. This stage involves various activities such as identifying environmental and socioeconomic trends, identifying future trends, developing structure and planning, developing strategies (e.g., preventive action, innovation, integration) and sharing of responsibility with stakeholders. The fourth step is monitoring and reporting on progress. This is a crucial element of the SEM process since it provides feedback on how the policies are being implemented by the relevant agencies and whether the desired outcomes are being achieved. The information obtained helps the planning agencies to prioritize action to ensure that the overall policy objectives are met.

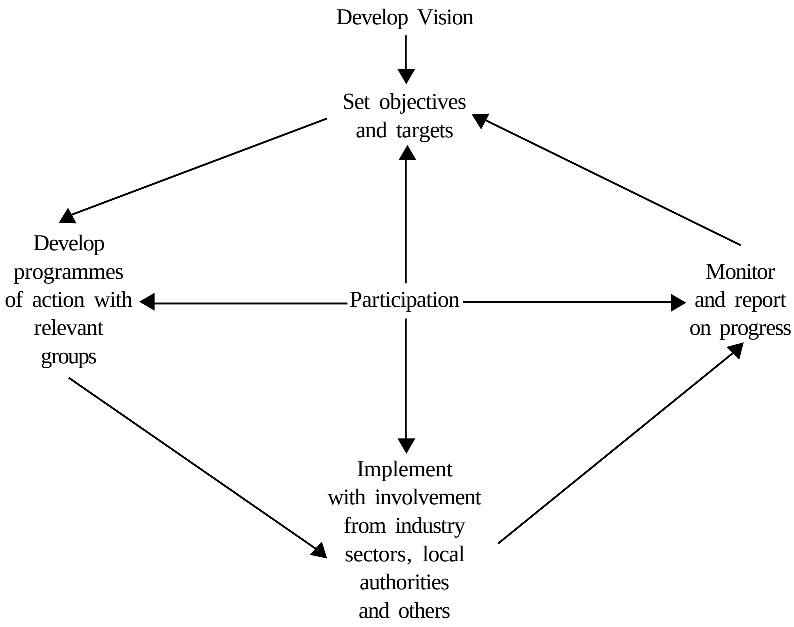
Proper implementation of the SEM process has the potential to deliver benefits to the government, the society and the economy at large. At the government level, the process helps to build trust with key external groups and also promotes accountability and transparency. The consultative nature of the approach will reduce the areas of conflict with other government departments. For the economy, implementation of SEM improves economic efficiency, reduces the cost of environmental clean up in the long run and improves the competitiveness of firms. The society as a whole benefits since it avoids long run economic and social costs, and environmental quality improves. Overall improvement of the economy leads to increase in employment and incomes, as well as a reduction in poverty.

There are currently no examples of SEM being applied in the Pacific Island Countries. However, implementing SEM is an important pre-requisite for integrating environmental and economic policies. A number of conditions are required to lay the foundations for effective implementation of SEM.

(i) There needs to be representation of the environment department/ division at a high level, preferably in cabinet. This is necessary in order to obtain political commitment for the vision;

(ii) There is a need for capacity within government agencies to make comprehensive assessment and forecasts of long-term environmental and socioeconomic trends. 'State of the Environment' Reporting, which has recently been adopted by a number of countries in the region, provides a good basis for long-term forecasting and performance monitoring;

Figure VI.5. The Process of Strategic Environmental Management



Source: Adapted from ESCAP (2003:36).

(iii) It is necessary to identify and obtain the involvement of all groups in the society whose decisions impact on the environment; and

(iv) There needs to be public awareness of environmental issues to enable firms and households to take the necessary action to minimize the environmental impacts of their behaviour.

Almost all the countries in the region have an environment ministry, department or unit. However, there are variations in their functions and levels of influence that often reflect the government's attention or priorities for the environment. In Fiji, environmental priorities are reflected in the State of the Environment Report (IUCN, 1993). There is an urgent need for capacity building in PICs to enable them to undertake strategic environmental management. A specific area of need is building up of skills in comprehensive analysis and forecasting of long-term environmental and socioeconomic trends. Currently, the responsibility for collecting socioeconomic information is undertaken by statistics departments, while environmental information of various forms is collected by various government departments. Implementation of SEM requires line ministries to work together in making socioeconomic and environmental forecasts. This could be best achieved by getting representatives of the relevant agencies and groups to work together and share information under one umbrella (e.g., a national sustainable development council). Finally, as indicated above, public awareness of environmental issues is important in facilitation the process of SEM. There is the need for ongoing discussion of environmental issues in the print and broadcast media, as well as inclusion of environmental issues in school curricula.

Case Study VI.1: Macroeconomic and sectoral impacts of the Ok Tedi Mine Closure[25]

Introduction

The Papua New Guinea CGE model consists of 37 domestic industries producing 34 commodities. In view of the importance of copper mining in the PNG economy, the Ok Tedi copper mine is included as a separate sector in the model. The model is comparative static because it only represents the effects of a particular factor under consideration and indicates how different the economy would be because of the effects of that factor. In this case, the factor under consideration is closure of the Ok Tedi mine. The model provides two types of solutions: a short run solution where the economy is assumed to achieve equilibrium 1-2 years after a shock, and the long run solution where equilibrium is achieved 5-10 years later. The simulation results represent percentage deviations from the equilibrium growth path of the economy after a shock has been applied. It is important to emphasize that the numerical results of the model should not be interpreted as forecasts. Unforeseen events, such as a new major mine coming on-stream, could reduce, or increase the percentage changes reported here. Rather, the results should be regarded as likely effects of changes in government policy. The main difference between the short and long run environments in the model is that capital and land are assumed to be held fixed in the short run and there is limited scope to substitute labour for these factors of production in all sectors.

Simulation results

The Ok Tedi mine currently accounts for all of PNG's copper exports and about 14 per cent of gold exports. The model was used to answer the following 'what if' question: What are the economic implications of a complete shutdown of the mine? This is equivalent to a 100 per cent reduction in copper exports and a 14 per cent reduction in gold exports.

[25] Based on Asafu-Adjaye (2002).

Impacts on key macroeconomic indicators

The simulation results for a full-scale shut down of the mine are shown in Table VI.2. Turning first to the short-run macroeconomic impacts, it can be seen that there is a 42.5 per cent decline in real foreign currency exports and a 21.3 per cent decline in foreign currency imports, resulting in a decline in the real trade balance of K 200 million. Due to the poor trade performance, real GDP is projected to decline by 6.4 per cent, while real household consumption declines by 19.1 per cent. The policy results in a decline in aggregate employment of 6.2 per cent. Due to a reduction in both public and private expenditure, the CPI falls by 12.9 per cent. The long-run situation indicates a worsening of the key macroeconomic indicators.

Agricultural sector impacts

The mineral sector, as a booming sector, competes with and draws resources away from the other tradable sectors. The drastic reduction in mineral output associated with the mine closure therefore frees up these resources. This effect becomes evident as one looks at impacts in the agricultural sector.

With the exception of fisheries, coffee, cocoa, palm oil and copra output expand by over five per cent. The forestry sector increases by 12 per cent. The long-run expansion in agricultural output is much less compared to the short-run.

Other sectoral impacts

Tradable sectors such as timber processing increase in output in the short-run. However, inward looking industries such as food processing, beverages and tobacco and transportation decline. As is shown below, the mine closure sharply reduces government expenditure and this is reflected in a reduction in government services such as health, education and administration/ defence. These sectors contract by more than 18 per cent. The long run simulations indicate that the adverse impacts are more pronounced.

Government sector impacts

Government revenue from duties, personal income tax and company tax decline by 6.5, 5.4 and 5.9 per cent, respectively. Aggregate government revenue declines by 20.8 per cent, while aggregate government expenditure declines by 36.6 per cent. The decline in aggregate government expenditure is partly caused by a decline in current government expenditure that is in part related to aggregate government revenue. Since aggregate government expenditure declines faster than aggregate government revenue, the government budget remains in surplus.

Table VI.2. Simulation Results for a Full-Scale Shut-Down of the Ok Tedi Mine

(percentage changes)

Variable/Sector output	*Short-run*[a]	*Long-run*[a]
Macroeconomic impacts:		
Real GDP	–6.4	–21.5
Real household consumption	–19.1	–34.5
Consumer price index	–12.9	–5.7
Aggregate real exports (US$)	–42.5	–51.6
Aggregate real imports (US$)	–21.3	–23.2
Aggregate employment	–6.2	–24.0
Real trade balance (million kina)	–200.3	–281.9
Agricultural impacts:		
Smallholder coffee	6.8	4.2
Smallholder cocoa	8.2	6.5
Smallholder palm oil	5.2	3.2
Smallholder copra	8.1	3.9
Plantation coffee	6.9	5.2
Plantation cocoa	7.8	4.6
Plantation palm oil	2.0	2.4
Plantation copra	6.9	4.4
Fishing	–7.6	–16.9
Forestry	12.0	5.8
Other sectoral impacts:		
Timber processing	11.2	–1.1
Food processing	–1.5	–12.3
Beverages and tobacco	–9.4	–29.4
Metals and engineering	7.5	–7.0
Road transport	–4.7	–29.0
Water transport	–0.8	–11.0
Air transport	–10.5	–30.3
Education	–18.8	–34.4
Health	–19.1	–34.6
Government admin. and defence	–18.5	–34.2
Government sector impacts:		
Government revenue from duties	–6.5	–5.3
Government rev. from tax on labour	–5.4	–8.2
Government rev. from company tax	–5.9	–3.2
Aggregate government revenue	–20.82	–22.8
Aggregate government expenditure	–36.56	–35.44
Government budget position (K mil.)	255.03	229.49

Note: [a] Capital is held exogenous in the short-run scenarios but is made endogenous in the long run.

Case Study VI.2: Effects of abolishing EU trade preferences for Fiji's sugar exports[26]

Introduction

Fiji is the second largest recipient of income transfers from the EU through preferential access for sugar exports. These income transfers are significant for the Fijian economy, amounting to 2.9 per cent of GDP in 2001. Sugar has become by far the most important source of cash incomes for rural Fijians and in 2001 accounted for 7.0 per cent of GDP. Sugarcane production comprised 30 per cent of output of the agriculture, fishing and forestry sector. Exports of sugar in 2001 accounted for 22 per cent of all merchandise exports, making sugar Fiji's second most important merchandise export after garments.

In the past, granting developing countries preferential access to protected developed country markets has been regarded as a strategy to help their development by increasing the value of their exports, promoting industrialization, and ultimately accelerating economic growth. The EU countries have used the preferences as a form of aid for some of their former colonies. However, in recent years, trade preference schemes have been criticized for their effects on world commodity markets, as well as on the developing countries that they are intended to assist (Topp 2001, Oxfam 2002). In general, liberalization of EU sugar markets could yield more substantial benefits than abolishing trade preferences alone, both in terms of efficiency gains within the EU and for the sugar exporters. The current regime tends to distort world sugar prices, and market access is denied for producers in countries that do not enjoy preferential treatment, including the large majority of sugar producers in developing countries. Developing countries as a group contributed 65 per cent of global sugar exports in 2001, while exports to the EU under preferential treatment accounted for just four per cent.

If preferential trading arrangements for sugar with the EU were to be abolished, there is likely to be considerable economic adjustment in some Africa, the Caribbean and the Pacific (ACP) countries. Faced with the world market price for sugar, production in many ACP countries would not be profitable given the current cost structures. Transition from reliance on sugar has already been occurring in most ACP countries over the last two decades. The importance of sugar preferences in the ACP economies has generally declined and other industries have assumed a commanding role. For example, in a number of ACP countries (including Fiji) there has been a strong shift towards tourism. In managing the transition from sugar preferences, it has

[26] Based on Levantis et al. (2003).

been suggested that the funds used to subsidize sugar could instead be used to invest in the social and economic infrastructure of ACP countries. For example, investing in the education or healthcare system could significantly enhance long-term development prospects.

Simulation results

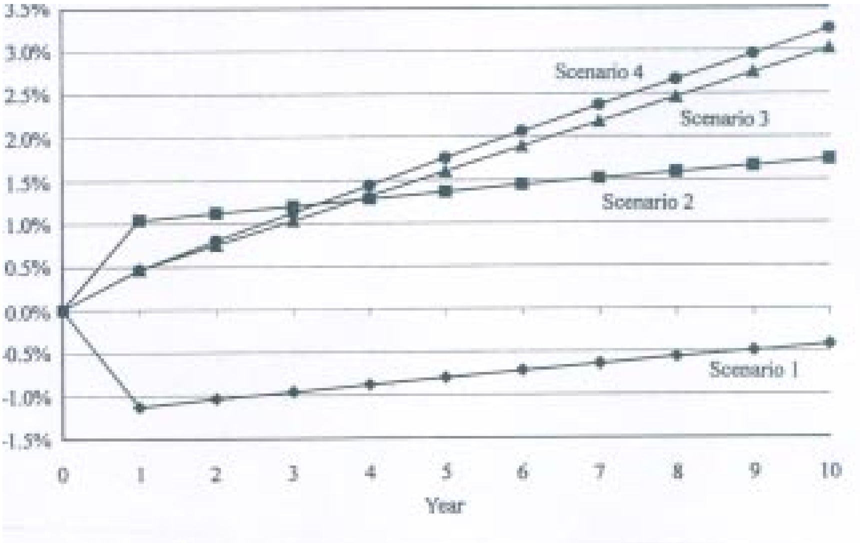
The Fiji CGE model was used to simulate a number of scenarios to analyse the implications of changes in the preferential arrangements for the Fiji economy. The Fiji model is a dynamic CGE model with 35 industries and commodities, including a sugarcane production sector and a sugar processing sector. The model incorporates the household sector, the government sector, the financial sector, the external sector and the production sector.

Four scenarios were simulated. These are:

- Scenario 1: Removal of preferential access;
- Scenario 2: Using the income transfers to fund a one-third reduction in income tax and tariff rates; and
- Scenarios 3 and 4: Investment in infrastructure.

Figure VI.5 presents the GDP impacts of the four scenarios. As would be expected with the removal of sugar subsidize worth 2.9 per cent of GDP the immediate impact in Scenario 1 is for a decline in economic activity. But with the substitution of factors toward other forms of production, the net impact on GDP of 1.1 per cent is significantly less than the amount of loss in transfer payments from the EU. Although the loss of preferential access would imply short term costs, Fiji could move onto a stronger growth path. However, the rise in the growth path is small relative to the size of the initial losses and after 10 years real GDP will still be 0.4 per cent below the level that would have been achieved in the absence of any change. This suggests that many years may pass before losses from an uncompensated removal of preferences can be recouped. The main reasons for the higher growth path are: (i) factor resources are diverted to sectors of the economy with stronger growth prospects; and (ii) factor resources are diverted to sectors providing higher productivity growth. Because growth in Fiji's sugar exports is constrained by the fixed volume quota for access to the European market, growth in other sectors of the economy consistently outpaces growth in sugar. Productivity growth in sugar production has been constrained by a lack of investment due both to the limited growth prospects in European markets and the current land tenure uncertainty.

Figure VI.6. Cumulative Impacts on Fiji's Real GDP; Comparison of Scenarios



Source: Levantis et al. (2003:15).

Diverting the funds directed to the sugar subsidy into financing a reduction in Fiji's taxes and tariffs (Scenario 2) results in a significant increase in real output. Under this scenario, there is an initial rise in real GDP of 1.0 per cent compared to the base situation of continued sugar preferences, and the policy moves Fiji onto a higher growth path (Figure VI.5). After 10 years, real GDP is 1.7 per cent higher than what would otherwise have been the case. This is despite a weakening of the benefits of tax reform due to the high propensity in Fiji for purchases of imports – a consequence of Fiji's relatively narrow production base. For this reason, the increase in disposable income associated with Scenario 2, and hence the increase in consumption, results in significant growth in imports, blunting the increase in GDP provided by the aid transfer.

Among the scenarios tested here, Scenario 3 and Scenario 4 (investing in infrastructure) clearly offer the largest long term gains for Fiji in terms of real GDP growth (Figure VI.6). Replacing the sugar subsidy with aid to finance infrastructure development does not generate the same short term benefits in terms of economic performance as is achieved with Scenario 2. This is because the tax reform modeled in Scenario 2 delivers large and immediate gains in economic efficiency that are not evident in Scenarios 3 and 4. On the expenditure side of GDP, increased expenditure on public investment in Scenarios 3 and 4 crowd out some private consumption and investment, with both of these falling in real terms. However, the public investment delivers returns in terms of gains in productivity and this enables Fiji to move onto a much stronger growth path. After four years, the gains in real GDP under Scenario 3 exceed those under scenario 2, and after 10 years real GDP is 3.0 per cent higher than otherwise, which is nearly double the gain compared to Scenario 2.

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VII. CAPACITY BUILDING AND INSTITUTIONAL ISSUES

A. Introduction

It was mentioned in previous chapters that PICs face numerous constraints in their efforts to achieve SD. These include population pressures, scarce land and water resources, lack of trade and economic diversification; human resource constraints, lack of institutional capacity inadequate funds, and high dependence on foreign aid. Most PICs, with the exception of PNG and Fiji, are small in terms of population size. Most of the countries have relatively fast growing populations which, given the limited land area, puts pressure on their natural resources. The small population size also implies that domestic markets are small, restricting prospects for the rapid expansion of economic activity. Furthermore the small population size contributes to the human resource constraints by limiting the pool of skilled personnel. Often, the few qualified people are made to take on numerous tasks, reducing their effectiveness. The problem of economic expansion is compounded by the fact that PICs are scattered over a vast area and are far remote from major world markets. PICs also experience natural disasters such as cyclones on a regular basis, which imposes substantial social and economic costs on them. This chapter considers institutional and capacity building issues that need to be addressed in PICs in order to facilitate the process of SD. The chapter is organized as follows. The next section discusses institutional issues such as governance, and the political and legal environment. This is followed by a discussion of the human resource constraints. Capacity building in this area is crucial for implementing the tools and techniques needed to plan for SD. The chapter concludes with a discussion of capacity building in the area of data and infrastructure.

B. Governance, the political and legal environment

'Good governance' is something that means different things to different people and defies universal definition. However, most people will not dispute the symptoms of bad governance. These include corruption and rent seeking, lack of clearly define laws conducive to economic development, excessive regulations and bureaucracy, misallocation of public resources, lack of transparency in the decision making process, and lack of accountability on the part of decision makers. Most PICs have weak political institutions, as is the case in much of the developing world. Past events in the region pointing to the lack of political stability include the Bougainville civil war of 1988-1998, the two Fiji coups of 1987 and the attempted coup of 2000, and the current civil unrest in Solomon Islands. It has been suggested that the development of political institutions in the PICs has been hampered by at least two factors. First, large proportions of the populations are still engaged in traditional non-market subsistence activities and sometimes their values clash with those people engaged in the modern market economy (Stretton, 1976; Fisk, 1995). Second, rapidly changing lifestyles and high expectations among the post-independence generation have often brought them in conflict with traditional values and institutions. These issues and others pertaining to local customs will need to be addressed in efforts to improve governance in the region. It has been argued that past programmes and policies introduced after independence in the PICs have failed because these issues were ignored in the planning phase (Ray, 1999). Institutional reform in the region needs to consider the following issues: (i) instituting political reform; (ii) improving public sector efficiency and accountability; and (iii) improving fiscal discipline.

1. Political reform

The lack of political stability means that governments often do not have the will to implement policies such as MBIs that they consider to be unacceptable to some sections of the society. In the majority of PICs, political parties are not elected on the basis of ideology or economic policies but rather on the basis of tribal loyalties, kinship, personal qualities, or even religion (Duncan et al., 1995). In some countries the political systems adopted after independence in 1975 have not worked out well. For example, after independence in 1975, PNG adopted a ‘first-past-the-post’ voting system that involves a single round of voting with the person receiving the most votes declared the winner. Under this system, it is not unusual to have several candidates campaigning for a single seat. For example, in the 2002 elections, 3,000 candidates competed for 109 seats. A politician can thus get elected with less than, say, 10 per cent of the votes. This electoral system has been blamed for much of the government overspending and official corruption.

To tackle various issues arising from the electoral system, the PNG government passed an ‘Integrity Law’ in 2001 that seeks to influence electoral behaviour by creating incentives for cooperation instead of competition between clans. The Integrity of Political Parties and Candidates Act is intended to encourage party coalitions and strengthen the government of the day, while the change to limited preferential voting (where voters mark at least three preference votes on their ballot paper) is aimed at increasing the level of representation. Politicians will have to campaign and win support beyond their narrow electorate interests. Making MPs more accountable to a broader cross-section of the population should reduce electoral spending binges over time. However, if the new laws are subverted by vested interests, they will not lead to meaningful change.

In Fiji, political instability has been cited as a key factor behind the country's poor economic performance over the past 16 years. After the 1987 coups, there was an accelerated decline in investments (Kumar and Prasad, 2002). The attempted coup of 2000 and the ensuing political crisis created sent further adverse signals to investors. Much of Fiji's investment comes from its traditional trading partners, Australia and New Zealand, both of whom were very critical of the coup. It is estimated that Fiji's economy declined by 12.5 per cent in 2000 (United Nations, 2001).

In an effort to provide a measure of stability, the 1997 Fiji constitution proposes multi-party representation in government. According to the Section 99 (5), in the event of a single party not winning an absolute majority of seats, opposition parties with a specified proportion of seats are entitled to a specified proportion of cabinet positions. In the general election of September 2001, the Social Democratic League (SDL) Party won 32 seats but a minimum of 36 seats was required for a majority. Given its 27 seats in the House of Representatives, the Labour Party was entitled to 38 per cent of the positions in Cabinet. However, the government refused to invite the Labour Party into government and the case went before the Fiji Supreme Court. In a ruling in July 2003, the Court ruled that the SDL Government is obliged to invite the Labour Party into government.

A current pressing institutional issue in Fiji is the unresolved land tenure dilemma. Sugarcane, Fiji's second most important industry is farmed mostly by Indo Fijians on land leased from indigenous Fijians. The leases began expiring in 1997 and by 2005 over 80 per cent of the leases will expire. There is currently great uncertainty and anxiety over what will happen since the legislation does not allow automatic extension when the leases expire. In several places, the leases are not used for farming only sugarcane but also for other food crops and for residential purposes.

In the Solomon Islands, there has been political instability following a civil war, which has lasted over five years. The country has been on the brink of collapse with mounting law and order problems that have brought the country's civil administration and economy to a virtual standstill. In July 2003, the Solomon's Island's parliament voted overwhelmingly in favour of inviting a military/police intervention force to stabilize the situation in the country. The force is led by troops from Australia and includes representation from New Zealand, PNG, Tonga, Samoa and Fiji (Courier Mail, 2003).

From the foregoing, it can be seen that political reform in the region is essential to lay the groundwork for sound economic growth. Political stability is also necessary to enhance the chances of success of economic and environmental policies. It is of utmost importance that political reform takes account of local values and customs to ensure that the reforms are sustainable.

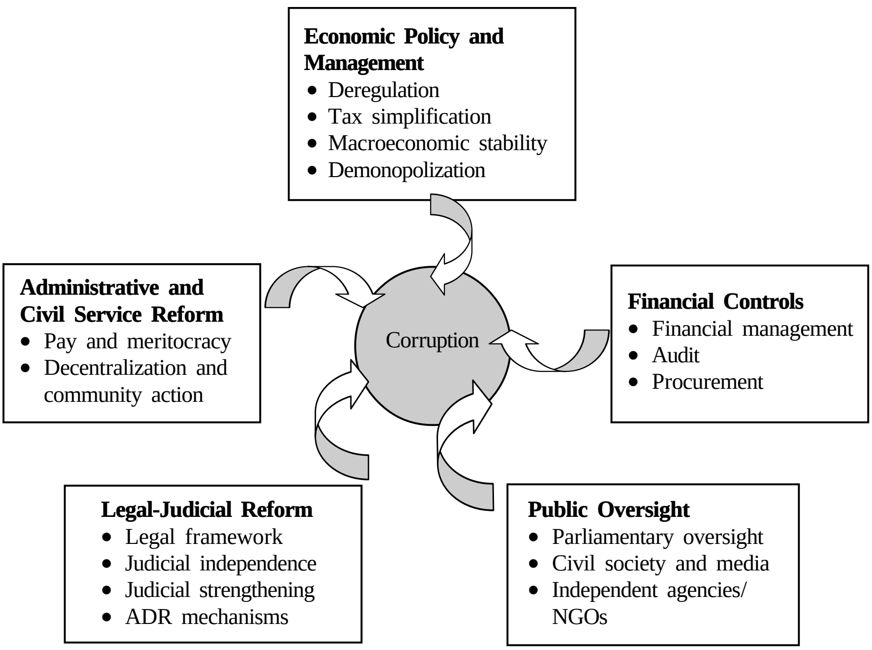
2. Public sector efficiency and accountability

In the majority of PICs there is no clear cut difference between the decision makers (i.e., elected government) and the administration (i.e., the bureaucracy). As indicated earlier, some elected representatives go into government incurring debts from their financial backers that they are obliged to pay upon assuming office. Almost invariably, policies and decisions tend to be tainted by these obligations. Examples include appointment of poorly qualified personnel to high positions, conflicts of interests in the award of contracts, and so on. These shortcomings do not encourage the development of an efficient and accountable public sector. Another area of concern is the issue of the business interests of government ministers and senior officials. Engagement in business activities by elected representatives, either directly or indirectly, while in government, removes the perception of neutrality and partiality, and often results in the adoption of inappropriate policies and administrative decisions.

In recent years, bilateral and multilateral donor agencies such as the World Bank, ADB and UNDP have made governance an important part of their development agenda. These organizations have funded programmes targeting public sector reform. The president of the World Bank declared in 1997 that the Bank would no longer tolerate corrupt practices in administering its projects (Wolfensohn, 1997). Since that time the Bank has adopted a multi-pronged strategy for combating corruption that focuses on economic policy and management, administrative and civil service reform, legal-judicial reform, public oversight and financial controls (Figure VII.1). The thrust of the economic policy and management reforms include deregulation of economies, tax reform and macroeconomic stabilization programmes. The civil service reforms have included downsizing and improvement of working conditions, while the financial reforms have targeted improving financial management and auditing. Some projects have also targeted improvement in the legal frameworks and strengthening of judicial systems. To date, the World Bank has undertaken more than 600 specific anti-corruption programmes and governance initiatives in 95 borrower countries. In PNG, a World Bank Project since the mid 1990s has focused on improving economic policy and management, and to some extent, reform of the civil service.

It is now generally accepted that good governance and transparency are important factors affecting sustained economic growth. However, the current aid programmes focusing on governance are unlikely to be successful without increased involvement of local communities and non-government organizations (NGOs) in the design and implementation phase. The participation of local communities will ensure that the proposed institutional changes will take account of local conditions and a given country's socio-political and economic situation. Traditionally, NGOs in the region have been primarily concerned with environmental and social issues. For example, in PNG, Vanuatu and Solomon Islands, environmental NGOs have led the campaign against unsustainable logging practices with some success. Other NGOs (including church-based NGOs) have been involved in development programmes. NGOs are in touch with people at the grassroots level and have developed credibility within the local communities. However, NGOs are not in the mainstream of the decision-making process, and have received limited recognition and funding from governments.

Figure VII.1. The World Bank's Anti-Corruption Strategy



Source: World Bank (2003).

3. Fiscal discipline

One area that needs urgent attention in the process of institutional reform is financial discipline and accountability. Government overspending is a common problem in the region. Available statistics indicate that, on average, government expenditure as a percentage of GDP is around 30 per cent in the PICs. However, it is as much as 100 per cent in Tuvalu, and more than 50 per cent in Vanuatu, Kiribati, Cook Islands and Western Samoa (ADB, 1996). Table VII.1 presents statistics for the budget balance as a percentage of GDP for selected PICs. The figures show that over the past five years, most governments in the region have run budget deficits. In 2001, the budget deficit was 6 per cent of GDP in Fiji and neatly 9 per cent of GDP in the Solomon Islands. These budgetary problems were obviously exacerbated by political instability in these countries. In recent years, some PICs have begun efforts to reduce the size of their public sectors. Papua New Guinea instituted a retrenchment exercise in 1996 as part of a World Bank Structural Adjustment Programme. Countries such as Niue, Vanuatu and Cook Islands have attempted to reduce the number of its public servants. However, in most countries, it has been impossible to carry out the significant job cuts required to make a difference in the budget deficit. This is due to the limited employment opportunities available for retrenched workers and the lack of a strong political base on the part of elected governments.

Table VII.1. Selected Pacific Island Countries: Budget Balance as a Percentage of GDP, 1998-2001

	1998	*1999*	*2000*	*2001*
Fiji	5.1	–0.2	–3.0	–6.0
PNG	–1.6	–2.6	–1.9	–1.4
Western Samoa[a]	2.1	0.3	–0.7	–2.3
Solomon Islands[a]	–1.6	–3.9	–5.0	–8.8
Tonga[a]	–4.3	–1.4	–0.9	–0.5
Vanuatu	–6.7	–0.9	–7.4	–2.5

Source: ESCAP (2002), Table II.10. p. 78.

Note: [a] Excludes grants.

Government revenues have lagged behind expenditures in the region due to the low tax revenues, which are due in part by the low tax bases. Taxes in PICs are low in comparison to other developing countries. With the exception of Western Samoa where taxes exceed 30 per cent of GDP, in most other countries they are 20 per cent or less of GDP. The financial problems of PICs have been compounded by a number of other factors including reduced flow of ODA, reduced flows of private investment and poor domestic savings rates. These financial pressures have forced some countries to undertake questionable revenue raising schemes. There is an urgent need for governments in the region to exercise fiscal discipline by reigning in public current expenditure, expanding their tax bases, and implementing policies to increase domestic savings and private direct investment. Overseas development assistance must be directed to capacity strengthening and building up of the social and physical infrastructure.

C. Skills requirements

The current level of specialized training in most government departments is inadequate. This is a constraint that severely restricts their ability to carry out tasks such as environmental management and enforcement. In some countries (e.g., PNG) government departments such as Environment and Conservation and the National Fisheries Authority have benefited from development assistance for institutional strengthening schemes. Agencies such as AusAID and ADB have provided assistance in administrative function, as well as some limited in-house training. In most PICs, there has been no specific training for government officials in the integration of environmental concerns into the development planning process.

Expertise is required in various aspects of environmental planning and management including collection, interpretation and analysis of environmental data, as well as implementation, monitoring and evaluation of environmental policies. Environmental training must not be restricted to only environment departments or divisions, but should be extended to other line agencies. The environmental training should also be carried out at different levels: top level government decision/policy makers; middle level specialists, policy analysts and planners; industry groups and the general public; and schools. The top level bureaucrats need to be trained to expose them to the complex and multi-dimensional nature of environmental issues which will enable them to better understand policy options brought before them. General environmental education among industry and community groups is also necessary to increase their understanding of environmental policies. Such education will improve cooperation from these groups and therefore enhance the effectiveness of the policies. Enhancing environmental education in the schools could begin with the aining of teachers in environmental studies.

Specific areas in which training is required include the following:

- Environmental impact assessment;
- Environmental monitoring and evaluation;
- Environmental information systems/database management;
- Environmental cost-benefit analysis;
- Environmental law issues;
- Environmental auditing and cost accounting; and
- Forecasting of environmental and socioeconomic trends.

Individual countries in the region do not have the resources to undertake such training on their own. The University of the South Pacific (USP) is the major provider of tertiary education in the region and is better placed to deliver this type of training. USP currently offers both formal and non-formal programmes in environmental education and awareness building. The Pacific Centre for Environment and Sustainable Development (PACE-SD), based at USP, coordinates certain environmental courses and training programmes. These include Post-graduate Diploma programmes in Environmental Science/Studies, Climate Change Vulnerability and Adaptation Assessment Course, and The Pacific Island Community-based Training Course. USP also offers courses that lead to a Bachelor of Science degree in Environmental Science. There are also other courses with relevant environmental content in disciplines such as economics, sociology and education. However, much more remains to be done in this area. For training of government officials, short-term training programmes such as seminars, workshops, and courses will be more appropriate. Regional agencies that could facilitate such programmes include the South Pacific Environmental Programme (SPREP) and South Pacific Applied Geoscience Commission (SOPAC).

D. Data and infrastructure requirements

The availability of good data is essential in enabling government planners and analysts to integrate environmental considerations into planning for sustainable development. Two broad types of environmental data are required to facilitate the integration of environmental issues into economic plans. The first type of information needs pertain to the types, locations, quantities and distribution of various categories of natural resources. The second relates to the use patterns of these resources and the effects of use on carrying capacities and the health of the ecosystems. The latter type of information includes the quality of air and water resources. The information has to be collected on a regular basis. In most of the countries environmental data is non-existent. Where they are available, they tend to be collected infrequently.

There is an urgent need for coordination of the information gathering process to avoid duplication of effort. In the larger countries, various government ministries already collect data for reporting purposes. Traditionally, the data have been stored in files. Recently, some countries have started computerizing their databases using ODA. For example, in Fiji, the current databases include:

- Fiji Land Information System – Department of Lands;
- Native Lands information System – Native Land Trust Board;
- Fiji Forest-Geographical Information System – Department of Forests;
- Geological Mapping – Fiji Minerals Resources Department;
- Agricultural Geographical Information System – Ministry of Agriculture and Forests;
- Environmental Information System – Department of Environment;
- Urban Development Information System – Department of Town and Country Planning; and
- Census Data Systems – Fiji Bureau of Statistics.

Vanuatu has established a Resource Information System (VANRIS) with the assistance of the Council for Scientific and Industrial Research Organisation (CSIRO) in Australia. A similar system is under consideration for PNG. Asafu-Adjaye (1993, 1994) has examined the feasibility of an environmental and natural resource ("Green") accounting system for PNG. He concludes that while the basic elements of such a system exist, there is a need for considerable work to make it operational. The key areas of need include training, financial resources and environmental awareness.

The data compiled by various government departments (e.g., GIS data) are often in different formats, presenting problems of compatibility for different types of users.[27] There is therefore a need to rationalize and harmonize the data collection process. Rationalization is important because large amounts of data are often gathered without regard to how they can be used by others for decision-making. If possible, efforts must be made to have a centralized database system. Such a prospect is far off since most countries have yet to

[27] For example, information produced in a database management system could refer to the record structure, whereas in a GIS, the information could in the form of digital images.

institute a programme of data collection and the basic infrastructure for storing the data do not yet exist. The best option is to pool resources in the region. In 1992, the Pacific Sustainable Development Network was established to encourage exchange of information on sustainable development between government bodies, universities, NGOs, the private sector and individuals in 30 developing countries. The Secretariat for the Pacific Community was based in Suva and was tasked with coordinating the capacity building programme, among other things. While Phase I has been completed, the second phase remains to be funded.

An important issue to be addressed is access to information. In some cases, various government departments or research agencies do not have access to each other's information. In this age of information technology, it is unclear who owns this information. Does the information belong to the public at large, the government at large, a ministry, or a specific research institution? It is of vital importance to resolve the problem of access in order to facilitate the free flow of information among government agencies and other users.

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VIII. FUTURE CHALLENGES

As we enter the new Millennium, the process of globalization is expected to intensify worldwide and this will pose challenges for Pacific Island countries. Globalization is defined here as the recent development of information technology that has greatly facilitated the movement of capital, labour and information, among other things, on a worldwide basis. As indicated earlier, development in the PICs has been severely constrained by various factors including the small size of the population and land, poor infrastructure, the geographical isolation, lack of access to world markets, and aid dependence, among other things. These constraints, as well as other factors such as weather and crop failure make PICs vulnerable to the process of globalization. It is highly likely that the current economic and environmental problems would be exacerbated if the right policies are not implemented now. The environmental threats include sea-level rise, attributed to global warming, the growing waste management problem, and destruction of natural resources such as tropical rain forests, coral reefs, and mangroves. There is also the potential for political instability in some countries. Partly due to their isolation, PICs are vulnerable to being used as transit routes for smuggling of arms and illicit drugs, as well as for money laundering. Political and economic instability could also accelerate the rate of migration from the region, thus compounding the problem of skills shortage.

In the short to medium term, agriculture provides the best comparative advantage for growth and development in the region. Agriculture (including fisheries and forestry) is the dominant sector in the region. On average, more than 85 per cent of the population are rural-based and depend on agriculture for subsistence, employment and income. However, increased agricultural production has associated negative environmental effects. Most PICs have fragile and closed ecosystems that are particularly vulnerable to increased conversion of habitat for agricultural purposes. A more sustainable long-term development path would require a structural transformation to less environmentally damaging production activities. One possibility could be sustainable tourism. In countries such as Samoa, Tonga and Vanuatu, tourism has emerged as the most important source of revenue generation.

Although the agricultural sector has received significant amounts of public investment in many PICs, its performance to date has been below expectations. For example, in Fiji, agricultural output (including fisheries and forestry) declined at an annual rate of 0.6 per cent between 1989 and 1997, whereas the overall economy grew at a rate of 2.4 per cent per annum. The decline in the agricultural sectors of PICs can be explained by external and internal factors. The external factors include the long-term decline in average world market prices for agricultural commodities such as coffee, copra and palm oil. There are a number of internal factors behind agriculture's poor performance. First, PICs tend to have a narrow export base, relying on a few commodities. For example, Fiji's merchandise exports are sugar, garments and gold; PNG's are gold, copper, timber and coffee; while Tonga's are squash, fish and root vegetables. Thus, the economies in the region are undiversified, making them vulnerable to adverse movements in both nominal and real world market prices. Second is the geographical isolation of PICs from major world markets. Their "smallness" in terms of land area and local demand presents logistical and economies of scale problems. Third, growth in the agricultural sector has been hampered due to inappropriate government policies. The key strategy for enhancing long-term development prospects in the region is through export-oriented growth. As the East Asian experience has shown, trade liberalization, or at least a greater degree of openness is essential in achieving such a goal.

Trade liberalization is also important for PICs because empirical studies (e.g., Asafu-Adjaye, 2000; Zhang, 2001) show that foreign direct investment is more likely to promote economic growth when a country adopts a liberalized trade regime. A good example, in this regard, is Fiji. Prior to 1989, Fiji followed an inward-looking import substitution strategy in which industries such as rice, dairy, poultry, beef, pork and tobacco were protected by a complex array of quotas, tariffs and subsidies. In the period 1989 to 1995, the agricultural sector became the focus of a national policy of deregulation. There was a switch from licensing and import controls to tariff protection with a gradual reduction in tariff levels. Available evidence (e.g., ADB, 1991; Lightfoot, 1994) suggests that the policy change yielded economic dividends in terms of increased exports.

Globalization will intensify the current level of competition, and to survive in such an environment, PICs will have to reform their economies in order to improve their external competitiveness and further their comparative advantages. In addition to trade liberalization policies, they would need to diversify their export bases, by moving into niche markets and non-traditional exports. A good example is kava and mineral water exports in Fiji. However, foresight in planning must be exercised in such new ventures to ensure that any adverse environmental impacts are forestalled. The implementation of appropriate trade policies must be accompanied by reform on several fronts. Chapter VII discussed the need for reform of the economic, political and legal institutions in PICs. Reform of economic institutions includes improving governance and economic management. The former involves putting in place structures to discourage corruption and improve public accountability, while the former involves reforming fiscal (including tax), monetary, exchange rate and wage policies. Such reforms are needed to stabilize the macro-economic environment and to attract foreign investment. There also needs to be stability in the political and law and order environment. Deterioration in law and order at various times in some countries has increased the cost of doing business in those countries, decreased their external competitiveness and depressed foreign investment. All in all, these situations have imposed a heavy toll on the respective economies.

Although it has been said that PICs have limited land resources, they are endowed with vast marine resources. However, to date, most countries have not maximized the potential of these resources. Most of the countries have neither the capital nor technical expertise to exploit their ocean fisheries and have to rely on income from granting fishing license fees. In 1995, the fish catch in the region was estimated at US$ 1.7 billion and yet, in 1996, the region received about US$ 66 million in access fees (Gillet, 1997). There is a need for PICs to take measures that would maximize the economic rent from their natural resources, in general, and fisheries, in particular. The issue of capacity strengthening in data collection canvassed in Chapter VII is particularly crucial in the case of fisheries resources. This is because PICs need to have up to date information on the value and quantities of their fisheries resources in order to make appropriate resource management decisions. The Forum Fisheries Agency (FFA) and the Secretariat for the Pacific Community have been successful in assisting PICs to negotiate license fees and collect data. However, in the long run the countries would need to explore ways in which they can reduce reliance on license fees, including prospects for exploiting the offshore fisheries.

In the case of forest resources, the current situation is that the resources are being harvested at a fast rate and there is little evidence of attempts to regenerate forests. Deforestation is also occurring from conversion of forestland to agricultural, urban and other uses. There is an urgent need for sustainable management policies for forests in the region. Beginning in 1990, PNG became involved in a World Bank-sponsored Tropical Forest Action Plan that brought together the Government, bilateral and multilateral donors, as well as NGOs. Out of this came a two-year moratorium on new logging projects (later extended for a further two years), the setting up of PNG’s own National Forestry and Conservation Action Programme (NFCAP), and the commitment of various donours to support a range of research and development projects within the NFCAP. In 1993, the Government adopted new Forest Development Guidelines that included, among other things, a new approach to gaining access to timber resources while empowering resource owners to have greater control over their resources. However, due to concerted opposition from logging companies, the Government suspended the implementation of all the Forest Development Guidelines. There is a need for governments in the region to acknowledge customary tenure systems and recognize the need for local communities to be taken seriously in resource management. This is the major factor that must be considered in trying to achieve the sustainable and equitable management of natural resources in the Pacific Island region.

A key area of capacity strengthening canvassed in Chapter VII is education and training. There is a need to improve education especially at the secondary and tertiary levels. While primary school enrolments are relatively high, secondary school enrolments are low, implying a high attrition rate. With the exception of Samoa which has a 70 per cent gross secondary school enrolment rate, the other countries have low gross secondary school enrolment rates. For example the rates for the Cook Islands, Fiji, PNG and Vanuatu are 46, 36, 23 and 22 per cent, respectively (ADB, 2003). It was also emphasized that there is a need for increasing environmental education at all levels of government and in schools and universities. Specialized environmental training is also required in areas such as environmental impact analysis, environmental impact assessment and monitoring and environmental information systems and database management.

Regarding environmental data collection, storage and dissemination, the current capacity of PICs is limited due to lack of skilled personnel and adequate infrastructure. It was suggested that one way to overcome this problem is for PICs to pool their resources to maintain a centralized database system. The acceleration of the flow of information across wide areas is one of the benefits of globalization that can be exploited in this regard. The University of the South Pacific currently operates USPNet which is used to facilitate distance education in the region. Development of such satellite communication networks in the region could greatly assist information flow and exchange among the Pacific countries. Although the financial resources of PICs are limited, there is scope for financing such schemes through donor assistance and domestic taxes.

To conclude, we return to the basic theme of this study, which is integrating environmental concerns into economic decision-making processes. Choosing the appropriate policy (or policy mix) to integrate the environment into economic decisions is a major challenge for countries in the region. At present, CAC measures are the most commonly used form of policies in PICs. However, they have been shown to be less cost effective than MBIs. While

CACs will continue to be used for some forms of pollution control, in the medium term MBIs would be required for more effective management of the region's natural resources. Chapter V discussed some of the constraints to implementing MBIs in Pacific Island countries. These include lack of institutional capacity, lack of political will, lack of public awareness and lack of well-developed markets and a strong legal structure. In addition to tackling these barriers to implementation, action is required in sectors such as agriculture, energy, fisheries, forests, mining and waste disposal to eliminate any existing government/policy failures before MBIs can work. The policy failures pertain to any environmentally damaging subsidies that make polluting activities 'cheaper' than they would otherwise be. It is also necessary for governments to ensure that property rights are well defined and secure to make certain MBIs more effective. Finally, it is not possible to have a 'one size fits all' policy prescription, given the great diversity in the region. Therefore, there is a need to find a mix of policy measures that suits a particular county's circumstances.

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Printed in Bangkok
October 2004 – 760

United Nations publication
Sales No. E.03.II.F.55

ISBN: 92-1-120329-5
ISSN: 0255-9250
ST/ESCAP/2273