

Trade Liberalisation and the Environment

Lessons learned from Bangladesh, Chile, India,
Philippines, Romania and Uganda

A SYNTHESIS REPORT

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NOTE

The views and interpretation reflected in this document are those of the authors and do not necessarily reflect an expression of opinion on the part of the United Nations Environment Programme.

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The United Nations Environment Programme

The United Nations Environment Programme (UNEP) is the overall coordinating environmental organisation of the United Nations system. Its mission is to provide leadership and encourage partnerships in caring for the environment by inspiring, informing and enabling nations and people to improve their quality of life without compromising that of future generations. In accordance with its mandate, UNEP works to observe, monitor and assess the state of the global environment, and improve our scientific understanding of how environmental change occurs, and in turn, how such changes can be managed by action-oriented national policies and international agreements.

With today's rapid pace of unprecedented environmental changes, UNEP works to build tools that help policy-makers better understand and respond to emerging environmental challenges. Towards this end, UNEP provides policy-makers with useful tools to monitor the environment, such as integrated environmental and sustainability indicators, and models for effective tools to manage it, such as economic instruments. UNEP's work concentrates on helping countries strengthen environmental management in diverse areas including freshwater and land resource management, the conservation and sustainable use of biodiversity, marine and coastal ecosystem management, and cleaner industrial production and eco-efficiency, among many others.

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The mission of the Division of Technology, Industry and Economics (DTIE) is to encourage decision-makers in government, industry, and business to develop and adopt policies, strategies and practices that are cleaner and safer, use natural resources more efficiently and reduce pollution risks to both human beings and the environment. The approach of DTIE is to raise awareness by fostering international consensus on policies, codes of practice, and economic instruments through capacity-building and information exchange and by means of demonstration projects.

The Economics and Trade Unit

The Economics and Trade Unit (ETU) is one of the units of the Division of Technology, Industry and Economics (DTIE). The work programme of the Unit consists of three main components, economics, trade and financial services. Its mission is to enhance the capacities of countries, particularly developing countries and countries with economies in transition, to integrate environmental considerations in development planning and macroeconomic policies, including trade policies. UNEP's mission in this field is also to address the linkages between environment and financial performance and the potential role of the financial services sector in promoting sustainable development. The trade component of the Programme focuses on improving countries' understanding of the linkages between trade and environment and enhancing their capacities in developing mutually supportive trade and environment policies, and providing technical input to the trade and environment debate through a transparent and a broad-based consultative process.

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Foreword

There has been an increasing concern over the potential negative impacts of trade liberalisation, particularly on the environmental and natural resources of developing countries and countries with economies in transition where trade has grown most rapidly.

In these countries, the threat of serious environmental harm from increased trade can be a substantial impediment to further liberalisation unless appropriate policies and measures to protect the environment are in place and enforced. Without these policies and enforcement, the resulting pollution of air, water, and soils and the unrestrained use of natural resources can spark a rapid decrease in national development.

The United Nations Environment Programme (UNEP) believes that the potential for negative impacts of trade on the environment can be minimised, if not avoided entirely, by integrating environmental considerations – that complement rather than inhibit trade – into development planning. Programmes to restructure economies in this way, however, must be designed to ensure that environmental values and natural resources are used in a sustainable manner. UNEP's mission in this field is to improve the capacity of nations to understand the close links between trade, the environment, and development and to help decision-makers integrate environment and trade policies.

This report is a review of studies in six countries commissioned under UNEP's "Capacity Building for Integrating Environmental Considerations into Development Planning and Decision-making" programme. Over a two-year period, UNEP has worked closely with national institutions in Bangladesh, Chile, India, the Philippines, Romania and Uganda to identify both the environmental impacts of trade liberalisation and the economic instruments can be used to sustainably manage these impacts. These projects are the first of their kind as they were entirely conceived, designed and conducted by teams of national experts in their own country.

The studies in this report focus on unique trade-related environmental problems and their social and economic implications as they apply to diverse economic sectors and a range of countries. Importantly, these projects involved a wide range of stakeholders who could accurately identify the dynamics of environmental degradation and develop innovative and acceptable national response strategies.

Each study includes recommendations for practical actions, including immediate "command and control" measures as well as economic instruments for national conditions. These actions have the potential to effectively halt trade-related environmental degradation, and in turn, ensure that a country's long-term trade remains robust and sustainable.

These projects do *not* end with published studies. The final component of each project involves a "pilot activity" to implement the proposed measures. These pilot activities, undertaken by national authorities in collaboration with project national teams and UNEP, will assess the environmental effectiveness and economic efficiency of implemented measures.

Based on the evaluation of these pilot activities, policy measures will be optimised for long-term effectiveness. Throughout this process, UNEP will assist governments by providing expertise and mobilising international assistance. Following successful completion of these first six country projects, UNEP will work with interested Governments in further sectoral studies.

I believe these studies offer valuable insights to high-level trade and environment officials who want to increase their understanding of the intricate relationship between trade and environment. I also recommend this report to national policy-makers aiming to effectively address the emerging environmental impacts of liberalised trade in their countries.

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The preparation of this synthesis report has been made possible by the cooperation and commitment of many individuals and organisations.

National teams – authors of the full country reports synthesised here – are to be commended for taking the lead in project execution. At the country level, each of the five national teams – with members coming from an array of research institutions, non-governmental organisations and national agencies – worked tirelessly to organise national workshops, gather field data, analyse economic and environmental trends, and develop policy recommendations. In several projects, National Steering Committees were established to ensure projects remained relevant and on-track, and in all projects, local citizens' groups helped identify emerging environmental problems, elucidate their causes, and elaborate policy responses.

The work of a varied set of national team members, supplemented with inputs from a wide group of national constituents that participated in consultations, was essential in ensuring that diverse cultural and social perspectives were integrated into each country's project. Indeed, all of these national actors are to be thanked for their genuine interest and commitment in national projects, and for the valuable contributions they made to each project's success. In addition, national authorities are to be thanked for their steadfast support of these projects' objectives.

The Economics and Trade Unit (ETU), Division of Technology, Industry and Economics (DTIE) of the United Nations Environment Programme (UNEP), was responsible for the overall coordination and management of all six country projects. Through a joint UNEP-UNCTAD (United Nations Conference on Trade and Development) collaboration, René Vossenaar and Veena Jha provided technical guidance and assistance to the national teams on various aspects of their research. International expert meetings further provided a forum for project implementation review by national teams and representatives of relevant International and United Nations organisations. Additionally, critical reviews of draft reports were provided by Theodore Panayotou of the Harvard Institute of International Development and Konrad von Moltke of the Institute of Environmental Studies of Vrije University.

Once national teams had completed their final reports, Kevin Lyonette of Sustainable Development Services, carefully distilled this synthesis report from the full country reports that are published separately in their entirety. Subsequently, Eugenia Nuñez, Desiree Leon and Rahila Mughal of UNEP worked closely with an external editor, Robert Hamwey, to process this synthesis report for publication.

Finally, it must be recognised that like so many international environmental research projects, funding from interested sponsor governments is the key to their existence. UNEP is indebted to the Ministry of Foreign Affairs of the Government of the Netherlands who generously provided the financing that made five of these country projects possible, and to the European Commission for their financial support of one country project.

Introduction

Within today's global economy countries now trade more intensively and frequently than in the past. Trade has become an increasingly important global economic activity, with annual trade volumes increasing sixteen fold over the last fifty years and the ratio of world exports to Gross Domestic Product (GDP) now approaching twenty percent. With this recent acceleration of global trade, countries throughout the world have benefited from more investment, industrial development, employment and income growth.

Recognising that the benefits of trade can strongly contribute to the improvement of basic living standards, many of the world's developing countries and countries with economies in transition, have sought to actively participate in the global trading regime. For most of these countries, efficient and effective participation in the global economy has required substantial economic restructuring at home. Thus, in recent years, national governments have implemented structural adjustment programmes to stabilise and reorient their economies in order to face the challenges of development. This included in the first instance the restructuring of economies to increase foreign exchange earnings through enhanced trade and trade liberalisation as embodied in the set of WTO agreements.

National experiences with structural adjustment programmes have been mixed. Nevertheless, trade liberalisation elements of restructuring programmes have provided countries with a wide range of trade-related benefits. This has been reflected in the rapid generation of increased domestic employment, income growth, and foreign exchange earnings. Trade liberalisation has also facilitated countries' increased imports of strategic goods and services, and attracted foreign direct investment, yielding enhanced technology transfer, the development of endogenous capacities, and the establishment of basic infrastructure needed to support national objectives for industrial development.

Trade liberalisation may also indirectly benefit a nation's natural and environmental resource bases, as increased trade-related fiscal revenues can provide national governments with new financial resources to support environmental protection, conservation and remediation efforts.

Recently, however, there has been an increasing concern over the potential negative impacts of trade liberalisation, particularly on the environmental and natural resources of developing countries and countries with economies in transition where trade has grown most rapidly. These countries have found that economic activities supporting, or supported by, rapidly expanded trade can result in serious environmental degradation when complementary environmental policies are not in place. Unless appropriate action is taken, such degradation can spark a progressive cycle of decline for national development. Pollution of air, water and soil, and unrestrained natural resource exploitation, grow to levels that jeopardise the viability of the economic activities they support. Trade thereby becomes unsustainable as the potential for future trade is significantly reduced. Accumulated trade benefits, and future trade opportunities, related to investment, industrial development, employment and income growth, gradually diminish.

Trade liberalisation driven by macroeconomic policies and economic reforms, including Structural Adjustment Programmes (saps), may have environmental impacts, both negative as well as positive. A clear analysis of these effects is needed. Policies should be designed to mitigate the negative effects and enhance positive ones. Policy integration at the national level is important in this regard. Economic instruments are tools to achieve environmental objectives. They would need to be properly designed and implemented in conjunction with command-and-control mechanisms to increase their flexibility and cost effectiveness.

A great deal of work remains to be undertaken in designing policy packages and mechanisms to integrate environmental considerations into structural adjustment programmes, especially when they involve trade policy reform, and in designing applicable economic instruments for specific sectors of high priority to countries or regions, as the case may be. Emphasis should be laid on enhancing the institutional and human capacities of developing countries and countries in transition to market economies for integrating environment, trade and development policies.

The challenge for national policy-makers is to identify and apply an effective mix of measures to ensure that negative environmental impacts of trade are avoided before they evolve, or at least reversed once they become manifest. In developing an optimal mix of measures, they will need to explore the strengths and weaknesses of traditional command and control measures, as well as economic (or market-based) in-

struments. As circumstances vary widely amongst countries, measures and instruments must be selected and designed to meet national social and economic conditions.

The United Nations Environment Programme (UNEP) believes that the potential for negative impacts of trade on the environment can be minimised, if not avoided entirely, by integrating environmental considerations – that complement rather than inhibit trade – into development planning. Structural adjustment programmes and trade liberalisation policies need to be designed while taking fully into account the sustainability of countries' environmental and natural resource bases. There is thus a need for countries to develop and implement policies and measures which not only address existing and potential environmental impacts of increased trade, but also promote the development and implementation of mutually supportive and integrated environment and trade policies.

In this context, UNEP has been requested by its Governing Council, to work closely with governments, particularly developing countries and countries in transition and assist them in their efforts to enhance their institutional and human capacities for integrating environmental considerations in development planning and decision-making. The country projects presented in this report are a response to this request.

Over the past five years, research at UNEP's Economics and Trade Unit (ETU) has focused on examining the linkages between trade, environment and development. Emphasis has been placed on developing innovative approaches to assess and respond to related environmental challenges. Supported by this research, over the past two years, UNEP has worked closely with six countries – Bangladesh, Chile, India, the Philippines, Romania and Uganda – on comprehensive projects to identify the impacts of trade liberalisation on national environmental resources and the use of economic instruments to sustainably manage these impacts.

Through each country project, UNEP sought to build institutional and human resource capacity for analysing alternatives for designing and implementing policies and measures that integrate trade, environment and development. Towards this objective, UNEP assisted countries in designing specific mechanisms for managing environmental impacts of macro-economic reforms, as well as instruments for environmental management in the context of national priorities. Through associated process-oriented capacity building, UNEP aimed to promote partnership and multi-stakeholder participation in the design process. Thus, unlike many previous environmental projects, undertaken with the active participation of expatriate experts and international organisations, these projects were entirely country-driven – conceived, designed and conducted by national teams of practitioners – making them among the first of their kind.

These projects have encompassed new action-oriented research on unique trade-related environmental problems and their social and economic implications in diverse sectors and varied country settings. Importantly, projects have involved multi-stakeholder participation in numerous consultations to accurately identify the dynamics involved in environmental degradation, and to develop innovative and widely acceptable national response strategies. Each study concludes by recommending a set of practical measures – comprising command-and-control measures and economic instruments designed to meet national conditions – that promise to effectively halt trade-related environmental degradation, and in turn, ensure that the country's trade remains robust yet sustainable over the long-term. But the projects do not end with published studies, the final component of each country project involves a pilot implementation of proposed measures undertaken by national authorities in collaboration with each project's national team and UNEP.

Each project was implemented by a national team, and began with a comprehensive review of global and national literature and methodologies, and a study of existing policies, particularly economic reform packages and their impact on natural resource management. Workshops and planning meetings were convened for the development of the country studies and finalisation of methodologies, including criteria and questionnaires, consultation meetings, and implementation of recommendations of the study. In each project, national teams benefited from significant interchanges of views and insights between different team members and with a wide range of stakeholders through national consultation meetings.

Following completion of detailed field studies and analysis of data, draft reports were prepared. These were submitted to peer review, and used as a focus for national seminars and brainstorming sessions to sensitise the private sector and relevant government officials to the problems identified, results outlined

Introduction

and the strategy for implementation and to discuss the policy options outlined in the reports. Based on these reviews, final reports, including a strategy for the implementation of results of the study, were submitted to UNEP for publication in their entirety.

At the time of writing, project studies have recently been completed and pilot implementation is just beginning in many of the participating countries. During these demonstration exercises, the environmental effectiveness and economic efficiency of implemented measures will be assessed. Based on evaluations, measures will be fine-tuned to optimise their long-term utility. Throughout this process, UNEP assists governments by providing its expertise and mobilising international assistance to maximise the yield of these efforts. Following successful completion of this first round of six country projects, UNEP intends to work with interested governments in a second round of projects involving additional sectoral studies.

This report is a synthesis review of the six country studies implemented under the first round of UNEP's *"Capacity Building for Integrating Environmental Considerations into Development Planning and Decision-making"* projects. Projects in the first round examine the shrimp farming industry in Bangladesh, the mining sector in Chile, the automotive industry in India, the Philippines forestry sector, the Romanian water sector and the Ugandan fisheries sector. Following a synthesis summary of each of the six country studies, this report sums up in its final section with a brief discussion of conclusions emanating from the ensemble of projects.

The complex trade-environment dynamics uncovered by country experts participating in these projects and the innovative strategies – emanating from extensive national consultations – to manage emerging environmental threats, are concisely summarised in this report. Moreover, by focusing on practice and specific sectoral challenges in real country settings, these studies fill the wide gap existing between academic research on environmental policy and much needed ground-level action.



The Shrimp Farming Industry in Bangladesh

*This project was implemented by the Centre for Policy Dialogue (CPD), Dhaka
with technical assistance from UNEP.*

Project implementation was managed by Debapriya Bhattacharya, CPD.

Summary of results

Shrimp Aquaculture in Bangladesh is a major economic activity. Shrimp exports in 1998 were at US\$ 260 million – a 70% increase from 1980. The economic success of liberalisation is recognised but there is strong criticism of the negative, often irreversible, impacts on the environment and on social issues such as landlessness and social discord. Partial cost-benefit analysis (CBA) was applied using costs of land degradation, of human health impacts and of mangrove destruction due to shrimp farming. Benefits were the income derived from export of processed shrimp. Land degradation causes a loss of 0.11% of total Gross Domestic Product (GDP) in foregone agricultural production, a reclamation cost of 0.22% of GDP and a cost of cattle loss equivalent to 0.01% of GDP. Water pollution from shrimp farming impacts on human health at a cost (adjusted to average income) equivalent to 0.09% of GDP. Mangrove destruction causes annual income loss equivalent to 0.02% of GDP and a biodiversity loss of US\$ 2.2 million. In 1998, the benefits of shrimp export amounted to 1.1% of GDP. The CBA ratio emerges as 0.21 on a production loss basis and as 0.30 on a restoration cost basis. The cost is thus 21% to 30% of the total benefit. Solutions recommended include a mix of MBIs and CAC approaches comprising: • a land use tax; • effluent charge on pollutants of water; • a soil conservation fund; • mixed rice-shrimp farming and clear land zoning; • licensing of shrimp farms; • mandatory mangrove development; • a ban on shrimp catch by trawlers; • strengthening of property rights; and • a rationalising of current laws. In Bangladesh, a major requirement is that all stakeholders, especially local communities, must be involved in the decision-making process.

Project Objectives

The objective of this study was to examine the environmental impacts of trade-related policies of structural adjustment programmes (SAPs), particularly those affecting the shrimp culture industry in Bangladesh.

The project sought to:

- **analyse the trend and structure of the export-oriented shrimp culture industry in Bangladesh against the backdrop of trade policy reform in the country;**
- **undertake a simple cost-benefit analysis to assess the environmental impact of shrimp cultivation; and**
- **set forth a policy package for sustainable shrimp culture, integrating environmental concerns and trade expansion objectives.**

The research methods deployed included literature review, discussion of policy evolution, consequences and intervening factors, interpretation of empirical evidence based on statistical techniques and integration of site/industry specific information. The study was largely based on secondary data, selectively supplemented by primary evidence.

Shrimp Farming in Bangladesh

Bangladesh is the world's fourth largest producer of fish from inland water bodies. Although subsistence shrimp culture had been a constituent of the country's fisheries sector for hundreds of years, shrimp culture as an export-oriented activity is a phenomenon of recent origin. Exports of shrimp from Bangladesh were worth only US\$ 2.9 million in 1972-73, accounting for 1 per cent of the country's total exports. Exports of shrimp increased to US\$ 33 million in 1980 and to US\$ 90 million in

1985. However, until the mid-1980s shrimp culture was principally dependent on open-water catches of shrimp. Commercial shrimp farming began to develop in the mid-1980s.

The policy initiatives and the incentives, many of which were implemented under the SAP during the mid and late 1980s, set the context in which shrimp culture in Bangladesh started to attain the characteristics of a major, export-oriented economic activity. A visible shift is discernible in the trend line for shrimp exports during the post-SAP period, reflecting structural changes induced by reform policies.

*Exports of shrimp
grew from
US\$ 91 to 260 million
between 1986 and 1998*

Bangladesh accounted for 4.1 per cent of the global production (721 thousand tonnes) of commercial shrimp in the mid-1990s. The total area of shrimp culture (a major component of coastal aquaculture) in Bangladesh covers about 145 thousand hectares. The 750-km coastline provided a conducive natural environment for commercial shrimp culture. Two areas in the south, the Chittagong-Cox's Bazar belt and Khulna, Shatkhira-Bagerhat belt accounts for 95 per cent of total acreage of shrimp culture in the country.

*There is a strong linkage
between the reforms
implemented under the
SAP in Bangladesh and
emerging incentives for
shrimp culture activity in
the country*

Production of shrimp by coastal aquaculture accounted for about 30 per cent of annual shrimp production, while the relative shares of marine capture and fresh water capture were 23 and 47 per cent respectively. The production of shrimp by aquaculture method is a 100 per cent export-oriented activity, taking place in about 9,000 farms. While shrimp from fresh water is destined

primarily for the domestic market, a part of the marine capture is also processed for export from the southern regions of the country.

Shrimp are exported from Bangladesh to the USA (31.8 %), Japan (18.3 %), Belgium (16.2 %) and UK (11 %). Commercial shrimp culture in Bangladesh is predominantly carried out by non-local entrepreneurs on leased-in lands. A semi-intensive method of shrimp culture is mainly practised, with an average yield rate greater than 130-250 kg/hectare/ annum.

Trade Liberalisation

Structural Adjustment Policies

The SAPs promoted by the Bretton Woods institutions have been of great influence in defining the development strategies of developing countries during the last decade and a half. An appraisal of the SAP policy package in Bangladesh is an appropriate point of departure for assessing the environmental impacts of the country's development efforts. The outcome of such inquiries may provide input for future policymaking with a view to integrating economic and environmental concerns into development strategies.

During the period 1979-1996, the World Bank's adjustment lending to Bangladesh amounted to US\$ 1.76 billion (i.e., 30 per cent of total ODA commitment to the country). This amount was channelled through fifteen structural and sectoral adjustment credits (SALs and SECALs). Bangladesh was one of the very first countries which benefited from the Structural Adjustment Facilities (SAF) and Extended Structural Adjustment Facilities (ESAF) of the International Monetary Fund (IMF) in 1986 and 1989 respectively.

The principal policy instruments of the structural adjustment programmes in Bangladesh included, *inter alia*, cutbacks in public sector expenditures, reduction of an anti-export bias in the tax structure, tariff rationalisation and overall trade liberalisation, incorporation of flexibility in the exchange and interest rates, privatisation, price decontrol and desubsidisation.

Aside from macro-economic management, SAPs targeted almost all the major sectors of the economy including agriculture and manufacturing, energy and communication, finance and trade for reform. The overarching goal of the reform measures under SAPs in Bangladesh was to stimulate the country's growth performance through the creation

of a market-based economic management structure reflecting the comparative advantages of the country.

In terms of implementation, a large part of the policy measures proposed under SAPs has been realised on the ground. However, according to a number of evaluation studies, the outcome of SAPs in Bangladesh has been, at best, mixed. At the aggregate level, the current account deficit and domestic resource balance improved and inflation remained under control. Growth in exports accelerated in the post-reform period, although the commodity base remained narrow. However, a declining trend of the investment rate could not be halted and the savings rate could not be increased. Consequently, restored macro-economic stability in the economy did not translate to micro-level dynamism. At the same time, the social impacts of SAPs in Bangladesh have been judged to be, largely, negative.

Economic Impacts of Trade Liberalisation

A close look at the policy changes under the SAP and the growth of commercial shrimp farming indicates that there is a strong linkage between the reforms which were implemented under the SAP in Bangladesh and emerging incentives for shrimp culture activity in the country. Fiscal and financial incentives and institutional support provided under the reforms, played an important role in terms of putting in place a conducive export-friendly environment which stimulated commercial shrimp farming in Bangladesh.

Under the reform package the average tariff rates for imported inputs was brought down from 88 to 21 per cent, anti-export bias in the trade and investment regime was substantially removed, and the private sector was encouraged to invest in export-oriented activities.

The shrimp industry was able to take advantage of the policy changes encouraged by the SAP. Within the overall policy framework of export-led growth, provisions such as zero-tariff access to imports, fiscal incentives for direct and deemed exports, income tax rebates, and subsidised credit. Additional support including the leasing of government land (khas) on favourable terms and assistance setting up downstream factories were provided as well. Taken together, these measures created a policy environment which stimulated private investments in shrimp culture, shrimp processing and shrimp exports.

The provisions of duty drawback, cash compensation schemes, concessional interest rates etc. stimulated investment in export-oriented activities such as shrimp culture and contributed to their better performance compared to the rest of the manufacturing sector, particularly in respect to labour productivity, capital productivity, capacity utilisation and returns on capital. Increasing returns in the fish processing enterprises promoted upstream activities in the shrimp culture industry of the economy.

The graduation of subsistence shrimp culture to an export-oriented activity can be traced back to policy changes initiated under the structural adjustment programme of the mid-1980s

The conducive domestic policy environment in this period was also reinforced by emerging global market opportunities. The growing demand for shrimp in high income countries came at a time when (a) there was a significant fall in shrimp production in some of the major exporting countries, and (b) capture of wild ocean shrimp was becoming more expensive and erratic.

The graduation of subsistence shrimp culture to an export-oriented activity can be traced back to the period when Bangladesh initiated policy changes under its structural adjustment programme in the mid-1980s. As is commonly recognised, both productive forces and production relations undergo crucial changes when an economic activity is transformed from one that is subsistence-oriented to one that is market-driven.

The emergence of commercial shrimp culture in Bangladesh may be viewed from three vantage points; viz. (a) transition of traditional shrimp farming into an export oriented activity, (b) the interface between this transition and changes in the policy regime, and (c) environmental implications and consequences stemming from the transformation of shrimp culture activity. This last aspect is critical in view of the fact that open capture fisheries are deemed to be self-sustaining, while closed culture fisheries, as commercial shrimp culture tends to be, generate a wide range of externalities

which make sustainability an important issue of concern.

Increased salinity of soil, and the destruction of mangrove forests has negative economic impacts including a reduction in grazing land and reduced crop productivity

The Environmental Impacts of Trade Liberalisation

Trade-Environment Linkages

With Bangladesh being increasingly exposed to the global economy following its implementation of structural adjustment policies, there is a growing apprehension that changes in the economy induced by these policies are causing adverse environmental impacts. Moreover, as resources switch from non-tradable to tradable sectors of the economy, and as major shifts occur in production and cropping patterns in response to the adjustment policies, resource degradation has been manifesting itself as a by-product of this particular pattern of growth.

A review of literature on the trade-environment nexus in the context of SAPs suggests that:

- there is a strong substitution effect of adjustment policies favouring the export sector;
- export-led growth induces structural changes, and the concomitant shifts in allocative efficiency and relative prices may result in environmental degradation; and
- future access of least developed countries (LDCs) to the markets of developed countries will critically hinge on the nature of the relationship established between trade and environmental factors.

The shrimp culture industry in Bangladesh received crucial support from a World Bank credit in 1985 amounting to SDR 20.6 million to Bangladesh for its 'Shrimp Culture Project'. In the project document, it was stated that the project could not possibly have any detrimental effect on the envi-

ronment. However, the coastal shrimp farming areas in the south experienced:

- environmental degradation;
- increased salinity of soil, canals and the ponds within the polders;
- reductions in grazing land and a consequent reduction of livestock; destruction of mangrove forests; and
- adverse affects on the potential crop-mix, cropping intensity, crop calendar and the overall cropping pattern in the areas concerned and a reduction in soil quality.

In addition, the shrimp cultivating areas experienced an increase in unemployment and an aggravation of social and economic conflicts and tensions. Protection of the environment as a policy objective in the context of Bangladesh was first incorporated in the SAP Policy Framework Paper for 1990/91-1992/93.

The Emergence of Environmental Concerns

In recent years, the cultivation of shrimp as an export-oriented commercial activity has come under close scrutiny. It has been argued that negative externalities generated by commercial shrimp culture, e.g., destruction of the irreplaceable mangrove resources in the south, increasing soil and water salinity, declining productivity of land, increasing deforestation, growing landlessness and increasing violence related to the shrimp industry far outweigh the tangible incremental economic gains. Such concerns have been raised by the following four sources:

- 'warning calls' from some of the local NGOs with close links to the international development community and who are actively involved in a global campaign for sustainable development and, more specifically, in the campaign against unregulated expansion of export-oriented shrimp cultivation in other countries (e.g., as Philippines and Thailand);
- 'wake-up calls' from political activists, NGO workers and media people from coastal regions of Bangladesh, as negative externalities became increasingly evident following shrimp cultivation over relatively long periods of time (i.e., 4-5 years);
- research studies undertaken to assess and evaluate the socio-economic impact of shrimp culture in the coastal regions of Bangladesh; and

- scientific reports examining the extent of environmental degradation in particular areas that have given rise to serious concern and alarm.

These sources emphasise an environmentally unsustainable character of shrimp culture under the coastal ecological conditions of Bangladesh. They allege that negative externalities are systemic, endemic and irreversible and, hence, there is a need to impose an outright ban on shrimp cultivation.

Views from the business community tend to downplay concern over environmental damage caused by the industry. They highlight the potential benefits of the industry, especially increased income, employment and foreign exchange earning capacity, and maintain that these benefits far outweigh the costs associated with possible negative impacts of shrimp culture. They further highlight the major role of the industry in the economy, pointing out its growing importance as the country's second largest non-traditional export-earning activity. According to these views, the benefits in terms of foreign exchange earnings, incremental employment and income generation far outweigh any short-, medium- or long-term negative externalities. Moreover, it is argued that the benefits are not limited to entrepreneurs only but that there are substantial multiplier effects that accrue to the local community as a whole.

The third perspective, whilst not undermining the negative environmental externalities, stresses that the negative environmental impacts of shrimp culture can be satisfactorily addressed through an effective set of policies and instruments.

Policy Options

The role of the Government of Bangladesh (GoB) has figured prominently in the discourse over shrimp cultivation in the country. The GoB's favourable disposition to shrimp cultivation played a critical role in stimulating entrepreneurial activities in the shrimp industry. In the initial period, the government provided crucial support to the industry in terms of acquisition of land, leasing of khas (state-owned) land to shrimp farmers, and providing fiscal and financial incentives in the production and processing of shrimp.

When negative environmental impacts gradually emerged and ecological-environmental concerns precipitated a debate as to the future of the industry, the government initiated a number of measures to contain these negative impacts. These included enactment of laws governing lease of land, designing guidelines for the setting up of shrimp

farms, provisions for consent of local farmers in the setting up of shrimp farms and the formation of Shrimp Culture Steering Bodies at national, regional and local (thana) levels.

Major views with respect to the role of the GoB are the following: (a) many of the negative environmental impacts originate because of the government's flawed policies; (b) existing provisions, regulations and laws do not adequately address environmental concerns; (c) weakness of enforcement has led to the violation of rules enacted by the GoB; and (d) there is a need for a comprehensive shrimp farming policy in Bangladesh which should be designed, implemented and monitored in collaboration with major stakeholders.

Some stress that the negative environmental impacts of shrimp culture can be satisfactorily addressed through an effective set of policies and instruments

Policymakers are faced with the following choices concerning the future of shrimp culture in Bangladesh. (a) closing down commercial shrimp culture at the cost of export deceleration, loss of employment and income as well as other negative socio-economic consequences, (b) continuing 'business as usual' to the detriment of the environment, and (c) incorporating environmental policy measures in order to strike a balance between short- and long-term benefits as well as private and social welfare.

Obviously, if the third choice turns out to be the most desirable option, concerns to be addressed regarding export-oriented shrimp culture in Bangladesh encompass political, socio-economic and environmental issues.

Environmental and Social Issues to be addressed by policy-makers include:

- **non-resident entrepreneurs having no motivation to practice sustainable shrimp farming;**
- **increased salinity leading to drastic decreases in soil fertility;**
- **irreparable damage to traditional economic activities such as cattle grazing and poultry farming;**

- **damage to household crops and communal forests;**
- **loss of common property rights;**
- **increased income erosion and growing income inequality;**
- **irreversible damage to mangroves and coastal vegetation; and**
- **irreparable damage to flora and fauna and biodiversity.**

Governing the shrimp industry with environmental policies, incentive systems and a regulatory framework should be the focus of government attention and action. Admittedly, a consultation process, with multi-stakeholder participation, will be critical in better understanding the set of related issues which, considered in isolation, do not point to feasible and practicable policy solutions. Problems encountered both at the stage of farming as well as at the stage of processing in the shrimp industry must be considered.

Economic Costs and Benefits of Shrimp Farming

Given the debate regarding environmental impacts of export-oriented shrimp cultivation, a partial cost-benefit analysis has been made to compare the gains and losses from shrimp culture activity. The types of *costs* which have been examined are (a) land degradation due to salinity, (b) health impacts

In 1994, the total value of shrimp export was US\$ 327 million, which is 10 % of total export income

in terms of mortality and morbidity, and (c) mangrove destruction. The *benefits* are estimated on the basis of the income of the industry received through the export of processed shrimp.

Assigning value to all environmental and social problems as well as quantification of all economic benefits arising from shrimp cultivation is clearly impossible, either because of lack of data or absence of usable methodology. The exercise done here is based on many critical assumptions and tentative information. These are discussed in the process of cost and benefit estimation. The reference year used in this study is 1994.

Economic Benefits of Shrimp Culture

In 1994, the total value of shrimp export was US\$ 327.14 million, which is 10 per cent of total export income and 1.22 per cent of total GDP in this reference year. Since it is a local resource-based industry, 90 per cent of the income can be taken as value added and the rest accounted to machinery and other production costs. Therefore, the export earning from shrimp cultivation is US\$ 294.43 million, which is 1.1 per cent of total GDP of the country and 3.39 percent of the total GDP of the districts where shrimp are cultivated. Admittedly, there is a distributional issue – not dealt with in this study – involved with respect to these earnings.

Economic Costs of Shrimp Farming

Land Degradation: Production Loss

The total area under shrimp cultivation is estimated to be 145 thousand hectares, which is about 1 per cent of total land area of Bangladesh. About 80 per cent of the total shrimp cultivating area is located in Khulna, Satkhira, Bagerhat, Barisal, Patuakhali, Jessore and Noakhali districts and cultivation of food and cash crops has totally or partially been eliminated in these areas. If agricultural production is to be carried out in these districts using the same level of inputs and similar methods of management, the land-output ratio will not be the same as before the switch to shrimp culture activity. The difference between the outputs during the two periods is the loss in production.

A moderate degree of land degradation, which results in a production loss of 45 per cent, is estimated to cause a loss of 146,160 mt of rice in physical terms and US\$ 30.65 million¹ in monetary terms. This is 0.35 per cent of the agricultural Gross Domestic Product (GDP) and 0.11 per cent of the total GDP of the country in 1994.

Land Degradation: Restoration or Reclamation Cost

Salinisation and water logging can be reversed, and the productivity of land partly restored by reclamation. The main elements of the technology involved here are: (a) installation of deep drains to lower the water table; (b) leaching of salinised areas, requiring the appli-

¹ Rate of exchange used throughout is US\$ 1.00 equals Takka 40.38

cation of non-saline water in amounts considerably in excess of the irrigation requirement; and (c) treatment of sodic soil with gypsum. In Pakistan, soil salinity was reduced from 28 to 40 per cent during 1969-85 using such technologies, and since then 80,000 hectares of lands are being restored to production each year. Assuming that the cost would be similar for Bangladesh, given the similar socio-economic situations of the two countries, the reclamation cost for degraded land in shrimp cultivating areas (except Chittagong) would be US\$ 57.74 million, which is about 0.22 per cent of the total GDP of the country and 0.66 per cent of the total GDP of the major shrimp cultivating districts.

Loss of Livestock

It has been claimed in other studies that there has been a drastic reduction in the number of livestock-owning households following the introduction of commercial shrimp culture. Based on the 'recall method' among 607 households, it was estimated in other studies that the rate of reduction in cattle per household is (-) 8.9 per cent year during this period. This rate has been used in this study. The number of cattle lost in the area under study was 22,792. Taking US\$ 99.05 as the average market value of the local cattle, the loss of income due to cattle reduction as a result of shrimp cultivation is found to be US\$ 2.26 million. This is equivalent to 0.01 per cent of the total GDP of the country and 0.03 per cent of the total GDP of the seven districts in the reference year.

Mangrove

The present study estimates only the direct use value of Chokoria mangrove area which has been totally lost due to salinity and human intervention. The area of this mangrove is 8750 hectares, which is 1.5 per cent of the total mangrove area in Bangladesh (577 thousand hectares) and 0.46 per cent of the country's total forest area (1,908,600 hectares). An annual income could have been earned from the products extracted from the area had it not been destroyed. The GDP contribution of the national forestry sector was US\$ 1.1 billion in 1994. Therefore, the amount of annual income lost from this mangrove is US\$ 4.86 million. This is 0.02 percent of the total GDP of Bangladesh in 1994.

Biodiversity of the affected mangrove is valued here only in terms of the value of medicinal plants using estimates from an Indonesian study on the

assumption that the same benefit would be derived from Chokoria mangrove area. Taking a net benefit of US\$ 15 per hectare for medicinal plants from mangrove, the total value for the Chokoria mangrove is estimated to be US\$ 131,253.

Various social costs are associated with shrimp cultivation which cannot be measured in monetary terms

Health Impact

Water pollution induced by shrimp cultivation causes premature deaths (mortality) and increases the occurrence and incidence of diseases (morbidity). The economic value of mortality is estimated based on the value of statistical life (VOSL). The VOSL is the marginal willingness to pay (WTP) to reduce the risk of a fatal accident or willingness to accept (WTA) for increased risk aggregated over a large number of people. The cost of morbidity has been estimated in terms of treatment cost and wages lost.

Restoration costs equal 30 % of the benefit derived through shrimp cultivation

As epidemiological data on water-borne diseases induced by shrimp culture are not available, it is assumed that half of the attacks and deaths due to diarrhoea and dysentery (only water-borne diseases are included in the estimate) are due to water pollution induced by shrimp culture.

Adjusting the VOSL in the UK to Bangladesh in proportion to the average income difference between the two countries, the mortality cost of water pollution induced by shrimp cultivation is estimated to be US\$ 22.92 million. This is 0.09 per cent of the total GDP of the Bangladesh and 0.26 percent of the total GDP of the districts concerned.

The treatment cost is estimated by multiplying the number of morbidity cases by the treatment cost per person. US\$ 24.05 per person is taken as the treatment cost following a survey finding. The total treatment cost in this study is estimated to be US\$

116,394. Losses due to days when the workers cannot go to work due to illness and, therefore, lose income are equivalent to US\$ 96,582.5.

Some allege that negative externalities are systemic, endemic and irreversible and, hence, there is a need to impose an outright ban on shrimp cultivation

Social Costs

Apart from economic costs, various social costs are associated with shrimp cultivation which cannot be measured in monetary terms. Most of the shrimp farms are cultivated by entrepreneurs who are not residents of the area and thus have no social obligations to the area. Area residents who protest against shrimp cultivation are often subject to torture and violence and even killing. Small and marginal farmers are not allowed to work in the shrimp fields, as the entrepreneurs are afraid of theft of shrimp. Consequently, they have to look for employment somewhere else, often outside the village, resulting in family dislocation.

As output from this industry is consumed primarily in export markets, the degradation of the Bangladesh environment in affected regions remains a local externality whose costs go unaccounted for in consumption markets.

As a vulnerable group of the society, women are the most affected victims of environmental degradation. Not only are they engaged in the collection of shrimp fries and the processing of shrimp but they also have to perform household activities in a degraded environment which poses serious threats to their health. They are also harassed and tortured by the owners of the shrimp farms. Children, on the other hand, miss their classes during the season when shrimp fries are collected. It is, however, maintained by some that even after accounting for such social costs, the benefits accrued from shrimp cultivation outweigh the costs incurred.

Comparison of Costs and Benefits

A comparison of the costs and benefits of shrimp culture activity is difficult to make at this stage since the estimates of this study are partial and based on a number of assumptions. Nonetheless,

an approximation of the costs and benefits is worth estimating for policy-making purposes.

The total cost of shrimp cultivation was found to vary from 0.23 to 0.33 per cent GDP in the reference year. This gives a Cost-Benefit Ratio of 0.21 (on a production loss basis) and 0.30 (on a restoration cost basis). In other words, the cost is 21 per cent (production loss) and 30 per cent (restoration cost) of the benefit derived through shrimp cultivation.

As the estimates are not complete, they should be interpreted cautiously when used to make policy interventions. Notwithstanding the partial nature of the estimates, they give an indication of the environmental damage induced by shrimp cultivation and of the benefits derived from this industry. Though economic gains outweigh the environmental costs, conclusions have to be defined carefully because environmental costs are far-reaching and their impact may be observed later over a long period of time. Moreover, some of the environmental impacts, such as biodiversity loss, are irreversible. The value of environmental resources is far greater than any quantifiable amount since they are essential for human existence. Keeping these limitations in mind one can argue that some of the damages, especially those estimated in this chapter, can be avoided and benefits can be increased with the right type of measures and interventions.

Policies for Sustainable Resource Management

Environmental problems, and associated social problems, precipitated by substantial growth of export oriented shrimp cultivation in Bangladesh – as with other types of environmental problems – arise due to market failures, policy failures and institutional failures.

Overcoming these failures in shrimp cultivation calls for a judicious mix of market-based and non-market-based measures. Market-based instruments are easier to implement as they often provide fiscal and financial incentives. However, given the limited efficacy of the incentives in certain cases, regulatory instruments also need to be deployed to effectively address the environmental problems associated with the industry. The policy instruments suggested below include only price- and technology-related instruments, and exclude quantity-related instruments (e.g., tradable permits) as they do not seem to be appropriate in the case of shrimp

cultivation in Bangladesh. As the direction of changes in resource use will depend to a large extent on the nature of intervening institutional factors, the roles of the institutions in policy implementation are discussed separately.

Bangladesh has traditionally used restrictions and regulations to contain environmental damage resulting from an economic activity. This command-and-control approach gave rise to standards-driven environmental policies that espoused quantitative limitations on levels of pollutants and on levels of resource exploitation. However, the experience of developed countries suggests that mandated environmental standards and technologies may act as a drag on economic growth and the costs involved may be excessive for a low-income economy like Bangladesh.

The challenge of integrating environmental and economic policies in the context of sustainable shrimp culture can be addressed largely by economic instruments for environmental management. Such instruments motivate behavioural change, inducing differential response by economic agents and allowing them to adjust flexibly to evolving circumstances. Use of economic instruments may also generate financial resources.

This is not to say that command-and-control regulations have to be abandoned and replaced by economic instruments altogether. This is neither desirable nor possible. Accordingly, what has been suggested below entails improving the efficiency and flexibility of existing regulations through selective introduction of economic instruments.

Economic Instruments Based on Price Related Measures and Fiscal Incentives

The first group of market-based instruments examined here are *price-related measures* and *fiscal incentives*. If used properly, price related measures and fiscal incentives can be mutually beneficial to entrepreneurs, workers and the community at large. Three specific instruments are discussed below.

Land Use Tax

Since there is no tax on agricultural land, it is considered as a free good and, therefore, tends to be misused. This can be reduced through a tax imposed on the users of land for shrimp cultivation. This would make certain land unprofitable for shrimp culture. This measure has relatively low monitoring and enforcement cost and may raise substantial revenue. The revenue earned can be used to finance technological improvements that

would reduce natural resource degradation induced by shrimp cultivation.

Economic instruments motivate behavioural change, inducing differential response by economic agents and allowing them to adjust flexibly to evolving circumstances.

The use of economic instruments may also generate financial resources.

Effluent Charge on Pollutants of Water

The shrimp farms should pay for polluting the water through effluent charges on pollutants containing BOD (biochemical oxygen demand) and COD (chemical oxygen demand) materials. This charge may vary according to the size of the farms in order to account for their varying pollution intensity. Apart from the positive revenue effect, this will provide the entrepreneurs with an incentive to employ more environmentally sound production practices. The revenue raised may be used to construct water treatment plants. The charge rate can be increased gradually over time so that prices are correct.

The challenge of integrating environmental and economic policies in the context of sustainable shrimp culture can be addressed largely by economic instruments for environmental management

Soil Conservation Fund

Loans could be given on flexible terms to shrimp farms for using environmentally sound technologies to reduce salinity and water logging. However, subsidising soil conservation loans to finance environmentally sound technologies is not a dynamically efficient instrument, since it might make shrimp culture activities more profitable and induce additional entrants in the industry, thereby giving rise to increased environmental damage.

Economic Instruments that Promote Environmentally Sound Technologies

The second group of market-based instruments is designed to promote *environmentally sound technologies* in shrimp cultivation. The technology requirements in shrimp cultivation are mostly indigenous by nature. Two specific, but complementary, means are relevant:

Rice-Shrimp Mix Farming

A pilot (model) project could be designed to examine closely the process which carries out semi-intensive shrimp culture during the first half of the year, and then, during the second half of the year, changes to fin fish culture in marine/brackish water, sweet water fish culture or rice cultivation, depending on the land type. By encouraging this traditional practice, the long-term gains will be maximised in terms of both productivity and land quality. There could be shared leasing between the crop farmers and the shrimp farmers for the shrimp-rice cultivation cycle. In this practice, since the rice farmers have to maintain the quality of their land to produce rice, they will therefore have to take measures to stop land degradation. Furthermore, the shrimp farmers will have to allow the monsoon sweet water to wash away salinity in the shrimp cultivating lands. It may serve the dual interests of land owning small farmers and landless poor people of the area. It would also support protection of the environment.

Semi-Intensive Shrimp Farming

As a principle, semi-intensive shrimp cultivation should be encouraged with necessary safeguards. A pilot project could seek to understand hydro-morphological land changes associated with this practice, and examine technologies to overcome related problems.

Regulatory Measures

The command-and-control measures discussed below seek to strengthen existing policies and regulations.

Land Zoning

There is a tendency for shrimp farming to expand the area under cultivation, which is responsible for destruction of mangrove forests and of agricultural lands. There should be definite guidelines for use of the resources of brackish water areas for the cultivation of marine and freshwater shrimp as

well as other suitable species of shrimp and fish. Criteria for selection should be based on topography, tide fluctuations, salinity and soil quality. The government, basing its decisions on an extensive survey of the geographical and environmental features of current shrimp culture locations, should decide which areas remain suitable for shrimp cultivation. Accordingly, there should be a clear demarcation of areas and land zoning for shrimp cultivation with a view to minimising the conflict between shrimp culture and agriculture while ensuring protection of the environment.

Licensing

Licensing of shrimp farms should be reintroduced. This will help to control the indiscriminate and unplanned expansion of shrimp cultivation.

Mandatory Forest Development

It should be made mandatory for the shrimp cultivators to develop a green belt of mangrove forest to maintain the biodiversity of the area. It should be at least 30 per cent of the total cultivated area. This will maintain the aquatic and plant diversity of the coastal area. Tradable mangrove conservation obligations could be developed.

Ban on Trawler Shrimp Catch

Trawlers contribute to only 3.5 per cent of total shrimp production and they catch mainly mature and gravid shrimp. Shrimp catch by trawlers should be banned to increase the supply of broods for hatcheries and to enhance the productivity of the natural breeding cycle.

Strengthening of Property Rights

Land use rights favouring local people are one of the pre-requisites for sustainable shrimp culture activity. At present *khas* government lands are leased out to the shrimp cultivators on flexible terms, leading to inefficient use of land. Expanded programmes in land registration and titling are needed to clarify property rights. Adequate compensation for those people who lose lands to shrimp cultivation should be ensured. The government can introduce a minimum cost for per-unit leasing of agricultural land for shrimp farming.

Securitisation of property rights will reduce institutional constraints that prevent 'buy-outs' or prevent the mixing of shrimp and rice farming activities. Strengthening of security rights may also be also attractive for equity reasons.

Legal Reforms

Apparently, there is no shortage of policies or regulations directly concerned with the environmental impacts of shrimp cultivation. These include, the Fish Act (1950), the Shrimp Mohal Management Policy (1992), the Tiger Shrimp Cultivation and Pond Regulation Policy for Bagerhat District (1993), the Shrimp Cultivation Tax Act (1992) and the National Fish Policy. Documents such as Bangladesh Environment Conservation Act (1995), the National Environment Management Action Plan (NEMAP), the National Conservation Strategy, etc., also have relevance for developing sustainable shrimp culture.

Most of these policies and regulations are never implemented properly. Often there is an absence of necessary supportive legislation. At the same time, relevant rules have not been formulated as provided for under these policies. Thus, there is a need to review all of these documents and come up with a comprehensive law (e.g., Sustainable Shrimp Culture Act) which encompasses all aspects of the activity.

Institutional Initiatives for Sustainable Shrimp Farming

Currently, a plethora of public agencies are involved in one way or another in regulating shrimp culture in Bangladesh. These include first of all, the Ministry of Fisheries, the Ministry of Land, and the Ministry of Forests and Environment. While the Ministry of Industries is involved in the shrimp-processing phase, the Ministry of Commerce deals with exports of shrimp. Scientific and technological support with respect to shrimp cultivation is supposed to be forthcoming from Fisheries Research Institute (FRI), Bangladesh Agricultural University (BAU), and Khulna University. Law enforcement agencies are quite often involved in mitigating shrimp cultivation related violence.

Besides public institutions, a host of private bodies and NGOs are actively engaged in the industry. The Bangladesh Frozen Food Exporters Association (BFFEA) is the most representative trade body of industry entrepreneurs. NGOs (e.g., Nejera Kori) and many political parties are involved in mobilising the small and marginal cultivators, as well as landless labourers, to protect land rights, and limit growth of the shrimp cultivation industry.

A convergence between these institutions may be achieved through a tripartite initiative involving the government, the private sector and NGOs. For such an initiative to yield results, the Department

Policy Instruments

Recommended in this Study:

- *land use tax*
 - *effluent charge on pollutants of water*
 - *soil conservation fund*
 - *rice-shrimp mix farming incentives*
 - *semi-intensive shrimp farming incentives*
 - *land zoning*
 - *shrimp farm licensing*
 - *mandatory forest development*
 - *ban on trawler shrimp catching*
 - *strengthening of property rights*
 - *legal reforms*
 - *institution building*
 - *eco-labelling*
 - *rural development*
-

of Environment has to emerge in a leading role, whereas the private sector has to commit itself to a socially responsible (environment sensitive) code of conduct. Last but not least, the local community should be involved through a social mobilisation process which may be catalysed by the NGOs.

If undertaking a pilot scheme on sustainable shrimp culture under a tripartite initiative seems to be a difficult exercise, the proposed joint initiative may launch a voluntary eco-labelling project that may ensure quality standards at all levels of production and protect the country against possible loss of its overseas market due to a poor image of the Bangladesh shrimp industry.

Concurrently, building social institutions like schools, health-care centres for the local people near the *ghers* and ensuring sanitary and safe drinking water facilities in the areas is an important task. Also, there should be some provisions to ensure that the shrimp farms employ the majority of their workers from the locality. Such a measure will decrease social tensions and rising unemployment caused by the loss of land to shrimp cultivators.

Conclusions

Overcoming market, policy and institutional failures in shrimp cultivation calls for a judicious mix of market-based and non-market-based

measures. The *market-based* instruments are easier to implement as they usually entail provision of fiscal and financial incentives. However, in certain cases, given the limited efficacy of the incentives, *command-and-control* types of instruments need to be deployed to address the situation. The policy instruments suggested in this study seek to ensure an environmentally sound export-oriented shrimp culture industry. The direction of changes in resource use will depend to a large extent on the nature of intervening institutional factors.



Chile's Mining Sector

*This project was implemented by the
Centro de Investigación y Planificación del Medio Ambiente (CIPMA)
with technical assistance from UNEP.
Project implementation was managed by Nicola Borregaard, CIPMA.*

Summary of results

Copper mining in Chile generated 41% of total exports in 1995 although it accounts for only 2% of national employment. The recent success of the sector is mainly due to the effects of the removal of barriers to trade. Growth, however, has tended to be at the cost of environmental quality and may not be sustainable. Already there is evidence that Foreign Direct Investment (FDI) in mining in Chile is declining. An Assessment Framework was applied to the sector and indicated that trade liberalisation was the central factor in the scale of increase in mineral production and export:

- Liberalisation had a reduced effect on mining which is declining as a percentage component of exports; private sector participation in mining has reached 61% of total production, with considerable foreign participation.
- Liberalisation has produced technology effects which reduce costs, increase competitiveness, make possible the exploration of marginal areas and reduce negative environmental impacts through more efficient use of resources and reduction of emissions and wastes;
- the product effects of liberalisation include an increase in the export of copper concentrates which may cause more serious environmental problems.

Current environmental problems associated with mining include air pollution, overuse and pollution of water, soil contamination and land degradation and damage to species and their habitats. The basic conclusions of the assessment indicate that:

- scale effects will increase environmental damage;
- structural emphasis on natural resource exploitation tends towards an unsustainable pattern;
- the transfer of technology has reduced environmental impacts per unit of output and the current policy experience with trade liberalisation in Chile has had a significant and positive effect on environmental policy, standards and management overall.

Recommendations include:

- to develop an explicit environmental policy framework which will permit the integration of economic, environmental and social factors into the development perspective;
- to extend environmental planning and management to cover entire ecosystems;
- to develop regulatory standards of environmental quality;
- to encourage a greater transfer of technology and to explore eventual alternative forms of economic activity which can replace copper mining.

Project Objectives

The objective of this study was to examine the environmental impacts of trade liberalisation policies in Chile, particularly those affecting its mining sector.

The project sought to:

- **review the historical development of trade liberalisation in Chile;**

- **analyse the economic effects of globalisation and national trade liberalisation policies on the mining sector;**
- **survey the environmental impacts of trade liberalisation on the mining sector; and**
- **set forth directions for future policy to integrate environmental concerns and trade objectives for the mining sector.**

The research methods were based primarily on published literature reviews and policy analysis.

The Chilean Mining Sector

Profile of the Mining Sector

The mining sector in Chile has, over the years, played an important strategic role in the economy. The main factors are the fiscal contributions and foreign exchange it generates, its role in attracting external investments, and its importance for employment. However, given that most mineral production is destined for export, and because of the high levels of investment and sophisticated technology required, the mining sector has also caused

Mining accounts for approximately 8 per cent of Chile's economic activity

vulnerability in the economy and distortions in the pattern of economic development. These are apparent in the unbalanced growth of mining to the detriment of other economic activities, a limited creation of external economies, irregularity in fiscal contributions and problems in the generation of employment.

Copper and its sub-products generated an average of US\$ 920 million in 1960-1965 in foreign exchange, increasing to US\$ 7.32 billion in 1996

Geographical Location

Mining is concentrated mostly in the northern and central parts of the country where there is copper, iron and iodine. This area has low population densities and is characterised by mountainous relief and desert conditions which have historically precluded diversified economic activities. Mining is of particular importance in these areas, constituting up to 60 per cent of economic activity. In the south of the country, mining revolves around coal, petrol and gas, but is of lesser economic importance, because of other productive sectors. Copper is the pivot of mining activity in Chile, although iron,

silver, zinc, manganese, molybdenum and lead are also important. Almost all mineral production is exported, and historically minerals have been the largest trade item in the Chilean economy.

Economic Contribution

Overall, mining accounts for approximately 8 per cent of Chile's economic activity. In spite of its importance for trade, the contribution of mining to the national economy is lessening, being roughly 10 per cent in 1986 and 8 per cent in 1990. However, the mining sector is expanding; sector annual growth in 1996 was up to 11.9 per cent while the overall economy was growing at an annual average of 6.4 per cent. Fiscal contributions from the mining sector, while important, are difficult to gauge overall. Changing production and pricing conditions in the sector have resulted in wide fluctuations. Available data covers only state-controlled production which is estimated to be US\$ 18.5 million in the last 10 years. Copper production from the two main government enterprises, CODELCO and ENAMI, made up 5.7 per cent of total national fiscal contributions in 1982 and 25.1 per cent in 1989. In 1995, payments for mining concessions and exploration permits contributed US\$ 16 million. There is, however, a high level of non-payment especially by the largest concessions. To cushion the economy from fluctuating fiscal contributions, the Fondo de Compensacion del Cobre (FCC) was created in 1985 in line with the Structural Adjustment Programme of the World Bank. The Fund is based on long-term projections of the price of copper, with a symmetrical mechanism for the deposit or withdrawal of funds from CODELCO, according to price movements. In actual fact, the Fund has been used in part to pay off the national foreign debt and to establish a fund for stabilising petrol prices.

The mining sector is the largest single contributor to the balance of payments. Copper and its sub-products generated an average of US\$ 920 million in 1960-1965 in foreign exchange, increasing to US\$ 7.32 billion in 1996. In 1995, total exports generated US\$16 billion. US\$ 7.85 billion came from the mining sector, and, of this, US\$ 6.487 billion was generated by copper exports alone.

Employment

Generation of employment in the sector has been fairly weak, mainly because of the capital-intensive nature of production. The already low contribution to national employment has slowly decreased since the mid-1980s. Overall, the mining

sector accounted for 1.4 per cent of total employment in 1980, 2.2 per cent in 1986, 1.7 per cent in 1993 and 1994, and 1.8 per cent in 1995 and 1996. In comparison, agriculture, forestry and fisheries, which account for 7.7 per cent of GDP, employed 15.2 per cent of the labour force. The trend of decreased employment is the result of globalisation of the economy and the concern to develop a more rational and cost-effective production system. This is particularly true of copper production, where product prices are generally low. Therefore, the mining companies have pursued a policy of flexible labour functions, salaries and contracts, allowing adjustments to the fluctuations of the market. Overall, the trend is to substitute direct employment in the mines with a system of subcontracting. In 1987-90, direct employment accounted for 56.4 million person-hours and out-sourced employment for 14.1 million person-hours. By 1995, direct employment was down to 48.9 million person-hours and out-sourced was at 13.1 million person-hours. The workers suffered insecurity of employment and salaries. For the corporate sector, these policies have had a positive effect, allowing the creation of many new small and medium enterprises specialising in the provision of services. The indirect labour force connected to mining is estimated at some 220,000 individuals. External contracting of accessory functions by mining companies has been, in the last few years, extended to all core functions.

Public and Private Sector Involvement

Both public and private sector companies operate in Chile. Large companies tend to be multinationals, medium and small ones tend to be national. In 1976, during the Pinochet military regime, the copper mines were consolidated into one large company, Corporación Nacional del Cobre de Chile (CODELCO). Subsequently, a second state corporation – ENAMI – was created. In 1986 the Comisión Chilena del Cobre (COCHILCO) was established to manage the state corporations.

CODELCO is largely responsible for mining development in Chile. It depends on the Ministry of Finance and Mining, and is structured around four mining Divisions located in Chuquibambilla, El Salvador, Andina and El Teniente. In addition, CODELCO is empowered to sell undeveloped mining concessions and to enter into partnerships with private sector investors and developers. It is the third largest mining company in the world but, since 1989, its international importance has decreased because of the declining quality of minerals, limited new exploration and the constraints of

being a state-controlled corporation. It is, however, still the largest mining operation in Chile and in 1994 accounted for 26 per cent of all export earnings from mining.

ENAMI – Empresa Nacional de Minería – does not operate any mines but buys minerals for processing and sale. It has four processing plants, one refinery and two smelters. It has made a very original contribution to mining by fostering the modernisation and development of small and medium-sized companies. It has helped to transform production, has provided opportunities for entrepreneurs and labour through provision of technical assistance and credit, and through creation of a market for their products. In 1994, ENAMI revenues from product sales were US\$ 841 million.

The private sector is playing an increasingly important role in mining operations in Chile. Although the sector is dominated by a few large foreign companies and multinationals, there are also various small-scale private mining operations which play an important role. In 1994, for the first time since the mines were nationalised, copper production by private companies overtook that of state-owned corporations and is expected to account for 65 per cent of production by the year 2000. Four of the largest current operations are in the private sector.

Links with other economic sectors

The mining sector, especially copper mining, has had a progressively greater impact on the national economy, influencing increases in demand for local goods and services. This is the result of growth of the sector as well as of government policies to rely on the internal market. Official statistics point to a growing decentralisation in investments and closer links between the primary mining sector and industrial sectors associated with non-primary mining industries, including chemicals, basic metals, metallic products, non-electrical machinery, energy and others. The impacts are also felt in other economic sectors not directly linked with mining, such as demand for hotel accommodation, tourism and construction, and for consumer goods linked to the greater purchasing power of workers in the mining sector.

Trade Liberalisation

National Policy Development

Government policy has varied considerably over the past decades, with greater or lesser emphasis

on the role of the state in the mining industry, and greater or lesser emphasis on either national industry to provide for local needs or on imports of foreign goods and services. Since the 1930s Chile had pursued a highly restrictive foreign trade regime. An initial phase of import substitution in the 1960s was followed by the nationalisation process in the early 1970s. The subsequent redefinition of the role of the state in the mid- 1970s was followed by the economic crisis of the 1980s, when there was again a sharp turn in policies towards an emphasis on national production and investments.

The private sector is playing an increasingly important role in mining operations in Chile

Liberalisation of imports and a growing competitive environment have had, overall, a positive effect on the development of local industry, driving technological innovation, increases in production and lower prices. However, because of a certain weakness in national design capacity and lack of financing and marketing expertise, the role of foreign firms and imports is still important.

Tariff reduction measures on the whole did not affect exports, but had a strong impact on the imported components

After the military coup, in 1976, Chile adopted a neo-liberal economic policy framework, emphasising the opening of the economy to world markets and removal of trade barriers. This placed larger emphasis on short-term gains. Production systems were intensified and there was a trend towards increased exploitation of natural resources, increasingly seen as the driving force of economic growth. The role of the private sector expanded while that of the public sector decreased. These wide-ranging policy reforms led to increased economic growth, but this growth has been at the expense of environmental quality, and has raised questions about the long-term sustainability of this pattern of development.

The strategy for trade liberalisation promoted by the Chilean government was articulated in various stages, with several periods of change and reversal. In the period 1974 – 1979, tariffs were progressively reduced from the previous high levels and uneven treatment among investors was equalised.

Government policy is now in favour of exports and trade liberalisation. However, when the Latin American debt crisis developed in the early 1980s, the currency was devalued and the real exchange rate fell continuously from 1981 to 1988. In 1982, tariffs were raised up to 20 per cent, and again in 1984, to 35 per cent. In 1985 when the balance of payments crisis was addressed, tariffs were again reduced, first to 20 per cent in 1987, then to 15 per cent in 1988. In spite of these changes in tariffs, the main policy instrument for export expansion throughout the decade was an undervalued currency, rather than tariff reduction.

In the 1990s the democratically elected government adhered to the free market policies of the previous administration, but put somewhat greater emphasis on social provisions. In 1991, continuing with the policy of liberalisation, tariffs were further reduced to a uniform 11 per cent. Subsequently, trade policy moved beyond tariff reductions to a more proactive stage of bilateral and multilateral agreements.

Tariff reduction measures on the whole did not affect exports, but had a strong impact on the imported components. Local industry could have taken advantage of the greater access to foreign technology and components, but it was foreign companies, in particular firms from the USA, which benefited from the lowered tariffs by stepping up exports and bringing the needed components into the country.

The impact of liberalisation on the copper mining sector, – in particular, increased trade due to lower tariffs – is relatively minor in terms of exports, imports and employment. On the other hand, trade agreements have had important dynamic effects – in particular, increased foreign investment due to the stability of the market.

In the 1990s, Chile completed the process of negotiating a series of agreements and treaties with its main markets, including trading blocs and individual countries. APEC is the most important market for Chilean copper exports in volume, accounting for 52 per cent of the total.

A framework for economic and political cooperation was signed with the European Union in 1997,

but it is still too soon to draw conclusions as to its effects. Overall, the EU is an important trading partner, capturing approximately 27 per cent of copper-related exports alone. An associate membership agreement between Chile and MERCOSUR was signed in 1996 reducing average weighted import tariffs levied on Chilean exports from 8.2 percent to 3.2 percent, and average weighted tariffs applied to imports from member countries were reduced from 8 per cent to 5.7 per cent. To date, this is possibly the most important free trade agreement signed by Chile and currently accounts for 7 per cent of copper related exports.

Chile has been negotiating accession to NAFTA for some time, but there has been resistance to finalising the agreement, primarily on the part of the USA. This trading bloc accounts for 10 per cent of Chilean copper exports at present, and it is calculated that the integration of Chile would increase exports of copper products to a level of US\$ 10 million annually. Bilateral trade agreements have also been signed with Canada, including an associated agreement on environmental cooperation, and with Mexico (1991), Venezuela (1993), Colombia (1993) and Ecuador (1994).

Intervention by the government in the mining sector has fluctuated widely. A policy of minimal regulation between 1925 and 1932 gave way in the 1950s to a mild intervention, including exchange controls, increase in taxation and buying of mineral production by the Central Bank. Control of copper mining by foreign investors has contributed, since the beginning of the century, to the development of the concept of nationalisation. This led, in 1971, to a modification of the Political Constitution of the State (Law 17.450) designating the government as the depository of the mineral wealth of the country and, subsequently, to the expropriation and nationalisation of the copper mines. The change was reversed by the Constitutional Organic Law on Mining Concessions (LOCCM) in 1982 and by the Mining Code of 1983. These laws are unique in the Latin American legal system, and exemplify the extreme liberalisation of the mining sector, ensuring very limited intervention by the state and protection of the rights of investors.

Private ownership of mineral deposits is established through the mechanism of full concession, which allows any enterprise – be it national, foreign or mixed – to acquire private control of mineral deposits for an indefinite period, through the payment of an annual license and provision of a guarantee for full indemnities in case of expropriation. In effect, the concession becomes, by its

content, juridical nature, object and effects, a true civil property, with all the attributes of dominion, protected by the Political Constitution of the State.

State Mining corporations are regulated by specific provisions of the Political Constitution, the juridical framework applied to Public Enterprises, Decree No 37 and Law No. 19.137.

Chile has also adopted provisions for controlling capital flows, including requirements for deposits in foreign currency, so as to deal with the massive influx of capital, which, by 1989, amounted to 8 per cent of GDP

The 1974 decree law on the Statute of Foreign Investment freed up the flow of foreign direct investments and established a legal framework which safeguards investments, guarantees the rights of the investor for the duration of the contract, and provides fiscal benefits, including a favourable tax regime and the establishment of thresholds on taxes for foreign investors. It also allows offshore accounts, remittance of profits and the option of re-exporting the original investment capital after a period of three years (reduced to one year at present).

As a result of openness to the global economy and international investment, the Chilean mining sector has become ever more dependent on the evolution of world markets, global demand, supply and prices

In 1997 the minimum limit for investment capital was raised to US\$ 1 million, to avoid speculative capital entry. An additional financial mechanism is that of conversion of debt into capital (which involves an implicit subsidy of 46 per cent of the value of the investment). This mechanism has been responsible for up to 75 per cent of total FDI. It has been utilised mainly in the wood, paper and cellulose industry but has not played a very important role in the mining sector.

Chile has also adopted provisions for controlling capital flows, including requirements for deposits in foreign currency, so as to deal with the massive influx of capital, which, by 1989, amounted to 8 per cent of GDP. Because this has a potentially destabilising influence, the Central Bank continues to play an active role, in spite of the deregulation of the market. There is considerable controversy surrounding the tax regime applied to foreign investments, because of the various loopholes that permit legal payment of less tax than is due. Multinationals transfer debts to their Chilean corporate divisions and repatriate funds under the designation of payments of interest on the debt, which is therefore taxed at a rate of 4 per cent instead of the customary 35 per cent. There is a growing consensus that it is necessary to reform the tax system further.

Tax reform, another element of the structural reforms carried out by the military regime in 1974, affected the entire national tax system, including taxes on income, sale of goods and services and foreign trade. The main objective was to give the private sector greater prominence in the process of resource allocation and reduce distortions in decision-making. A single income tax bracket was established, so as to give all economic sectors the same treatment and help avoid interfering with the allocation of resources between sectors.

Global copper production has maintained a fairly steady rate of annual growth, going at 1.52 per cent for mine copper and 1.02 per cent for refined copper in the 1990s

The Value Added Tax (VAT) supplants the sales tax, at a level of 20 per cent, so as not to distort prices in the different sectors. An additional reform in 1984 reduced disincentives for savings and investments, reduced progressive personal income tax and integrated personal and corporate taxes, thus avoiding double taxation on the same income.

In 1989, further reforms eliminated some corporate taxes. In 1990, the civil government – with the objective of increasing government revenue – increased VAT from 16 per cent to 18 per cent and corporate taxes from 10 per cent to 15 per cent. These measures were strengthened by further reforms in 1993.

Globalisation and the mining sector

The mining sector has played a pivotal role in the liberalisation of the market in Chile. The country is seen by some analysts as an example to other Latin American nations in this area. Compared to its neighbours, Chilean economy has the highest indices of openness.

Mobility of capital has led to growing foreign investment in the mining sector. In the early 1970s, the Chilean Government endeavoured to attract foreign investment, but domestic political conditions at the time were not propitious and the global recession and declining prices of minerals limited the amount of capital available for investment in the mining sector. By the mid 1980s this began to change, and, between 1990 and 1994, investment surged. A reason for this change centred partly on the situation in the emerging markets of Latin America including high returns on short- and medium-term investments and less stringent environmental regulations. Other reasons included global developments such as technological changes improving processing methods of copper and gold, and the loosening of international restrictions in capital markets. All of these factors made international investment in mining operations attractive. Copper mining now absorbs around 51 per cent of global investments in the sector.

As a result of this openness to the global economy and international investment, the Chilean mining sector has become ever more dependent on the evolution of world markets, global demand, supply and prices. Due mainly to technological innovation, allowing more efficient use of materials and substitution of minerals with new materials, global transactions in minerals are less dynamic and economic cycles have less effect on demand for minerals than in the past. Transactions in minerals on global markets dropped from 7 per cent of the total in the 1970s to 3 per cent in the 1990s. Nevertheless, global consumption of copper has shown a steady annual increase, particularly in the last three decades, because of increased consumption in newly industrialised countries in Asia and Latin America. In 1996, the most important markets for copper were the USA (22 per cent); Japan (12 per cent); China (9 per cent); Germany (8 per cent); South Korea and Taiwan (5 per cent). Projections for the future indicate a probable annual increase rate of 2.88 per cent between 1995 – 2005, due in part to increased demand in the communications, sanitary and energy sectors.

Global copper production has maintained a fairly steady rate of annual growth, going from 1.41 per cent for mine copper and 1.54 per cent for refined copper in the 1980s, to 1.52 per cent for mine copper and 1.02 per cent for refined copper in the 1990s. There has been a restructuring of the production system however, due to costs and relocation of investments. Production has fallen in Zaire and Zambia and has ceased in Uganda and Japan; production in the USA is regaining ground; production has increased substantially in Chile, and new producers have emerged in Indonesia, Papua New Guinea, Poland and Mongolia. Argentina, Bolivia and Brazil have launched a restructuring process of their mining sector which should allow them to enter world markets in the near future.

There is however, evidence of a growing imbalance between global supply and demand for copper. Projections for the period 1996 – 2000 for global supply of refined copper indicate an annual growth of 4.4 per cent, whereas demand is expected to grow only 3.6 per cent. This overproduction results in the lowering of prices paid for copper. Prices for copper dropped considerably between 1993 and 1995. It should be noted that an important characteristic of producing countries is that they are 'takers' of international prices. This is particularly so in the case of Chile, where private sector companies are free to place their products on the market and define the efficiency of their operations in terms not of prices, but of production costs. This in turn influences the global choice of options for investment.

Decrease in prices is of limited concern to multinationals, which believe that countries with large, high-quality deposits and efficient production technology, such as the case of Chile, will be able to survive drops in prices. However, it is estimated that most producers in Africa, Australia, Canada and the countries of the former Soviet Union, will be vulnerable. Because so much of Chilean copper production is in the hands of multinationals, prices tend to be kept low because copper is an input into the production cycle of other enterprises owned by the same multinationals.

Chile is a major global producer of copper, second only to the USA. Five of the seven most important copper mines in Latin America are located in Chile (Collahuasi, El Indio, Escondida, Chuquicamata, El Teniente). Chilean copper production has steadily increased its contribution to international markets over the past decades. Mine copper has gone from 10.6 per cent of total world production in the 1970s, to 16.7 per cent in 1986, to 28.6 per cent in

1996. Foundry copper accounts for 13.5 per cent of total world production. Refined copper has doubled in the last decade, making up 18.6 per cent of the total world production. By 2001, Chile is expected to account for 42 per cent of world copper production.

Economic Effects Of Trade Liberalisation

Economic liberalisation in Chile resulted in significant growth, including an unprecedented expansion of trade. Both the policy reforms enacted by the government and world economic trends

As a consequence of the economic adjustment, exports grew at an 11 per cent annual rate between 1986 and 1995

played a significant role. From 1976 to 1979, the average annual growth rate of exports was 17.5 per cent, going from US\$ 1.2 billion to US\$ 3.6 billion. From 1981 to 1990, growth slowed to 7.4 per cent annually. As a consequence of the economic adjustment carried out between 1982 and 1985, exports grew from US\$ 3.8 billion to 8.3 billion. During this overall period, global trade grew 16 per cent annually between 1975 and 1980, decreased to 1 per cent between 1981 and 1985 and then grew again by 11 per cent between 1986 and 1995. In comparison to world trends, Chile's performance was positive. The main destination of exports (1993) was 26 per cent to countries of the European Union, 19.8 per cent to the Latin American region, 17.6 per cent to the USA, 16 per cent to Japan and 14.9 per cent to the rest of Asia.

From 1984 to 1995, the average growth rate of the national economy was 6.5 per cent. Per capita incomes doubled, aided in part by the 20 per cent real appreciation of the national currency. Between 1990 and 1995, the economy grew by an average of 8.9 per cent annually.

Foreign investments in the overall Chilean economy have been somewhat variable. The annual rate of growth was of the order of 47.6 per cent in the 1950s, but declined to 6.4 per cent in the 1960s. Between 1971 and 1978 the annual rate of investments was negative, going down to minus 7.1 per cent as a result of nationalisation of the copper

mines and indemnisation. Thereafter, investments rose continuously from 9.8 per cent of GNP in 1983 to 21.8 per cent of GNP in 1989. During 1990 – 1993, FDI reached US\$ 1.73 billion and by 1995 there was an increase of 20 per cent to US\$ 3.02 billion. With a sound legal framework, political stability, economic reforms and growing confidence in the performance of the economy, investments in Chile are increasingly considered to be of a high investment grade.

The mining sector plays a central role in capturing foreign investment, but here too, the situation has been in flux. Between 1974 and 1995, FDI materialised in mining projects was of the order of 56.2 per cent of all investments in the economy, reaching up to 70 per cent in certain years (1989 and 1994). During the economic crisis of the early 1980s, investments in copper mining fell to less than 27 per cent, of which only 15.4 per cent was materialised, representing the lowest rate of investment in any sector. In 1996 FDI in copper dropped to 19.4 per cent.

During 1990 – 1993, FDI reached US\$ 1.73 billion and by 1995 there was an increase of 20 per cent to US\$ 3 billion

In the long term, mining will give way to investments in other sectors and funds will go towards maintenance and development of existing installations rather than to large new projects. An early indication of this trend is current allocation of FDI funds among registered projects, with 49.6 per cent going to services, 23.3 per cent to industry and only 9.3 per cent to mining.

Scale Effects

In the last decade there has been an explosive growth in exports, fuelled by increases in production by the private sector. It is quite clear that trade liberalisation has played a central role in the rise in scale of mineral output and exports. Nevertheless, other factors have also come into play, namely fluctuating prices, which have been countered through a strategy of raising production as a means of maintaining competitiveness. In the future, it is probable that this growth will continue, as many of the mines have not yet reached their full production capacity. It is estimated that overall copper production will reach 4.8 million tonnes by 2001,

which represents a growth rate of 10 per cent between 1996 and 2001. Exploration for new deposits has been very aggressive with good results. Increases in production may reach 15 per cent.

Structural and Sectoral Effects

Changes in the relative weight of mining sector exports in relation to those from other sectors have been striking. Natural resource exports (including fisheries, forestry, agro-industrial products and various non-traditional products) increased exponentially, growing at an annual rate of 8.2 per cent over the period 1970 – 1990, as compared to the 1.7 per cent growth rate for copper-based products. In 1970, the composition of exports was made up of 85.4 per cent minerals, 9.9 per cent forestry products, 2.7 per cent agricultural products, 0.1 per cent fish and 11 per cent other products. By 1990, the composition of exports had changed considerably: it was made up of 55.3 per cent minerals, 11.2 per cent agricultural products, 10 per cent forestry products, fisheries products 9.7 per cent and 14.8 per cent other products. The contribution of mining to total exports was of the order of 59.4 per cent (46.1 per cent copper) in 1980; 50 per cent (41.9 per cent copper) in 1986; 43.2 per cent (35.3 per cent copper) in 1993; 44.7 per cent (30.6 per cent copper) in 1994; and 48.6 per cent (40.4 per cent copper) in 1995 and 46.1 per cent (39.3 per cent copper) in 1996.

The increasing importance of the private sector is one of the most visible effects of the influx of foreign capital. The contribution of the private sector to total copper production was of the order of 15 per cent in 1972; increasing to 47.2 per cent in 1994 and reaching 60.7 per cent in 1996, when the three largest companies, all financed by foreign capital, accounted for 39.9 per cent of total copper production. This amount is slightly higher than production by the State. The importance of the private sector is even more striking in the case of gold, where it contributes 94 per cent of production and in non-metallic substances, where its participation is nearly 100 per cent. It is estimated that by the end of the century, private sector participation – mainly foreign – will control two thirds of total copper production. The transnational character of privatisation in the copper mining sector is also very apparent. Among the most important foreign investors are groups from Australia, Canada, Japan, South Africa and USA. Participation by Chilean private sector companies is smaller, mainly because of the limited amounts of capital they bring to operations; thus they tend to enter into partner-

ship with foreign firms which are looking for small-scale investment opportunities. There is a clear decrease in the relative participation in physical production of the large mining sector and a correspondingly higher participation of the medium sector to the detriment of the small sector.

Technology Effects

The State has played a pivotal role in the development of the physical infrastructure necessary for mining while the mining companies have been responsible for technological development in mineral processing with the aim of reducing costs and increasing competitiveness in world markets. In addition to technologies such as satellite imaging for exploration, foreign mining companies have introduced a series of innovative technologies in the processing of minerals. This has allowed not only a significant reduction in costs and consequent rise in competitiveness, but has also made possible the use of deposits hitherto considered marginal. A related benefit is the reduction of negative environmental impacts through more efficient use of resources and reduced emissions and wastes.

Product Effects

Product effects are the changes that take place, as a result of the process of liberalisation, in the degree of processing of exported goods. First, in the mining sector, there has been a tendency towards exporting a somewhat higher percentage of more highly refined copper and copper products. However, the highest growth rate is in copper concentrates, which surpasses copper cathode exports. This may have greater environmental consequences, although no corroborating data is available. Second, the government is currently promoting export of machinery and other mining inputs mainly to Latin American countries. Chile's competitive advantage in this area is significant and the products have a high added-value. As the sector develops, it could become one of the most important product-related effects of trade.

The Environmental Impacts of Mining

Environmental Regulation in Chile

Chile has over two thousand laws and regulations that refer to environmental issues. These do not provide a coherent framework for harmonisation of production and environmental protection. In addition, environmental regulatory responsibility is

dispersed among various branches of government. In 1994, in order to remedy this situation and improve this somewhat rudimentary system, a broad environmental legal framework was put in place, and is still in the process of development.

Air

A 1992 Supreme Decree regulates emissions from fixed sources of sulphur compounds (SO₂ and particulate matter (PM)). Norms for arsenic are currently under study. Standards are similar to those used by USA-EPA. Applicability of the existing norms is limited to establishments that have high levels of emissions. A two-tiered system of standards exists: basic standards regulate protection of human health and supplementary standards cover ecosystems and natural resources. The latter are applied according to the degree of vulnerability – e.g. stricter provisions apply in forested areas in the south, as a safeguard against damage from acid rain. Urban areas are exempt from supplementary standards. A zonal classification system ranks areas according to prevailing air quality; provisions for individual compliance vary in each zone. Compliance is strictly regulated with provisions for monitoring and recording of emissions and the approval of permits and plans. The overall system is managed by the Ministries of Health and Agriculture, through their regional services. A consultative system between these bodies and the Ministries of the Economy and Mines is in place, and decontamination plans must be approved by the President of the Republic.

Water

Water use and water quality standards are defined only in general terms. To date, the prevailing approach has been to treat important interventions – such as large water management schemes or mining projects – on a case-by-case basis. There is no provision – actual or planned – for integrated planning and management of water resources over a larger area than the project level. Water quality regulations do not provide adequate protection. Many of the legal provisions are not backed up by technical norms or standards. Responsibility for administration is dispersed among seven distinct bodies with overlapping functions. Norms for emissions make a distinction between pollutant discharges in sewers and in water bodies. Provisional norms will be replaced by new standards according to criteria set out by the framework law.

The 1981 Water Code (article 5) establishes that water is a national good for public use; rights to

use water are accorded to individuals in perpetuity and no payment is required. However, monetary transactions do take place when individuals transfer their water rights. Since 1992 a series of amendments have been before Congress for approval. The new dispositions call for payment for dormant water rights, the requirement to justify a petition for use of water, integrated consideration of all water endowments, including superficial and underground sources when assigning the right to use water and norms on conservation and protection. This has generated considerable controversy from those quarters wishing to see a minimum of government intervention as well as from large consumers of water, such as the hydroelectric sector.

Soils

There are no specific regulations in this area.

Flora and Fauna

A National System of Areas protected by the State was established in 1967 and covers parks, reserves and national monuments. There is a mechanism to issue exploration permits within protected areas, but this is exceptional and must be approved by the President of the Republic, after consultation with CONAF, the National Forestry Commission.

Environmental Regulations Specific to Mining Activities

A 1970 decree of the Ministry of Mines regulates construction of tailing dams. At present, most of the facilities built by the mining companies are designed to higher standards than those required by law. There are no standards for the decommissioning and/or rehabilitation of mining installations but provisions are under study. Transport of dangerous wastes is not subject to any regulation other than that stipulated by the 1992 Basel Convention.

In Chile, environmental regulatory responsibility is dispersed among various branches of government

Framework Law

The 1994 basic law on the environment is directed towards ensuring effective coordination of environmental decision-making at all levels and establishes two levels of institutional structures for this

purpose. The National Commission on the Environment (CONAMA) has as its main task the coordination and promotion of cooperation among all government bodies concerned with environmental issues. The Regional Environmental Commissions (COREMA) are the operational authority for environment; their principal function is to administer the system for environmental impact assessment.

Management Plans are an integral requirement of the framework law and are proving to be a useful mechanism for ensuring a broader system of environmental protection in that they deal with issues that are not covered by other laws, including protection of water courses, soil, landscapes and wild-life species.

The more important elements of the framework law include:

A System of Environmental Impact Assessment (SEIA)

This is similar to that applied in many countries. Projects in which application of SEIA is mandatory include mining, coal, petroleum and gas projects. Although Environmental Impact Assessments (EIAs) were established in 1994, their application became mandatory only in 1997. In general, under the SEIA, only an Environmental Impact Statement is called for. However, if the project has important environmental implications, an EIA is required. EIAs are contracted and paid for by the proponent and carried out by an accredited body, such as a University. COREMA is responsible for review and approval. In addition to description of the project and its effects, the requirement is to present plans for measures directed to the mitigation, correction, reparation and/or compensation of environmental problems. There is also a system for monitoring relevant environmental variables.

In those cases where no national guidelines or standards exist, international ones are applied. A weakness of the SEIA is the lack of explicit definition of terms of reference and scope. Furthermore, EIA is not a definitive step in implementation and other permits may be required of particular relevance for mining projects. Other problems include the fact that a system for environmental insurance is not contemplated, nor is there provision for funds for management of the actual closure of projects nor thereafter. Public participation in the SEIA is enshrined in the framework law allowing citizens to comment on projects and submit appeals to public authorities. However, the same law also stipulates that such recourse shall not affect

the decision which is being appealed. Experience shows that participation usually comes too late and there are no structures to deal with conflicts over controversial projects.

Environmental Norms

The basic law provides general guidelines for development of norms applying to water, air and soils. A 1995 provision establishes the modalities for the formulation of these norms, including technical, economic and scientific analysis, consultation with public and private sector bodies and dissemination of information to the public. Norms are to be re-examined every five years, using the same procedure.

The provisions of the basic law allow use of a variety of instruments as a means of ensuring prevention and correction, including tradable permits, taxes on emissions and user charges.

Trade liberalisation, market pressures and the need to comply with international standards have had a significant influence on the Chilean government in the development of environmental legislation. The most significant has been the example set by foreign companies operating in Chile, whose Chilean divisions have tended to apply the same high environmental performance standards, procedures and technologies as those used internationally. Repeated pressure from the external governments to introduce more appropriate environmental regulation has also had an effect. Finally, there has been the indirect pressure of public opinion, influenced in part by developments in other countries. More recent developments, such as the signing of an Agreement on Environmental Cooperation between Canada and Chile will influence development of environmental legislation and management plans.

In the early stages of development of environmental regulations, there was a tacit understanding between the government and industry, in particular the mining industry, that international norms for the protection of the environment would be voluntarily applied by industry. There is now growing evidence that the systematic application of the regulatory framework, rather than reliance on a purely voluntary approach, is beginning to have an effect. There has been an increase in the EIAs carried out. The mining industry has spearheaded this movement. Application of mitigation and corrective measures is on the increase. These plans are carefully monitored and regularly controlled for performance. Implementation of broad management plans is also on the rise, mainly in the private

sector. Finally, there is also evidence that emissions have decreased considerably, partly as a result of environmental regulation coming into force.

Environmental Impacts of Mining

Exploration and Development

In the initial exploration phase environmental impacts are unlikely to occur and are easily remedied. More in-depth exploration covers a smaller area and involves drilling, digging of trenches and building access roads. Environmental impacts may be significant, but can be mitigated later by general rehabilitation and revegetation of the area. Only 10 per cent of areas where deposits are found are eventually developed. During the development phase, installations including infrastructure and processing plants are built. Environmental impacts may be serious but less so than the risks associated with later stages.

Exploitation

This phase involves extraction of ores through superficial trenches that cause geological and visual disfigurement. Mining operations generate dust particles and most minerals occur in low concentrations. Copper is usually present in a ratio of 1 per cent weight. This gives an indication of the enormous amounts of materials that must be processed to extract the pure metal. Solid residues do not necessarily cause serious problems, except aesthetic impacts. Water interacting with residues may produce sulphuric acid that contaminates drinking water and surrounding ecosystems. How-

Although EIAs were established in 1994, their application became mandatory only in 1997

ever, the alkaline nature of Chilean soils acts, to a certain degree, as a buffer against acid emissions, both in water courses and air. Underground mines produce fewer residues than open mines.

Processing

Extraction of metals can be done in three ways, – hydrometallurgical processing, pyrometallurgy or electrometallurgical processing – or by a combination of methods, depending on the type and specific characteristics of the mineral being extracted.

The environmental impacts of this phase revolve around the generation of solid residues (various solids, acidic sludge and toxic residues); liquid residues (acidic water, tailings); emissions of gas (particulate matter, toxic and reactive gases) and noise.

Copper is usually present in a ratio of 1 per cent weight ... an indication of the enormous amounts of materials that must be processed to extract the pure metal

Closure and Rehabilitation

Underground mines are usually sealed; surface mines undergo a process of rehabilitation, regrading, stabilisation and revegetation. Environmental problems in this phase include acid leaching and subsidence, as well as aesthetic impacts. There is little experience in this area, as few mines have actually been closed.

Environmental Impacts of Copper Mining in Chile

Recent studies show a variety of serious problems. Among the most important are the following:

Exhaustion of Non-Renewable Resources

The main environmental impact of copper mining is the eventual exhaustion of the resource, although it is estimated that reserves may last for another 48 – 100 years. The inevitable effect is therefore still to come.

Contamination by copper is the most serious problem connected to soil pollution at the national level

Air Pollution

The main components of emissions from copper mining that affect the quality of air are sulphur compounds, arsenic and particulate matter, re-

leased mainly in pyrometallurgical processing in smelters. Over the last few years, emissions have decreased due to improved technology and plans to reduce emissions and pollution.

Overuse of Water Resources and Pollution

The main problem in terms of water use is the competition for scarce resources, in particular in the northern regions where most of the mines are located. At present, enough water is available, but projections indicate that in the future, demand may be greater than the available supply. Information on water pollution is scarce but studies carried out at the end of the 1980s and early 1990s suggest that water quality standards were often not met due to effluents from nearby mines, although without serious effects.

Soil Contamination

Information on soil contamination either by direct deposition or through leaching is not readily available. Because mines are located in areas of low population density, whatever pollution occurs has gone largely unnoticed. In any case, it is likely that acid pollution is largely neutralised by the alkaline soil.

Species Depletions

To date, there has been only a negligible impact on flora or fauna because most mines are located in the desert where there are few species. Recently however, exploration has been approved in the ecologically important and vulnerable Andean ecosystem. There is also a case where a protected area was de-listed to facilitate exploitation.

Abandoned Mining Sites

The main concerns are residues remaining in tailing dams and disposal sites after the closure of a mine. In the past, there have been some serious incidents. At present, there are 717 tailing dams with liquid wastes and 149 sites with solid wastes. 299 are unstable, and have a degree of leaching into water courses. It is not known how many of these installations have been abandoned. Most of the mines currently operating have an expected life of 8 – 10 years, so additional problems are not expected to arise until they are decommissioned.

On the basis of very limited information available, the most important environmental problems arising from mining activities are connected to air and water pollution. The large mining companies, which process upwards of 10,000 tonnes/day, are likely to cause more damage. However, because they employ more advanced technologies and management practices, they produce a smaller degree of impact/unit of production. Medium mining operations are somewhat different. Older installations have a significant unit/impact, due to the use of inappropriate and antiquated technology. More recent installations, pressured by market forces and regulation, are incorporating advanced technologies and management methods. The 2,000 small installations currently operating – mostly gold mines – have not yet incorporated modern technologies and environmental management practices. They also have little managerial capacity and access to credit. The environmental problems from these operations are likely to continue for some time. However, they only account for very localised impacts.

Present mitigation measures appear to be fairly limited although it would seem that environmental management by larger companies is thorough and reasonably effective.

The Mining Sector and Environmental Problems in Chile

The environmental problems caused by mining activities must be seen in the context of Chile's natural environment, as well as in relation to national and regional environmental problems. Chile is located on the southern Pacific coast of South America. It is 4,352 km long, and has an area of 756,946 km². The rainless northern desert gives way gradually to a Mediterranean type climate in the central region and then to a temperate climate with high precipitation in the south. The north is well endowed with mineral deposits, the central and southern zones provide good conditions for agriculture and forestry, and coastal fisheries are abundant. Population, is 13.8 million – 85 per cent urban. The northern areas, where most of the mines are located, are sparsely populated.

National Level Environmental Problems

Air pollution: This affects urban areas, mainly the capital Santiago. Pollutants include suspended particulate matter (from dirt roads, diesel engines), carbon monoxide and nitrous oxides (from vehicles) and sulphur oxides (from industry). Non-urban areas are affected by pollution from mining,

as well as from cellulose and fishmeal processing plants. **Water pollution:** Microbiological contamination of water is a serious problem caused by inadequate treatment of wastes from both domestic and industrial sources. This affects rivers and coastal waters adjacent to urban centres. Pollution of groundwater is an emerging issue. Industrial effluents from copper mining, cellulose and fish processing plants are also a serious problem. **Land and soil deterioration:** Desertification affects approximately 33 million ha and is estimated to be increasing by 300,000 ha/year. Erosion and loss of soil fertility occur throughout the agricultural areas and are estimated to be increasing at a rate of 40,000 ha/year. Overall estimates of the percentage of land affected vary between 50 per cent and 70 per cent of the national territory. **Endangered species and habitats:** Ecosystem diversity is relatively high. Approximately 8 – 3 per cent of the 4,758 plant species is endangered. Fauna is also threat-

The most important environmental problems arising from mining activities are connected to air and water pollution

ened – overall 50 taxa are endangered, 93 are vulnerable and 53 are rare. Freshwater fish are endangered by pollution and introduction of exotic species; marine species are threatened by over-exploitation. Ecosystem deterioration is prevalent, and although 17.5 per cent of the national territory is designated as protected, it has been suggested that protection is necessary for a further 80 sites.

Considering the evidence, it is clear that mining activities have a significant influence on environmental problems at the national level. However, in terms of population affected, the environmental impacts of mining have lesser importance than desertification, erosion, urban growth and water pollution from waste water. Mining activities accounted for 92 per cent of the sulphur emissions, 5 per cent of the water use, and for a significant amount of water pollution. Contamination by copper is the most serious problem connected to soil pollution at the national level. At the regional level, the environmental impact caused by mining activities is even more striking. It is clear that in some regions of the country, environmental problems are caused principally by copper mining. A more detailed analysis shows that specific prob-

lems are: air pollution caused by smelters, and water pollution from, and high levels of water use by, mining operations.

The Environmental Impacts of Trade Liberalisation

The economic effects of trade liberalisation in Chile have been significant. There have been changes in the scale and structure of the economy, with greater diversification of activities and a shift in the types of products exported. Transfer of technology, particularly in the mining sector, has been facilitated by trade liberalisation. At the same time, the new technologies that have entered the country

Trade has allowed the transfer of environmentally sound technologies and a related transfer of environmental management methods.

have affected the manner in which the mining sector operates. Finally, regulatory and policy factors have both fostered the process of liberalisation and been influenced by liberalisation itself. Environmental impacts occur during the various phases of mining and affect air, water, soil, biota and ecosystems, and have significant regional and national significance.

To what extent is it possible to link the economic changes that have taken place as a result of trade liberalisation with the environmental impacts that are clearly visible?

For the purpose of answering this question, trade liberalisation is understood in its broadest sense to encompass the overall process the opening of Chile's economy to world markets, the internal factors that caused and strengthened this, and indeed, the evolving ideas on the nature of the econ-

It is obvious in terms of scale effects that, as mining activities expand, environmental impacts increase

omy. While quantitative evaluation of the effects of trade on the environment is impossible here, it is certainly possible to make a qualitative assessment, based on the data presented earlier. However, it is difficult to state categorically whether the overall effect has been positive or negative in environmental terms.

What is clear is that there is a very complex interplay of economic and environmental effects. Each type of effect is linked with and conditioned by various factors. Thus, effects of scale are mitigated by technology; structural and product effects are intertwined; and regulation and policy are in turn influenced by the other effects. In the analysis below, only the environmental aspects will be examined, but it is understood that there are various economic and social elements that come into play, both in terms of present as well as future effects of trade on the environment.

Scale Effects

It is obvious in terms of scale effects that, as mining activities expand, environmental impacts increase. Even though in Chile there have been technological advances that have tended to reduce environmental impacts caused by the new production, there will still be effects from increased mining production. Growth in exports will continue to rise as trade and global economic exchanges develop further. Consideration of scale effects in isolation in the case where virtually the total stock of minerals is exported shows that the link between trade and environmental impacts is unequivocal. In purely environmental terms, trade liberalisation has led directly to two distinct types of effect. First, there is the inevitable depletion of non-renewable mineral resources. As efforts are made to offset decline in production by more intensive exploration, it is likely that environmental impacts will also increase. From a regional perspective, export-led growth in mining activities has had extensive and pervasive effects in the north of the country, where most of the mines are located. There may, in the future, be particularly serious and long-term damages to unique ecosystems in the high mountain plateau (Altiplano).

Structural Effects

Chile's comparative advantage has been, and continues to be, based on natural resources. As a result of trade liberalisation, exports have diversified considerably, moving away from non-renewable minerals towards renewable natural resources. The environmental effects of this diversification and

shift towards renewable natural resources are not well documented, but there seems to be an emerging tendency towards an unsustainable pattern of exploitation. This concerns not only the eventual collapse of some resources through exploitative pressure (e.g., fisheries) but also generalised pressure on the ecosystem, including pollution, erosion, desertification and loss of habitats and species. Thus, the shift from non-renewable mineral resources can be considered as generally positive, but the long-term environmental viability of exporting renewables will depend on various factors extraneous to trade itself.

In addition to structural changes within the larger economic arena, there have also been structural changes within the mining sector itself. There has been a shift away from state-controlled companies towards the private sector, mainly multinational companies, although smaller local companies also are playing a role. It would appear that, because of greater managerial capacity and access to international level technologies, the multinational companies are likely to manage environmental impact more effectively. This is offset however, by the scale of their operations.

Technology Effects

Trade has allowed the transfer of environmentally sound technologies. There has been a related transfer of environmental management methods as well as broader managerial skills. Both technologies and management practices are being applied on an increasingly larger scale, and are already having beneficial effects on the environment. The evidence shows that pollution originating in the mining sector is steadily decreasing in terms of loads per unit of output. Efficiency in the direct use of resources has also increased, both in terms of the ratio of minerals extracted from ores as well as in terms of resources used for processing, such as water, chemicals and energy. Recycling is also increasingly common. At present, it is mostly the large mining companies that have applied improved technologies and management methods, but there is evidence of this spreading to medium and small companies, which will eventually contribute to diminishing the overall negative effects of mining.

Product-Related Effects

As a result of changes in demand in international markets, there has been a noticeable shift in the types of products exported, both at the level of the economy as a whole, and within the mining sector

itself. In terms of copper exports, there is a greater emphasis on concentrates, rather than refined copper. The relative proportion of each product has changed dramatically, with export of concentrates increasing 375 per cent since 1990. It is difficult to judge the environmental effect of this product shift as it has been accompanied by growth in absolute terms. In addition, the degree of environmental impact of concentrates varies according to the nature of the ores and type of processing technology used. Improved pyrometallurgical and hydrometallurgical technology is contributing to reduce the environmental impact of concentrates per unit of output, thereby offsetting to some degree increases in the scale of production.

Regulatory and Policy Effects

The process of economic and trade liberalisation has had a significant influence on the development of environmental regulations, management practices and policy in Chile. There has been a move to rationalise existing environmental legislation and modernise the system by introducing new regulations and procedures. Broader environmental management procedures are being influenced to a significant degree by the practices introduced by large foreign companies operating in the mining sector and conform to international environmental standards. Chile's continued emphasis on liberalisation indicates that a market-based approach to environmental protection is emerging as the preferred management route. Environmental issues are also now becoming part of the political agenda and have even been the focus of agreements for international cooperation on environmental matters, as part of trade agreements.

Effects on Environmental Media

It would be useful to have a precise indication of the net effects of trade on the various environmental media. However, because of lack of data, the dynamic nature of both the causal factors and effects, and the presence of countervailing forces, this is not really possible.

Application of the Trade-Environment Assessment Framework to the Chilean Case

Assessing the environmental impacts of trade liberalisation is a new challenge in the context of Chile. Environmental aspects have not been dealt with before in this manner. A serious difficulty was the lack of relevant data. Economic data are comprehensive and readily available but they are not in a form amenable to interpretation in terms of

environmental issues. Data on the mining sector were accessible but not relevant to the task. The real difficulty was with environmental data, which were extremely limited. The data that are available is presented in the form of point/source pressures; but there is no information on the actual environmental impacts. In the absence of baseline data on the state of resources and ecosystems, and of adequate monitoring to record changes in these systems as the result of human induced pressures, there is no basis for understanding how the environment is affected or is changing as a result of economic activity or trade. Because these conditions, the case study analysis was very difficult. For the moment, improvisation in the way data are gathered and analysed is probably inevitable.

This study found that the most pervasive difficulty in assessing the environmental impacts of trade is the blurring between the overall effects of economic activity and the specific effects of trade.

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Thus the applicability and usefulness of the proposed Trade-Environment Assessment Framework is compromised. Establishing robust causal links was also difficult due to the lack of information rather than to methodological problems. Specific methodological difficulties concerned the analytical categories. Their discrete application, focusing on one element at a time was not wholly productive, resulting in considerable overlap between the economic, trade and environmental analysis, as well as between the categories concerning effects. This led to iteration of the findings rather than allowing new insights.

A related issue was the difficulty in distinguishing between positive and negative effects. For example, economic effects were often associated with environmental effects which balanced each other out, making it difficult to arrive at an unequivocal assessment. New technologies have, on the whole, had a beneficial environmental impact, but have allowed massive increases in production (scale effect), which in itself has negative impacts. Disen-

tangling the different causes and effects was simply not possible. Finally, the analysis did not allow the full complexity of the environmental impacts to be reflected. This was partly a function of the unavailability of data, and also because the framework itself did not seem to lend itself readily to including other elements, even though this is recognised as an important part of the approach.

The following are some suggestions to improve the Framework:

Focusing on a qualitative, selective and in-depth analysis: Given that availability of data will always be a problem, a frankly qualitative focus on selected and representative items analysed in depth, is probably the best option at present. A thorough understanding of how environmental systems work, coupled with an analysis based on deduction, inference and extrapolation, can go a long way in helping to understand what is happening.

Application of analytical categories: Difficulties encountered in applying the various categories of effects to the analysis can be overcome by being more flexible. Rather than considering them as fixed categories that occur in all cases, they should be considered as possible but not necessary effects.

Focusing on the interaction of systems: In order to overcome the tendency towards overlap and iteration, it would be useful to consider all the elements of the analysis together as an interacting system, rather than as separate (albeit linked) elements to be reviewed in a sequential manner. Thus, instead of studying each type of process separately, it would be helpful to carry out a multidimensional matrix analysis, simultaneously considering economic, social and environmental systems on one hand, and effect categories on the other. Such a complex analysis will necessarily focus on qualitative interactions.

Focusing on the dynamic nature of environmental impacts: Considering the dynamic interactions between the various types of pressure, the manner in which environmental pressures act together and result in synergistic and cumulative effects over time and space, can help to give a clearer idea of the complexity and real nature of environmental impacts. Here again, a multidimensional matrix system can be useful.

The overall focus: In order to overcome the basic difficulty of distinguishing between the effects of economic development and the effects of trade, it might be better to modify the focus of the analysis

slightly. Rather than emphasising the need to determine the links between trade and environmental impact, it might be more productive to accept the overall influence of trade on the economy as a given as both are inextricably linked. It would then be possible to focus more deliberately on the economic mechanisms mediated by trade that are causing environmental impacts.

Cooperative approaches to the assessment process and an interdisciplinary focus can help overcome skewed perspectives (as occur when the analysis is done from a preponderantly economic or environmental point of view), as well as the problems linked to lack of data. Involving the main stakeholders – local communities, research institutions, the public and private sector – brings to light their accumulated knowledge and various points of view, needs and capabilities. It also makes subsequent action possible because it engages people through participation.

Policies for Sustainable Mining

Managing the Environmental Effects of Trade

Experience in Chile shows that, to date, the most effective way of addressing the environmental impacts of mining activities has been through regulation and improved technology. It is suggested that additional measures be undertaken to improve the beneficial effects.

Environmental Policy Framework

It would be desirable to develop an explicit policy framework to deal with environmental issues and which would give focus to the various initiatives and provisions that exist. Among the main elements that should be considered is the introduction of a long-term perspective to development policy and the integration of economic, social and environmental elements within it. This framework should inform government activities, including legally binding agreements connected to trade – for example, when negotiating the proposed accession of Chile to NAFTA.

Environmental Planning and Management

Going beyond the current approach to environmental protection that focuses principally on point intervention and regulation, the introduction of a system of regional planning and management – covering entire ecosystems or river basins – would help to deal more effectively with the interactions

between different environmental pressures and the competing demands of economic sectors. This approach would also make feasible the systematic collection of data on the environment and monitoring changes over time.

Environmental Regulatory Framework

Both the regulatory system and the associated institutional structures should be rationalised. A comprehensive set of norms and standards for environmental quality should be developed, including not only the present thresholds on pollutants, but also indicators of ecosystem integrity and status of biota and habitats.

Development and Transfer of Technology

These two elements have been shown to be the most effective means of integrating environmental protection with economic activity. Explicit provisions to encourage such transfer on a larger scale, throughout the economy, would contribute to enhancing environmental protection.

Specific Action Programs

The development of a strategy to ensure the transition towards a more sustainable pattern of development in mining areas is a priority. This would entail exploring development of other forms of economic activity that do not rely solely on non-renewable resources

Financing of Environmental Protection

A Fund could be created for this specific purpose. The mechanisms for funding include reform of the tax regime and direct contributions by the mining sector.

Looking to the Future: Towards an Improved Policy Framework

Trade liberalisation has a series of effects that need to be examined. It is useful to understand what the specific effects are but these factors need also to be considered as a system. To date, the tendency has been to focus on trade principally from the economic point of view. But it is known that this economic activity has far reaching consequences that affect both social and environmental factors. The practice of giving primacy to the economic dimension of trade, and, in the best of circumstances, dealing with the other effects in side agreements, no longer seems desirable. The many cases when the economic dimension of trade has been given primacy over social considerations (the WTO ruling against the EU's ban on hormone treated beef)

or the environment (the GATT ruling on tuna import restrictions), show that this approach is ultimately self-defeating. If the economy is an instrument to promote human welfare, not an end in itself, then this imbalance between the weight accorded to the different dimensions of trade needs to be redressed.

Moving Towards Policy Integration

It is becoming increasingly recognised that it is necessary to integrate the various dimension of development – including trade. Efforts towards greater policy integration are already under way, but need to be extended and applied more vigorously. A deterrent to progress in this area is the complexity of integrating disparate elements in a world that is organised along sectoral lines. All levels of human endeavour and all stages of decision-making are sectoral. The current approach is to try and achieve integration at the level of action by trying to reach a balance among competing interests and needs, all of which are legitimate within their own bounds. Often, none is served adequately, or the strongest sector has primacy. At present, economic factors are acquiring an ever growing influence over all other aspects of society.

A way to address this dilemma may be to integrate the various interests and needs at the initial stage of policy formulation, where goals are defined. At this level, goals should refer to the overall goals of society, not to purely sectoral ones. The problem is that these very broad goals are seldom defined explicitly and are consequently often overlooked, and indeed, society inadvertently moves counter to them.

Recognising this problem, it would seem possible to state these broad goals explicitly, and from there to devise a broad strategy leading to an integrated policy framework that gives a balanced direction to sectoral policies. There is abundant advice as to how this must be done. Agenda 21, the internationally recognised strategy for sustainable development, outlines such a framework, most notably when describing the means to integrate environment and development in decision-making (Chapter 9).

This framework should also inform trade policy, and steps need to be taken to ensure that, on a global level, trade agreements are truly balanced and not favouring one need against another. The steps towards this are perhaps complex, but certainly clear. What is lacking is the collective will to

reach balance. Recognising this is the first step to achieving this balance.

Conclusions

The introduction of neo-liberal policies in Chile in the early 1970s was accompanied by deliberate moves to lessen the role of the state, create a favourable climate for private investment, open up the economy and increase trade exchanges. This process coincided with an overall expansion of the world economy and increasing globalisation. The conjunction led to a remarkable growth in the Chilean economy, fuelled to a great extent by exploitation of natural resources at an ever increasing rate. This has affected the quality of the environment and even raises questions as to the long-term sustainability of this pattern of economic development.

Following this process through the case of the Chilean mining sector, it is possible to establish a chain of causal events that have led to the current impacts on the environment:

- 1. Economic liberalisation in Chile resulted in the opening up to world markets and a freeing of trade and economic exchanges. This in turn resulted in a marked growth in exports in the mining sector.**
- 2. Increased trade resulted in structural changes in the mining sector as well as in a shift in production patterns and changes in the type of products exported.**
- 3. Scale effects resulting in great part from trade contributed to increasing environmental pressure which is a significant concern in terms of waste disposal, site abandonment, social, environmental and economic sustainability of mining communities and water scarcity;**
- 4. External factors have played a significant role in environmental management in the Chilean mining sector and have influenced the manner in which these impacts were perceived and dealt with, spurring the government to set in place a regulatory framework to address environmental impacts;**
- 5. At the same time, trade liberalisation encouraged transfer of more environmentally effective management practices and technologies to deal with the emerging environmental impacts;**
- 6. Improved environmental regulation, management and technologies are allowing, and in the future will continue to allow, reduction of**

the negative environmental effects of mining activities per unit of production, thereby offsetting at least part of the effects of growth;

7. Although the lack of information makes an overall environmental balance difficult, the increase in production and trade of mining products is responsible for the following negative impacts and concerns: waste disposal (especially solid waste), social and economic sustainability of mining communities, water scarcity and site abandonment. On the other hand, environmental progress has been achieved with respect to air and water quality.

8. Because the mining sector is based on a non-renewable resource, its activities will ultimately be reduced and then cease. Abandonment of mining sites may leave a legacy of residual environmental problems.

This step-by-step review of the findings of the study shows clearly that trade liberalisation has indeed had an important and negative environmental impact, but that countervailing forces, also directly linked to the liberalisation process, are contributing to their mitigation.



The Automotive Industry in India

*This project was implemented by the
National Council for Applied Economic Research (NCAER), Delhi,
with technical assistance from UNEP.
Project implementation was managed by Rakesh Mohan, NCAER.*

Summary of results

The automobile sector in India has a combined turnover of US\$ 10 billion. Private investment – domestic and foreign- has increased dramatically and, from 1992 to 1997, the compound annual growth rate of the sector was 18%. This case study focuses on the automobile sector in the capital, New Delhi, where, since liberalisation was introduced, the number of registered motor vehicles has increased by 136% to 3 million. The city is also a major centre of air pollution, 67% of which is caused by motor vehicles. Nevertheless, liberalisation, SAPs, FDI and increased competition have led to major improvements in the quality and to major reductions in the price of motor vehicles. A vehicle sales equation was estimated econometrically to establish incremental sales due to SAPs. Incremental vehicle emissions for Delhi were estimated with the result showing significant increases in all pollutants from 2000 to 2005. As regards the use of MBIs, it should be noted that both complementarities and conflicts occur across various policy frameworks. For example, improving fuel efficiency reduces emissions but tends to increase passenger kilometres travelled which, in turn, increases emissions. Behavioural factors and travel demand management assume crucial importance. There needs to be a comprehensive campaign of awareness and education to generate stakeholder acceptance of more efficient consumption patterns and of new policies to be introduced. Recommendations: • For new vehicles, an environmental excise duty (EED) should replace mandatory emission standards. In theory, it would be legal to sell any vehicle, however polluting, provided that EED is paid. However, the economics of production costs (including EED) would create a very strong incentive towards cleaner production. • For vehicles already in use, analysis showed that retro-fitting of high-use vehicles such as buses and trucks with CNG would be more cost effective than, for example, reducing the sulphur content in diesel fuel.

Project Objectives

The objective of this project was to examine the increases in urban air pollution in India resulting from trade liberalisation policies and their effect on the Indian transport sector.

The project sought to:

- **review the historical development of trade liberalisation in India;**
- **analyse the economic effects of globalisation and national trade liberalisation policies on the automobile manufacture and sales;**
- **estimate the environmental impacts of increased automobile use in Delhi; and**

- **set forth directions for future policy to integrate environmental concerns and trade objectives for the automotive industry.**

Focusing on a Delhi case study, research methods were based primarily on published literature reviews and policy analysis.

The National Capital Territory of Delhi

To examine the effect of trade liberalisation on vehicular emissions, the National Capital Territory (NCT) of Delhi has been chosen for examination in this study. There are several reasons for this choice, one of them being that a sizeable propor-

tion of vehicle sales take place in Delhi – it has more registered motor vehicles than the other three metropolitan cities (Calcutta, Mumbai and Chennai) put together. The other reason is that for most air pollutants the location of emissions is important since pollution is a spatial phenomenon. Therefore, the analysis of vehicular emissions must be made with reference to a specific spatial setting.

Delhi is the capital of India, situated on the bank of the river Yamuna in North India. It has an area of 1,483 square kilometres and a metropolitan area population of around 13 million. Since 1912, when it became the capital of India, Delhi has emerged as a multi-dimensional and multi-functional urban centre. Its growth has essentially been haphazard and uncontrolled, leading to serious infrastructure and environmental problems. The city's population grew by about 53 percent between 1971 and 1981, and by another 52 percent between the 1981 and 1991 census. The compound annual growth rate of population has been around 4.3 percent since 1951, which is twice the national average.

Given its vast and rapidly increasing motor vehicle population, it is not surprising that Delhi faces an acute air pollution problem

Delhi is also a relatively affluent city. Its per capita income, at about double the national average, is the highest among Indian states and union territories. This partly explains the large and rapidly growing number of motor vehicles in Delhi. The number of registered motor vehicles increased 9 times from 0.2 million in 1971 to 1.8 million in 1991 – over this same period population increased by about two times. In particular, since the partial liberalisation of the automobile sector in 1983-84, there has been tremendous growth in the demand and sales of motor vehicles in Delhi. Over the last decade the number of registered motor vehicles has soared from 1.3 million to over 3 million – an increase of 136 percent.

The growth in the number of motor vehicles in Delhi, however, has not been even across all categories – personalised modes of transport (two wheelers and cars) have dominated in this growth. This category accounts for more than 90 percent of motor vehicles in Delhi and has been increasing

throughout the 1990s. Both demand and supply factors have contributed to a shift towards personalised modes of transport which has been the dominating factor in the growth of the automobile industry.

Given its vast and rapidly increasing motor vehicle population, it is not surprising that Delhi faces an acute air pollution problem associated with the use of energy in the transport sector. It is among the 12 megacities mentioned by WHO/UNEP as having serious particulate pollution. Furthermore, it is estimated that approximately 67 percent of air pollution in Delhi is caused by motor vehicles.

Trade Liberalisation

Economic Reforms and the Environment

There is considerable debate and discussion on the environmental impacts of structural and sectoral adjustment programmes. This debate has to be viewed against the background of increasing reliance on the market and the market friendly economic reforms throughout the world. Structural adjustment programmes (SAPs), which set the course of economic events in many developing countries, emphasise the greater use of market mechanisms and enhanced outward orientation of an economy. These programmes tend to reduce government intervention in economic activity and create a more export oriented trading economy. This also translates into less reliance on command-and-control (CAC) environmental regulations.

The basic arguments for economic and trade liberalisation are that they expose domestic producers to competition (both internal and external) which in turn leads to greater capacity utilisation, a reduction in costs and overall enhancement in efficiency. They also provides an improvement in total factor productivity (TFP) and access to a larger market.

In general, environmental problems stem from policy distortions and market failure. The former are a result of government actions (e.g., subsidies, tariffs, quantitative restrictions, etc.) that distort the functioning of markets by creating disparities between optimal levels of resource use by producers and consumers. Market failure on the other hand, can occur even in the absence of these distortions due to: (i) the presence of negative environmental externalities, (ii) inadequate valuation of ecosystems, and the absence of well defined property rights.

Since the costs of environmental degradation (or conversely the benefits of environmental protection) are not reflected in the price of the goods and services, intervention is necessary to reduce output of the negative externality generating activities to socially optimal levels. This can be achieved either directly by government intervention (CAC) or through market-based instruments (MBIs).

Policy distortions and market failures may reinforce each other to degrade the environment. For example, air pollution (an environmental externality) is worsened by energy subsidies that encourage wasteful use of fossil fuels. Similarly, the failure to account for the value of biodiversity in forests (improper economic valuation) is compounded by policies such as low timber harvest fees.

The link between economic reforms and the environment can be complex and is usually country specific. Shifts in relative prices due to changes in the pattern of taxes, trade duties, real wages, exchange rates, etc., have impacts, both positive and negative, on the environment. SAPs in particular can have wide ranging implications for resource use and the environment. For example, there are usually strong positive linkages between energy conservation and reforms in energy pricing.

In India, SAPs are not even a decade old and the impact of these programmes on the environment has not been studied. Since the late 1970s, however, stabilisation and structural adjustment programmes have been adopted by several developing countries to maintain a viable balance of payments to expedite economic growth.

India embarked on a policy of liberalisation and structural adjustment in July 1991. The common objective of all the measures undertaken is to improve economic efficiency. The regulatory mechanism hitherto in place involved a multitude of controls, which in effect fragmented capacity and reduced competition across sectors. The new economic policy aimed at creating a more competitive environment, thereby improving productivity and efficiency in the economy.

The stabilisation policies of the Indian government during the early 1990s included policies for demand management such as fiscal measures to control the budget deficit, improve the balance of payments and reduce inflation; industrial policy and factor market reforms; financial sector reforms and liberalisation of capital flows. The thrust was towards export-led growth.

Partly as a result of these policies, the automobile sector in India has grown tremendously over the last fifteen years. The Indian automobile industry has a combined turnover of about \$10 billion with annual sales of around 400,000 passenger cars, 3 million two wheelers and 200,000 commercial vehicles, making it the twelfth largest industry in the country. Further decontrol and opening in recent years has led to an even more significant increase in domestic and foreign investment in the automotive sector. The compound annual rate of growth for this sector during 1992-97 was about 18 percent, compared to about 10 percent during 1972-83.

There has been a substantial increase in exports as well as imports of automotive vehicles and components during the post liberalisation phase. In the passenger car segment, almost all new vehicles manufacturers initially import cars in knocked down kits (KDKs) but increase the indigenous component quite rapidly. Exports as a percentage of vehicle sales have increased for almost every segment (except medium and heavy commercial vehicles) over the last few years.

Trade leads to an expansion in the scale of economic activity as efficiency gains are realised

The Environmental Impacts of Trade Liberalisation

With respect to policies for trade liberalisation, *per se*, the key questions are whether these policies reduce or increase economic distortions and whether they in some way mitigate the problem of market failure mentioned above. In general, trade is not the main cause of environmental problems. To the extent that trade liberalisation leads to policies that reduce economic distortions and promote economic efficiency, such reforms are generally good for the environment.

Trade leads to an expansion in the scale of economic activity as efficiency gains are realised. In addition to this scale effect, changes may also occur in the composition of output, the production

techniques used, and in the location of economic activity. To trace the effect of trade-induced economic expansion on the environment, it is necessary to analyse the structure of this growth in terms of these four components.

In the presence of un-addressed market failures and policy distortions, increased trade may aggravate environmental problems

In the presence of un-addressed market failures and policy distortions, increased trade may aggravate environmental problems. For example, trade liberalisation may encourage deforestation or over-fishing. When negative impacts exist, the solution is not in delaying or slowing stabilisation programmes, but rather in devising specific measures, such as sensible forestry and fishing laws, to counteract the negative effects. In other words, there is a need to introduce complementary measures to address the market failure or policy distortion that causes environmental damage.

In general, trade policy is not able to directly address specific environmental problems. This calls for a joint policy programme of trade liberalisation and specific environmental policies. The use of trade policy *in lieu* of more efficient instruments reduces the level and growth of global economic welfare, and may even add to, rather than reduce, global environmental degradation.

Another reason for not using trade policy to attain environmental goals is that it may be used to erect trade barriers. Widely used in this way, it may trigger escalating trade wars which could potentially unravel the multilateral trading systems. An important corollary to this discussion is that rigid standardisation of environmental regulations across countries could be counterproductive.

Since the costs of pollution control are usually a small fraction of total production costs, more stringent environmental regulations do not necessarily lead to reduced trade competitiveness. Similarly, the empirical evidence so far, does not support the pollution haven hypothesis (i.e., firms relocating in countries with lax environmental regulations). On the contrary, there is some indication that open economies, by attracting foreign investment, lead

to the adoption of cleaner technologies and better pollution standards.

This study focuses on the environmental impacts of the SAP introduced in India in 1991 with reference to the automobile sector. The SAP contributed to the rapid growth of the automobile sector by bringing about irrevocable changes which have opposing effects on vehicular emissions. On one hand, an increase in vehicle population increases emissions (scale effect) but on the other hand new technologies and replacement of old vehicles drastically reduces emissions per vehicle for all categories (technology effect).

Motor Vehicles and Air Quality in Delhi

Consumers throughout India, including Delhi, have been primary beneficiaries of liberalisation and globalisation as the competitiveness of Indian industry has improved, particularly in the automobile sector. With increased foreign direct investment (FDI) and competition, there has been tremendous improvement in the quality of motor vehicles. Their prices in real terms have also fallen. In effect, the automobile industry has become a buyers' market with greater consumer choice in terms of different models and superior technology. These changes are a direct result of the SAP.

In analysing automotive pollution in Delhi, this study mainly uses sales data instead of registered motor vehicles. The primary reason for this is that sales can also be viewed as derived demand. To estimate incremental sales for different types of motor vehicles as a result of SAP, this study used vehicle sales for two periods – post-SAP (1992-97) and pre-SAP (1977-91) – and applied a linear time trend to project vehicle sales from 1998-2005. The difference between the two projections provides an approximate estimate of incremental sales due to the SAP.

As an alternative to this approach, the study also econometrically derived a vehicle sales equation for each vehicle type. The reason is that a linear time trend ignores the impact of other variables on future vehicle sales such as population, population density, per capita income and state domestic product. Thus, despite a rather simple specification of the sales equation, it may be more appropriate to use this as a basis for projecting sales than the time trend method. Projections based on the vehicle sales equations are much lower than those based on the linear time trend (except for 3 wheelers).

In order to examine the environmental effects of the SAP in the context of the automobile sector, incremental vehicle emissions in Delhi due to the SAP were computed by multiplying future vehicle populations by an average vehicle emission factor. It indicates an increasing trend for all pollutants from 2000 to 2005. A crucial element in these calculations is the vehicle emission factor, calculation of which require extensive data on a multitude of determinants the type of fuel, engine design, vehicle speed, age and maintenance. India has not been able to develop reliable emission factors so far. Therefore, this study's estimates should only be viewed as indicative.

Market-based Instruments for Vehicular Pollution Abatement

The Role of MBIs In Pollution Abatement

MBIs are schemes that make use of the market and price mechanism to encourage firms/individuals to adopt environmentally-friendly practices. The common element among all MBIs is that they work through the market and alter the behaviour of economic agents, such as firms and households, by changing the nature of incentives/disincentives that these agents face.

Economists have advocated the use of MBIs to address environmental problems for over three decades. This advocacy is primarily on grounds of efficiency. In other words, MBIs are a more cost-effective means of achieving a given environmental objective than alternative approaches such as the direct regulation of polluters. It is only recently, however, that MBIs have been endorsed both by the international community and by the Indian government.

Two broad categories of MBIs that have received the most attention are pollution taxes and tradable permits. Taxes are levied on polluters based on the quantity of pollutants discharged into the environment. Permits are rights to discharge pollutants which are allocated to firms. These rights can be subsequently bought and sold, subject to an overall ceiling on discharges which is fixed *a priori*. Both taxes and permits have advantages and disadvantages. One of the most important reasons advanced in favour of permits is that they allow the regulatory authority to control the quantity of emissions, whereas under a tax system the level of emissions is determined by the polluters. The advantages of

permits, however, will not be realised if market imperfections prevent the permit market from functioning smoothly.

MBIs are schemes that make use of the market and price mechanism to encourage firms/individuals to adopt environmentally-friendly practices

In general, permits work better when there are a few, large polluters, whereas taxes are more suited for a situation where there are a large number of relatively small polluters. In the latter case, monitoring of permit trades would be extremely difficult.

Vehicular Emissions: An Analytical Framework

Emissions from motor vehicles can be decomposed in a number of ways. For instance, vehicular emissions may be viewed as the product of: (i) emissions per unit of fuel; (ii) fuel consumed per kilometre, and (iii) total vehicle kilometres travelled (VKT). The main reason for disaggregating vehicular emissions is that it facilitates analysis by identifying the underlying components and the actual point of impact of different measures for emission abatement. It also makes transparent the interlinkages and feedback mechanisms among these measures. For example, in the United States fuel consumed per kilometre (due to bigger cars) and VKT are high by world standards, but emissions per unit of fuel are quite low. The reverse is true in developing country cities such as Delhi.

The analytical framework indicates that complementarities exist across policies – policies to reduce traffic congestion, for instance, increase average speed and thus reduce emissions. These complementarities, however, may at times work in opposite directions. For instance, improving fuel efficiency may lower emissions but also increases passenger kilometres travelled (PKT) due to reduced cost of travel. This in turn increases emissions and the two effects may balance out on the whole.

Similarly, fuel taxes may not lower emissions for two reasons. First, fuel taxes may encourage the purchase of fuel efficient cars and the lower oper-

ating costs of the new vehicles may increase PKT/VKT. Second, while a fuel tax encourages the purchase of fuel efficient cars, researchers find that the correlation between emissions per kilometre and fuel efficiency (kilometres per litre of fuel) is weak. The reason is that fuel efficiency depends in part on vehicle weight, engine size and performance, and vehicle aerodynamics and gearing. These features generally do not affect emissions, which depend on the completeness of the fuel burning and the presence or absence of emissions control systems such as catalytic converters.

The high dependence of motor vehicle emissions on behavioural factors implies that it is difficult to predict the magnitude of abatement induced by different policies. Policy combinations and complementarities complicate matters further. However, behavioural modifications are crucial for reductions in automobile emissions. For example, while stringent emission standards can significantly reduce emissions per unit of fuel, aggregate emissions can still increase. This is because of the unregulated component, namely, PKT. In fact, new cars may emit 95 percent less CO, HC, and NO_x than did uncontrolled cars in the 1960s. Thus, abatement opportunities through technological improvement have been extensive. At the same time, however, travel demand management has received little attention. Emission abatement through reducing PKT could be more actively pursued.

The critical state of air pollution in Delhi indicates that policies currently in use have failed to have an impact

International Experience in Controlling Vehicular Emissions

Many countries use MBIs to control vehicular emissions. Very few of these instruments, however, are of the classic Pigouvian tax or tradable permit variety. Most of them would be classified as indirect price-based instruments, that is, those that alter prices of outputs or inputs which are complementary or substitutes to the polluting activity. In particular, the use of differential tax rates to encourage use of unleaded petrol or cleaner fuel in general, is widespread. A good example of a direct

price-based instrument would be the deposit refund system for old cars in Greece and Norway and for automobile batteries in the US. The toll system in Bergen, Norway and the Area Licensing Scheme (ALS) of Singapore are particularly good examples of user charges. In general, there are important lessons here for the case study on Delhi.

A review of urban transport projects for several cities reveals an emphasis on reducing emissions per vehicle through technical fixes such as cleaner fuel, emission standards and technology, and inspection and maintenance (I&M) programmes. It is noted that unrelated government policies (such as incentives for private car ownership in use in Mexico City and Seoul) often undermine air pollution and transport efficiency goals.

Current Policies for Reducing Vehicular Emissions in Delhi

Vehicular pollution in Delhi is addressed mainly through command-and-control (CAC) strategies. The Supreme Court of India, in particular has been very active and has passed several orders for controlling vehicular pollution that are to be implemented by the Government within a specified period. Slow progress in converting buses to compressed natural gas (CNG) indicates, however, that it is unlikely these orders will be efficiently implemented.

Motor vehicle emissions norms are promulgated under the Environment Protection Act (EPA) and apply to the entire country. Mass emission standards (gm/km of pollutants emitted) for new vehicles were first promulgated in 1990 and have been progressively tightened since then. With respect to in-use vehicles the rules stipulate maximum volumetric concentration of exhaust gases. In addition, stringent Euro I and II mass emission standards for Delhi were promulgated by the Supreme Court in April this year.

Other policies to control vehicular emissions in Delhi include the phaseout of leaded petrol and introduction of low sulphur diesel (0.05 percent sulphur content); mandatory conversion of all buses to CNG within a specified time period; use of premixed fuel (oil and petrol) for 2-stroke engines in two- and three-wheelers; and a ban on old commercial vehicles (including taxis and autorickshaws) from operating in the city.

Except for non-compliance fines of emission standards, economic instruments to control vehicular emissions are absent in Delhi. At the same time the

critical state of air pollution in Delhi indicates that policies currently in use have failed to have an impact. The major thrust of regulatory (and more recently judicial) efforts is towards enforcing mass emission standards for new vehicle and volumetric emission limits for in-use vehicles. With reference to the analytical framework mentioned above, there is no attempt at demand management to reduce vehicle kilometres travelled (VKT) or to create disincentives for the use and ownership of private motor vehicles.

Even with respect to end-of-pipe emissions, most of the emphasis is on new vehicles. In-use vehicles have not been given much attention except for volumetric emission limits. A vehicle's emissions, however, are directly proportional to its vintage. In other words, old vehicles pollute more and incentives for scrapping old vehicles are required. New vehicles (up to 5 years old) constitute only about 37 percent of all registered vehicles and more than one-third of all vehicles are over ten years old (a period when there were no emission norms). It is obvious that a more focused approach towards controlling emissions from older in-use vehicles is needed.

Problems and Prospects for Using MBIs in India

In order to move from the theory of MBIs to practice, it is necessary to examine potential problems and identify solutions in using market-based approaches for environmental protection in the Indian context. This is because MBIs for vehicular pollution abatement cannot be viewed in isolation from the overall context in which they are implemented. For instance, the manner in which unleaded petrol was introduced in Delhi – without resorting to any economic incentives or CAC policies for vehicular pollution abatement – reveals something about perceptions of governance in India.

There are a number of barriers to implementing MBIs in India:

- The biggest barrier is an inadequate understanding of MBIs among stakeholders that results in a number of misperceptions. More generally, the use of economic approaches to address environmental problems is not commonly appreciated.
- There is a vested interest among stakeholders in favour of the status quo – they are more comfortable with a CAC regime where they

can lobby and manipulate regulators. Similarly, the bureaucrat-dominated regulatory agencies are more comfortable with CAC measures and remain suspicious of market mechanisms.

- There is lack of good governance – the institutional/organisational framework for pollution abatement is not very effective and needs to be strengthened. Moreover, there is limited capability at the local/municipal level to address environmental problems. Moreover, state boards are often managed by non-bureaucrats who do not understand the complexities of pollution abatement.
- A major legal barrier is that since the CAC regime is enshrined in the current legislation, new legislation to supersede/modify existing laws will be required, which may be difficult to initiate.
- State-owned enterprises (SOEs) such as road transport corporations, are less responsive to market forces (including MBIs) than private firms since they face 'soft' budgets.

General recommendations on implementing MBIs in India:

- While there are several specific recommendations that can be made for the implementation of MBIs in India, by far the most important requirement is that there should be a desire and commitment to implement them on part of all stakeholders.
- In order to create a better understanding of MBIs among stakeholders, it is important to initiate discussion and debate. Furthermore, the knowledge base for MBIs should be strengthened. To this end, information on best practices around the world should be compiled, regularly updated, and analysed for possible application in India.
- Existing environmental laws should be amended and/or new ones enacted to empower central/state governments to prescribe MBIs. Some degree of CAC measures, however, may be unavoidable at least in the short- to medium-term, as MBIs are gradually phased in. In other words, a hybrid MBI-CAC regime may be required at initial stages.

Policy Options for Abating Emissions from New Vehicles

The main policy recommended for reducing new vehicles emissions, the environmental excise duty (EED), is *in lieu* of the current emphasis on mandatory emission standards such as the Euro norms. Thus, the government could levy EED on manufacturers of motor vehicles in proportion to their level of tailpipe emissions. Manufacturers would be charged a duty on each vehicle that would be proportional to its emissions of specific pollutants. Taxes based on this principle already exist in Germany, Japan, the Netherlands, and several other countries. In Germany, for example, the annual motor vehicle tax is structured so as to provide tax incentives for cars meeting EU emissions standards.

EED has two objectives: (i) it attempts to recover from vehicle manufacturers the cost imposed by their product on the environment, and (ii) it encourages them to produce cleaner products by

With environmental excise taxes, manufacturers would be charged a duty on each vehicle that would be proportional to its emissions of specific pollutants

giving them an economic incentive to do so – the lower the level of emissions the less is the amount of duty paid. In addition, rather than the all-or-nothing nature of emission standards at present, EED allows vehicle manufacturers to reduce emissions incrementally. Thus, they can reduce their tax bill for each gram/kilometre (or fraction thereof) of emissions reduced. EED does not mandate technologies for emission abatement (such as CNG). Manufacturers are free to choose whether and how they reduce emissions: it would be legal to sell any vehicle, regardless of how polluting it is, provided EED is paid.

The EED, however, is not a ‘license to pollute’ – it does not simply allow a manufacturer to pay and pollute. If the rate of EED were high enough it would not make good business sense for a manufacturer to do so. This makes it all the more imperative that despite starting from a relatively low rate, EED should be increased continuously until it

starts having its desired effect in terms of cleaner vehicles.

Policy Options for Abating Emissions from In-Use Vehicles

In-use vehicles given their age profile, are a significant source of emissions. Current approaches for curbing in-use vehicle emissions are inadequate. Policy options for in-use vehicles can be classified as direct and indirect. The former target vehicle emissions directly as in the case of emission taxes/standards, whereas the latter (e.g., vehicles taxes or I&M), affect complements and substitutes to vehicular emissions. Within each category one can further distinguish between market-based and CAC policies. Often the same goal, e.g., clean fuel can be attained either through MBIs (differential fuel taxation) or through CAC measures (mandatory fuel quality standards).

In the case of Delhi five control measures for vehicular emissions are considered:

- I&M for in-use vehicles;
- random checks of on-road vehicles;
- use of CNG as an alternate fuel;
- reducing sulphur content in diesel; and
- use of low smoke lubricating oil for two-stroke engines.

The reason for focusing on these actions is that they are all currently being implemented or are under active consideration in Delhi. Thus, it is possible to quantify the potential reduction in emissions they can achieve. The first two actions are explicitly CAC in nature, whereas the last three can be implemented either through CAC policies or through MBIs. For instance, low sulphur diesel could be phased in through administrative fiat and/or enhanced supply (as has already been done in Delhi) or through differential taxation.

To quantify the reduction in vehicular emissions through these five actions, daily vehicular pollution load for the year 2001 is estimated using projected vehicle sales. Emissions in 2001 of each pollutant for each vehicle type are a weighted total of sales in each year until 2001 multiplied by the emission factor for that year and by the vehicle utilisation factor. Applied to these figures is a percentage reduction in emissions due to each of the five measures above to arrive at the total reductions in emissions.

Given the variety of potential policy measures for addressing vehicular emissions, some ranking and

prioritisation among them is required. Since a cost benefit assessment is not feasible given an absence data on environmental benefits of abating vehicular emissions, the control measures proposed above are analysed instead in terms of cost effectiveness, that is, in terms of cost per ton of pollutant reduced. Given the paucity of information and the limited scope of this study, estimates from other developing country cities where similar options have been implemented were used. Thus, retrofitting of high-use vehicles such as buses and trucks with CNG and centralised I&M facilities are found to be more cost effective than other measures such as reducing sulphur content in diesel.

Health Benefits

With respect to the health benefits of improving air quality in Delhi by curbing vehicular emissions, the main pollutant of concern is particulate matter (PM), especially fine particles (PM10). There is a scarcity of dose response studies for Delhi. However, a recent study using daily mortality and air quality data for Delhi (Cropper et al. 1998) suggests that extrapolations based on dose response functions from the US generally overstate premature deaths due to elevated PM10 concentrations in Delhi. This study suggests that a reduction in PM10 concentration to WHO levels in Delhi would result in only 3,430 avoided deaths as compared to 7,490 deaths estimated through extrapolated data. If roughly two-thirds of the pollution load in Delhi is due to vehicular emissions about 2,300 premature deaths (two-thirds of 3,430) annually in Delhi could be due to excessive vehicular emissions. This rough estimate could serve as an approximate measure of the health benefits of vehicular pollution abatement in Delhi until further research makes better estimates available.

Conclusions

This study developed an analytical framework for projecting motor vehicles emissions and examining policies for reducing vehicular emissions with particular emphasis on MBIs. It also examined issues of implementation as well as international experience in controlling vehicular emissions. Various policy options, including MBIs, for reducing vehicular emissions in Delhi were explored.

The report proposes two broad sets of policies – for new vehicles and for in-use vehicles. The main policy recommended for reducing new vehicles emissions, the environmental excise duty (EED), is *in lieu* of the current emphasis on mandatory emission standards. For in-use vehicles, the study recommends the use of inspection and maintenance programs to cost-effectively reduce emissions.



The Philippines' Forestry Sector

This project was implemented by the University of the Philippines, Los Baños (UPLB), and the Resources, Environment and Economics Center for Studies, Inc, Los Baños, with technical assistance from UNEP.

Project implementation was managed by Herminia Francisco, College of Economics and Management, UPLB.

Summary of results

The important role that market-based instruments can play in the management of the Makiling Forest Reserve is recognised by key stakeholders. Consultation meetings attested to the positive attitude and wide acceptance of the rationale of using of MBIs in resource management. Essentially, MBIs would keep the use of resources at sustainable levels, while at the same time generating revenue from resource use that could be used to finance reserve maintenance and conservation activities. Considered in this study are water, forest, land and recreational resources. Investigative surveys of stakeholders in the Makiling Forest Reserve yielded the following results: • Willingness to Pay (WTP) analysis showed that the cost of watershed conservation was negligible when applied to a cost per cubic meter of water consumed. • In Tourism, WTP showed that current entry and user fees were severely un-economic and should – and could – be increased considerably, by as much as 100%. • WTP showed that farmers were ready to contribute through rent payments to conservation. • Surveys of Net Annual Value of non-timber forest products showed that there was significant annual loss due to the absence of a true market in such products at their point of source. The basic solution was to apply cost recovery pricing principles.

Project Objectives

Full valuation and the proper pricing of natural resources have been an important component of policy in the Philippines since the formulation of the national Strategy for Sustainable Development in the late 1980s. Additionally, the Department of Environment and Natural Resources (DENR) has instructed its agencies to explore the use of market-based instruments in the management of natural resources such as forests, grasslands, shorelines, river systems and recreational sites within Protected Areas.

In this context, the Makiling Forest Reserve (MFR) was chosen as a site in which to implement a national feasibility project on the development of economic instruments for natural resource management. This project evaluated the feasibility of subjecting the various resources of the MFR to the use of MBI. The resources considered are: water resource, recreation and eco-tourism, farm/land resource, and non-timber forest products.

With application limited to the MFR, the project thus:

- **analysed the costs and benefits of resource management and protection of national parks, watershed, lands, and biodiversity resources;**
- **assessed the economic value of resources and users' willingness to pay for integrated resource management and protection services;**
- **set forth a policy package for sustainable resource management and protection of the MFR.**

The Makiling Forest Reserve: A Need for Resource Management

Makiling Forest Reserve (MFR) is located in Laguna, some 100 kilometres south of Manila. Half of its total area of 4,244 hectares is under forest, its soils are very fertile and it serves a major watershed function for a large part of the sur-

rounding area. Some 245 households are settled in the MFR.

The administration of the MFR is vested in UPLB in view of the MFR role as a laboratory and research site for the UPLB College of Forestry and Natural Resources.

The major natural resource function of the MFR is that of a watershed. The MFR is a catchment area for Laguna del Bay, the largest freshwater lake in the Philippines and one of the largest such lakes in Southeast Asia. The MFR water function is also of importance to the regulation and functioning of the nearby geo-thermal power facility. The MFR supplies water to five water districts and several coop-

***Environmental Problems
Addressed in this Study:***

- ***soil erosion***
 - ***biodiversity loss***
 - ***watershed depletion***
 - ***deforestation***
 - ***land-use conflicts***
-

eratives for domestic, institutional and commercial use. Activities in favour of watershed protection are practised but only to a very limited extent.

There are several important recreational sites within the MFR. The Pook ni Maria Makiling Park was gazetted in 1976 and contains facilities such as cottages, executive homes, pelota, squash and tennis courts, picnic grounds, tree houses and huts plus an Olympic sized swimming pool. The natural environment of the park has suffered little damage but the built facilities have deteriorated badly. Revenues from entrance fees and various user charges are by no means sufficient to cover the related costs of repair and maintenance.

The Makiling Botanical Garden (MBG), created in 1963, is a unit of the College of Forestry in the University of the Philippines at Los Banos (UPLB). The garden comprises 300 hectares of forestland divided between arboretum, nursery and recreational area. Its main purposes are as a research centre and a public recreation area. Due to financial constraints and to low levels of entrance and user fees, repair and maintenance cannot be carried out.

Makiling Mud springs, another recreational site, is located at the foot of Mt. Makiling and is accessi-

ble from the MBG by road and nature trails. The springs constantly emit sulphuric gas. Waste disposal facilities are very inadequate and, due to crowding by sightseers, erosion around the volcanic mouth of the springs has been considerable. Peak 2 is a high mountain with a panoramic view of Laguna. Nature trails lead to the peak from the mud springs. Trekking is free of charge and the condition of the nature trails and of the forest bordering the trails has deteriorated.

Land use for agriculture is practised in the MFR by some 1,000 small farmers. They pay no rent and there is a long-standing dispute about their rights to access and use the land for agricultural purposes. A plan, currently under discussion, would encourage the farmers to undertake conservation and management activities themselves instead of paying rent.

The MFR is home to many valuable species of fauna and flora, and as such it has an abundant and valuable supply of forest tree species. The trees are a major source of food, wood, energy, medicine, recreation and other raw materials. Furthermore, they assist in the global recycling of gases, reduce flood potential and recharge springs. A conflict often arises between the utilisation of a tree for its timber value and its non-timber values. To harvest the trees for their timber means forfeiting the supply of non-timber products and vice versa.

Economic Valuation of MFR Resources

The total project group (24 persons) was divided into five teams. Four teams dealt with the issue of market-based instruments in one of the areas of water, land, recreation and eco-tourism and non-timber resources. The fifth team dealt with institutional issues.

The first four teams formulated a price for their assigned resource or commodity or, if available data were insufficient to do this, proposed a set of activities so as to set such a price. Previous resource pricing studies were analysed. A data set from a previous study of the profitability of farming systems in the MFR was used to estimate economic rents for MFR land resources. Results of a research recently concluded on Willingness To Pay (WTP) for watershed protection were used to establish a price range for a watershed protection fee. A survey of current water consumption was conducted and the results incorporated into the calculation of

a fee and into the assessment of the distribution among the different user groups of costs for watershed conservation.

To assign values to the MFR as a recreational and eco-tourism resource, contingent valuation methods were employed through several user surveys.

The increasing rate of deforestation for timber extraction points to an assumed higher value attached for timber resources as compared to non-timber resources, that is non-timber forest products (NTFPs) such as fruit and nuts. To test this hypothesis, estimates of the net present value (NPV) per tree of timber resources vis-à-vis the non-timber products for dominant tree species in the MFR were made. Benefits reflected the monetary value of the product in the market. Costs included establishment cost, maintenance cost and extraction cost for timber and non-timber products. Five dominant tree species found in the MFR were considered in the analysis: coconut, coffee, mahogany, jackfruit and mango.

Forty households living within the MFR area were interviewed. The information gathered focused on the extent and nature of utilisation of timber and non-timber products of the dominant trees in the area. Technical information on the harvest values for different products of the trees was obtained from UPLB experts. Separate NPVs of timber and non-timber resources were computed as well as NPV for joint use of the resources. Costs included not only maintenance, establishment and extraction cost, but also foregone benefits from the non-use of timber or non-timber resources. 12 and 15 per cent discount rates were used over the rotation cycle of the various tree species.

The NPVs for coffee, coconut, and mango timber were lower than their respective NPVs for joint timber and non-timber use, indicating a loss from their use as timber only. On the contrary, the corresponding figures for jackfruit and mahogany showed joint-use NPVs were lower than their non-timber NPVs alone.

The non-timber forest products of the MFR are certainly of high value, non-tree derived products included. The latter take the form of rare orchids, flowers and seeds. At present, UPLB only charges, at a minimal level, for permits to collect and to transport. No fee per item collected is charged. Before sound proposals for changing this situation can be formulated, it is necessary to carry out an inventory of such non-timber resources.

Lastly, valuation of biodiversity was not possible in this study due to an absence of an up-to-date in-

ventory. Also, due to uncertainties in world prices for carbon offsets, carbon sequestration value was not covered by the study.

Market-based Instruments for MFR Management

The Process Used in the Study

A very widespread participation was employed in order to emphasize the issues of participation. This included the seeking and sharing of as much relevant knowledge as was available by all stakeholders involved so as to promote the building of local capacity to address similar issues in an effective manner. It involved the local resident communities (farmers and the UPLB community), local government, commercial water users, water district agencies, UPLB, the International Rice Research Institute (IRRI) – both major institutional players locally – the local development authorities, the National Water Resources Board, tourism associations, the local and regional Chambers of Commerce and the national DENR.

So that decisions would be supported by all stakeholders, a very widespread process of consultation was employed by the project

Two extensive consultation meetings were held. The first concerned water use and the second concerned issues such as recreation, agriculture and non-timber products. Basic thematic presentations were made and followed by parallel workshops

Farmers pay no rent for their land use and there is a long-standing dispute about their rights to access and use the land for agricultural purposes

and final plenary sessions. A Forum on water use policies was held subsequently to elaborate mechanisms for management of water use. Sixty

organisations – from the local to the national level – took part.

A final meeting, a National Consultation on Resource Pricing in the Philippines, was held in June 1999. The research teams presented specific recommendations emanating from the process described above. Institutional arrangements and structures to deal with the collection of fees were

There are two main issues to be addressed: by how much should existing fees be increased and by which mechanisms should they be managed?

discussed. The teams presented the results of the WTP user surveys which had been carried out. The final decision was that UPLB should move forward on finalising the proposed fee collection schemes and schedules in conjunction with the other stakeholders.

A Market-based Instrument for Water

The MFR supplies the needs of two provinces and at least four municipalities. Water use ranges from domestic through irrigation to commercial and institutional. While most conversion of MFR land

Market-based Instruments Recommended in this Study:

- *national park user fees*
 - *watershed protection fees*
 - *transferable water use rights*
 - *transferable forest harvest quotas*
 - *land taxes*
-

has been in the creation of upland agroforestry, there is still concern about its impact on the MFR's watershed function.

In addressing the question of an instrument for water based on WTP, the analysis took into account a WTP survey done in 1996, but relied heavily on the data generated in a further survey done in 1998. The 1998 survey was conducted in five municipalities, three water districts, four

community waterworks, 149 residences, nine government/religious institutions, eighteen resort owners and 77 commercial/industrial users. The watershed protection fee would be additional to fees and charges which users are currently paying.

The 1998 survey showed that 67 per cent of domestic users were prepared to pay an extra monthly fee of between US\$ 0.03² and US\$ 0.04 per cubic metre of water. Commercial users were much less willing to pay extra. Monthly charges would produce a total of US\$ 37,840, annual charges would produce US\$ 101,62 and a 'one-time' contribution approach would produce US\$ 82,703. Such levels of funding would meet a considerable proportion of the costs of watershed protection.

Follow-up action is needed in identifying and monitoring the quantity and quality of major streamflows from the MFR, establishing a complete database of MFR water users and consumption patterns and in consultations to refine the specific details of the proposed instrument.

Based on the identification of major users, the annual consumption of MFR water was estimated at 48.6 million cubic metres, of which 18.6 million was consumed by the water districts, 0.72 million by resorts and private pools, 110.6 million by institutional users and 18.7 million by household users without regular connections to the official system. It must be acknowledged that even this survey did not include all major water users since certain industrial installations in the area and agricultural users were not included.

A five-year investment plan for conservation and development in the MFR indicates a total requirement of US\$ 2.6 million. If the total investment cost is to be borne by water users, the fee based on cost recovery would be US\$ 0.014 per cubic metre. If the investment cost is shared between water users and users of other MFR resources or services, the cost recovery fee to water users would decrease by US\$ 0.001 per cubic metre. In essence, the overall cost of watershed protection and conservation is negligible when applied to a cost per cubic metre of water consumed.

Studies have shown that the Southern Tagalog region, in which the MFR is located, is already a water-scarce region, i.e., with annual renewable reserves of less than 1,000 cubic metres per capita.

² Rate of exchange used throughout is US\$ 1.00 equals Philippine pesos 37.00

The fee based on cost recovery as calculated above is negligible, well within the parameters of the WTP identified by the survey and, therefore, while covering the total costs of conservation, maintenance and development of the MFR, such a fee would even generate a certain net benefit surplus.

A Market-based Instrument for Recreation and Eco-tourism

There are two main issues to be addressed: by how much should existing fees be increased and by which mechanisms should they be managed? The analysis focused on the Makiling Botanical Garden (MBG). A comparison was made with a privately owned resort nearby. Facilities in both sites are comparable. The natural setting is comparable although MBG offers a greater variety of natural resources. The private resort is open 24 hours a day while MBG is open only between 08:00 and 16:00 each day. The private resort charges an 'all-inclusive' entrance fee of US\$ 1.35 during daytime and US\$ 2.16 at night. MBG charges US\$ 0.08 entrance and US\$ 0.40 swimming fees for UPLB personnel. For non-UPLB users, entrance costs US\$ 0.14 and swimming US\$ 0.68.

The survey of 80 visitors showed a WTP level of US\$ 0.50 as an increase on existing entrance fees to the MBG. The sample of visitors surveyed can not be considered as either truly random not comprehensively targeted since most of the respondents were UPLB students.

The financial feasibility of improving MBG as outlined in the Master Plan for Conservation and Development of Mt. Makiling was assessed. The conclusion reached was that, given the projected number of visitors, the total revenue would not cover the costs involved. The problem is not so much the total number of visitors as the number of visitors who will swim – and pay an extra charge. The percentage of current visitors who swim is about 5 per cent.

Effective marketing might solve this problem. On the other hand, given the wide availability of swimming facilities, MBG might concentrate on the 'niches' of eco-tourism and mountaineering. In order to refine the idea of emphasis on the eco-tourism 'niche', a further feasibility study should be carried out. Moreover, since MBG is a research facility, UPLB should bear a proportion of the costs.

Recommendations

On the basis of an average of 105,801 visitors per year projected over 25 years, of whom 25 per cent

will swim, the entrance fee should be US\$ 0.53 and the swimming fee US\$ 1.41 in order to cover the annualised costs of the proposed MBG improvement and maintenance. The mechanisms for collecting the increased fees are already in place. Fees at MBG were increased by 100 per cent in January 1999.

Further specific recommendations advanced by consultations include:

- the differential pricing between UPLB and non-UPLB visitors should be abolished. It is inefficient and discriminatory;
- the eco-tourism/forest recreation option should be pursued as well as the education/research option;
- aggressive marketing of MBG is needed;
- accurate visitor statistics should be maintained;
- in eco-tourism/forest recreation, there should be differential pricing in favour of local, i.e., Filipino, visitors.

A Market-based Instrument for Land Resources

The efficient and sustainable use of land is an important consideration in the MFR. At present, the area occupied by farmers (1,000 households, resident and non-resident) comprises 1,924 hectares (45 per cent of total area) in 1,267 farm lots found mostly in the disturbed/cultivated portions of the MFR. The cultivation of farmlands within the MFR has no legal basis but the farmers have been living in the area for quite some time. UPLB has already accepted their presence and is currently working on an accreditation mechanism to prevent further expansion of cultivated areas in the MFR.

This accreditation scheme is also seen as a means to offer the farmers security of tenure. Since this recognition was only given in the last few years, and since the mechanism to make this occupancy legal is still under discussion, the farmers have not been paying any rent for the use of the land. It is, however, recognised that farmers, just like other resource users in the MFR, should pay for the use of land. In the recent consultation, they did acknowledge that they should pay but they also hoped that whatever efforts they make to protect the MFR would offset whatever rent payments will be asked of them.

In the MFR, there are three main cultivation systems. In the « kaingins », of which there are few, cultivation is relatively intense, usually within cleared secondary forest growth areas. Crops are

usually fruits for the local market. On plantations, up to fifteen crops are grown simultaneously in a stable system where soil erosion is limited and the topsoil remains thick. Nevertheless, conservation practices need to be improved. On the home garden system, the family lives on the farm. Otherwise the system is the same as the plantation system. Conservation practices are better on the home gardens.

The intent to charge major users is anchored on the policy of 'pay as you use'

In terms of profitability, a 1992 survey showed that, in an agroforestry mode, 1 and 2 hectare plots had positive Net Present Value (NPV) and benefit-cost ratios (BCR) higher than 2.0. The internal rate of return (IRR) was 63 per cent for 2 hectares and 88 per cent for 1 hectare plots. In the mixed-perennial version, 1 hectare plots were most profitable with positive NPV, a BCR ranging from 2.81 to 4.57 and an IRR of 66.77 per cent.

The economic rent was estimated using the 1992 data plus a 50 per cent increase in costs to allow for normal overall profit. Different discount rates were used for estimating future value. On a 1 hectare agroforestry plot, the estimated annualised rent ranged from US\$ 129.80 to US\$ 298.95 per hectare. On a 2 hectare plot, the same rent varied between US\$ 181.50 and US\$ 597.65 per hectare. The 3.5 hectare plots indicated inefficient use of land and, therefore, a diminished economic rent. In the mixed-perennial version, estimated rents varied between US\$ 335.62 per hectare to US\$ 1,075.30. Rent estimates were lower on larger farms and the mono-perennial farms showed a negative rent.

Farming in the MFR generally produces soil erosion. A 1998 survey showed rates between 199 and 382 tons/hectare/year. In opened secondary growth forest areas or areas which were formerly grasslands, conservation measures include the establishment of hedgerows. In plantation areas, conservation involves cover crops, contour ditches and

walls and drainage canals. The following costs were identified for conservation of 1 hectare of farmland in the MFR:

- establishment and annual maintenance of single hedgerow US\$ 270.30
- cover crops (*Centrosema pubescens*) US\$ 43.25
- inter-planting and maintenance of tree crops US\$ 165.55
- contour ditches and drainage canals, including maintenance US\$ 237.85

In overall terms, these are low cost measures that yield high benefits. Farmers have requested technical and financial assistance for the implementation of such measures.

There are a number of conservation measures which are currently carried out through communal efforts. They were identified and valued as follows on an annual average of persons involved, person-days spent and overall cost:

- boundary delineation: 39 persons, 647 person-days, US\$ 2765.65
- guarding against illegal cutting: no specific estimate could be made
- reforestation: 51 persons, 227 person-days, US\$ 920.48
- reforestation nurseries: 49 persons, 435 person-days, US\$ 1795.65
- ground maintenance: 300 persons, 675 person-days, US\$ 2736.48

Recommendations

Farmers, like other resource users, should pay for their use of the land. As indicated, rent for the use of the land is positive and of high value owing to the locational advantage and inherent productivity of the MFR. It is unreasonable to assume that all of the rent estimated for MFR farms can be collected through taxes. Even if only 10 percent were collected, this amount would provide a significant source of revenue for the MFR to finance conservation efforts at the farm and watershed levels. The high rent estimates can also be used as basis to appeal to farmers that they can very well afford to invest in soil conservation efforts given the very high level of profits that they enjoy. The discussion on how the rent can be collected will be the subject of subsequent discussions with the farmers, as part of the on-going consultations and discussions. UPLB is hesitant to pursue this matter with farmers given past conflicts.

As a whole, there is a high level of awareness among the various POs in the MFR that they need to work closely with the University in pursuing efforts to manage the MFR in a sustainable manner. The University has also accepted this fact. Both parties, however, are taking things slowly given the past atmosphere of animosity. Furthermore, there is a general acceptance of the value of the principle of resource pricing to make the use of MBIs acceptable to all parties concerned. The key to an acceptable and workable MBI, however, is to develop it with stakeholders in a very consultative manner.

Market-based Instruments for Non-Timber Minor Forest Products

Information on product flow, prices and market options is scarce given the informal nature of the market for NTFPs. Many NTFPs are gathered for domestic use. Those who gather such products tend to regard the MFR as a common resource and feel no need or incentive for conservation. In 1994, it was estimated that over 16 per cent of MFR residents gathered such products « illegally » i.e., without a permit. The extra income thus generated was estimated to range between US\$ 1.35 and US\$ 232.43 per year. The net annual value of NTFPs is estimated at US\$ 10,385.76, through direct extraction from the forest or acquisition at nurseries in specified sites.

A stakeholders' meeting was held to determine the market price of NTFPs and to consider measures to conserve the resources. The group consisted of landscapers and plant growers from the district plus some from Metro Manila. 78.6 per cent of the stakeholders confirmed that there is a strong demand for high quality products from the MFR.

Recommendations

- the existing permit system should be continued but data on the user and the scope of intended use should be improved;
- an up to date user charge should be levied per product depending on its type, size, volume or end use;
- the activities of permit holders should be monitored. Sanctions should be applied to wrongdoers;
- collection of NTFPs should be confined to areas where extraction will not harm MFR's biodiversity;
- a detailed inventory of the NTFPs available in the MFR is urgently needed;

Institutional Framework for Implementation

The intent to charge major users of the Mount Makiling Forest Reserve (MFR) a watershed protection and conservation (WPC) fee is anchored on the policy of 'pay as you use'. It is viewed as an equitable means of sharing not only the benefits derived from the watershed resources but also the burden and the responsibility for sustainably managing the forest reserve. The various stakeholders such as the UPLB, IRRI, institutional leaseholders, LGUs, POs, NGOs, industries, water districts, resort owners, LGUs, recreational users, and other groups recognise the need to conserve and protect the MFR as an important watershed. Likewise, these sectors have expressed their commitment and desire to plough back resources to implement projects and activities pertaining to conservation of the MFR.

There is a need to develop an institutional framework that will define institutional arrangements, guidelines and mechanisms for more equitable, efficient and effective conservation, and protection of the MFR watershed resources. The proposed institutional framework specifically aims to: establish and sustain a more representative multisectoral institution that will manage the resources derived from market-based instruments designed for the MFR; rationalise and systematise the collection, allocation and use of watershed conservation and protection (WCP) fees that will be charged from the various resource users of the MFR; install mechanisms that will enable responsible users to participate more substantively in the direct management of the MFR and operationalise the values of equity and transparency in natural resource management

Institutional Arrangements

All fees that will be collected from market-based instruments (MBIs) shall form the fund for the implementation of various projects and activities identified in the MFR Conservation and Development Program (MCDP). The Fund shall be managed by a MFR Trust Fund Management Board, an independent body attached to the Office of the Chancellor (Figure 2). The Trust Fund Management Board shall draw membership from the stakeholders or resource users who have paid or contributed their due share of the WPC fee in cash or in kind. Relevant sectors and user groups shall choose their representatives to the Board.

The MFR Trust Fund Management Board shall be composed of the UPLB, Institutional Leaseholders,

People's organisations, LGUs (Laguna and Batangas), Laguna Tourism Association, Laguna Chamber of Commerce and Industries, Industries from Sto. Tomas, Batangas and NGOs.

The MFR Trust Fund Management Board shall have the following functions:

- formulate the policies, guidelines, and criteria for funding of projects and activities related to the MFR Conservation and Development Program (MCDP);
- ensure effectiveness and efficiency in the implementation of various projects supported by the Fund.

The Technical Secretariat shall serve as the technical staff of the Board so as to review the technical feasibility of all projects and activities proposed for funding from the Trust Fund; recommend to the Board projects to be funded; keep a repository of records and documents and information pertinent to MCDP and continuously monitor and periodically evaluate project implementation to ensure effectiveness and efficiency.

Financial Management: The Board shall use the services of the UPLB Foundation, Inc. (UPLBFI) to manage the funds generated from WPC fees. A Memorandum of Agreement (MOA) to this effect shall be executed between the Board and the UPLBFI. Specifically, the UPLBFI shall allocate and disburse funds for the projects and activities approved by the Board; monitor financial operations of all supported projects under the MDCP and prepare periodic financial reports to the Board.

Conclusions

The important role that market-based instruments can play in the management of the Makiling Forest Reserve is recognised by key stakeholders in the MFR. Consultation meetings attested to the positive attitude and wide acceptance of the rationale of using of MBIs in resource management.

At present, user-fees are imposed on the collection of minor forest products and the use of Makiling Botanical Gardens. However, there are other recreational sites in the area in which no fees are currently charged. There is a need to review current fees for recreation and the harvesting of minor forest products to ensure that they closely reflect the true value of these resources.

The biggest challenge lies in the imposition of a watershed protection and conservation fee as part of the water bill of water users. Water users were convinced that watershed protection is a service that is required in the 'production' of water, and hence, just like other inputs, must be paid.

An important finding of this study is that only a small increase in existing fees is required to cover water resource management costs. Watershed protection and conservation activities require a payment which is less than half of users' Willingness to Pay.

Of the various resource sectors, the most difficult to apply MBIs to is land resources given the long history of dispute that has existed between the University and farmers on this subject. However, farmers are expected to assist in watershed protection and restoration, and their efforts can offset the rent they should be paying. It is recognised, however, that implementing MBIs for land resource use will take time.

Overall, the atmosphere appears good for MBI implementation in the MFR and the basic structure is already in place.



Romania's Water Sector

*This project was implemented by
the Center for Environmentally Sustainable Economic Policy (CESEP)
of the University of Polytechnics, Bucharest,
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with technical assistance from UNEP.
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Summary of results

Analysis of Romania's water sector shows that current prices are based on demand-side allocation although the legal and institutional systems for full cost recovery are already in place. Between 1950 and 1990, demand for water in Romania increased fifteen-fold, making reform urgent. A Marginal Opportunity cost (MOP) approach was used to analyse the full cost of water in a selected river basin. Results showed that even under the 1998 legal and pricing arrangements the national raw water price is only 25% of the full economic price. WTP in an urban setting showed that 90% of respondents said that water should be priced to cover service and administration costs plus the value of water "as a natural resource". However, only 2% saw privatisation of water as the best solution. The impact of higher water prices on industrial production, export and trade competitiveness was analysed with the conclusion that until water prices better reflect the value of the resource to society as such, there will be over-use of public water supplies and incentives for technological and management improvements will be delayed. Tradable rights could help towards a solution for water pricing and for pollution management.

Project Objectives

The objectives of this project were to identify the impacts of recent structural adjustment programmes (SAPs) on the water sector, and to identify policies that can be used to ensure sustainable use of water resources.

The project sought to:

- **examine the impacts on the water sector resulting from recent structural adjustment policies and associated trade liberalisation;**
- **review existing economic instruments in the sector and examine economic instruments to promote full-cost pricing of water; and**
- **identify policy options for sustainable water resource management and conservation.**

SAP impacts were identified through analyses of social and environmental costs and benefits.

The underlying problem causing unsustainable water use is that current water prices are not de-

termined on the basis of cost-recovery, but on the basis of demand-side allocations. Two case studies were undertaken to determine the economic value of water and to survey users' willingness to pay for water services.

The impact of higher water pricing on the international competitiveness of economic enterprises – and on their export volumes – was also examined. Based on national data on input demands and related price elasticities for 50 surveyed industrial enterprises, additional analyses were made to infer what management strategies might develop as industry is faced with higher water prices.

The Water Sector in Romania

Romania is located in the south-eastern part of Central Europe and three important structures define its geographical position in Europe: the Danube River, the Black Sea and the Carpathian Circle. Romania covers an area of 237,500 km² with three main regions: mountainous (31 %), hills and plateau (36 %) and plains (33 %).

The surface of the country is drained by a hydrological network with a permanent flow of about 76,000 km belonging to the Danube River basin accompanied on its lower course by the Black Sea basin. Out of the total boundary length of 3,190 km, the river boundary is 1,865 km, the terrestrial boundary 1,036 km and the sea boundary 288 km. The Danube River defines 1,075 km of the Romanian border, discharging into the Black Sea through the Danube Delta, which is an important marshland area declared as a biosphere reserve for its large diversity of unique flora and fauna.

Romania has a continental temperate climate. Annual mean rainfall is 640 mm. In the mountainous region, the average annual rainfall is 1,200-1,400 mm, whereas along the Black Sea Coast it is below 400 mm. The population is 22.8 million of whom 56 per cent live in urban areas and 44 per cent in rural areas.

Water resources and their allocation – Romania's water resources are relatively poor and unequally distributed, deriving from surface waters – inland rivers, lakes and reservoirs, the Danube River – and from groundwater reservoirs. Black Sea water resources, although very important, cannot be exploited for the time being because of technical and economic difficulties in seawater desalination. Water resources of inland rivers and lakes are estimated at about 40 billion m³/year of which, in the natural flow regime, only 5 billion m³/year are utilisable and, in the current river draining regime, 13 billion m³/year.

Potentially utilisable resources can not be used efficiently unless there are significant investments in improvement of hydrological basins and treatment installations

Out of the Danube's theoretical resources, Romania consumes 85 billion m³/year, but, because of the river's navigable character, only 30 billion m³/year contribute to the water stock available for consumption. Only 400 million m³ of lakes are fresh water. Because only 12 per cent of this re-

source can be used in the natural flow regime, many reservoirs had to be developed.

In 1996 reservoirs stored a total volume of 13 billion m³. Taking into account existing and future reservoirs, inland rivers can provide about 25 billion m³ in a drought year – a maximum limit that cannot be increased. Groundwaters, generally of better quality than surface waters, are estimated at an available annual amount of 9 billion m³, of which about 3 billion m³ can be accessed under existing capacities and conditions. Potentially utilisable resources can not be used efficiently unless there are significant investments in improvement of hydrological basins and treatment installations.

Water Quality

Water quality monitoring began in Romania in the mid-70's. Resources are grouped in three subsystems: rivers, lakes (natural and artificial) and groundwater aquifers. For surface water, the monitoring system provides surveillance of 20,000 km of river, with daily sampling of 60 control points upstream of big polluters and with periodical sampling in another 240 control sections. For groundwater, a national system of monitoring was set up in 1984 –based on a background monitoring system of 3,000 wells and an impact review system of 10,000 wells – but has ever since been subject to change. The quality of surface water is determined by its use. Discharge into natural receivers, especially by large industrial sources, of non-treated or insufficiently treated wastewater, renders downstream water courses unusable as drinking water without high-cost treatments. The very high water flow in the Danube ensures sufficient dilution of wastewater to improve quality but even the treated water is often not potable. The main causes of deterioration of water quality are:

- the development of polluting industries, the retention of highly polluting production technologies which in developed countries have already been abandoned;
- the rapid growth of non-point source pollution;
- sewerage facilities and treatment plants whose capacities cannot meet increased industrial production and urban development; and
- inadequate operation of existing treatment plants and the lack of an organised collecting, storage and management system, especially for mining, industrial and domestic wastes and for sludge resulting from wastewater treatment.

The Institutional Framework

Until 1990, the National Water Council – named as such in 1974 – has been the central national authority responsible for water management through 9 water departments and 40 county level offices. In 1990, the National Water Council, the National Council for Environmental Protection and the Ministry of Silviculture were amalgamated into the Ministry of Waters, Forests and Environment. In 1997, this ministry was reorganised as the Ministry of Waters, Forests and Environmental Protection.

In April 1991, Apele Romane was created as the operational agent of the Water Department charged with the implementation of the national water management strategy. Drinking water supply, wastewater collection and treatment, the central heating network, state real estate, housing and street maintenance, solid waste collection and disposal are the responsibility of municipal enterprises. The new government decision, published in March 1999, took into consideration the EU IPPC Directive and created a new water management structure which implements full self-financing and facilitates integrated management by the environmental protection agencies. The pollution control functions of the river basin authority were vested in Apele Romane. In addition, the government transferred regulatory responsibility for water management to the EPA.

The legislative framework – Since the early 60s, national standards were issued for water quality, water management and water works. The standards are reviewed every 5-7 years and progressively revised in order to meet the standards of Western Europe. In 1979, admissible limits were set for polluting substances in wastewater before discharge into natural receivers and in 1983, an ordinance established admissible limits for the main polluting substances in wastewater before discharge into sewerage systems.

Water management is now based on the new Water Law and for the first time in Romania, a legal system has been established that allows the public to review and comment on environmental assessment, permits, applications or policy and legislation. At the same time, the Ministry of Water, Forest and Environmental Protection has updated regulations establishing water quality parameters, the criteria for water classification and water standards for different end-uses in a similar way to that of the EU Directives.

The Financing Mechanism

Until 1989, tariffs were applied only on drinking water, industrial water and water for sewerage system use. In January 1991, an integrated system of payments for products and services of water management was created to manage the protection of water against pollution and overuse, the establishment of water intakes, protection against flooding and the implementation of market-based instruments for those purposes. Apele Romane, the institution charged with collecting fees for the use of surface and groundwater, calculates total expenses of water management at the national level to be recovered by payments by users or beneficiaries.

Water prices are uniform throughout Romania but differ according to the source of water and the category of user. Tariffs are levied on water pollution using limits set by the law. If the limits are exceeded, fines are levied. The penalty revenues and 5 per cent of prices and tariffs from water management provide funding for the 'Water Fund' created in 1991 and administered by Apele Romane to finance improvements in water quality, river bed stabilisation, flood control, efficient water use and to cover water management units' expenses in critical periods. The Ministry of Waters, Forests and Environmental Protection allocates the resources of the fund.

***Private sources will
need to play a much
greater role in
meeting water
financial needs***

Water demand has increased significantly in recent years from 1.4 billion cubic meters in 1950 to 20.4 billion in 1990, of which 11 per cent was for domestic and drinking use, 44 per cent for industry and 45 per cent for agriculture. Wastewater discharge has also increased. In 1990, of 10 billion cubic meters discharged, 50 per cent required treatment; of that amount, only 25 per cent was treated, 50 per cent was insufficiently treated and 25 per cent not treated at all.

Water is not regarded as a resource with a value, and demand is increased by industrial technology requiring high water consumption, excessive use for irrigation, waste and loss in user installations,

inadequate measurement systems and lack of a management system based on true economic values. The pricing system introduced in 1990 highlighted these problems. Users reduced demand but continued to invest in production technologies without parallel investment in treatment systems. Payment of dues was severely delayed, implying delay in and reduction of maintenance and repair work. Demand reduction and shutdown of large industrial users ultimately implied price increases.

In the beginning of the transition period prices were very much lower than costs. However, Apele Romane can adjust prices. The approach followed by Apele Romane is that costs should include all operation and maintenance costs, including repair, but not costs for future investments. Private sources will need to play a much greater role in meeting water financial needs. The main financial problem at present is the inability of industry, agriculture and municipalities to pay for the costs of water management. Collection of payments and enforcement of standards must be given high priority. In the medium and longer term, consumers should be able to pay for their water services.

Structural Adjustment Policies in Romania

General Economic Developments

At the end of the 1980's, Romania had an extremely centralised government, a non-competitive economy, no experience in economic reform and inadequate institutions and capacity to support and guide a market economy. Democratic practices were totally absent and the standard of living was the lowest in Europe.

The transition process began with the promulgation of legal and institutional reforms. Private property and the right to choose residential location were recognised. Decentralisation gave local governments management authority along with the responsibility to finance local services. Democratic elections made local officials more accountable. With a few strategic exceptions, state-run economic enterprises were transformed into independent commercial entities. Private ownership of arable land was restored.

At first, industrial and agricultural output declined sharply. Since 1997, the situation has improved with the transfer of decision-making on planning and resource allocation to the new commercial entities, new legislation on privatisation, environ-

ment, water resources and forestry and the restructuring of industry, agriculture, financial services and internal commerce. However, at the national level problems persist with the budget deficit, money supply and inflation.

In 1993, the government began to implement a phased programme of market-oriented reform, including liberalisation of prices (including that of fuel) and of trade margins. By 1994, only extractive industries continued to be subsidised. By the end of 1995, the state controlled prices for only 3 per cent of consumer goods and public services, 7 per cent of industrial products, but 30 per cent of raw materials. In 1997, price controls were removed for all except 20 items (mainly public services and energy) and raw material imports and essential agricultural products were liberalised. It is only recently that the government has agreed to reform the forestry and timber sector by liberalising stumpage auctions, sawed timber exports and the privatisation of forests.

In the field of privatisation, progress has been strong in agriculture and small scale enterprises, though less progress was made in industry. In 1998, however, there was massive privatisation, and between 1994 and 1999, 750,000 new private enterprises were created in total.

The Move to Full-Cost Pricing

In overall terms, current policy recognises consumer sovereignty and the need for full cost pricing. In 1997 and 1998, the government legally incorporated environmental standards and liability into privatisation contracts.

To date, the favoured economic instrument to ensure environmental standards has been an improved permit system with state co-financing of investment for pollution abatement. Such state financing is, however, decreasing. The time is ripe for Romania to examine the issue of command-and-control versus economic instruments to achieve sustainable development and environmental policy objectives. The cost of regulation is too high for both government and economic agents and could well affect Romania's international competitiveness. Regulation has also proved ineffective, given the institutional weaknesses of human skills and capacity for monitoring and enforcement.

New policy thinking focuses on 'getting the prices right' on the assumption that such measures would result in higher internalised prices. Given that not

even the current low prices for environmental goods and services are paid, the validity of the above assumption is open to doubt. Open market competition has certainly brought some positive environmental results but problems remain concerning economic instruments to address environmental issues.

Obstacles to the introduction of economic instruments and full-cost resource pricing include:

- **the perception that such instruments are not yet affordable;**
- **a poor understanding of the relationship between policy, priorities and investment;**
- **limited capacity to design policies, goals and charges (the latter being based almost exclusively on toxicity levels rather than the true economic value of damage caused);**
- **limited capacity for monitoring and enforcement, and the political desire to raise revenue.**

The Economic Value of Water

Full-Cost Water Pricing

The value of water must be determined so that full-cost pricing can be effected. In a case study, this project conducted research to determine the economic value of water in the Somes-Tisa River Basin.

Water resources are relatively abundant in the Somes-Tisa River Basin, however, many sectors of rivers are polluted as a result of untreated wastewater discharge. The river basin area, covers 22,300 km² in the north-western part of the country. The typical climate is temperate continental with mean annual temperature ranges between 2 and 4 °C in the mountain zones, and 11 °C in the flat area. Altitudes range from 70 m to 2,500 m.

The forest plays a very significant role in relation to its hydrological, climatic, counter erosion and environmental protection functions. There are both surface waters (rivers and natural lakes) and ground waters (phreatic and deep aquifers). There is also a variation in time and space of water distribution – floods occur in spring, produced by the combination of heavy rainfall and snow melting, and alternate with long periods of drought. The multi-annual average volume of flow of the Somes-Tisa river is around 6,05 km³. The ground-water flow is average.

The total water demand for all users is assessed at 407 million m³/ year, of which 158 million m³/ year is for the population living in urban areas and 10 million m³/ year for the rural population. Within the river basin, there are four reservoirs (91 million m³). The hydropower scheme includes four reservoirs totalling 218 million m³ usable capacity, at 501 GWh/year.

The water demand was calculated by taking into account a percentage annual population increase of 0.2 per cent, and the restructuring/modernisation strategies of the main industries. The estimated demand for the year 2010 is 553 million m³, with residential demand at about one fourth of the total.

Private sources will need to play a much greater role in meeting water financial needs. Economic planners took neither the full cost of water nor the development of the utility industry into consideration.

Methodology

The paper applies the Marginal Opportunity Cost (MOC) pricing approach to analyse the full economic cost for raw water using three principal components for the supply of a natural resource: a) marginal production costs; b) marginal user costs and c) marginal external costs. The socially optimal price, P, equals the sum of these components where:

MPC is the direct cost paid by resource users in the process of resource production. MUC is the net gain or loss to future generations that will use the water resources. MEC is the cost imposed by the resource users on other users or society. The main component of MEC is the environmental cost incurred through water supply projects which are not included in current prices.

The methodology is based on:

- raw water demand for the next 10-12 years with 1998 as reference year;
- the identification from the accounts of Apele Romane Cluj of current incremental costs of water management activities and hydraulic structures maintenance;
- the calculated capital incremental costs of water management activities and hydraulic structures maintenance;
- the calculated capital incremental costs related to external costs;
- the prognosis of development investments; and

- a discount rate of 12 per cent.

Only the MPC as the direct cost paid by the resource users in the process of raw water resources production is included.

The results were as follows:

- actual value of the costs for water management activities;
- water volume consumed; and
- raw water incremental average cost.

The 1998 national raw water price of 67.72 lei/ m³ is much lower than the full economic price calculated at 267.31 lei/m³.

Recommendations for Full-Cost Water Pricing

The water price must incorporate social, economic and ecological factors. The analysis considered only the economic principle.

The price reform should be gradual/incremental. The raw water price reform should be integrated into the economic reform as a whole and should be adjusted in accordance with piped water price reforms. The introduction of a differentiated water price for each river basin would be appropriate.

Alternative methods of recovering the cost of flood protection need to be developed, possibly through land or property taxes

Raw water tariffs should be calculated to cover operating costs of Apele Romane, capital charges associated with the water resources and supply infrastructure, and operating costs and capital charges of flood prevention and protection

In the short term, the price should be raised, at the minimum, to a level which covers the full economic cost of provision. In the long term, it is undesirable that flood prevention costs should be included in the water tariff since the benefits of flood protection do not correlate with raw water consumption. In the short to medium term, flood protection costs will either be included in the raw water tariff or paid directly by the state, but the accounts for flood prevention and protection should

be presented separately from those for raw water supply.

In the long run, the user cost and the environmental costs of exploiting the resource should also be included in the raw water price.

Differential pricing is permissible as long the price reflects real differences in the cost of supplying water to different users. These differentials will be an incentive for developments with a large demand for water to locate in basins with abundant supplies and low costs rather than in basins of low supply and correspondingly high costs.

Research should be carried out to ensure that water prices reflect the varying costs to different users of extraction from the particular source, distribution system and sewage system. In addition, alternative methods of recovering the cost of flood protection need to be developed, possibly through land or property taxes.

Water Services Tariffs

Water charges should include a component that covers costs for water resource management and conservation. As a case study, this study conducted research to determine the willingness to pay (WTP) potential of water users in urban areas.

The supply of urban environmental services has become the exclusive domain of local governments. Unfortunately, at the local level, service delivery strategies are failing rapidly. The cost of service provision is rising, while household incomes are falling. In addition, the role of the central government in funding and directing local services is diminishing as reforms proceed. Consequently, service levels are falling due to inadequate financing. Finally, several pre-revolution institutions remain in place, which impede the sustainable financing of services by creating perverse incentives for producers and consumers.

Finished water is supplied by municipal water supply systems. Municipalities buy raw water from Apele Romane, treat the water, adjust the price by as much as 100-fold and supply it to households or other users. As households characteristically are not metered, charges to residential users are based on the number of inhabitants in each unit. Water prices were very low in the past. In 1999, however, they ranged between 1,500 (Bucharest) and 6,000 lei/m³ (Petrosani). Generally, in each locality the degree of metering is between 30 and 50 per cent. At present, the revenues cover the costs for the

maintenance and operation of drinking water systems and a very small part of development costs.

The Autonomous Community Authority Satu Mare (RACSM) is a countywide utility, which purchases raw water from Apele Romane. RACSM treats the water and sells it locally. By law, RACSM must price its water to cover its costs of production in addition to which it is allowed to take 5 per cent in profits.

The drinking water for Satu Mare City is supplied from the groundwater located in the Somes river basin. Raw water represents only 2.6 per cent of the total production costs of the Water Services Company.

Survey on consumer demand and preferences: RACSM has developed a long-term strategy for gradual improvements until the year 2005. The basis for the new water service strategies should be consumer preferences since ultimately consumers will have to pay, through higher user fees and local taxes, for improvements in the existing system. A major need in developing final recommendations for water pricing policy is information on how coverage is likely to vary in various river basins with changes in water prices and tariffs. Water consumers were interviewed on how much they are willing to pay (WTP) for the amount of water they want.

Firstly, a random sample of officials from the following agencies were interviewed:

- Ministry of Industry and Trade
- National Privatisation Agency
- State Ownership Fund
- Chamber of Commerce and Industry
- Romanian Register of Commerce
- Ministry of Water, Forests and the Environmental Protection
- Apele Romane
- Environmental Protection Agency
- National Commission for Statistics

Then a questionnaire was distributed to 200 people living in the municipalities of Satu Mare and Bucharest. In the survey, several questions were posed concerning the possibility of current inadequate services being improved, to what level these services should be raised and whether consumers are willing to pay for these improvements. The questionnaire also included questions on institutional reforms and the users' attitudes to the water sector and policy makers.

71 per cent of the total surveyed population replied. The survey revealed that the average family consists of three members (sample mean = 2.9). In the average household, there is one member employed full-time (sample mean = 1.6) earning an average income of 1,150,000 Lei (\$ 100) per month. From the sample, 85 per cent were employed, 11 per cent were either self-employed or in the private sector, 4 per cent were students.

Results of the Interviews on Water Services

Tariffs

- every individual who was interviewed mentioned the need to charge a price for water as a natural resource;
- about 90 per cent of respondents said that water prices should cover the cost of service plus administration plus the cost of water as a natural resource;
- about 80 per cent of respondents said charges should be on a volumetric basis; and
- the highest willingness to pay for water occurs among industrial users.

Results of the Survey on Water Services Tariffs

Many of the attitudes are positive towards the principle of full cost pricing. About 30 per cent of the respondents indicated their top two priorities for the water sector in Romania during the next 10 years. The Percent column indicates the frequency distribution of checks. For example, 7 per cent of all responses were for eliminating subsidies. The Rank column ranks the items according to the frequency of check marks. For example, eliminating subsidies had the fifth highest number of responses. The lowest priorities were to privatise the sector. This probably derives from the common belief that households are poor and need to be cross-subsidised by industry, and that government's role is to ensure such subsidies.

On water pricing attitudes, most of the respondents generally accepted that pricing principles apply or that special pricing principles are needed. About 90 per cent said water is a special good.

In response to the question whether water prices for cities and industries should include a component for pollution abatement or whether pollution costs should be charged separately, about two-thirds of the respondents said the water price should also cover pollution control, and only one-third thought that pollution should be covered separately.

There are obstacles to a targeted metering programme in Satu Mare. An improved metering programme would require the utility to significantly expand its capacity to read and maintain the meters, set performance standards for meters and implement a billing process based not on the associa-

Surveys were undertaken to establish baseline information on the conditions faced by water consumers in identifying which are the signals being received by consumers about the value of water. At a basic level, raw water is an input into production just like any other. When faced with higher input

Survey Results		
<u>Question</u>	<u>Percent</u>	<u>Rank</u>
government involvement	29	1
eliminate subsidies	7	5
democratise water institutions	7	5
decentralise the sector	10	4
improve infrastructure	28	2
privatise the water sector	2	6
reduce water losses	17	3

tion, but on either staircases or individual households. In that context, the role of the association as a mediator between the utility and the consumer would need to be reconsidered. To install meters will also require capital investment. It is questionable whether this is feasible, given the utility's inability to bear additional debt and the low incomes of the population.

Tight budgetary conditions have placed severe constraints on any further expansion in water supply capacity

The Economic Impacts of Higher Water Prices

Tight budgetary conditions have placed severe constraints on any further expansion in water supply capacity. There is a foreseeable need to economise on infrastructure investments and to encourage allocation of water to uses with the highest rates of return. There has thus been a shift to demand management by promoting more efficient water use.

prices, enterprises can be expected to adjust levels of inputs, outputs and net exports, depending on substitution possibilities as well as input and output market structures.

Econometric Analyses

The main purpose of the analyses undertaken in this project was to estimate input demands and related price elasticity. The water demand elasticity provides a key piece of information for addressing the impact of higher water costs on production and net exports. It is necessary to develop an empirical link between water use, production, and exports. At a simple level, the goal is to estimate a 'shift back' in a supply function due to higher water costs. This shift in supply as an approximation depends on the elasticity of output supply with respect to water price.

It is assumed that enterprises act so as to minimise production costs and maximise profits. From the profit function, the profit-maximising level of output supply and water demand is identified. The profit function and the profit-maximising water demand and output supply functions provide a direct link between water and other input prices, and output prices and water use in production. The results show that the shift back in production due to higher water prices is identical in behaviour to the increase in the demand for water at higher output prices. The impact on water use of higher output price can be defined as the product of two terms.

The first term shows how water use increases when output increases, while the second term shows how output increases when output price increases.

The impact of higher water prices on output (and, as result, on exports) depends on three components:

- Water costs as a share of total revenues;
- The output supply elasticity with respect to output price; and
- The water demand (cost-minimising) with respect to output level.

As a first step, the approach was implemented at a sector level within the economy using rough estimates of water costs as a share of revenues. This analysis identified which sectors are especially vulnerable to water price increases. The second stage focused on a limited number of key sectors, involving direct data collection from 50 enterprises (based on two formal surveys) to provide better expert estimates on the relevant elasticity and the minimum data necessary to estimate econometrically the parameters needed to estimate the need elasticity from a cost function. The data set of the selected enterprises came from Food and Beverage Manufacturing, Textile and Fibre Mills, Petroleum and Chemical Manufacturing, Non-metallic Mineral Product Manufacturing, Cement Manufacturing, Glass Manufacturing, Fabricated Metal Products and Pulp and Paper.

Water Costs as a Share of Total Revenues

Water costs were calculated from revenue data from enterprises and data from Apele Romane. The industrial products were grouped into four main categories:

- Water costs represent between 7 and 9 per cent of the total revenues: thermal-power generation, pulp production, oxygenated water production and mainly those products which demand the largest ratio of water intake and water-related expenditures to value of output.
- Water costs represent between 0.7 and 3 per cent of total revenues: products from wood industry, paper production and mainly products which require medium water quantities or which have a high degree of re-circulation and reuse.
- Where water costs represent 0.3 to 0.7 per cent of total revenues: pigment and medical drugs industries, heavy water production and iron pipe industry. Despite the fact that these products demand high water quantities (300-475 m³/t.), their cost is too high compared to the

water price and therefore the water price impact is too low.

- Water costs are less than 0.3 per cent of total revenues: metallurgical products, fertilisers and some chemical products with high monetary value and a re-circulation degree over 80 per cent.

The Output Supply Elasticity with Respect to Output Price

The elasticities calculated were as follows:

- A 1 per cent increase in output product price (OPP) will lead to an increase of production between 0.5 and 4 per cent. This group includes pulp, cast iron, and coke, rolled pipes production.
- A 1 per cent increase in OPP will lead to an increase of production between 0 and 0.5 per cent. This group includes medical drugs, liquid chloride, lye, ammonium sulphate, and textile thread production.
- The third group where the OPP modification will not have any influence includes leather and technical thread production.
- For the fourth group, OPP change not only will not lead to an increase but will decrease the production, possibly due to low demand for a product that is too expensive or of low quality. This group includes power generation, organic pigments, some leather products for which the production decrease reaches limits between 0.01 and 5.7 at a price increase of 1 percent.

Water Demand with respect to Output Level

The findings show five product groups:

- The first group, including leather and some chemical products where water is re-circulated, covers large water consumers for whom a production variation of 1 per cent will produce an increase by 15 to 40 per cent of water demand.
- The second group, with water demand variation between 6 and 15 per cent at a 1 per cent variation of production, includes polyamidic and technical thread products due to the high degree of water re-circulated (around 85 %) and the water demand of 368 m³/t.
- The third group, for which water demand variation is between 1 and 4 per cent for a variation of 1 per cent in production, includes metallurgical products, paints, varnish, and resins, with water consumption of 20-27 m³/t and a re-circulation degree of 70 per cent.

- The fourth group, with water demand variation between 1 and 4 per cent for a 1 per cent variation of production, includes thermal-power generation, printing paper, heavy water, urea, etc.
- The last group covers products for which an increase of production will not lead to water demand increase and includes medical drug production.

Output Supply Elasticity with Respect to Water Price

- First are those products for which a 10 per cent increase of water price would lead to a production decline of from 2 to 11 per cent. This group includes oxygenated water production, caustic soda and paper production.
- Second is the product group where a 100 per cent increase in water price would lead to a production decrease ranging between 0.01 and 2 per cent. This category includes medical drugs, varnish, paints, and resin and liquid chloride production.
- Third are products for which an increase in water price, even by 100 per cent, would not influence production. This includes rolled products in particular.

Policies for Sustainable Water Resource Management

Policy Recommendations

Raw water tariffs should be calculated to cover the operating costs of the national company related to water resources and water supply, the capital charges associated with the water resources and supply infrastructure and the capital and operating costs related to flood prevention and protection infrastructure.

In the short term, price should be raised at the minimum to a level, which can cover the full economic cost of provision. In the long term, it is undesirable that flood prevention costs should be included in the water tariff since the benefits of flood protection do not correlate with raw water consumption. In the short to medium term, flood protection costs will either be included in the raw water tariff or paid directly by the state, but the accounts for flood prevention and protection should always be presented separately from those for raw water supply. In the long run, user costs and the

environmental costs of exploiting the resource should also be included in the raw water price.

Differential pricing between users is permissible as long the price reflects real differences in the cost of supplying water to different users. These differentials will create incentives for developments with a large demand for water to locate in basins with abundant supplies and low costs rather than in basins of shortage and therefore high costs. Raw water price reforms should be integrated into economic reform as a whole and price reform should be gradual and incremental.

Research should be carried out to ensure that water prices reflect the varying costs to different users of extraction from particular sources and use of distribution systems and sewage systems. In addition, alternative methods of recovering the cost of flood protection need to be developed, possibly through land or property taxes.

Pollution discharge tariffs should be increased, differentiated between types of suspended and dissolved substances.

Legislative action is required to support the implementation of the selected economic instrument (*full-cost pricing*) in terms of drafting water-pricing methodology and implementing the methodology over a six-month period on a pilot basis.

Conclusions

Price structures actually encourage overuse of public water supplies. Until water prices better reflect the value of the resource to society, incentives for technological change will continue to be significantly delayed.

Tradable rights in water use could be one of the solutions. The main rationale for permitting trades is that water, as an input to production activities, will be allocated to the activities with the highest rates of return on water inputs.

Environmental resources are, almost without exception, undervalued in relation to their contribution to economic activities.

The market system provides incentives for private gain, which, in turn, leads to the generation of new technologies. In water management, the mechanisms underlying technological change are not well understood and have rarely even been acknowledged.

Romanian water prices are very low. Little or no account is taken of economic factors in forecasting water demand, resulting in forecasts that are upwardly biased, with the consequent overbuilding of systems. Low prices also mean that cost recovery is not achieved.

In simple terms, the Romanian Government can influence use patterns by controlling the quantities/qualities of environmental or natural re-

source attributes that are traded, or by controlling their prices, either directly, where there is a mandate to set prices, or indirectly, through charges, taxes, subsidies and other economic incentives.

This study has proposed policies and tools that can be used to move the water sector towards greater sustainability.



Uganda's Fisheries Sector

This project was implemented by the Economic Policy Research Centre (EPRC)

Makerere University Campus, Kampala

with technical assistance from UNEP.

Project implementation was managed by Godfrey Bahiigwa, EPRC.

Summary of results

In Uganda fisheries, liberalisation provoked major growth in foreign investment and in exports of processed fish to new, developed country markets. The sector's export value rose from US\$ 1.3 million in 1990 to US\$ 45 million in 1996. Fisheries provide up to one million jobs. An analysis of fishing on Lake Victoria was done to establish pricing and profitability levels. Profitability ranges from US\$40 to US\$1250 per ton of processed fish exported, depending on the species. Domestic, artisanal processing shows a much lower profitability. A Sensitivity Analysis was carried out to test the ability of enterprises to pay for environmental compliance. The test case was a medium-sized firm with a daily processing capacity of 30 tons. Using data from 1989 to 1996 (environmental regulations were strongly introduced in 1995), pre- and post-compliance Net present Value (NPV) and Internal rate of Return (IRR) were determined and compared. In the base case, NPV was US\$ 54,160 while that for the Sensitivity case was US\$ 47,150. The IRR remained very healthy at 21%. The ability to pay for environmental compliance is clearly established. A mix of MBIs and CAC approaches is proposed: • Quality Control – EU directives on hygienic processing of fish should be implemented. Fishers should be required, and assisted, to invest in cold transportation, which will increase revenue by US\$148 per ton transported: Pollution management; • A Marginal Cost estimation suggests that voluntary compliance for pollution control is not economically attractive to firms. Therefore, an appropriate combination of regulatory measures, induced self-regulation and incentives should be designed. The Malaysian model for Control of Industrial Effluents is recommended; • Solutions to the problem of overfishing require several actions. Measures should be taken to define property rights, conferring common resource ownership rights on a specified group. The cost of resource harvesting must be raised through user fees while resource rights, within overall limits, and these could be made tradable. The net annual benefit to be derived from application of this combined policy mix would be US\$ 3.1 million.

Project Objectives

This objectives of this project were to:

- **investigate how trade liberalisation under structural adjustment programmes (SAPs) has fostered substantial growth of Uganda's fisheries industry;**
- **examine both the positive and negative impacts of trade liberalisation on economic, social and environmental systems; and**
- **identify an array of policy mechanisms, including economic instruments, that can be implemented to maintain sustainability of fisheries' resources and ensure their continued economic exploitation.**

Trade Liberalisation and the Uganda Fisheries Sector

The fisheries sector has evolved to become a major industrial sector in Uganda's economy during the last decade. Fish processing on a large-scale started in the late 1950s, but was interrupted in the early 1970s. However, with favourable market conditions made possible under the country's SAPs instituted in the late 1980s, fishing and fish processing activity has increased dramatically in this decade.

Uganda's SAPs were established to promote investment through economy-wide liberalisation and reforms in its the trade regime. Owing to its rich fisheries resource base – up to 17 % of Uganda's geographical surface area is made up of lakes and

rivers – fish processing for export in Uganda is one of the industries that has experienced rapid growth as a result of these new investment and trade policies. Uganda fish derives mainly from natural lakes and more than 1 million workers are directly engaged in the harvesting, transporting, processing, distributing and marketing of fish.

The SAPs for economic recovery undertaken by Uganda as of 1987 were, by usual standards of judgement, successful in that they achieved an average annual growth rate of 6.5 per cent. The programmes included measures of trade liberalisation, privatisation and active promotion of investment through a mixture of tariff and tax incentives, profit repatriation, deregulation and guarantees of private property rights. In terms of investment, success can be judged by the fact that the ratio of investment to Gross Domestic Product (GDP) went from below 7 per cent in 1987 to over 17 per cent in 1996.

*Expansion of the sector
led to unplanned
urbanisation and lakeside
settlement*

The fisheries sector provides a good basis for analysing the performance and impact of the SAPs. It is an important sector for provision of domestic food, exports, creation of employment and the earning of foreign exchange. Similarly, it is important in terms of management of the environment and of natural resources. Lake Victoria is the largest and most important source of fish for processing. Unfortunately, the volume of fish stocks is not known with precision. Despite strong indications of decline, it is not possible to establish an accurate maximum sustainable yield (MSY).

The benefits derived from economic reform are considerable. By 1996, the fisheries sector was the second largest export producer and the main source of foreign exchange earnings. The growth stimulated by new investment raised the sector's export values from US\$ 1.3 million in 1990 to US\$ 45 million in 1996, following which there was a certain decline due to a ban on fish imports from Uganda by the European Union based on health and quality concerns. The sector provides up to 1 million jobs. Fish harvests increased from 175,000 tonnes in 1985 to 219,000 in 1997. Higher quality standards were introduced and prices and earnings

increased for those involved in the sector. Privatisation also meant that, with the abolition of the limited state role in the sector, adequate equipment became available and was used regularly. The promotion of exports created an outlet for the sale of Nile Perch, for which there had previously been only a limited domestic demand but whose « cropping » by heavy fishing had been recommended to maintain ecological balances within the lakes. The creation of new processing plants stimulated investment in local infrastructure, partly financed by local and municipal sources. Factory demand for Nile Perch of 3-8kg has been a major disincentive to the harvest of immature fish despite local demand.

Unfortunately, the reforms also had negative impacts. Between 1989 and 1997, the catch in Lake Victoria declined by some 20 per cent. The catch in Lake Kyoga also declined. This could be due to over-fishing under the impulse of reform and new investment. It could also be an effect of changes in the ecology of the water bodies due to pollution by the growth of water hyacinth, harvesting of immature fish, eutrophication and the degradation caused by the discharge into the lakes of untreated or poorly treated waste effluents. These effects were magnified by the poor quality of environmental management in terms of extension assistance, monitoring and supervision. Expansion of the sector led to unplanned urbanisation and lakeside settlement with the concomitant effects of degradation of coastal wetlands, fish breeding grounds and habitat, increase of siltation and sanitation problems. On the social and domestic level, prices for fish increased, causing difficulty for the poor and creating a demand for immature fish. The traditional livelihood of the intermediaries operating between the fishers and the domestic market was destroyed.

Government Policies in Relation to the Sector

Policies were essentially aimed at liberalising trade, earning foreign exchange and removing price controls. Measures included: replacing export licences with export certification; easing customs procedures for imports and exports; replacing import quotas with tariff-based controls and seeking partnership arrangements in large, common market groupings such as EAC, ACP and WTO; permitting open trade in foreign exchange; a 100 per cent export retention scheme for non-traditional exports; and abolition of state trading monopolies. Under the stimulus of these measures, the export market for fish from Uganda expanded considera-

bly to include Europe and the Middle East and a greatly increased market in neighbouring countries such as Kenya, Democratic Republic of Congo and Rwanda. A major privatisation programme was begun in 1991. The government's intention was to restrict its own role to those of enforcing the rules of the market, collecting taxes and creating an enabling environment for business. In the fisheries sector, the state role had never been strong and was limited to the supply of fishing inputs at subsidised rates. When these activities were devolved to the private sector, reliability of performance and supply were greatly improved.

Fish Processing Firms and Their Capacity

By 1998, there were ten fish processing firms. To encourage sustainability in use of the resource, there was no total de-regulation. The Committee on Fisheries Exploitation (COFE), set overall processing limits and allocated quotas to individual companies. In the current decade, each plant has tended to increase its own maximum processing capacity. This capacity level has always been far greater -by almost 100 per cent - than the levels approved by COFE. Fish purchases by the processors reached a high of 48,138 tonnes/year in 1995. At that point, purchases were virtually equal to approved capacity but still very much below maximum processing capacity. However, by 1997, purchases had declined by some 36 per cent and approved capacity levels had also declined by some 30 per cent, largely due to temporary, or in some cases, permanent closure of plant.

Fish Stocks, Regeneration and Harvesting

There are no up-to-date data on fish stocks which could guide management on the question of sustainable harvests. The last comprehensive survey was done on Lake Victoria in 1969-71 and found that the total ichthyomass could be estimated at 679,000 metric tonnes of which Nile Perch constituted less than 1 per cent by weight and haplochromines 83 per cent. Shallow, inshore waters (4-29 metres/depth) carried 30 per cent of the total and catch rates in those areas were recorded at 800 kg/hour. Limited surveys carried out since 1993 show Nile Perch at 96.5 per cent of the total by weight with haplochromines reduced to 0.3 per cent. This represents a very dramatic population reversal. Furthermore, surveys show that 90 per cent of the ichthyomass is found in shallow waters where a mean catch rate in the period 1994-97 was recorded at some 150 kg/hour. Regeneration rates, location, volume and timing vary according to the individual fish species but major threats include

cannibalism by Nile Perch, invasion by water hyacinth, pollution from lakeside settlement and industry, and destructive fishing methods.

The national rate of harvesting was 60,000 tonnes in 1961 but rose to 276,000 tonnes in 1993, then declined to 219,300 tonnes in 1997. The overall increase is mainly due to the increased take of Nile Perch. While precise data is not available, it is evi-

While precise data is not available, it is evident that there has been over-fishing and use of destructive gear and fishing methods

dent that there has been over-fishing and use of destructive gear and fishing methods. On the large lakes, the landing sites are not equipped or manned to undertake data collection. On the small lakes, there is no coverage at all.

Processing capacity (expressed in fish purchases) shows a similar trend to fish harvesting - an increase up to 1995 followed by a steady decline. Nevertheless, all processing plants operated at below approved processing capacity in the period 1990-97 and at well below their maximum installed processing capacity. The harvest figures include a significant component of immature fish since the relevant regulations are not enforced. If the regulations were to be enforced, the total harvest would decrease. On the other hand, if the regulations are not enforced, resource availability will crash over time. In terms of establishing the maximum sustainable yield, it must be emphasised again that precise and absolute figures are simply not available. Nor has the impact of environmental and other changes in the sector and in the ecosystems involved been fully established. Based on fish harvest figures, an MSY level of 300,000 tonnes per year has been suggested. If the component of immature fish mentioned above is factored into the calculation, the MSY would need to be adjusted downwards.

Policy Recommendations

Appropriate rate of harvest: this cannot be established with accuracy due to the lack of data. Major problems include stock depletion from over-fishing and the use of destructive gear and fishing methods. The policy of open access to almost all national water bodies also causes problems such as

permitting the increased intensity of fishing on Lake Victoria, where, in 1989, there were 3,470 canoes in use compared to 10,000 in 1999. Action towards ensuring an appropriate harvest should cover regular and comprehensive stock assessments, the definition of resource rights among and between fishers where quotas (defined in time and volume) would be transferable. Action should also entail the promotion of community ownership of the resource rather than open access, the strengthening of the basic regulations and the involvement of local communities and other resource users in the implementation of regulations and collecting of fish landing statistics for the purposes of resource management.

Harvest Management

Given the declining stocks, earnings should be improved by adding value rather than by increasing catch. Local food needs should be safeguarded through the quota system and market differentiation based on species. A mix of market mechanisms and government regulation is required to guarantee the observance of environmental requirements. A major need is for training and capacity-building. This could, for example, minimise the post-harvest losses which are currently estimated at 20 per cent.

Considerably greater returns and value could be derived from current yields by improved fish handling measures

Other Measures

District authorities should assume greater responsibility for management, including environmentally sound planning and re-investment of local revenue for the welfare of the lakeside communities. A comprehensive re-stocking and aquaculture programme is needed to diminish the threat to domestic supply and to the small-scale cross-border trade. Diversification of export destinations would alleviate the current volatility. Fish stocks should be improved by control of the water hyacinth and by eliminating pollution from degraded catchments and lakeside industry. On a more micro level, considerably greater returns and value could be de-

rived from current yields by improved fish handling measures, in the factories and during transport. Percentage flesh recovery could be improved and used for other saleable products

The Impact of Nile Perch Harvesting on Fisheries

Nile Perch is a high-value fish, contributing 45.9 per cent of total national commercial fishery yield. Nile Perch stocks increased dramatically in 1965 in Lake Kyoga and in 1977 in Lake Victoria. Other species declined or even disappeared. In the absence of alternative food, Nile Perch even began to cannibalise its own young. In terms of the sustainability of fisheries in Uganda, it is clearly important to analyse the issues of the harvesting of Nile Perch and its predation rates.

Nile Perch is found in Lakes Albert, Kyoga and Victoria. It is native to Lake Albert and provides only 20-25 per cent of catch from that lake, where the other fish fauna have adapted to the predator. In Lake Kyoga, in 1965, total yield was 18,000 tonnes but rose to 167,000 tonnes in 1978 with Nile Perch constituting 43 per cent of that total. This boom was followed by a strong decline in both total yield and Nile Perch yield. By 1989, the total yield was only 55,000 tonnes. The decline in Nile Perch yield is attributed to the use of small gill and seine nets. In the natural course of events, over-fishing of the predator Nile Perch caused a resurgence of the haplochromines. In Lake Victoria, the situation has been similar to that of Lake Kyoga. Total yield rose to a peak in 1989 of 132,000 tonnes of which 76 per cent was Nile Perch. Other species declined or disappeared. In stock terms, haplochromines, which had constituted 80 per cent of total ichthyomass in 1982, declined to 6.9 per cent in 1985. In the same period, Nile Perch stock rose from 16.8 to 90.4 per cent. Even despite more intensive fishing effort in the current decade, overall yields have declined. Fishers now use smaller nets.

Eleven factories are operational in the processing of Nile Perch for export. Export demand has driven the cost of Nile Perch beyond the reach of the majority of the local lakeside population. Therefore, fishers use small, often illegal size nets to catch juvenile Nile Perch for the local market, particularly since the factories look for a 3-8 kg fish.

Different methods of harvesting can be used to manage the Nile Perch. When a combination of gill nets and beach seines is used, predation decreases considerably, given that such nets capture a large

proportion of Nile Perch. When large gill nets are used, the number of all fish harvested is lowest but the total biomass of Nile Perch is highest. Large mesh size nets provide the greatest overall yield of fish, predominantly large, mature Nile Perch, but fail to capture the smaller Nile Perch who increase the predation rate on other species. If the use of gill nets of 5/6 inch mesh were enforced, predation rates by Nile Perch would decrease substantially. Similarly, if nets of that size were used, only about 1 per cent of Nile Perch initial population would reach breeding size. Other factors which need to be taken into account are the water hyacinth and eutrophication. Both of these reduce habitable lake space for both the Nile Perch and its prey.

Policy Recommendations

There is a clear need to institute measures which balance both the Nile Perch stocks and the stocks of its prey. Such measures should include enforcement of the law prohibiting use of seine nets, enforcement of a 5 inch gill net mesh minimum size limit, promotion of the use of 6>10 inch gill nets for Nile Perch, control of fishing nets and gear, control of processing plants and their capacity, limiting water hyacinth and eutrophication, and involving user communities in management of the resource.

The Environmental Impact of Waste Discharges into Water Bodies

Rapid industrialisation took place in many sectors following the success of the macroeconomic reforms. However, most of these sub-sectors produce large quantities of toxic waste water. There are currently no legally binding standards for the discharge of industrial effluents. Regulations and standards are still in a draft stage. Industry in general does not treat the issue of waste management as a serious problem. There is very little professional treatment of wastewaters. Most industries simply discharge raw, untreated effluent into the surrounding environment or into the public sewer system. A further and major problem is that, even after the enactment of appropriate standards and regulations, enforcement would, in all likelihood, remain deficient due to a lack of labour in the government sector, a lack of finance for the purpose and a lack of relevant equipment and training. It is urgent that both government and industry become aware of the risks involved.

Concerning fish processing plants, typically 80 cubic metres of water are used per day per plant for waste treatment. However, of the eleven plants in

operation, only two have reasonable wastewater processing facilities, and of those two, only one operates with acceptable quality. Thus, there is a strong likelihood that up to 800 cubic metres of untreated wastewater are discharged into the local environment or the public sewer system per day. A survey showed that the effluents contain chlorine which can be harmful to human health and which remains in the water even after it has been treated for domestic use.

Most industries simply discharge raw, untreated effluent into the surrounding environment or into the public sewer system

Policy Recommendations

Pollution control bodies should be fully represented on the industrial licensing and quota boards to ensure that environmental factors are taken into account from the very beginning of the planning, licensing, implementation and monitoring process. The government should levy charges on the polluting industry in line with the Polluter and User Pays principles. The Malaysian system for Control of Industrial Effluent would be a useful model to replicate.

Training in wastewater management is of the highest priority. Complete training packages should be made available to industrial managers and technicians, while there should be an active communication and awareness programme aimed at the general public to promote the observance of environmental standards.

The locally competent and knowledgeable investment and environmental agencies in Uganda should provide information and advice on clean production processes to future investors. Similarly, companies should be ready to provide information and access to researchers working on the improvement of environmental management.

Standards should not be seen merely as technical instruments. They should be viewed as a means of industrial improvement, a means of protecting the health and safety of all Ugandan citizens and resi-

dents and, ultimately, as a partnership between consumers, industrialists and the public sector.

A basic element of monitoring of pollution should be that manufacturers maintain and provide accurate data, on an input-output basis, concerning chemical utilisation and the release of such chemicals into the ambient environment.

All plans for new industrial development should include an Environmental Impact Assessment (EIA) as an integral part of the planning process. The EIA should provide a detailed management and monitoring plan to deal with waste management.

As a logical corollary to the above recommendations regarding waste management, the following recommendations concerning quality control should be implemented in the light of recent experience with the standards imposed by export buyers such as the European Union:

- Handling of harvested fish by the vendor before purchase for processing must be hygienic.
- Appropriate equipment such as toilet facilities, clean potable water and acceptable landing arrangements at the jetties should be provided at landing sites.
- Plant layout and design should prevent product cross-contamination.
- Hygiene training programmes should be institutionalised in the sector.
- Processing plants should operate self-monitoring and audit schemes.

Sectoral Policies and Standards in the Three Riparian States: Benefits of an Eco-Regional Approach

Each of the three riparian states – Kenya, Tanzania and Uganda – has a policy framework through which fisheries resources are managed. Commercial fishing is important to each of the economies. Of the total catch from Lake Victoria, Tanzania

lands 40 per cent, Kenya 35 per cent and Uganda 25 per cent. In most cases, fishing is artisanal. In the three countries, there are approximately 100,000 fishers using 21,000 canoes. 270,000 traders depend on the industry and up to six million people depend on fishing in Lake Victoria for their livelihood. Fisheries in all three countries employ an open access policy which is highly vulnerable to exploitation by high investment industrial companies whose activities threaten the survival of the small, artisanal fishers.

Basic policy in all the states aims to sustainably exploit the resource so as to provide food, employment, income and foreign exchange through export of surplus fish and derived products. All policies incorporate environmental protection and call for cooperation with neighbouring countries so as to sustain the fish resource and its environment. However, the policies are silent on the question of industrial fishing and several common objectives are not being achieved. These include increased production, where 20 per cent of catch is currently lost after harvesting due to deficient techniques for the improvement of which finance is not available. Nile Perch is now beyond the financial reach of the local, domestic consumer. The basic concepts of environmental protection are well formulated but are not acknowledged at the grassroots community level, nor are the concepts backed up by statutory standards and regulations. Each country has a National Environmental Action Plan (NEAP) but implementation of the NEAPs varies and although Uganda has made significant progress, Kenya and Tanzania still have to enact the required legislation.

If the region is to achieve sustainable development, an eco-regional approach to fisheries is needed. Strategies which should be common to the three riparian states include maintenance of major fish stocks, the aquatic environment and associated biodiversity, restoration and conservation of habitat, development of aquaculture, establishment of maximum sustainable yields accompanied by appropriate selective fishing techniques and distribution of the benefits of the resource use equitably to the local riparian communities. An eco-regional approach is logical and would require improvement of wetlands, careful development of aquaculture and a major investment in the improvement of data on fish stocks.

If the region is to achieve sustainable development, an eco-regional approach to fisheries is needed

Legislation Relating to the Management of Fisheries Resources

The Constitution (1995) provides that the state shall protect natural resources on behalf of the people of Uganda. Natural resources are described as including land, water, wetlands, minerals, oil, fauna and flora. Parliament is empowered to take measures to protect and preserve the environment from abuse, to control pollution and resource degradation, to manage the environment for sustainable development, and to promote environmental awareness. Article 189(a) states that land, minerals, water resources and the environment shall be the responsibility of the government but does not specify the role of government in this respect. It is not clear whether the government is meant to manage the resources or simply to develop policies and standards for management. There is no definition as to whether fisheries are included in water resources nor as to whether, if they are part of such resources, fisheries should be managed by the central government or by local authorities.

The Fish Act aims at the control of fishing, stocks, purchases, processing, sale and marketing but does not aim at conservation of the whole ecosystem. The fines for which it provides are minimal and totally ineffective. The Trout Protection Act displays very similar aims and deficiencies.

The Fishing Rules define the use and size of fishing nets but have no resource conservation objective. The Fish and Crocodiles Order specifies the open access policy and system, and exempts National Parks from the provisions of the Act. The number of licences permitted per water body is specified but the fines to be levied on offenders are far too low to be effective.

The National Environment Statute of 1995 defines environment in a manner which definitely includes fisheries and provides for sound principles of environmental management, including local participation, equity, awareness, true costing to be borne by the user/polluter and a requirement for environmental impact assessments of proposed projects. Fines range from US\$ 100 to US\$ 30,000 for offences related to fish. Implementation of the Statute is vested in local committees but, given the lack of clarity in the provisions of the Constitution (see above), management of fish resources within a decentralised system may well be confused.

The Water Statute embraces use of water for purposes other than domestic consumption and includes local fishing. However, it concentrates on water supply rather than resource management.

Under the Forest Act, fish are not included in the definition of « forest produce ». The Local Governments Act of 1997 makes no clear provision for the decentralisation of fisheries resources and it

Laws relating to fisheries resources are outdated and do not reflect recently accepted principles of conservation and resource management

appears that the resource is to be managed on two levels with the central government retaining responsibility for policy, legislation and standards and the local government being responsible for day-to-day implementation. The Investment Code Statute requires the investor to ensure that business operations do not injure the ecology or the environment. This has clear application to the fisheries industry.

On a regional level, the convention regarding Lake Victoria Fisheries Organisation was adopted in 1994. The agreement, designed to promote the integrated conservation and development of the fish resource has yet to become fully active and the organisation is more of a liaison, advisory body than an executive one. In any case, signatory states retain full sovereignty over those portions of Lake Victoria within their national boundaries.

Budget provisions for equipment and training of staff to implement existing laws are inadequate

A New Policy Framework

Laws relating to fisheries resources are outdated and do not reflect recently accepted principles of conservation and resource management. In some instances, the scope of the law is limited to only a few water bodies. Other bodies should be included. Similarly, current laws include no provisions aquaculture. Current laws do not incorporate the principle of ecosystem or eco-region conservation as a basic component of resource conservation. Existing laws have no incentive or disincentive components to facilitate proper resource utilisation and conservation. Enforcement of current laws is

deficient. There are illegal landing sites, use of destructive gear and fishing methods which are not controlled or actively regulated. Cooperation with neighbouring countries, especially the Democratic Republic of Congo, in relation to shared water resources is weak and encourages smuggling. Budget provisions for equipment and training of staff to implement existing laws are inadequate. Fishers know that they cannot be pursued. Local communities are not sufficiently involved in the management of fish resources. Ignorance of existing laws is widespread and hinders compliance.

The Economics of Fish Marketing in Uganda and its Implications for Environmental Management

The analysis aimed to establish pricing levels for various types of fish in both export and domestic markets, to determine any market distortions, to determine transaction costs and profit margins, to determine how profit margins can be re-distributed to improve resource utilisation and environmental management in the sector, and to make appropriate policy recommendations.

The analysis was restricted to Lake Victoria, focused principally on the Nile Perch species, and revealed the following costs and revenue elements for both factory and artisanal processors and distributors of fish. Artisanal costs cover actual cost of fishing, transport and handling, processing, packaging, taxes, permits and licences. Industrial sector costs cover cost of machine operation and maintenance, energy and water, skilled and unskilled labour costs, waste management and other environment-derived costs. Revenue included the proceeds of the sale of fish and fish products. The stakeholders in the sector are the fishers, the marketing agents, retailers, factory fish processors, exporters and the consumers, both local and foreign.

The following major causes of price differentials were identified: the classic operation of supply and demand, certain socio-economic situations, such as, in 1998, a fear of fish poisoning due to the use of poison to catch fish, the accessibility of the sources of fish to the market, seasonal variations, and the mode of transport used.

Profitability

Taking into account total revenue against the costs of raw material, freight charges, capital costs and processing/handling costs, it is clear that the business is profitable. The range of profitability of fish processing and export per tonne was, at lowest,

some US\$ 40 and, at the highest, US\$ 1250. All incurred capital costs were viewed as borrowed capital calculated at the current interest rate of 18 per cent.

There was no significant variation in costs and prices over the period 1995-97. The annual price of processed fish remained between US\$ 3,000 and US\$ 3,200 per tonne. The average cost of raw materials varied between some US\$ 800 and US\$ 1,000. Processing and handling charges were steady at US\$ 300 per tonne. Average freight charges were estimated at US\$ 1450 per tonne and profit margins fluctuated between US\$ 700 and US\$ 800 per tonne. By-products also make a significant contribution to profit margins. Fish oil may sell at US\$ 0.60 per litre.

The profitability of artisanal fish processing is affected by the fact that processors buy fish which are not judged fit for factory processing or fish which are landed after the factory agents have completed their purchases. Prices are lower, in the range of 25-50 per cent of the price of factory grade fish. Prices varied dependent on the species of fish, the level of post-harvest processing done, and the proximity of the market to the fish source. According to distributors and traders, profit margins are adversely affected by high taxation (income tax, licences and daily market dues range from US\$ 5 to US\$ 20 per month), high operational costs for fuel, space, labour, transport, storage and handling facilities plus post-harvest losses mainly from fish rotting in heat or rain.

Policy Recommendations

In order to support the profitable fish processing and marketing industry, the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) should improve and maintain fish marketing infrastructure, particularly feeder roads, landing sites and lakeside facilities. The government should go ahead with its plan to build and equip at least ten fish landing sites on Lake Victoria in the period 1999-2001. Involvement of private investors in obtaining land for infrastructure development at gazetted landing sites should be promoted. The government should tender improved landing sites to private operators on a user fee basis. The District Local Authorities should, however, retain management oversight. The government should charge fish processing firms and other polluters fees high enough to act as an incentive to them to improve their effluent management practices. A

combined standard and economic incentives approach on the Malaysian model is proposed.

Willingness to Pay for Environmental Compliance

In the past, the pressures of development on the environment were not monitored or reported in a systematic way in Uganda. However, a monitoring system has been established within the National Environmental Planning Framework, one of whose first outputs was the National Environment Statute enacted in May 1995. The statute requires all development actors to comply with environmental standards, to undertake Environmental Impact Assessments (EIAs) and to conduct regular environmental audits. The Statute further requires processing firms to eliminate pollution or to pay for pollution in excess of prescribed standards. This situation creates a number of new costs to industry, many of which were not identified in the initial assessment of the national environmental policy process. This study examines the effect of such incremental costs on two indicators of project value – Net Present Value (NPV) and the Internal Rate of Return (IRR) – so as to determine whether the viability of firms will be undermined by the costs of environmental compliance.

Because fish export transactions are costly, the market clearing price should be sufficiently high to cover such costs and maintain profitability. Similarly, given that, in liberalised market conditions, prices are determined by exogenous market forces, firms no longer can use pricing to influence profitability but must try to minimise the costs of production and marketing. Fisheries in Uganda have several specific cost constraints. The total cost of production is high compared to the level of price offered on the international market mainly because of prohibitive internal transport and electricity costs. Moreover, standards of product quality and acceptability have obliged firms to invest in quality control. Despite the above, incremental costs for environmental compliance do not have a significant effect on competitiveness. Firms and agents have an ability to pay such costs.

The cost implications of environmental compliance stem from the primary nature of fish processing. Large quantities of wastes are discharged into nearby lakes, waterways and sewer systems. The National Environment Statute presented a set of actions to counter this pollution. The measures proposed can save money in the medium term by increased re-cycling of useful materials and by the reduction of charges for pollution. However, in

Uganda, most plants have no provision for re-cycling or re-use and thus cannot benefit from such measures.

A sensitivity analysis was conducted to test the ability to pay for environmental compliance. A medium-size firm, of 30 tonnes per day processing capacity was studied using data and projections from 1989 to 1996. The changes in total production costs were limited to those due to environmental compliance. Pre- and post-compliance NPV and IRR were determined and compared. Production costs and revenues were adjusted using 1990 base data. However, real international prices increased rapidly after 1990 when new export markets were established. For example, real price increases of 80 per cent were recorded in a two-year period in the European Union market. The main source of revenue examined was the sale of fish products per se. Sales of by-products were not included since they were not incorporated into the 1990 base cost used. This factor however, has a negligible effect on the sensitivity analysis.

It is clear that fish processing firms can invest in environmental compliance without compromising their competitiveness

In 1995, when the National Environment Statute began to demand a cleaner environment, incremental costs due to environmental compliance contributed up to 0.7 per cent to total production costs. In 1997, that figure rose to 0.8 per cent and, by 2000, will rise to 1 per cent. The Net Present Value for the base case was US\$ 54,160 while that for the sensitivity case was US\$ 47,150. There was a 12.94 per cent drop in NPV. In both cases, nevertheless, the firm is viable and enjoying positive NPV. The IRR remained healthy at 21 per cent, above the benchmark level for export of fish and fish products to the European Union. There is negligible impact on the viability of firms and it is clear that fish processing firms can invest in environmental compliance without compromising their competitiveness.

Policy Recommendations

The starting point should be a comprehensive sensitisation process on cost-effective compliance

measures, which would present and explain the various standards, regulations and procedures, and demonstrate to industry the benefits of improved environmental performance. The government should charge fish processors and other polluters at a sufficiently high level so as to cause them to improve their equipment and management practices. The level of charge must be carefully balanced between achievement of a cleaner environment and the continued competitiveness of the industry. Finally, supervision and monitoring of the fish industry must be improved and, to that end, the National Environment Management Authority must be strengthened. The long term effect of the above measures will be a clean and efficient industry which still generates substantial and broad economic benefits.

Command-and-control measures have been criticised for being economically inefficient and difficult to enforce

Market-Based Instruments for Sustainable Fisheries Management

The section focuses on: the nature and applicability of market-based instruments for fisheries resource management in the Lake Victoria Fishery. Relevant issues examined are:

- environmental and quality management in the fish processing sub-sector;
- the nature and applicability of incentives for better product and process quality across the entire fish handling and processing chain;
- the size and nature of incremental costs of firm compliance with raised environmental and quality standards; and
- the role of various stakeholders and lead agencies in introducing and operationalising the proposed economic instruments.

Regulatory measures in the fish processing sector specifically aim at regulating the level and methods of fishing, the methods and quality of fish han-

dling and processing, and environmental performance standards for the sector. The command-and-control approach also specifies schedules for meeting standards, enforcement procedures, liability assignment, and penalties for non-compliance. The responsibility for defining and enforcing these standards is usually apportioned by law between relevant sector agencies and local governments.

Command-and-control measures in other countries have led to substantial progress in reducing pollution and resource abuse. The approach has, however, been criticised for not achieving legislative mandates and deadlines and for being economically inefficient and difficult to enforce.

Economic Instruments for the Sustainable Resources Management

To varying degrees, economic instruments incorporate the polluter pays and user pays principles into the market mechanism and, in contrast to direct regulations, allow polluters and/or resource users the freedom to respond to certain stimuli in ways they themselves think is most advantageous. Economic instruments induce cost-effective behaviour.

Economic Instruments for Quality Control Management

Regulatory Measures for Quality Management of Fish Exports

The fish product quality and standards compliance framework in Uganda is guided by the EEC Council Directive 91/493/EEC of July 1991 which stipulates that all fish products from Uganda should be processed, stored and transported in a hygienic manner. In addition to self-checks, the EU Directive requires a formal auditing, inspection and monitoring mechanism. The UNBS is the competent national authority for monitoring and is allowed free access to all parts of processing establishments. It is also mandated to take appropriate action, including closure or de-certification of any establishment. To improve compliance, an incentive mechanism has been built into the import-export arrangements between EU member states and fish exporting countries. Exporting countries are divided into classes. Class I exporters are free to export to the European Union under a multilateral arrangement. Class II exporters have to satisfy importing countries on quality performance. Class III countries are not allowed to export chilled fish products to the EU.

Economic Instruments for Quality Control

Hygiene and sanitation measures on the lake and at landing sites are the responsibility of individual economic agents (fishers). Quality management in this regard needs to be tackled at two points, i.e., on the lake and at the landing sites. On the lake, a system of differential pricing of fish landed at landing sites needs to be established to reward fishers who invest in better sanitation and hygiene through cold transportation. A willingness to pay for this investment has already been demonstrated by a number of stakeholders in the fishing and fish processing industry. The Government of Uganda intends to invest US\$ 1.5 m per annum (1999-2001) to construct and improve landing sites. This investment has to be supplemented with improved hygiene and sanitation conditions throughout the fishing and fish handling chain. Fish processors occasionally provide fish distributors with ice for cold transportation of fish from the islands, thus contributing to lower organoleptic and parasite loads. During this study, fishers stated a willingness to pay for cold transportation to attain higher fish prices, at least to the value lost due to poor organoleptic performance and the related differential pricing by fish processors. Normally on landing, fish is sorted based on organoleptic tests into good, medium and bad fish, with each category fetching a different price. Fresh table fish consumers stated a willingness to pay an incremental cost of US\$ 200-500 per kilogram of fish if better organoleptic performance could be guaranteed.

Operationalisation of Economic Instruments for Quality Control Management

Fishers will be required to invest in cold transportation to improve the sanitation and hygiene standards of their fish. In addition, UNBS, fish processors, fishers and other stakeholders should establish a system of fish product and price differentiation based on quality standards relying on organoleptic performance and product grading. Many fishers, however, cannot afford insulated boats. Acquisition of insulated boats will need to be subsidised or facilitated through loan arrangements. Fishers therefore, need to organise into groups to articulate the demand and need for such credit. The financial worthiness of this investment is illustrated below.

This is a feasible investment. The private sector should have interest in this because, at fish landing sites, the rejection rate can be as high as 50 per cent. Reduction in that rate would mean that the processors obtain a higher ton-

nage of fish for processing, and therefore a higher capacity utilisation and revenue.

Product Monitoring and Consumer Protection

The existing system of product monitoring, quality assurance and differential pricing needs to be adapted so as to reflect the added advantage due to investments in cold transportation. At landing sites, processing firms purchase only the fish that pass the physical inspection, rejecting the rest which is used for domestic consumption. The challenge however, lies with product monitoring and protection of consumers of table fish. UNBS and the Uganda Consumer Protection Association should extend their traditional mandate of quality assurance and consumer protection to cover fresh table fish, and consumers should be sensitised on quality measures and quality assurance and the associated differential pricing of table fish to stimulate their vigilance.

At landing sites, the main problem is infrastructure. Landing sites need to be equipped with clean and sanitary landing jetties, reception slabs, chilled

A willingness to pay for quality control has already been demonstrated by a number of stakeholders in the fishing and fish processing industry

and clean portable water with sufficient icing to inhibit microbial proliferation, in addition to toilet facilities for the fishing communities. As already mentioned, the Government of Uganda intends to construct and equip at least 10 fish landing sites in the Lake Victoria area in the period 1999-2001. Government should, however, facilitate private investors to acquire land at gazetted landing sites to supplement the above investment

Factory Handling, Processing and Packaging of Fish

In 1993, the UNBS and the Fisheries Department formulated and adopted basic national standards in accordance with the European Union (EU) Directive 493/91 of June 1991. Besides the competent authority and certification system established by the EU, a number of economic instruments for performance improvement at the factory handling,

processing and packaging level exist. They include the 'Investor of the Year Award', which is based on an annual performance auditing by the Uganda Investment Authority (UIA). These measures can be further strengthened by instituting a performance certification system, publishable in the local press to indicate the best and worst performing fish processing plants regarding product quality and standards compliance. The EU Directives on quality monitoring will support the above proposed incentive framework and probably further encourage better performance, particularly if the competent authority (the UNBS) develops better and more reliable inspection and monitoring capacity.

Economic Instruments for Pollution Management

The strategy for the management of pollution in Uganda is outlined in the National Environment Management Policy (1994), the National Environment Action Plan (1994), and the National Environment Statute (1995). The underlying principle is the Polluter Pays Principle (PPP). The National Environment Management Authority (NEMA) developed air and water standards, standards for the discharge of effluent into water, standards for the control of noxious smells; noise, vibrations and soil quality standards and emission discharge levels in their sectors. NEMA has moved on to draft effluent discharge regulations to enforce some of these stan-

Cost-Benefit Analysis of Cold Transportation for 30 per cent of the Annual Catch

1997 Data: Lake Victoria-Uganda Side

Total Landing = 101,000 tonnes

Price per Kg = US\$ 1,200

Catch/boat/day = 26.81 kg

Differential pricing per kg = US\$ 200 (*proposed*)

Level of Investment = 30 % of catch cold transported (i.e., 30,300 tonnes/year)

Cost of Cold Storage per boat = US\$ 4 mn

The number of boats with cold storage that are needed to achieve a 30 % annual penetration is computed as follows;

Days of active fishing per year = 264

Catch cold transported per day = $30,300 \times 1/264 = 114.773$ tonnes or 114,772.70kg

Estimated catch per boat/day = 26.81 kg/boat/day

Therefore 4,281 boats (43.5 % of the total fleet of fishing boats) would need to be fitted with cold transportation.

The cost of fitting boats with cold storage is US\$ 4mn; the desired level of investment therefore is equal to cost of technology multiplied by the number of boats fitted with cold storage = $4 \text{ mn} \times 4,281 = \text{US\$ } 17.124$ billion.

The revenue scenario:

30,300 tonnes per year is cold transported to capture an incremental revenue of US\$ 200 per kg for cold transported fish;

Incremental revenue = $30,300 \times 1,000 \times 200 = \text{US\$ } 6.06$ bn per annum.

The return on the capital investment in the first year would be 35.4 % which is very good. At the sector level, therefore, an investment of US\$ 17.124 bn would be fully recovered in less than three years at an annual return on investment of 35.4 % per annum.

Source: Calculations based on survey data

dards. The National Environment Statute (1995) specifies imprisonment or heavy fines for those who break the law.

However, environmental compliance involves the adoption of costly process and technology modifications. This cost implication determines whether firms voluntarily comply with environmental requirements or risk penalties due to non-compliance. The management decision to comply will follow if the monetary penalty for non-compliance is equal to or exceeds the amount of money polluters save by not complying.

An opportunity cost of compliance (OCC) framework has been developed to examine how management decisions are reached to comply or not to comply, for cost adverse firms. Firms compare the level of private benefit they forego by complying (OCC) with the potential private cost of non-compliance including fines, penalties and indirect losses. Firms normally comply to avoid the private cost of non-compliance if it is greater than the net benefit of polluting, that is, if the opportunity cost of compliance is zero or negative. Administration and enforcement of penalties, however, requires that the polluters be caught by the regulatory agency. Mainly due to shortage of labour, NEMA is not equipped to perform its role and the process of inspection and apprehension of defaulters becomes very difficult. The economic decision to comply with regulation, therefore, depends on comparing the probability of facing a penalty with the net benefit of polluting. The decision by firms to comply, following an opportunity costs comparison decision matrix, can be summarised by the following inequality:

$$P1 \geq f (p \times P1 + OCC),$$

where P1 = penalty; p = probability of facing penalty, OCC = opportunity cost of compliance.

The above suggests that environmental compliance of point source polluters is economically undesirable at the firm level. However, polluters must invest in compliance technology. The question therefore, is whether the marginal net private benefit of compliance is empirically comparable with the marginal cost of compliance (MCC) to encourage voluntary compliance.

In studies elsewhere, the marginal net private benefit of compliance was found to be more often lower than the marginal cost of compliance. This variance between costs and returns undermines voluntary compliance. The undermining effect has been explained by the fact that most point source polluters generate large amounts of waste of low recycling value while compliance equipment is expensive and is usually not subsidised. Moreover, the marginal net private benefit of compliance diminishes at a rapidly increasing rate as environmental cleanliness levels are approached.

In Uganda, voluntary environmental compliance is further undermined by the empirical fact that NEMA has limited capacity to ensure adequate inspection coverage. In practice, therefore, the certainty that polluters will be caught and penalised runs at less than 100 per cent. Firms, therefore, unlawfully pollute rather than incur the costs of environmental compliance. A combination of regulatory measures, induced self-regulation and economic instruments, need to be designed, developed and implemented to offer a source of incentives for a behaviour change towards compliance.

The Malaysian Model for the Control of Industrial Effluents

The Malaysian Environmental Quality Act of 1974 included provisions for using economic incentives and disincentives in the form of effluent charges in support, rather than replacement, of regulatory

Effluent Charge Equivalent Using the Malaysian Model

For a daily effluent charge of US\$ 24,658 per 120m³ of effluent discharge of 300mg/l BOD, each fish processing facility would be paying (for polluting above the 50mg/l standard) US\$ 82,193 per tonne of BOD (or US\$ 61) calculated as follows:

For 120m³ of waste water of 300mg/l BOD, daily BOD loading beyond the standard will be
 $120 \times 250 \times 1000 / 1,000,000 \times 1,000 = 0.3$ tonnes BOD;

The cost per tonne of BOD, therefore, will equal to the daily effluent charge (US\$ 24,658) divided by the number of tonnes of BOD discharged into the environment;

$24,658 / 0.3 =$ US\$ 82,193 per tonne of BOD. This is equivalent to US\$ 61 at the 1998 exchange rate of US\$ 1 = US\$ 1,350

controls on discharges. The act requires that all firms discharging effluents pay a fee to obtain a license to discharge waste into public water bodies. Because the license fee varies with the level of waste discharged, it is effectively a discharge. The fee varies according to the class of the premises, the location of such premises, the quantity of waste discharged, the pollutant or class of pollutants discharged and the existing level of pollution. In 1977, the discharge fees provided by the Act were combined with discharge standards into an incentive-supported regulatory regime for controlling pollution from palm oil mills. The standards were announced in advance, spurring firms to make early capital investments in treatment facilities. The first discharge fees were collected in 1978. With the standards becoming more stringent over time and the discharge fees becoming larger with the quantity of waste discharged, the results were dramatic. Despite a 50 percent increase in the number of palm oil mills between 1978 and 1982 and a steady increase in palm oil production, the total waste released into public water bodies dropped steadily from 222 tonnes per day in 1978 to 58 tonnes in 1980. This was reduced further to 19 tonnes in 1982 and 5 tonnes in 1984.

The Malaysian mixed regulation-incentive system holds valuable lessons for developing countries that are contemplating the introduction of economic instruments in support of environmental regulations. The model can be modified and adapted to manage pollution problems in the fisheries sector in Uganda where standards for effluent discharges have already been developed.

The standards approach could be combined with an economic incentives approach of effluent charges based on the following empirical calculation: Fish processing firms generate an average of 120-150 m³ of wastewater of about 300mg/l BOD (i.e., biochemical oxygen demand) content per day. The management objective in the sector is to reduce the amount of discharges in volume and BOD pollution loading to less than 25 m³ of waste water discharge of BOD = 50mg/l per day.

Firms that cannot achieve this desired environmental performance level, however, may pay an effluent discharge fee. The fee will vary according to the quantity of waste discharged (m³); the pollutant or class of pollutants discharged and the existing level of pollution. Effluent charges will be structured such that each processing firm pays up to US\$ 9 million (US\$ 6,593) per annum or, on average, US\$ 24,658 (US\$ 18) per day. Nine million shillings is the aver-

age capital cost of constructing an anaerobic lagoon treatment facility for a medium sized fish processing plant at 1997 prices.

Economic Instruments to Reduce Overfishing

The management of fisheries resources in Uganda is provided for under the Fish Act, the Trout Protection Act of 1964 and the Fishing (Amendment) Rules, 1998. The principal management tools for the sector under the two Acts are the licensing system, and the control of fishing gear. The fisheries resource is also regulated through Administrative Orders under which the Minister may prohibit the use of a particular fishing method if it is considered destructive, or declare specific periods of the year to be closed to fishing in any specified area through an order. These orders, however, do not carry the force of law and are thus not enforceable in court.

The problem of resource over-exploitation in a fishery is theoretically related to the variance between private property and open access sustainable yield equilibria. The private property sustainable yield equilibrium is well below the maximum stock of a fishery, while the open access equilibrium is very close to it. The single private owner of a fishery (PROF) always aims to maximise profits. The owner thus sets a harvest effort HPROF at a point that maximises the difference between Total Revenue (TR) and Total Cost (TC). Starting from unity, such a point is reached at some effort level EPROF to the left of the theoretical Maximum Sustainable Yield (MSY), where the slope of the TR curve equals that of the TC curve, i.e., where marginal revenue is equal to marginal cost.

In an open access fishery like Lake Victoria, where there are no defined owners and no rules for using the resource, everyone who realises/or will realise a profit enters the fishery. Accordingly, as long as the Total Revenue (TR) exceeds Total Cost (TC), new entrants come to harvest the resource. They only stop when Total Cost (TC) exceeds Total Revenue (TR), which it does later after the theoretical MSY closes to the maximum carrying capacity i.e., at points beyond EOA (which is the open access equilibrium).

The risk of resource over-exploitation associated with open access conditions is referred to as the tragedy of the commons. The tragedy does not always occur. Use of common property is usually governed by rules and regulations. In the case of Lake Victoria, local fishing communities have, through the centuries, developed rules which

regulate the fisheries. These rules stipulate who may fish, in what season, in what area, what types of fishing gear are acceptable, and what type or size of fish can be caught. Local communities have also developed institutions to enforce these regulations. The system of local management collapsed under the pressure of commercial fishing and the more significant problems of open access, market

fish product quality improvement. The approach involved partial valuations of both direct and indirect costs and benefits (gross values at landing site based prices) and option and existence benefits. The potential annual direct benefits include revenue streams from ITQs, quality improvement, and effluent discharge fees.

Summary of quantifiable economic costs of improving the management of the Lake Victoria Fishery (Ugandan side, annual)		
	UShs million	US\$ (m)*
Management Expenses		
Government	561	0.387
Business Enterprises	268	0.185
Fishing Communities	5,708	3,937
External Donors	2,000	1,379
Opportunity Costs	Nil	Nil
Total Cost	8,537	5,888

Source: MFEP (1997) Background to the Budget, MFPEP (1999) Plan for the Modernisation of Agriculture, Survey Data.

* For a June 1999 exchange rate of UShs 1,450 to 1 US\$.

liberalisation and collapse of the regulatory capacity of the Government Fisheries Department.

A comparison of the private property and open access equilibria suggests that the following measures could be critical:

- a property rights definition needs to be instituted to confer to a group of people a common property rights ownership over the resource; and
- the cost of harvesting of the resource must be raised through appropriate resource user charges and resource use rights should be transferable.

The Benefit and Cost Implications of Improving the Management of the Lake Victoria Fishery

In this section, an attempt is made to estimate both the incremental economic costs and benefits that will accrue to the Ugandan economy as a result of implementing the policy actions proposed in this chapter, i.e., individual transferable quotas (ITQs) for fishing, a system effluent discharge fees (SEDFs); and a cold transportation programme for

Revenue from ITQs

The estimated sustainable catch per boat per day for Lake Victoria is 28 kilograms of fish. If this figure is used to calculate the annual individual transferable quota per boat, the annual quota per boat will be 10,220 kilograms (10.22 tonnes). Survey data indicate that the profit margin on one kilogram of fish at the landing site is UShs 250. If the price of an ITQ permit is set to be 17 percent of the total profit margin on the annual quota for a single boat permit (i.e., 17 per cent of UShs 250 times 10,220 kilograms), the price of an annual ITQ boat permit will be UShs 434,350. It is estimated that for the Nile Perch fishery alone (with a sustainable catch estimate of 6,385 tonnes), the total revenue (gross) generation capacity is UShs 2.8 billion.

Incremental Revenue Due to Quality Improvement

Currently, approximately 50 per cent of fish landed is rejected due to quality deterioration during on-lake transportation. This study proposes that transport boats be fitted with cold storage to prevent such deterioration. It is estimated that the invest-

ment would increase total catch acceptability from 40 to 90 per cent over a period of three years. The benefit is that at least a 40 per cent increase in fish acceptability would be realised to capture the price differential of about US\$ 380 (e.g., at the Kasenyi landing site, rejected fish is sold for only US\$ 354 per kg while grade 1 fish is sold at US\$ 734 per kg). The annual gain to the economy (Nile Perch fishery alone) would be equal to US\$ 9.9 billion which is calculated as follows: 40 % x 65,250 tonnes (the total annual Nile Perch catch from Lake Victoria) x 380 US\$/kg x 1,000 kg/tonne.

Revenue from Effluent Discharge Fees

It is proposed that each polluting firm pays in the range of US\$ 9 million per year as effluent discharge fees. There are about 40 major polluting firms on the Ugandan side of Lake Victoria in Kampala, Jinja and Entebbe. The total revenue contribution from this source therefore will be US\$ 360 million.

The implementation of the plan will give rise to economic costs associated with resource and ecosystem management and opportunity costs associated with the preclusion or interference of the operation of marginal but polluting economic activities. Based on available data, the total quantifiable annual economic costs associated with the improved management of the Lake Victoria fishery was estimated to be US\$ 8.5 billion based on incremental management expenditure comprising of staff, equipment, infrastructure, running costs and other physical inputs associated with implementing the proposed policy plan (ITQs, SEDF, and cold storage). These are costs incurred by government agencies, business enterprises, particularly polluting firms, non-governmental organisations, fishing communities and external donors. For the govern-

ment alone, the quantified value of costs per year is in excess of US\$ 561.4 million. Costs to other agents are estimated from government estimates and survey data in the table below. Opportunity costs would range from missed employment by fishers to reduced profitability of marginal processing firms. Opportunity costs were, however, not valued due to lack of reliable data.

The net annual economic benefit of the proposed policy package to the aggregate Ugandan economy is therefore: US\$ 4.5 billion or US\$ 3.1 million.

Integrated Policy Recommendations

There are a wide range of economic instruments of relevance to the management of fisheries resources, including indirect fiscal and financial instruments. Among these, direct incentives like differential pricing and transferable quota systems can be applied as an integrated package to improve both resource and environmental performance in the sector. The discussion in this paper demonstrates how various economic instruments can be applied through regulatory and incentive-based policy mixes.

The proposed policy actions however, need to be supplemented with demand side management involving the careful assessment of expected fish harvest levels and their ability to sustain the actual (or allowed) processing and export capacity. Further disincentives (tax policy mixes) can be applied at the fish processing level where the analysis of ability to pay demonstrated a capacity to pay of up to 21.94 per cent of the net annual cash flow of fish processing firms. One effect of such taxation could be the relocation of productive resources to other

Summary of the potential quantifiable economic benefits of improving the management of the Lake Victoria Fishery (Ugandan side, annual)

Incremental Economic Benefits (Annual)	US\$ (billion)	US\$ (million)*
Revenue from ITQs	2.773	1.90
Incremental Revenue due to quality Improvement	9.918	6.84
Revenue from Effluent Discharge Fees	0.360	0.25
Total Benefit	13.051	9.90

Source: Survey Data.

* For a June 1999 exchange rate of US\$ 1,450 to 1 US\$.

sectors with lower saturation levels and correspondingly higher absorptive capacities.

The regulatory measures in the mix, including supervision, monitoring and regulation of fishing effort and behaviour need to be strengthened. Fisheries research and monitoring must also be modernised. Community participation in the management of the resource should be emphasised, with a clear plan to re-equip fishers and establish fish conservation associations to drive this effort. The long-term effect of these measures will be a sustainable use of the Lake Victoria Fishery that still generates broad economic benefits.

Measures to Improve Management and Use of Fisheries Resources

Overfishing

Various stakeholders (MAAIF, Fisheries, NEMA, Local Authorities etc) should develop a system for the definition of property rights of fishers by evolving quota systems per landing site under which a restricted amount of fish will be caught over a specified period of time. The challenge is to ensure proper management, especially by local authorities together with local fishing communities. The quota would be based on parameters such as sustained catch, number of boats and number of fishers. The price of the quota should be based on the market rate for fish and fishing inputs used by fishers. Revenue generated from sale of quotas should be used to hire sufficiently trained personnel to routinely collect fish landing statistics, inspect sites, and assist in the management and use of fisheries resource. For transborder lakes, there is need for common practices on all sides of the border to avoid distortions in markets.

Ecosystem-based organisations should be established to help stakeholders harmonise their interests and management of resources. Lake Victoria already has the Lake Victoria Fisheries Organisation (LVFO) and one is also needed for Lake Kyoga.

Extension of the on-going stock assessment project for Lake Victoria that is being conducted by the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) to cover all water bodies with a view to obtaining a complete picture of the national level of fish stocks and lake-wide changes, which can then be used to determine the MSY.

Support private sector development in aquaculture by providing district-based aquaculture centres, and by providing support to Kajjansi Experimental

Fish Farm to develop appropriate fish farming technologies for transfer to owners of fish ponds.

Support and promote other sectors that provide alternative sources of protein, e.g., poultry and pork farming, in order to lessen domestic dependency on fish as a source of dietary protein.

Outdated Law

The Fish and Crocodiles Act 1964 should be revised into a new law that recognises the current status and needs of the fisheries sector and aligns it with current economic conditions. Seminars and workshops should be held to sensitise and consult all stakeholders as preliminary stages in drafting of a new bill. The bill should establish new regulatory measures (e.g., minimum recommended sizes of various fishing gear) and economic instruments (e.g., individual transferable quotas) for sustainable fisheries management. Non-compliance fines and charges must be upwardly revised to ensure effectiveness. The fines and charges could be pegged to the United States dollar to lessen the effect of high Ugandan inflation. The new law should be very clear, articulating who is responsible for fisheries resources in areas that are managed by various bodies, e.g., game parks, and forest reserves. The Fisheries Department in MAAIF would be responsible for drafting the bill.

Local fishing communities are key to the survival of the fisheries. How they perceive the sector and exploit fisheries resources is crucial to sustainability. Community-based education programs are vital. The communities can also be assisted to form associations or co-operatives to better manage the resource on which their livelihood depends.

Quality Control

An education campaign/program needs to sensitise all stakeholders to the benefits of quality enhancement. This can be done by UNBS in collaboration with the Fisheries Department, NEMA, UFFCA, and the Ministry of Health. Fish processing firms should be encouraged to undertake vertical integration by making them aware of the industries that would use the secondary (or waste) products from their processes. The fishmeal industry is one example that would benefit from poultry and pig production. Factories should be made to conform to recommended adjustments in accordance with the EU directives. Prevention of cross-contamination will require plant layout to be certified by UNBS working together with the Fisheries Department. The inspection and audit system

should be strengthened through institutionalising self-monitoring and audit systems. In view of rampant fish poisoning, the testing capacity for chemical presence in fish samples, in addition to organoleptic tests, should be strengthened.

Regional Economic and Environmental Policies

A memorandum of understanding requiring the three countries to harmonise their economic and environmental policies is necessary to avoid distortions in the fisheries sector. The Lake Victoria Fisheries Organisation (LVFO), East Africa Community (EAC) and UNEP should work together to ensure that regulations are put in place for co-operation and compliance. The starting point would be an assessment of pertinent economic and environmental policies in the three countries and their implications for fisheries. Differences in policies would be identified and bilateral discussions held to harmonise them.

Infrastructure

The Fisheries Department, working together with local authorities and other relevant ministries, should develop fish marketing infrastructure. A tax on fisheries can be assessed, based on the value of product sales. Local authorities would handle tax administration and the tax revenues could be used to improve infrastructure at each market level (landing site, roads, and retail markets).

Pollution

Standards for effluent and wastewater discharge and regulations to enforce them should be finalised and gazetted by NEMA, in collaboration with the Directorate of Water Development (DWD). NEMA should put a comprehensive, regular environmental audit system in place. An education and awareness campaign is needed to sensitise polluters, and also the general public, to the environmental damage caused by pollutants and the tangible benefits of reducing pollution. Particular emphasis should be placed on standards, regulations and procedures. Firms should train their employees to uphold the standards. Higher institutions of learning should be encouraged to develop tailored programs on environmental performance improvement at the corporate level. In line with the polluter pays principle (PPP), polluters should be charged. NEMA and DWD should work out the modalities for collection of polluter fees and how they would be utilised. NEMA & DWD should begin to levy pollution charges. Use should be made of combined standards and economic incentives

approach based on the Malaysian model of pollution control. The study established that firms are able to pay for environmental damage. Analytical results indicate that firms can remain viable with investment in waste treatment facilities that meet the required standards.

Conclusions

This project investigates how Structural Adjustment Programmes (SAPs) have fostered substantial growth of Uganda's fisheries industry and examines both their positive and negative impacts on economic, social and environmental systems. It further identifies an array of policy mechanisms, including economic instruments, that can be implemented to maintain sustainability of fisheries' resources and ensure their continued economic exploitation.

The project proposes a range of economic instruments and institutional measures to address:

- **overfishing and resource depletion;**
- **quality management;**
- **the loss of biodiversity associated with exotic species introductions and unsustainable fishing methods;**
- **effluent pollution from fish processing and other industries;**
- **the degradation of coastal ecosystems and environmental health conditions associated with rapid market development of the industry; and**
- **resource mismanagement due to unharmonised national environmental standards among the riparian parties of Lake Victoria (Uganda, Kenya, and Tanzania).**

These include:

- **establishing the level of fish stocks and setting an appropriate MSY for each of Uganda's major water bodies;**
- **implementing an MSY constrained ITQ system;**
- **devising quality standards and improving sectoral infrastructure;**
- **limiting the number of fish processing firms and monitoring the activities of licensed ones;**

- **revising Fish Act legislation so that it is at-tuned to the current economic conditions, recognises technological changes in the fish-eries sector and protects the environment;**
- **involving fishing communities in fisheries resource management by setting up com-munity-based sensitisation and awareness campaigns, in conjunction with the Uganda Fisheries and Fish Conservation Association (UFFCA) and local governments;**
- **strengthening the capacity of the National Fisheries Department to effectively carry out its regulatory role; and**
- **using subsidies to promote and support fish farming so that fish harvests from natural water bodies can be supplemented.**



General Conclusions

Emanating from the Projects

The basic aim of these projects was to identify the environmental impacts of Structural Adjustment Programmes, particularly their trade liberalisation components, and to formulate policy recommendations – especially market-based economic instruments – which can facilitate environmental conservation and sustainable development in the sector concerned.

Despite the geographical and thematic diversity of the projects undertaken, there are a certain number of commonly supported conclusions which can be identified from the process. Based on the experience of national teams, and of UNEP, in conducting the projects, general conclusions can be drawn. These are presented thematically below.

What is happening and what can be done?

- Although through trade liberalisation, enhanced trade objectives were achieved in the countries studied (in certain cases with remarkable success), there were serious negative environmental, and related social, impacts of expanded trade activity.
- Ideally, in the first instance, minimising environmental damage should be addressed from the outset when designing trade policies. This requires integrated trade-environment policy development which can ensure trade remains sustainable while avoiding environmental damage.
- When integrated policy-making is not realised before environmental damage occurs, it is too late to remedy irreversible damage and measures to correct reversible damage are costly.
- Provided with guidance through a process to develop sustainable development policy packages, participating countries enthusiastically embraced a proactive environmental policy stance. There was no lack of commitment to environmental protection in any of the country projects undertaken.

Which policies and measures are most effective?

- Many existing command-and-control policies, although in some cases effective in the past, are currently inefficient in the evolving economic settings for the countries studied. In most cases, command-and-control policies are in need of revision and require supplementary market oriented policies to enhance the effectiveness of environmental protection.
- The most effective components of new approaches involve full resource valuation and full-cost pricing of resources. Consequently, the use of market-based instruments should be maintained and expanded. In most cases, a judicious mix of market-based instruments and standard setting is the most appropriate approach.
- Even though the variety of sectors chosen for specific analysis was wide – forest reserves, urban automobile sector, shrimp aquaculture, water resources, mining and fisheries – the choice of basic instruments and approaches, such as economic valuation and full-cost pricing of natural resources, was remarkably similar in all cases. However, each country situation is different, and while the choice of instruments may be similar their designs are very different.

What drives the process of problem identification, policy development and policy implementation?

- Decision-makers initially reluctant to adopt strengthened environmental policies can become strong advocates of proactive environmental policy after awareness raising activities provide them with an appreciation of the linkages between trade, environment and development.
- Country ownership of projects is an essential factor in ensuring this process is successfully implemented. Moreover, wide stakeholder participation further ensures that problem causes are accurately identified and that policies responding to a full spectrum of social and sectoral needs are developed.
- The country projects reported here all demonstrated that an endogenous process of problem identification and policy development is required to effectively manage trade and environment according to country strategies, priorities, needs and circumstances.
- There is no shortage of in-country expertise to identify trade-environment problems and design trade-environment policies. What is needed, however, is strengthened capacity to initiate, integrate and sustain these activities. Process-oriented capacity building can effectively address this need.
- Through the country projects reported here, UNEP's approach to enhance process-oriented capacity by engaging and supporting national actors in project identification, formulation and implementation has been, and continues to be, extremely effective. Throughout these capacity building activities, UNEP places emphasis on '*learning by doing*' ('*learning by showing*' is strictly avoided).

What is needed to support the process of problem identification, policy development and policy implementation?

- Access to information and both domestic and international networks of specialists and decisionmakers was identified as being indispensable for national team productivity.
- Methods of data gathering and the techniques of integrated analysis should be further developed so that the causes of environmental problems can be more clearly identified and the benefits of market-based approaches can be systematically calculated.
- Importantly, these projects demonstrated that there is no shortage of in-country environment- or policy-oriented expertise, but there is a great need to build bridges and networks between national actors with potential contributions to the process.
- Being process-oriented, coordination at the national level between government ministries, industry and non-governmental organisations must be sought if the process is to evolve efficiently.
- '*Cultural preferences*' – often different from '*rational economic preferences*' – are a major factor in the acceptance of new policies. Multi-stakeholder consultations thus play a very important role in the eventual acceptability and sustainability of such reforms.
- Only modest financial support is needed to launch this process and promote the development of future action.

It is UNEP's hope that these conclusions, as well as the country studies themselves, will have a multiplier effect by providing guidance to those seeking to undertake a process of addressing sectoral trade-environment problems in their country, region or locality.

